Delving into Real-World Cultural Adaptation

Conceptual, Theoretical, and Methodological Advances in
Dynamic Intercultural Contact

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by

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Contents

Chapter 1

Introduction

Borders are set up to define the places that are safe and unsafe, to distinguish us from them. A border is a dividing line, a narrow strip along a steep edge. A borderland is a vague and undetermined place created by the emotional residue of an unnatural boundary. It is in a constant state of transition. The prohibited and forbidden are its inhabitants.

Anzaldúa, 1987, p. 3

When do you consider someone to have successfully transitioned or 'adjusted' to your culture? Think for a moment about the many aspects of your daily life that are affected by culture. Think about how your culture shapes your motives, your thoughts, and your behaviors in profound ways. How it dictates the structure of your days, the milestones of your life, the relationships you form, and the dreams you nurture. From the food you savor to the political ideas you hold, from the way you communicate to the humor you appreciate — culture permeates virtually every facet of our existence.

Imagine now, if you will, yourself as a newly arriving migrant facing the vast and rich complexity of a new culture. With your own cultural complexity in mind, when do you consider yourself as having successfully adapted as you arrive in this new cultural region? Is it when you master the local language, mimicking the accent with near-perfect precision? Maybe when you develop a taste for the local cuisine, no longer flinching at the unfamiliar flavors? Or is it perhaps when you have a job here, once you adopted the local traditions, or once you understand local jokes? But, with your own culture in mind, could it be that the cultural experience is more than just learning to replicate customs, that you negotiate your own cultural ideals, that cultural experiences are much less linear, and, ultimately, that there is actually much more agency in your

individual experience? However, if arriving in a new cultural field is truly more nuanced and introspective, how then can we understand and embody the deeper cultural adjustment that truly encompasses the rich, complex, and profoundly social dimensions of the cultural experience?

This dissertation is an exploration of that deeper, more elusive aspect of cultural adaptation — the complex cultural experience as it unfolds over time. We will reexamine how people experience transitions in new cultural contexts, building a broad conceptual framework for this adaptation process. We then use the structure to look at the psychological driving forces as newcomers enter real-world contacts with local cultural groups. With these mechanisms at hand, our final step will be to capture how people differ in their developments over time. I invite you to have an open but critical mind for a set of texts that places the migrant experience at the center to propose new ways of thinking about acculturation concepts, the psychological theorizing on contact between groups, and the methods of capturing important psychological developments.

1.1   The research premise: Defining the topic and scope

It seems useful to me to start with a number of contextual parameters or boundary conditions (Busse et al., 2017)[1]. What exactly are the phenomena that I will discuss? What is the problem I seek to address, and why is it a problem in the first place? But also, what is the scope of the undertaking, and what do I not attempt to do? As the empirical chapters of this dissertation are themselves standalone pieces of writing, I will try to find a balance between introducing the focus of the dissertation and avoiding repetitions of what will follow within the individual chapters.

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[1]Allow me a short note on the use of personal pronouns within the dissertation. All the work presented in this thesis is undoubtedly a collaborative effort with coauthors, collaborators, and advisors. Throughout the thesis, I will, thus, predominantly use "we" and "our" to describe the research. This Introduction chapter, as well as the discussion and epilogue sections, form a slight departure from this general rule. As the principal investigator of the project and the person publicly defending this work, I have taken the liberty of introducing and situating our work more broadly. In these sections, I will use "I" and "my" pronouns — demarcating my meta-commentary from our theoretical propositions and empirical findings.

1.1.1 The topic: Migration experiences?

Let me start by addressing the term "migration experiences", which broadly captures the focus of this dissertation. Migration experiences are notably the focus of the dissertation in several different ways. Migration experiences are our focus in terms of (1) the societal issue we seek to address and (2) the conceptual lens we apply to the concepts of interest. But the migrant experiences are also (3) the context in which we develop and test new psychological theories and (4) where we apply new methodological advances, in service of the earlier points. I will briefly address each of these vantage points as they lay out some of the conceptual ground that this dissertation covers.

Migration experiences are, firstly, the community matter that has motivated this undertaking. Despite the undeniable economic, social, and cultural contributions that migrants make to the countries in which they settle (Portes & Rumbaut, 2014), migrants often occupy positions of significant disadvantage and vulnerability. Economic and political factors, but also prejudiced attitudes, social exclusion, and the stresses associated with acculturation often place migrants in precarious situations, exacerbating the risk of mental health issues, including anxiety, depression, and post-traumatic stress disorder (Berry, 2006; Fazel et al., 2005; Silove et al., 2017). Societal organizations at all levels have called the healthy adaptation of migrants one of the core challenges of the 21st century, including the United Nations (McAuliffe & Khadria, 2020), the European Commission (European Commission, 2020), and the Dutch Research Council (de Graaf et al., 2017).

However, despite its pressing importance, the lived experiences of migrants have often remained under-researched, and their voices are often marginalized in scientific discourses (Viruell-Fuentes et al., 2012). As an example, research studies often adopt a majority-centric perspective, overlooking the unique challenges and narratives of migrants (Levitt, 2012), and the field has seen an over-reliance on top-down methodologies, which largely test pre-established theories, often not adequately capturing the migrants' realities (Schinkel, 2018). In this dissertation, I explicitly want to foreground the experience of migrants in a bottom-up approach embedded within everyday life. For me, this means working with migrants and resettlement organizations to address issues that

are relevant to lived realities and collecting data that captures these everyday life experiences. I believe that such an approach can catalyze a knowledge base that mitigates the harmful effects of migration-related stressors and promotes migrant well-being (Sirin & Rogers-Sirin, 2015).

Beyond the practical application, migration experiences are, secondly, also a focus of my work because they are the approach I have chosen for the issues of migrant well-being and adaptation. I chose to focus on the lived experiences of migrants as a way of approaching the concepts of adaptation and psychological acculturation in clear contrast to other more top-down approaches. As an example, a normative-cognitive perspective would tend to emphasize the role of pre-existing cultural norms, values, and cognitive schemas in the adaptation process (e.g., Schwartz et al., 2010), or a purely psychopathological perspective would tend to focus predominantly on the mental health issues and challenges faced by migrants, sometimes to the extent of pathologizing the migration experience (Bhugra, 2004). I instead focus on the full and lived experiences and personal narratives of migrants. This means that in my theoretical and empirical work, I consider multiple aspects of cultural adaptation (i.e., a complex or multidimensional approach) and in my data collection I focus on migration as a process that unfolds over time (i.e., a dynamic approach). In short, with 'migrant experiences' as an approach to acculturation, I aim to work on a holistic, embedded, and dynamic perspective of the changes people experience due to continued cultural contact (i.e., acculturation).

The third way in which migration experiences are my focus is as an important context to test new social psychological theorizing. While the experiences are important in hypothesis- and insight generation — for example, allowing us to use lived realities as a starting point for understanding the conceptual and theoretical landscape of acculturation — the experiences of migrants are also ideally suited to test important theoretical questions. The migrant experience is typically marked by dramatic changes in social and cultural circumstances, both of which can have significant psychological impacts (Berry, 1997b; Kirmayer et al., 2011). As such, migration provides an ideal context to develop high-impact theories related to adaptation, intergroup contact, and stress — especially as they evolve over time (Berry, 2006; Silove et al., 2017).

A fourth and related way in which migration experiences are the focus of our work is as an important context for methodological innovation. The real-world experiences of migrants outside the lab provide complex, context-sensitive, and dynamic data (Myin-Germeys et al., 2018). Dynamic, because migration experiences develop in the real world and are thus best captured with methods that sample such experiences over time (e.g., experience sampling methods, ESM; Myin-Germeys et al., 2018; O'Donnell et al., 2021). Complex because many of the important concepts in the migration experience, such as adaptation or acculturation, are multi-dimensional and multi-variate (Ward, 2001). Context-sensitive because data from real-world experiences can capture additional situational detail, such as the type of social interaction (e.g., Keil et al., 2020), but can inversely also exhibit complex missingness, for example when contact-specific questions cannot be answered for times without interactions (e.g., McLean et al., 2017). All these types of data are becoming increasingly prominent in psychological theorizing and data collection (Hamaker & Wichers, 2017), but methodologies capturing the differential developments are often less readily available (van der Maaten et al., 2009). The migration experiences are thus also a good match with the rising need to understand more complex longitudinal data.

The process of individual adaptation when a person gets into continuous contact with a new culture is, thus, broadly speaking, the topic, focus, and context of the research presented in this thesis. Exploring what exactly I mean with *culture*, *contact*, and *adaptation* will be the content of Chapter 2 and Chapter 3, but it might still be important to briefly discuss, the term I will be using to refer to this adaptation process in the coming sections and throughout the chapters. The term most commonly found in the psychological literature and thus also in our chapters is "psychological acculturation" (also see Box 1.1 below). However, rather than looking at how this term is similar or different from the many terms and definitions associated with migration experiences, I would like to briefly dissect this term to narrow in on the level of analysis in our empirical work. With psychological acculturation, I specifically focus on the experience of the *individual* (i.e., psychological) — I do not investigate physiological, societal, or cultural changes. I also, specifically, focus on *contact*

with another culture — not potential or imagined contact. And lastly, I focus on the *continuous process* of adaptation — not a singular contact event or cross-sectional recall. With this narrower focus in mind, let us turn to the research problem(s) I would like to address within the realm of migration experiences.

Box 1.1   Supplementary Information: On Concepts, Terms, and Definitions

Researchers have used a wide range of terms in the context of migration experiences, including acculturation, enculturation, transculturation, assimilation, integration, and cultural adaptation, -adjustment, or -transition. While there are often important conceptual differences between the terms, they all aim to capture and describe a process of change when two cultures interact. This interaction between the two cultures can be conceptualized on a group- and individual level. As a result, the Social Science Research Council originally defined the *acculturation* as described in Definition 1. As psychologists, we are, however, specifically interested in the individual rather than the group-level experience of acculturation. In this dissertation, I will, thus, mostly use the term *psychological adaptation* as it is described in Definition 2.

Definition 1 (Acculturation)
Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original culture patterns of either or both groups.
                                                    — *Redfield et al., 1936; p. 149*

Definition 2 (Psychological Acculturation)
Psychological acculturation refers to the changes an individual experiences as a result of being in contact with other cultures, or participating in the acculturation that one's cultural or ethnic group is undergoing (Graves, 1967).
                                                    — *Sam et al., 2006; p. 14*

I would like to highlight that the term (psychological) acculturation was originally used as a neutral and descriptive umbrella term (e.g., Berry, 2003). However, over the past 90 years, users of the term have most frequently used it in a static manner (Brown & Zagefka, 2011; Ward & Szabó, 2019) and have placed disproportional responsibility on migrants (Bourhis et al., 1997) – despite its more neutral original intention (e.g., Berry, 2009). I believe that part of this confusion stems from the word itself, where the ac- prefix indicates a movement (of an individual) towards a cultured end-state.

Future works might thus consider moving beyond the acculturation term and move to a term that re-emphasizes the dynamic and interactive nature of the concept. One such term is *cultural adaptation*. The term 'adaptation' in its etymology takes a functional approach — where both individuals and interactive systems adjust in order to be better suited for their environment. In this understanding, cultural adaptation is (1) relevant on an individual- and a group level, (2) places responsibility on any individual and group in the environment, and (3) is inherently a temporal and interactive process. Note that I do not specify what exactly is adaptive in any circumstance and that 'adaptation' is not a necessary outcome (i.e., many change processes do not enhance the livability of groups or individuals). More likely, cultural adaptation is a target that underlies most measures and definitions in the field.

1.2 Deconstructing migration experiences: Concepts, mechanisms, and methods

Knowing that we focus on understanding the complex and dynamic experiences of migration, it becomes important to map out what exactly the issues are, I seek to tackle, and why it matters to address these issues. There are undoubtedly many challenges that can be identified within, even this narrower, topic of migration experiences. I would, thus, like to spend some words on how I developed one possible research line that addresses the issues I found to be most pressing with the experience-focused approach I took.

I essentially identified three crucial issues I seek to address in this dissertation. Firstly, I explore the difficulty of conceptualizing psychological ac-

identify key migration experience aspects
Chapter 2: real-world qualitative evidence
↓
build conceptual framework
Chapter 3: scoping review
↓
assess mechanism based on the framework
Chapter 4: experience sampling studies
↓
capture mechanism as it unfolds over time
Chapter 5: methodological cluster application
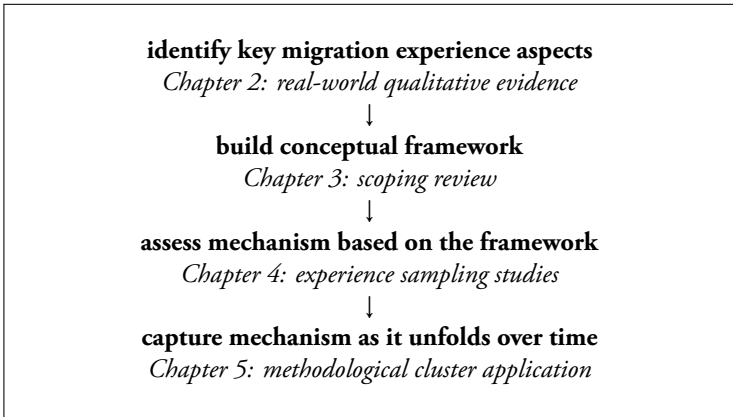
Figure 1.1: Chapter flow: Each chapter forms the conceptual building blocks for the following chapters.

culturation and develop a broader conceptual framework. Secondly, I then use the structure of the framework to zoom in on the mechanisms of real-world intercultural contact to propose a new theoretical model. Thirdly, I ultimately introduce a new way of capturing shared differences in how these mechanisms unfold over time. As each of the chapters builds on the structure and mechanism developed in the preceding chapters (also see Figure 1.1), in my descriptions of the issues I address I will thus mainly focus on the main arguments and how they address the broader challenges across the chapters.

1.2.1 The conceptualization problem

When I started working on the topic of psychological acculturation, the most immediate challenge I faced was an overwhelming unclarity on what acculturation actually entails. While the definitions were clear and straightforward (e.g., see Box 1.1), neither my societal partners nor the literature could provide a finite list of acculturation elements and I found little guidance on how the different conceptual elements could be organized and understood. Given that so many aspects of life are affected by culture, it is likely not surprising that researchers of cultural adaptation have focused on many different aspects, have

used various theoretical perspectives, and applied a number of methodological approaches. However, the plethora of disconnected perspectives has crucially led to a scattered field, where it is often unclear which aspects are relevant, how the aspects differ, and how conceptual aspects are connected.

As an example, our understanding of migration experiences from a psychological perspective has been shaped by a variety of fields, theoretical perspectives, and methodological approaches. Research in fields such as anthropology (Brettell, 2003), sociology (Castles, 2007), economics (Stark & Bloom, 1985), geography (Ralph & Staeheli, 2011), political sciences (Schiller et al., 1992), and history (Manning, 2013) have all influenced the psychological literature on migration. At the same time, migration experiences have been approached from a broad variety of theoretical perspectives, including acculturation theory (Berry, 2005), social identity theory (Phinney et al., 2001), and intergroup contact theory (Tropp et al., 2018). Across theoretical traditions, researchers have investigated a diversity of psychological outcomes, including stress and health (Berry, 2006), attitudes and behaviors (Berry et al., 1989), as well as skills and functional adaptations (Searle & Ward, 1990) using a variety of methods including qualitative (Iosifides, 2016), quantitative cross-sectional (LaFromboise et al., 1993), and even some first longitudinal approaches (Ward and Szabó, 2019; also see Figure 1.2).

Importantly, the variety of psychological approaches has led to a taxing heterogeneity within the literature and the associated societal applications. In particular, the heterogeneity in psychological theories and measures of migration experiences has led to challenges in understanding and interpreting past research, including conflicting findings (Snauwaert et al., 2003) and difficulty in integrating previous theories and empirical work (Taft, 1981). Additionally, this diversity presents obstacles in developing new theories and measures, particularly in selecting appropriate conceptualizations of acculturation (Escobar & Vega, 2000). As an example, in the early 2000s, reviews found that the conceptual unclarity contributed to the more than 70 overlapping and inconsistent theories at the time (Rudmin, 2003). Similarly, the same heterogeneity extends to societal and community-based interventions, where it is difficult to compare and evaluate the effectiveness of interventions (Tyrer & Fazel, 2014).

In short, despite a rich body of literature on psychological acculturation, researchers and practitioners face conceptual unclarity that leads to inconsistent theorizing, conflicting research findings, and difficulties in synthesizing past works into new directions. Our first challenge is, thus, to build a common conceptual understanding of migration experiences that spans theory, measurement, and empirical practice.

What do we mean by acculturation?

To form a clear and common understanding of what we actually mean by migration experiences and which psychological aspects might be relevant to understanding the concept, I begin by engaging with key societal players in the migration process. In particular, in **Chapter 2** I invite migrants, teachers, politicians, administrators, and volunteer coaches to reflect on what we mean by positive migration experiences. The first empirical study I ran, is thus a focus group discussion that offers space for a wide variety of perspectives on the topic. Guided by three moderators from the research team, the participants are invited to discuss the challenges of migration, but importantly also what they considered key aspects and experiences to be.

The focus group discussion specifically highlighted that beyond the commonly considered cognitive and behavioral adjustments to social norms, language, and work, positive migration experiences also critically depend on more internal adjustments of the migrant. The discussants describe that migration experiences can only fully be understood when we also consider identities, emotional experiences, and psychological goals. Importantly, the strong contrast the participants placed on the distinction between the more visible and the more hidden parts of the experiences carved out a potential experience-based perspective to understanding the more abstract concept of psychological acculturation.

The narratives of the participants suggest that focusing on what people want (desires), feel (affect), think (cognition), and do (behavior), might offer a practical, bottom-up, and inclusive structure to the concept of psychological acculturation. It is this distinction of affect, behavior, cognition, and desire — the ABCD of acculturation — that has guided all the following chapters.
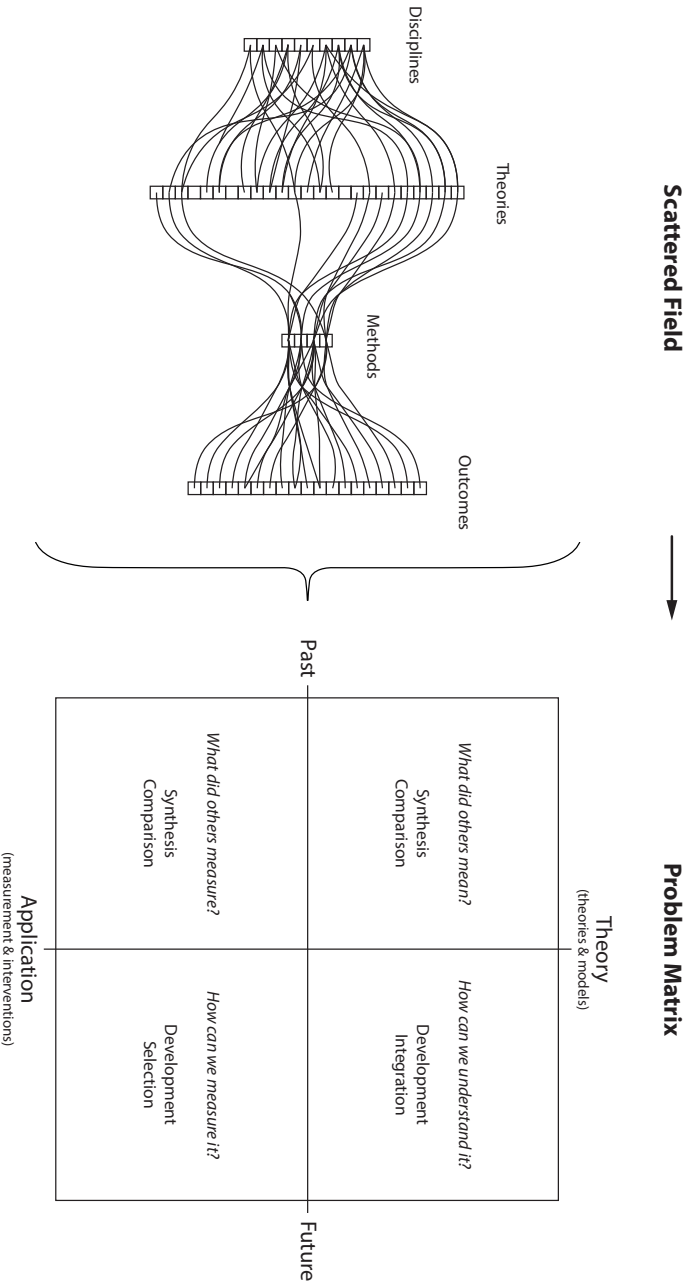
Figure 1.2: Conceptual Problem Matrix.

Scattered Field

Disciplines

Theories

Methods

Outcomes

Problem Matrix

Theory
(theories & models)

Past

Future

What did others mean?

Synthesis
Comparison

How can we understand it?

Development
Integration

What did others measure?

Synthesis
Comparison

How can we measure it?

Development
Selection

Application
(measurement & interventions)

From the most internal motives and goals through emotional experiences and cognitive processes, to the most visible public behaviors, the ABCD distinction helps us organize the four distinct aspects of the migration experience.

How can we structure the literature and study of migration experiences?

Armed with the insights from the focus group discussion, will need to move to a more formal conceptualization of the migration experiences. If the affect, behavior, cognition, and desire distinction should offer a stringent framework to research psychological acculturation, it would need to be clearly articulated, embedded within the academic literature, and applied to all conceptual levels.

Crucially, a conceptual framework of migration experiences needs to work on a number of different levels. These levels include theoretical conceptualization, operationalization, and measurement. With theoretical conceptualization, I here mean the development of a theoretical structure that guides the research by providing a general understanding of the phenomenon being studied. For example, acculturation theory (Berry, 1997b) provides a theoretical model that guides research on the psychological and cultural adaptation of individuals to a new culture.

With operationalization, I refer to the process of defining and measuring specific concepts or variables within a theoretical model. For example, operationalizing the concept of acculturation might involve defining and measuring the variables of the cultural identity, and adaptation to the host culture (Searle & Ward, 1990).

Finally, the empirical measurement speaks to the process of obtaining data to quantify the variables that have been operationally defined. Measurement can, thus, be seen as the application of operationalization. For example, a researcher can use self-report questionnaires or interviews to measure the cultural identity and adaptation of an individual to the host culture (Phinney & Ong, 2007; Ward & Kennedy, 1999). Altogether, a complete conceptualization of psychological acculturation would need to provide a common understanding across the theoretical, operational, and measurement levels of the phenomenon.

To address this broader and more fundamental challenge, in **Chapter 3** I use the ABCD structure to build out a descriptive conceptual framework to analyze, measure, and understand the concept of migration experiences across the theory-, operationalization-, and measurement levels. The proposed framework, thus, has a different objective than previous efforts which have cataloged literature on acculturation (e.g., Castles et al., 2003), built multidimensional measures of integration (e.g., Harder et al., 2018), normative frameworks (e.g., Ager & Strang, 2008), or theories of acculturation (e.g., Berry, 2005). Rather than offering a new measurement, definition, or theory, I aim to build a framework to assess and compare these conceptual elements.

In the chapter, I explicitly develop the framework by positioning it within the broader literature and by discussing how the affect, behavior, cognition, and desire aspects relate to culture, cultural contacts, and psychological adaptation — which are essential to the idea and definition of psychological acculturation. I then apply the framework to the past literature to examine its utility and identify gaps within the literature. With the broader chapter, I aim to aid researchers and practitioners in reviewing past acculturation literature based on the aspects considered. By doing so, researchers can consider broader integration efforts and make novel predictions about the psychological development of acculturation processes. Additionally, the framework's distinction between affect, behavior, cognition, and desire allows for clearer and more transparent decisions about which aspects of acculturation are relevant to research questions and measurement. Practitioners can also utilize the framework to make more informed decisions about which aspects are relevant for policy development and intervention design.

1.2.2 The theory problem

With a clearer understanding of the individual aspects of psychological acculturation, the next challenge is understanding the functional mechanisms of the experience. When and why do cultural contacts actually lead to positive outcomes?

When it comes to understanding the functional mechanisms of migration experiences, there are a number of potential experience aspects that offer a

promising and rich body of literature on understanding adaptive cultural change mechanisms. One experience that sits at the center of cultural adjustment are the real-world interactions with members of the local cultural groups. Understanding when and why interactions with the local cultural groups are positive, thus, offers the potential for a key psychological mechanism of positive migration experiences. Intercultural contact is per definition a necessary condition for cultural change to occur (Berry et al., 1989, p. 186), and particularly direct in-person contact is often the most pervasive type of contact within the literature (as opposed to indirect and non-animate contact, such as through media or food). Promising results from the literature on intergroup contact theory would suggest that *continuous positive contact* should have the most beneficial effects for the migrant (e.g., higher well-being) and for intergroup relations (e.g., positive outgroup attitudes; Tropp & Pettigrew, 2005).

However, despite this extensive and theoretically rich literature on intergroup contact, very little research has thus far focused on the psychological mechanisms of what makes contact *positive*. While we have substantial research on the psychological processes that explain how positive contacts improve intergroup relations (e.g. see, Paolini et al., 2021), it remains largely unclear when and why an interaction is perceived as positive in the first place (e.g., Pettigrew & Tropp, 2006). This literature gap remains a substantial theoretical and practical challenge when we consider that there is now consistent evidence showing that negative intergroup contacts lead to worse attitudes, prejudice, and reduced future interaction motivation (e.g., Barlow et al., 2012; Graf et al., 2014; Prati et al., 2021). In light of these findings, understanding interaction quality thus sits at the heart of understanding when an intergroup contact is successful (e.g., Allport, 1954; Brown et al., 2007; Tropp et al., 2016).

In short, understanding the psychological mechanisms of when and why interactions with local cultural groups are perceived as positive is a central and relevant challenge for migration experiences. Finding a psychological mechanism is an essential roadblock to understanding whether an interaction leads to more positive migration experiences, and the second challenge of this dissertation.

What are the psychological mechanisms of positive migration experiences (in real life)?

In **Chapter 4** I focus on the psychological mechanisms of positive intercultural contact in everyday life. In particular, I propose that the fulfillment of relevant situational needs during real-world inter-cultural interactions should flexibly predict higher interaction quality, which in turn should drive more positive outgroup attitudes. As an example, if a migrant seeks to be accepted and this need is fulfilled during the interaction, the migrant should experience the interaction as more positive and perceive the majority group more favorably.

To test the theoretical mechanism, I collect data on the natural daily inter-cultural interactions the migrants have with the cultural majority group members[2]. Such an approach is also in line with a large majority of theories and models that discuss real-world adaptation (e.g., Berry, 1997b, 2005; Pettigrew, 1998, also see the results from Chapter 3). Studies that actually follow migrants in their natural interactions over an extended period of time are extremely rare, and prominent voices in the field have long been calling for more real-world longitudinal data (Brown & Zagefka, 2011; Pettigrew, 2008; Pettigrew & Tropp, 2011; Ward & Szabó, 2019). Countering the historical difficulty of collecting such data, we were able to leverage recent technological and methodological developments (Arslan et al., 2020; Keil et al., 2020; O'Donnell et al., 2021) to collect three independent studies, which follow the daily inter-cultural interactions of recently arrived migrants over a one-month period.

With the three experience sampling studies of real-world intercultural interactions, I was able to track interaction-specific situational needs, interaction quality, and outgroup attitudes to test our proposed psychological mechanism.

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[2]In psychology, extensive longitudinal data collection methods are often referred to as experience sampling method (ESM), ecological momentary assessment (EMA), or ambulatory assessment (AA) studies. These terms, while stemming from different conceptual backgrounds, share a focus on capturing people's behaviors and experiences as they vary over time and in response to different situations and events. Throughout the chapters, I will use the term "experience sampling" (ESM) as it is the most commonly used term in the literature.

1.2.3   The dynamics problem

Armed with a functional mechanism, the final vital challenge I encountered was the difficulty of capturing the essential temporal patterns of the internal mechanisms. Because cultural adaptation is an idiosyncratic and dynamic process, our methods must capture the evolving nature of the migration experience and, crucially, how these developments differ between individuals and contexts.

Capturing important developmental characteristics from studies that follow participants' everyday experiences has recently seen an enormous interest (e.g., Hamaker & Wichers, 2017). Researchers working with experience sampling data have assembled several "dynamic features" that capture important and meaningful developmental patterns of everyday experiences (Dejonckheere et al., 2019; Krone et al., 2018; Kuppens & Verduyn, 2017). Taking the example, of migrant well-being, dynamic features could include information on whether a migrant's well-being is generally high (i.e., central tendency), whether well-being changes drastically from one measurement to another (i.e., stability), whether there is a consistent well-being increase or decrease (i.e., linear trend), along with many other aspects that are key to understanding real-world psychological time series (Wang et al., 2006).

However, despite this rich diversity of meaningful time series features in psychology, most methods for identifying person-level differences in developmental patterns have thus far utilized only a small and restrictive selection of the dynamic features (Ariens et al., 2020). In particular, the most common approach has been to cluster participants based on person-specific model parameters — notably intercepts and slopes from vector autoregression models (VAR; e.g., Ariens et al., 2020; Bulteel et al., 2016; Stefanovic et al., 2022). These models, however, restrict the different types of dynamic features that can be considered and often have strong assumptions about the experience data (Lütkepohl, 2005). These restrictions crucially stand in contrast to the non-linear, erratic, and context-specific developments of real-world migration experiences (e.g., Hamaker & Wichers, 2017; Helmich et al., 2020; Kivelä et al., 2022; Myin-Germeys et al., 2018).

The most commonly used models for comparing and grouping peoples' developmental patterns might, thus, not always accurately capture the time

series and are often restricted in the features they capture. Finding and introducing alternative methodologies that utilize dynamic features more flexibly and directly is, thus, pivotal to capturing important trends in psychological migration experiences.

How can we understand complex migration experiences over time?

In **Chapter 5** I focus on the main variables of our theoretical mechanism to explore how we can begin to understand the more complex developmental trajectory patterns within the migration experiences. I particularly seek to extract developmental structures that allow us to find groups of different developmental trajectories (e.g., for migrants that have an easier or a more difficult experience trajectory).

Such an undertaking is far from trivial because there might be many dynamic features that might describe a migrant's developmental trajectory across multiple affective, behavioral, cognitive, and motivational variables. Moreover, ESM data is usually messy real-world data that is plagued by situation-specific missingness.

In order to compare participants based on several features across multiple variables and with messy data, I introduce feature-based time series clustering — an analysis technique prominent in other scientific fields. I use the ESM data on migration experiences to illustrate the individual analysis steps, as well as the interpretation and utility of the developmental patterns that were extracted by the analysis. I show that the method offers a flexible and theory-based approach, with fewer strict assumptions, easy and intuitive implementation, as well as meaningful psychological interpretability. To make the analysis even more approachable, I provide fully reproducible code and plug-and-play functions as online supplements to the chapter.

In sum, for the experiences of migrants, I have identified three crucial issues I seek to address in this dissertation. In particular, I argue that the study of migration experiences faces challenges on three conceptual levels, meaning that there is an urgent need for developing reliable, flexible, and robust analytical frameworks, theories, and methodologies that can successfully capture the complex and dynamic real-world experiences faced by migrants. Accordingly,

the broader aim of this dissertation is to propose initial resolutions for the conceptual heterogeneity (i.e., organizing conceptual parts; Chapter 2 and Chapter 3), the theoretical unclarity (i.e., testing psychological mechanisms; Chapter 4), and methodological challenges (i.e., capturing diverging developments; Chapter 5) of the migration experiences.

1.3 Reflections on the approach of this work

Before I turn to the empirical chapters, I would like to situate our approach and the scope more broadly. For such a reflection, it is essential to expand on how my own beliefs, judgments, and practices have shaped the development of the thesis and the chapters within it. In particular, I will briefly speak to (1) the general research approach of the dissertation project, (2) my own positionality, as well as (3) our transparency practices.

1.3.1 Research approach

To start off, let me briefly speak about the general research approach I have taken with this project. Throughout the research project, my approach has been problem-focused and grew out of a participatory collaboration with Humanitas Groningen — a local refugee resettlement organization. The conceptual question of what we mean by 'acculturation' and how we should assess it was initially raised during this local collaboration. Similarly, also the contact-focused mechanism question was co-developed with staff and volunteers at Humanitas when I initially prepared the funding proposal for this project.

Participatory research practices proved invaluable here. Through the collaboration, I gained insight, experience, and a deeply enriched understanding of acculturation from the perspectives of those living it. By working closely with stakeholders, I was able to construct a rich, multifaceted understanding of psychological acculturation. I had initially planned to collect a much larger part of the empirical ESM data with clients of Humanitas — to also offer direct insights for the refugees under their care. Unfortunately, at the time when I had planned to start data collection, the 2020 Covid-19 pandemic rendered most research on mechanisms of intergroup contact irrelevant.

The problem-oriented and collaborative ethos was essential throughout the entire research cycle (Kreienkamp et al., 2020). From idea generation, through research funding, research planning, data collection, and data analysis, to the ultimate creation of the scientific output, each step included deliberate discussions on the practical utility of the research and its applicability to the lived realities of those involved. This includes providing feedback dashboards to our study participants, the creation of openly accessible and interactive research materials, as well as engagement reports for our societal partners. With the approach, I aimed to facilitate active co-creation of knowledge, where we were able to exchange ideas, identify knowledge gaps, and co-develop approaches that could inform future work in the field.

Importantly, the problem-focused approach in our understanding does not preclude theoretical or methodological innovation. In fact, being guided by real-world societal issues at times forced us to think outside the academic canon and has been the source of genuine theoretical inspiration. The same was the case for the methodological experience sampling approach I took and the associated methodological proposals I provide. While the experience-focused method was also guided by the migration challenges I seek to address, the depth and complexity of the data arguably places us at the frontier of the growing ESM literature.

1.3.2   Positionality

Next, to fully understand the motives and approaches of this dissertation, it might also be important to consider how my own backgrounds and past experiences have guided this research. I have been working with forced migrants for over 10 years in three countries around the world — in refugee resettlement programs under the UNHCR, as a volunteer, language teacher, and integration coach with several smaller and larger migration organizations. Additionally, while writing this dissertation, I am a first-generation migrant myself — albeit a highly privileged voluntary migrant. Nonetheless, my own, decidedly applied experiences with the importance and diversity of psychological acculturation, have assuredly influenced the research process. Most notable are the choices to take a phenomenological, experience-focused perspective, and the focus on

the migrant minority perspective in understanding the psychological mechanisms of acculturation. Taking a bottom-up and migrant-centered focus is fundamental to the approach of this thesis.

On a more abstract level, I would like to address some of the ontological and epistemological influences that have shaped this research. In terms of how I approach the concepts of interest (i.e., ontological approach), the research questions and the empirical works presented here are all influenced by structuralist and functionalist ontologies. In the context of the research on cultural adaptation, I have worked with the strong assumption that things like affect, behavior, cognition, and desire are basic human capacities that fulfill adaptive functions. Importantly, in my view, this does not imply cultural determinism or deny cultural and individual diversity. While I assume functional structures in the world, I also assume infinite variety within these structures (for more detail, see Chapter 3). Similarly, the ways in which I test and validate our frameworks, theories, and methods are arguably the result of my own empiricist epistemological background. I academically grew up in a largely quantitative tradition that mainly uses deductive hypothesis-testing methods, which is also reflected in the main empirical studies.

1.3.3 Transparency

Finally, I will briefly mention our efforts for the transparency and openness of our research. The scholarship and additional funding for this project largely come from public funders, and as such I consider the results and insights from this research to be part of the public domain. To ensure the accessibility of the research data and results, I have taken a number of practical steps. Firstly, wherever possible, I publish in open-access journals and share all materials necessary to replicate our study. In general, I usually provide a publicly accessible repository within the 'Open Science Framework' or as part of a 'DataVerse', where I provide open materials, open data, open code, and open supplements. Additionally, most studies include a publicly accessible GitHub repository for the documentation of research packages (including all supplementary code as well as the manuscript preparation documents).

Beyond these open science practices, I have taken a number of additional steps to make our findings accessible to our research participants as well as the broader audience. As an example, at the end of our main ESM study, I provided personalized dashboards to the participants, where they could interactively explore their own data. Similarly, as part of the scoping review in Chapter 3 I have created an interactive web application, where users can access the coded dataset of theories and measurements of acculturation that I identified during the systematic review. Likewise, as part of the introduction of the feature-based clustering, I provide a code tutorial that includes pre-made functions for the extraction of the most common time series features for psychologists and directly integrates the features into the clustering code. I hope that these practices make the results of our work more easily accessible to all interested parties and help increase the transparency and openness of our work.

Chapter 2

What do we mean by positive migration experiences? Deconstructing the conceptual elements of refugee- and migrant acculturation

Abstract

In the context of global migration, understanding the psychological adaptation of migrants is crucial yet challenging due to diverse experiences and backgrounds. This study addresses this challenge by exploring the multifaceted nature of psychological acculturation among migrants in the Netherlands through a qualitative focus group. Engaging twelve participants, including migrants, refugees, educators, and government representatives, the study unveils the complexities of acculturation experiences. It identifies four key experiential dimensions: wanting (desire), feeling (affect), thinking (cognition), and doing (behavior). These dimensions highlight the holistic nature of acculturation, provide structure, and highlight the broad range of experiences. The findings emphasize the intricate interplay between more external cognitive and behavioral, as well as the more internal affective and motivational adjustments. Challenges associated with each dimension underscore the individualized nature of migrant experiences. The outcomes suggest a need for comprehensive, empathetic approaches in supporting migrants, offering the affect-behavior-cognition-desire framework as a practical, inclusive tool for understanding and aiding their acculturation process. This framework serves as an embedded starting point for a robust conceptual framework and more nuanced explorations of migration trajectories.

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Public significance statement: The study sheds light on the complex psychological journey of migrants, emphasizing the need for more empathetic, inclusive approaches in their acculturation process. By identifying key dimensions of adaptation — affect, behavior, cognition, and desire (ABCD) — it underscores the diversity and individuality of migrant experiences, while also providing a structuring lens. The findings advocate for policies and support systems that recognize these multifaceted experiences, aiming to foster better integration and mutual understanding in increasingly multicultural societies. This research highlights the importance of considering both visible actions and internal experiences in addressing migrant adjustment and facilitating successful cultural integration.

Open Science Practices: ⬡ Open Materials, ⬡ Open Data, ⬡ Open Code, ⬡ Open Supplements

In our increasingly interconnected world, migration is not just about the movement of individuals across borders — it is a pressing matter of human resilience, adaptability, and aspiration. For migrants, the migration experiences, intertwined with the socio-cultural fabric of receiving societies, possess an immense transformative potential for both the individual and the community. However, oversimplifying, or inversely fragmenting these experiences can risk exacerbating societal tensions, misunderstandings, and missed opportunities for both migrants and their receiving communities (Castles, 2007). The urgency is clear: To prevent social friction and maximize mutual enrichment, it is imperative that we approach migrants' experiences with depth, clarity, and empathy, laying the groundwork for policies and interventions that recognize and harness their unique strengths and perspectives.

However, despite the abundant research on migrant adaptation, the field faces a fundamental problem: a lack of clarity regarding the conceptual elements of psychological acculturation. In other words, the field does not agree on the psychological parts of what it means to adjust in a new culture. What are the important aspects of adapting when interacting with new cultural groups? A multitude of theoretical perspectives and methodological approaches have generated a fragmented academic landscape, leading to conceptual ambiguity and conflicting findings (Snauwaert et al., 2003; Taft, 1981). As an example, one study may highlight the increased levels of anxiety among migrants during initial resettlement (Berry, 2006). Another might delve into a migrant's struggle to reconcile their birth country identity with that of their new home (Phinney et al., 2001). Meanwhile, a third could explore the interpersonal dynamics between migrants and residents of the host country (Tropp et al., 2018). While insightful, this disjointedness hampers both theoretical clarity, but the confusion also extends to societal and community interventions, making it difficult to assess the efficacy of these strategies (Tyrer & Fazel, 2014). Ultimately, the fragmented and uncoordinated approach to understanding migration experiences fails to offer a clear and actionable framework for supporting migrants, exacerbating the issues they face in their resettlement experience.

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In light of these problems, the need for a grounded and comprehensive structure to understand the conceptual elements of psychological acculturation becomes glaringly apparent. The current mosaic lacks a comprehensive and unifying narrative that guides researchers, policymakers, and practitioners to a more nuanced and integrated understanding of migration experiences (Escobar & Vega, 2000). We need a higher-level exploration of the broader experience.

To answer this call, we looked at bottom-up phenomenological approaches to identify the broader patterns that emerge from conceptual discussions and the narratives of those for whom migration is a lived reality. We chose a focus group discussion to jointly explore the real-world experiences of migrants and individuals working in the field of migrant resettlement. Grounded in the discussions of their real-world experiences, our analysis aims to cultivate a rich and enveloping understanding of migration experiences. Through focused, collaborative discussion with key societal players in the migration process, we aim to identify unified, actionable patterns that help us bring together the disjointed landscape of conceptual elements.

2.1 The present study

We conducted a focus group discussion to gain an in-depth, bottom-up, and practical understanding of how psychological acculturation is conceptualized and addressed by key players in Dutch society. To this aim, we invited a broad and diverse set of societal actors involved in the acculturation process and provided space for a wide variety of perspectives on the topic of migration experiences. The focus group consisted of voluntary migrants, refugees, teachers, language- and integration coaches, volunteers, and staff of a regional refugee resettlement agency as well as a representative of the local government. The 12 invited participants joined a 120-minute round-table focus group discussion on the concept of acculturation. The study received ethical approval from the university of the first author.

2.2   Methods

Given that focus group discussions are not a standardized procedure (Barbour, 2001; Morgan, 2010), we will sequentially describe the study design, the participants, the study setting, and the data collection.

2.2.1   Study design

We conducted the focus group discussion as a single cross-sectional round-table event. We chose this particular design because the focus group allowed us to bring together a diverse set of key societal actors involved in the acculturation process and how these different actors renegotiate with each other what acculturation means to them. As such, using a focus group discussion to gather data allowed us to not only investigate what people think, but why they think and behave the way they do within acculturation processes.

2.2.2   Participants

The focus group discussion was jointly hosted by a university in the Netherlands and the local refugee resettlement organization as part of a larger ongoing collaboration. The participants were purposefully selected and invited to represent the broad diversity of people involved in the acculturation process. Our purposeful sampling criteria focused on diversity in terms of gender, age, field, service provided, migration type, professional status, and job seniority. The participants were contacted by the main coordinator of the refugee resettlement organization. None of the forced migrants invited were still clients of the resettlement organization. The focus group discussion ultimately consisted of 12 people (including three trained moderators).

Given the small sample size of a focus group discussion and to uphold participant confidentiality and data privacy, we will describe participant demographic information in broader categories only. Of the twelve participating people, six were women and six were men (including moderators). The nine participants consisted of five women and four men. The ages of the participants ranged from 26 to 68 years. The group included three migrants and nine members of the local cultural groups.

Facilitators and moderators

Three researchers were present during the focus group discussion, with differing degrees of participation in the focus group discussion. A senior member of the research team acted as the main facilitator of the event, guiding and chairing the discussion. A second researcher acted as the moderator, introducing the topic as well as structured and follow-up questions. The third researcher was a participatory observant, who took notes and asked clarification as well as follow-up questions.

Acculturation partners

The societal partners who were involved in migrant acculturation were diverse in age, education, and profession. We invited both professional and volunteer workers and aimed to include the most relevant service providers for recent migrants. As a result, our societal partners worked in the fields of (language) education, naturalization, administration, politics, as well as cultural orientation. Our participants had a diverse set of responsibilities and worked as teachers and educators, coaches and counselors, administrators and coordinators, as well as volunteers and researchers. Notably, some of our participants fulfilled multiple roles in their work (e.g., language teacher and naturalization course coordinator, or administrator and volunteer).

Migrants

The three migrants were predominantly male and younger than the majority of the acculturation partners. The migrant group included two forced migrants and one voluntary migrant. The individual duration of residency was between four and five years, and both forced migrants were granted legal asylum status approximately three and a half years prior to the focus group study. None of the three migrants were fully naturalized at the time of the study. The countries of origin were Germany, Syria, and Sudan. We chose the three countries for their relative difficulty in adjusting to the Netherlands (in terms of cultural distance, as well as differences in literacy, education level, and reception). Two of the three migrants had some form of university education and two of the three migrants arrived alone while the third arrived with their family.

2.2.3 Study setting

The study itself was conducted in a university conference room. We chose the location as a neutral room for all parties, as an easily accessible building, and to retain control over the audio recording quality. We invited participants to join the focus group discussion in the early evening to accommodate the schedules of the working participants, and offered culturally appropriate food as compensation for the time the participants donated to the study. The focus group was conducted in Dutch, which was not the native language of the migrant participants. However, all three migrant participants had completed intensive language courses, and the moderators communicated clearly that non-Dutch responses were welcome during the discussion. A final note on the study setting is the use of local and colloquial terminology. The concept of psychological acculturation is commonly referred to as integration ("integratie" in Dutch) in Dutch society. To avoid confusion, we chose not to deviate from this common term.

2.2.4 Data collection

The focus group discussion was initiated by the senior facilitator of the research team. After an introduction of the topic and objectives, the facilitator informed the participants of their rights and obligations as study participants, and all participants gave oral informed consent (as approved by the ethics committee at the university of the main author). Following informed consent, the event was audio recorded, using four omnidirectional microphones. During the focus group discussion, we used a set of semi-structured questions to guide the discussion and ensure to cover all topics relevant to the research question. At the same time, using the semi-structured questions also allowed participants to highlight aspects of the acculturation processes that were important to them, independent of the research focus. To begin the focus group discussion, the participants were asked to introduce themselves shortly. We then opened the main discussion with a descriptive opening question ("How do you see integration in your daily life?"). The opening question was meant to offer practical initial access to the topic. The discussion then developed naturally

from this starting point, and the moderators only intervened when a topic was saturated or if the discussion straggled too far away from the main subject. A copy of the semi-structured questions that we prepared for such impediments is available in Appendix 2.A. In addition to the audio recordings, two of the three moderators also took field notes during the discussion as a secondary data source and to record nonverbal markers.

2.2.5 Data analysis

After the focus group discussion, our primary data sources were the audio recordings of the discussion. As our initial data preparation, we transcribed the full focus group discussion and added field notes. We then analyzed the text data using a content analysis with some phenomenological analysis elements. We chose a content analysis as our main analytical approach to explore the conceptual elements of psychological acculturation. We specifically chose an inductive content analysis, which is well suited for reporting common issues found in the data (Elo & Kyngäs, 2008; Vaismoradi et al., 2013). The analysis affords us a bottom-up, open, and broad understanding of the concept. We added to this a set of phenomenological analysis elements to capture contextual and systemic issues (Cresswell & Poth, 2018).

We used ATLAS.ti (v.08) to code the transcripts. The main author analyzed the text data in three coding cycles of (1) initial In Vivo coding using the participants' own words, (2) open coding inductively identifying common topics and elements, as well as (3) focused coding to group, categorize, and summarize the overarching themes. Please note that additional participant quotes are available in Chapter 3 but have been removed here to avoid repetitions.

2.3 Results

In the course of the open and focused coding, a clear pattern began to emerge, delineating the multifaceted dimensions of psychological acculturation in the Netherlands. Grounded in the rich qualitative data, we found that the narratives naturally coalesced around four salient experiential pillars: wanting (desire), feeling (affect), thinking (cognition), and doing (behavior). This is to

say that the narratives and discussions of the participants included *behavioral acculturation*, such as joining school or work activities, *cognitive acculturation*, such as dealing with issues of identity, *affective acculturation*, including feelings of depression or pride, and *motivational acculturation*, such as the wish to be competent or included. Importantly, these four pillars demarcated four qualitatively different experience aspects across a wide variety of narratives. Specifically, even though the four aspects were often overlapping and co-occurring, their distinct qualities comprehensively organized the narratives and shed light on the layered experiences of newcomers as they navigate their integration journey.

It should be noted that, while this structure emerged organically from the voices of participants, it dovetails seamlessly with our positionality as psychological researchers and the broader theoretical frameworks in social psychology. An affect, behavior, cognition, and desire structure is not uncommon in phenomenological research (often called an ABCD structure, Cottam, 2010; Hogg & Vaughan, 2005; Jhangiani & Tarry, 2014). Yet, its wide applicability all the more reaffirms the insights that such grounded discussions can offer to the conceptualization discourse of psychological acculturation. We, specifically, found a number of insights within each of the four experience aspects, as well as a set of broader observations about the structural qualities and applied utility of the four-fold ABCD structure in psychological acculturation.

2.3.1 Behavior

Behaviors, particularly outward actions and mannerisms, played a central role in the discussion. The participants brought up behavioral aspects of acculturation as the most visible manifestations of one's acculturation and as the aspect most clearly subjected to expectations by the dominant cultural groups. Participants particularly focused on social behaviors (such as language learning and contacts outside the home) as interactive and reciprocal elements of psychological acculturation because they enable connections to the culture and being "an active member of society". More than civic engagement (e.g., political-, or economic participation), individual interactions and social networking emerged as particularly pivotal components of the acculturation process.

2

Maria:

[Integration] means contact with people. That is very important. Because the people who come here, if they can't make contact with others, ... they aren't integrated. And that is, in my opinion, the hardest point in integration. From both sides, so to speak.

Importantly, all participants noted that contacts in the new environment essentially depend on reciprocity and quality. That is, firstly, contact is a two-way street and newcomers are not solely responsible for the interaction. And, secondly, the quality of interactions (and relationships) is more important than quantity — one does not necessarily need many interaction partners to be integrated (in terms of social contacts).

2.3.2 Cognition

Cognitive elements of acculturation — acculturation in thinking processes — surfaced when discussing understanding and navigating the new societal- and cultural context. Language-, social- and communication norms as well as learning about more formal social systems, values, and social rules were examples of how cognitive changes related to bridging social gaps and were seen as a form of healthy adaptation.

A second major focus on cognition was a clear assertion that acculturation is tied to identity developments. The newcomers pointed to both a break in identity (the struggle of defining oneself in the new environment) as well as the struggle of dealing with a singular (migrant or refugee) identity label and the process of developing a more complex identity narrative towards others. For the newcomers, developing a complex identity also related to a number of important changes in self-perception. These perceptions included a perceived connection with society, perceived purpose (a perception of being useful to society or others), and self-esteem.

Yahya:

[...] *Once I started my education, I felt part of society.* [...] *That was not the case when I was learning Dutch at the university, at the*

language school, or at other places before. Only later when I was at school, ... I feel: Okay, now I feel I am really in the Netherlands.

Joop:
Why did you not have that at the language school?

Yahya:
Because I was only a refugee.

2.3.3 Affect

What newcomers feel as they arrive in the new environment was a prominent theme in the focus group discussion because it foregrounded the importance of the subjective experience as acculturation. Instead of focusing on purely behavioral outcome conceptualizations (e.g., housing, job, education), the group highlighted the importance of considering the affective acculturation experience (e.g., feeling at home, feeling accepted). As an example, when asked why having a job is important to acculturation, newcomers and supporters pointed to a feeling of usefulness and being part of society.

The emotional aspect of acculturation was also highlighted due to the impact of its valence. While positive emotions such as pride in one's achievements and feeling accepted were described as a key acculturative bond, emotional stress, shame, anxiety, and depression were described as often causing an acculturative disconnect.

> Fariq:
> [...] *people are afraid to go to a psychologist or doctor and say, 'yes, I have a problem or something.' They feel ashamed. [...] They are depressed, and they have seen and heard a lot, ... bombs, ... I don't know. But it plays a very important role because they cannot integrate. So, they are depressed, and they are without energy, ... yes, ... someone who misses their mother or father or brother or ... knows what happened in the war. And that is a very important point in the integration as well.*

2.3.4 Desire

Desires — the motivational forces of the human experience — were likely the most insightful aspect discussed during the focus group discussion. The (lack of) motivation to interact with the new culture and its members was one key discussion point. However, motives for actions and psychological needs of the migrants were also discussed as more impalpable properties of other acculturation aspects (e.g., the need for acceptance during interactions). Yet, importantly, the motivational aspect also highlighted the functional essence of individual acculturation. Many needs are not necessarily expected by the dominant group, but are intrinsic and fundamental to the health and functioning of the newcomers during the acculturation process. Examples of such essential needs included the need for interactions, to be understood, for purpose, and for identity continuity.

This functional character was also highlighted in instances where need fulfillment might be a precarious balancing act. The volunteers and coaches, for example, pointed to conflicting needs for sufficiency and independence. While initial dependence on supporters and volunteers is unavoidable, the ultimate goal should be to foster independence and self-sufficiency, and ultimately cooperative interdependence.

> Jojanneke:
> *And I do hope that the goal in doing so is always to make people, well, not necessarily as quickly as possible, but certainly at a reasonable pace, self-sufficient in a less dependent way. I think that also does a lot with your self-worth...*

2.3.5 Functional structure

While there are likely a number of other ways in which the narratives and discussion points of the focus group discussion could be organized, we would like to highlight a number of functional and structural characteristics that have additionally compelled us to focus on the ABCD structure.

One key reason why the ABCD structure stuck out to us during the analysis was that the participants harshly contrasted the more external behavioral and

cognitive aspects of acculturation to the more internal affective and motivational aspects of acculturation. During the initial phase of the focus group discussion, the participants primarily focused on behavioral aspects of acculturation (e.g., work, school, language learning) as well as cognitive aspects of acculturation (e.g., cultural and navigational knowledge, values). Participants pointed to these aspects because they are often publicly discussed and relevant to everyday life interactions with the local cultural groups. However, as the focus group discussion continued, participants strongly emphasized that the more external aspects are only one side of acculturation. Especially when it comes to healthy adaptation and adjustment dealing with emotional stressors, feeling at home and welcome (i.e., affective acculturation) but also dealing with conflicting needs, wishes, and aspirations (i.e., motivational acculturation) is essential — not only to enable cognitive and behavioral acculturation but as aspects of acculturation in themselves. The participants emphasized that because these aspects are more internal, they are often the "*forgotten side of integration*" (Geert). The ABCD structure, thus, jumped out to us in service of highlighting the strong contrast between external and internal aspects of acculturation.

> Fariq:
> *Sometimes, I don't feel open to the people here, and when you don't understand the language well, you may think everyone is closed off. But after learning the language, you start to see whether people are open or not.*

In a similar vein, the four experience aspects also stood out to us because they highlighted that each of the four acculturation aspects also had corresponding challenges in everyday life (as well as corresponding advantages to some extent). As an example, in terms of behavioral acculturation, the participants highlighted a number of bureaucratic burdens and difficulty meeting new locals while also dealing with family and work obligations. Cognitive acculturation challenges, for example, included difficulties in acquiring navigational knowledge, such as information on the differences in education- and civic systems. In terms of affective acculturation, participants, for example, highlighted the

challenges of dealing with trauma, stress, and depression. And such challenges are often exacerbated when locals are "*stiff and distant*" (Sam), making meaningful connections more difficult. In terms of motivational acculturation, participants highlighted, among others, the challenges of managing conflicting needs and adjusting work or social goals. Such examples highlighted that the four-fold structure revealed a very applied utility of organizing everyday advantages and challenges that many migrant narratives included.

> Jasper:
> *Well, yes, but I tell them: You »must« complete your naturalization within 3 years. You have to.*
>
> Amaal:
> *Not everyone can do it like that, you know. Not everyone can just learn the language so quickly. People are different and ...*
>
> Jasper:
> *No, but if we don't complete it in 3 years, you get a fine.*

2.4   Discussion

The main focus of our analysis of the group discussion was to investigate conceptual aspects of psychological acculturation from a bottom-up and practiced starting point. We identified the affect-behavior-cognition-desire distinction as a structuring lens for the discussion of acculturation by practitioners and migrants.

The focus group discussion specifically highlighted that beyond the commonly considered cognitive and behavioral adjustments to social norms, language, and work, positive migration experiences also critically depend on more internal processes of the migrant. The participants describe that migration experiences can only fully be understood when we also consider identities, emotional experiences, and psychological goals (e.g., Levy et al., 2017). Importantly, the strong contrast the participants placed on the distinction between more visible and more hidden parts of the experiences carved out a potential experience-based perspective to understanding the abstract concept.

The ABCD structure captured not only the core aspects of the experience but also helped in organizing the challenges of migration. Each of the four aspects was associated with its own set of challenges. Some are more closely related to external expectations by the majority groups — especially when it comes to behavioral adjustments at work and within the local bureaucratic system. Other challenges were more internal — when dealing with conflicting cultural needs or more complex identity issues.

Beyond the functional properties of exploring the internal and the external, the advantageous and the challenging, the ABCD structure was also compelling to us in our analysis because of its elemental and comprehensive scope. We set out with the aim of finding a higher-level structure that would help us organize the many conceptual elements of psychological acculturation in everyday life. Because wanting, feeling, thinking, and doing are such fundamental human capacities that generally encompass the human experience (e.g., Jhangiani & Tarry, 2014), the structure also helped us disentangle different types of individual differences. Participants during the discussions emphasized the significance of recognizing the unique and multifaceted journey and that "*people are different*" (Amaal). It became evident that a singular approach does not account for the richness and complexity of the acculturation experience. By recognizing the different ABCD aspects of the experiences, the structure aided us in giving space to the different facets of the narratives. This was true for group-based differences — where newcomers from a country with lower literacy might struggle more with behavioral bureaucratic and language learning challenges, while newcomers arriving from a war-torn region might experience a stronger emotional disconnect because of trauma and stress responses. But similarly, the ABCD differentiation also helped in highlighting inter- and intra-individual differences — where one person might have an easier time dealing with cognitive value differences because of their inquisitive temperament or fewer family obligations.

Importantly, however, for the ABCD structure to provide space, the experience aspects should be seen as a broad and overlapping structure rather than a deterministic cage (Kreienkamp et al., 2023h). That is to say that although everyone has the capacity for affect, behavior, cognition, and desire, not every-

one feels, does, thinks, and wants the same things (also see the discussion on cultural universalism in Berry, 2009). Similarly, in most (but definitely not all) cases the migration experiences included multiple, deeply intertwined ABCD aspects. A cognition might have an affective value or an action is goal-directed. In short, the ABCD structure stuck out to us because the distinct quality of each of the wanting, feeling, thinking, and doing aspects helped us recognize the complexity of the migration experience while also providing words to have a shared understanding of the different aspects involved.

2.4.1   Limitations

In any research, inherent constraints arise from methodological and contextual choices. It is crucial to acknowledge these to ensure the study's transparency and to guide future inquiries. Below, we outline four key limitations of our investigation.

Our study's methodology focused on a singular focus group discussion, which inherently brings about certain limitations. The participants were drawn from a small, local sample, which while rich in detail and depth, may not represent the broader migrant population in the Netherlands and beyond. While focus groups provide the benefit of interactive discussions and spontaneous responses (Miles et al., 2020), individual interviews or diary studies can add more personalized experiences, deeper introspection, and unique challenges faced by migrants on an individual basis (Cresswell & Poth, 2018). Thus, while our findings are transferable to similar contexts, they are not generalizable to the entire migrant population in the Netherlands or elsewhere (e.g., see Hillekens et al., 2023). Future studies might further explore the generalizability of the general structure and the insights generated from it. Given the fragmented state of the literature, we particularly call for further literature embedding of the four-fold structure and encourage a structured applicability test of the framework within the acculturation literature.

Our study utilized a content analysis, a systematic and replicable approach for coding and interpreting textual data (Saldaña, 2009). We chose this method for its rigor and clarity, which enabled a focused examination of the data (Miles et al., 2020). However, it is important to recognize that content analysis is

but one lens through which to view the rich tapestry of acculturation. Additionally, only the main author of the article performed the content analysis. This is the most common approach for qualitative content analysis, and we have ensured credibility, dependability, and transferability by co-researcher agreement for the research methods, unit of analysis, and themes (Graneheim & Lundman, 2004, also see our 'Methods' section above). Nonetheless, future research could benefit from employing alternative methodologies to uncover additional nuances and subtextual themes within migrants' experiences (e.g., see Iosifides, 2016). Future studies could enrich this understanding by incorporating alternative analysis methods, such as thematic analysis to uncover deeper underlying themes (Braun & Clarke, 2006), or discourse analysis for a more nuanced understanding of language use and social context (Gee, 2014). These complementary analytical approaches can offer a broader and more diverse perspective on the migrants' experiences, thereby enhancing the depth and breadth of insights in this field.

The ABCD framework of affect, behavior, cognition, and desire provided a comprehensive structure for psychological acculturation. However, some experiences and challenges associated with migration might not be entirely captured within this framework. Notably, the role of physical health and the accessibility of healthcare systems were significant topics of discussion among participants (e.g., the bio-psycho-social model, Engel, 1997). Importantly, however, while these elements are not explicitly captured by an ABCD model, the psychological experience of physical or contextual aspects is captured within the affective, cognitive, motivational, and behavioral aspects. It is worth noting that such intricacies and external factors might necessitate a broader or modified ABCD framework for a more encompassing understanding. Such a framework should be more broadly situated within the acculturation literature and might need empirical validation across bodies of literature (e.g., Arksey & O'Malley, 2005).

Finally, we would also like to acknowledge that the research process, especially during analysis, was influenced by our own positionality (Corlett & Mavin, 2018). Two members of our research team are migrants themselves, which may have brought both unique insights and potential biases into the interpretation of the data (Bhopal & Deuchar, 2020) — a notable example is our strong focus on the migrant's perspective rather than the receiving so-

ciety. Our structuralist approach, rooted in our background as psychologists, guided the way we framed questions, interpreted responses, and structured our analysis (Muhammad et al., 2015) — including our focus on the broader ABCD structure. While our positionality provided depth and coherence, it also naturally introduced specific focal points and potential blind spots that another theoretical or disciplinary perspective might not have.

Recognizing these aspects of our research, we commit to transparency in our process and findings. We encourage future studies to engage with diverse theoretical frameworks, such as intersectional analysis or cross-cultural psychology, to illuminate aspects our structuralist approach may have overlooked. In particular, we advocate for future research to develop a robust and comprehensive conceptual framework that encapsulates a wider range of factors influencing migrant experiences. Additionally, there is a critical need for longitudinal studies that track real-world acculturation trajectories over time, providing insights into how these experiences evolve and interact with various societal dynamics. Such an approach will complement our current findings and offer a dynamic and in-depth understanding of the ongoing process of acculturation, contributing significantly to the field's depth and practical relevance.

2.5   Conclusion

The qualitative analysis of the focus group discussion revealed a rich tapestry of experiences, showcasing affective, behavioral, cognitive, and desire (ABCD) dimensions of the acculturation process. With these four aspects, the participants described the full breadth of the human experience — from the most internal motives and goals through emotional experiences, and cognitive challenges, to the most visible public behaviors.

The focus group discussion highlighted that the migration experience itself might offer a conceptual perspective and showed that taking the descriptions of the lived experiences clearly demarcated distinct aspects that jointly form the full adjustment process.

Ultimately, the narratives of the participants suggest that focusing on what people want (desires), feel (affect), think (cognition), and do (behavior), might

offer a practical, bottom-up, and inclusive structure to the concept of psychological acculturation. Through the lenses of these four conceptual structures, the focus group discussion has enriched our understanding of the migration experience, paving the way for more informed, targeted theories, investigations, and interventions to support newcomers in their journey of psychological acculturation.

Appendices

Appendix 2.A   Materials: Semi-structured question guide

The following questions form the guiding structure of the focus group discussion. All three moderators received a copy of these questions to guide the discussion. We placed a particular focus on giving space to the natural discourse of the discussion and only referred back to these questions if a topic was saturated or the discussion digressed from the main topic too much.

Next to the introductory section, the opening question, and the exit question, we organized the prepared questions around four topics: (a) the conceptual aspects of acculturation, (b) challenges to acculturation, (c) best practices of acculturation, and (d) the measurement of acculturation. While differing in abstraction and approach, all questions were aimed at exploring the conceptualization of psychological acculturation.

Welcome:
- General introduction of the project
- Aim of evening
- Informed consent

Introduction participants:
- Name
- Background

Opening Question:
(1.) How do you see integration in your daily life?

Aspects / Elements:

(2.) What does integration mean to you?

Clarification: Based on your experience, what are the most important aspects of integration?

Alternative formulation: What does successful integration look like to you?

(3.) Who should be involved in integration?

Follow-up question: What roles do these groups have?

(4.) What do you expect from refugees and what from Dutch people?

Clarification: What can Dutch society do?

Alternative formulations: How are the Dutch influenced by integration? How can the Dutch contribute to integration? What is the role of the Dutch in integration?

Challenges:

(5.) What are the biggest challenges for refugees coming to the Netherlands?

Alternative formulation: What doesn't work so well?

Follow-up question: What is the biggest challenge to (becoming a part of Dutch culture / or another key element identified earlier)?

(6.) What are the biggest challenges for Dutch people who receive refugees?

Support:

(7.) What works well?

(8.) How can we facilitate integration?

Alternative formulation: How can we improve integration?

Measurement question:

(9.) What should we absolutely ask/include in the survey?

Alternative formulations: What aspects of integration should we pay attention to if we want to measure integration? What should we not miss? From your experience what is the most important question (to add to a survey)?

(10.) Which challenges do you see for measuring integration?

Exit question:

(11.) Is there anything else you would like to say?

Chapter 3

The migration experience: A conceptual framework and systematic scoping review of psychological acculturation

Abstract

One of the key challenges to researching psychological acculturation is an immense heterogeneity in theories and measures. These inconsistencies make it difficult to compare past literature, hinder straightforward measurement selections, and stifle theoretical integration. To structure acculturation, we propose to utilize the four basic aspects of human experiences (wanting, feeling, thinking, and doing) as a conceptual framework. We use this framework to build a theory-driven assessment of past theoretical (final N = 92), psychometric (final N = 233), and empirical literature (final N = 530). We find that the framework allows us to examine and compare past conceptualizations. For example, empirical works have understudied the more internal aspects of acculturation (i.e., motivations and feelings) compared to theoretical works. We, then, discuss the framework's novel insights including its temporal resolution, its comprehensive and cross-cultural structure, and how the framework can aid transparent and functional theories, studies, and interventions going forward.

Public Abstract: This systematic scoping review indicates that the concept of psychological acculturation can be structured in terms of affect (e.g., feeling at home), behavior (e.g., language use), cognition (e.g., ethnic identification), and desire (e.g., independence wish). We find that the framework is useful in structuring past research and helps with new predictions and interventions. We, for example, find a crucial disconnect between theory and practice, which will need to be resolved in the future.

Keywords: Psychological Acculturation, Experience, Framework, Systematic scoping Review

Data Availability: Source data and software are available at https://github.com/JannisCodes/acculturation-review (Kreienkamp et al., 2022c). Protocols, materials, analysis data, and code are available at https://osf.io/n587w/?view_only=3e8aed00f2d34942bd5d2f3a710e0de4 (Kreienkamp et al., 2022d).

Open Science Practices: ⬡ Open Materials, ⬡ Open Data, ⬡ Open Code, ⬡ Open Supplements

The question of how people change when they get into continuous first-hand contact with other cultures is likely as old as the history of human migration. And also today, migration adjustment remains an important issue for many societies around the world. Over the past 80 years, researchers of the psychological sciences have proposed hundreds of models and measurements for this phenomenon of "psychological acculturation" (Rudmin, 2003). Yet, despite enormous theoretical and empirical advances, it remains unclear what psychological acculturation exactly entails and a conceptual framework allowing for a synthesis of the past literature on psychological acculturation is still missing (Birman & Simon, 2014).

We find an illustration of this challenging heterogeneity in the use of prominent theories of psychological acculturation. One prominent approach has been to conceptualize psychological acculturation as a two-dimensional set of orientations towards the heritage- and the dominant culture — Berry's (1980, 1997b, 2005) now famous 'acculturation orientations'. However, over the past 40 years, Berry himself has used various attitudes (i.e., preferences) and behaviors (i.e., actual activities) to describe what these orientations should entail (Berry, 2005). And a broader review of the theory found that other researchers had conceptualized and measured 'acculturation orientations' with even more diverse aspects. Conceptualizations had, for example, included attitudes, attachments, goals, identifications, or choices and uses of cultural elements (e.g., language, food, or dresses. See, Rudmin, 2003). We see a similar pattern with conceptualizations of psychological acculturation as a 'psychological and socio-cultural adaptation' process. Here, cultural adaptation has, for example, included aspects such as life satisfaction and well-being, as well as cultural skills, and work performance (Berry, 2003; Searle & Ward, 1990; Ward, 2001). Measurements of psychological acculturation are, thus, inconsistent across studies, and it remains unclear what aspects the concept exactly entails, and how these aspects are organized.

This heterogeneity of aspects presents fundamental challenges to researchers, practitioners, and policy-makers in the field. Looking back at past theories and measures, different conceptualizations might lead to different results (Snauwaert et al., 2003) and the diversities of included or excluded concepts

makes it virtually impossible to compare different studies — which makes it difficult to integrate them quantitatively or qualitatively (Taft, 1981). And looking forward, it remains difficult to select acculturation elements and develop new theories and measurements. A coherent conceptual framework would be necessary to make informed and transparent choices about which aspects are (ir)relevant to a given research question and how they relate to one another as a psychological process. Given these challenges, some have even suggested that psychological acculturation should not be measured until common terminologies and frameworks are available (Escobar & Vega, 2000).

We have, thus, developed a descriptive conceptual framework to disentangle, compare, and organize the many conceptual elements found within the literature. In this paper, we describe how this framework was developed based on recent developments within the literature and how the framework gives space to the complexities of psychological acculturation. We then apply the framework in a systematic scoping review of the literature to examine its utility and identify gaps within the literature. The proposed framework, thus, has a different objective than previous efforts which have cataloged literature on acculturation (e.g., Castles et al., 2003), built multidimensional measures of integration (e.g., Harder et al., 2018), normative frameworks (e.g., Ager & Strang, 2008), or theories of acculturation (e.g., Berry, 2005). Rather than offering a new measurement, definition, or theory, we aim to build a framework to assess, organize, and compare these conceptual elements.

To build a framework that enables the contextual complexity of psychological acculturation while structuring the concept across a wide range of contexts, we propose utilizing the basic aspects of human experiences. Bringing together the rich empirical literature and building on past reviews, we propose that the psychological acculturation experience can be understood in terms of affects, behaviors, cognitions, and desires. Psychological acculturation in this framework might, for example, be understood or measured in terms of behavioral acculturation, such as language use or voting; cognitive acculturation, such as ethnic identification, or cultural values endorsement; affective acculturation, such as feeling at home or loneliness; motivational acculturation, such as satisfaction of competence or independence needs; or as a combination of any or all of these aspects (also see Table 1 for a range of example concepts).

Such a framework, thus, explicitly aims to allow researchers and practitioners to review past acculturation literature based on the aspects considered. As a result, researchers can consider broader integration efforts and novel predictions of how acculturation processes develop psychologically. Moreover, the affect, behavior, cognition, desire separation allows researchers to make clearer and more transparent decisions about which aspects of acculturation are relevant to their research question and which aspects they measure. Similarly, practitioners can use the framework to make more informed decisions on which aspects are relevant for policy development and intervention design.

Importantly, this structural effort seeks to showcase the conceptual complexity and gives space to contextual idiosyncrasies rather than diminishing or reducing migration experiences. We hope to give prominence to the diversity of conceptual aspects that are relevant to the lived realities of migrants and other acculturating individuals. We offer the ABCD framework as a transferable structure to transparently address the similarities and shared mechanisms but also highlight the complexity and diversity of the full migration experience.

In the following sections, we will develop this framework in more detail and will then apply it in a systematic scoping review of the past theoretical, psychometric, and empirical literature on acculturation.

3.1 Framework development

This framework explicitly emerged from recent empirical and theoretical developments within the acculturation field in particular and the psychological phenomenological literature more broadly. We benefit from a strong theoretical tradition in the field and the broader conceptual framework we propose arguably brings together many of the past advances in capturing psychological acculturation at different levels of conceptualization. To adequately situate the conceptual framework within the past theoretical and empirical efforts, we will first briefly address our phenomenological approach and then introduce each of the experience aspects as they emerge from the literature on psychological acculturation. As a final step of the framework development, we will discuss which functional characteristics the framework highlights and how these functional elements integrate past theoretical advances.

3

Table 1: Examples of Coding Levels for the Experience Framework of Psychological Acculturation.

Aspect	Construct	Concept	Operationalization
Affect	Moods, Emotions, Feelings	Loneliness, Feeling at home, Satisfaction with life, Pride, Joy, Ease, Worry, Trust	"I feel ...", "My mood ....", "I enjoy ..."
Behavior	Activities, Habits, Mannerisms	Language use, Civic participation, Performance, Media consumption, Peer contacts, Food consumption, Delinquency, Marriage	"I do ...", "I speak ...", "I meet ..."
Cognition	Knowledge, Memories, Evaluations	Ethnic identification, Cultural values, Acculturation orientation, Knowledge, Importance ratings, Perceived obligations, Beliefs, Stereotypes	"I prefer ...", "I think ...", "I identify as ..."
Desire	Needs, Goals, Wants	Competence, Independence, Self-coherence, Belonging, Achievement, Justice, Growth, Respect, Acceptance, Identity continuity	"I want ...", "I would like to ...", "I need ..."

Note. Some of the concepts might include multiple experience aspects depending on the context.

3.1.1   A phenomenological perspective

There is a converging theoretical consensus that human experiences can fundamentally be understood in terms of wanting, feeling, thinking, and doing (sometimes referred to as the ABCs or ABCDs of psychology: affect, behavior, cognition, desire; e.g., Cottam, 2010; Hogg & Vaughan, 2005; Jhangiani & Tarry, 2014).[1]   Following the premise that any human experience can be conceptualized within these four basic aspects, we believe that an ABCD framework of psychological acculturation could offer a comprehensive and theory-driven framework to structure and analyze the many conceptual elements of psychological acculturation.

However, given the prevalence of ABC(D) structures within the psychological literature in general, it is important to ask how the affect, behavior, cognition, and desire aspects are conceptually relevant to psychological acculturation in particular. To address the conceptual relevance of the four aspects, we look at two common definitions of (psychological) acculturation to identify the conceptual contexts of psychological acculturation. Firstly, the Social Science Research Council originally defined the broader concept of *acculturation* as:

Definition 1 (Acculturation)
Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original culture patterns of either or both groups.
                                                    — *Redfield et al., 1936; p. 149*

From the broader concept, the individual level experience of *psychological adaptation* — which is the focus of the present framework — has commonly been further specified as:

---

[1]It should also be noted that ABC(D) frameworks have been used effectively to structure theories and models across a wide variety of fields — including research on attitudes (Breckler, 1984) and ambivalence (van Harreveld et al., 2015), the self (Côté, 2009) and self-regulation (Ben-Eliyahu & Linnenbrink-Garcia, 2015), the big five personality traits (Wilt & Revelle, 2015), suicidality (Harris et al., 2015) and in clinical interventions (Eifert & Craill, 1989). Interestingly, the affect, behavior, and cognition structure has even found application in the development of human-like machines (Guo et al., 2020).

3

Definition 2 (Psychological Acculturation)

Psychological acculturation refers to the changes an individual experiences as a result of being in contact with other cultures, or participating in the acculturation that one's cultural or ethnic group is undergoing (Graves, 1967).

— *as cited in Sam et al., 2006; p. 14*

Within both of these definitions, psychological acculturation, thus, fundamentally comprehends any individual changes as the result of cultures and contacts. The different types of individual-level *phenomena* and *changes* are the topic of this framework, but the prerequisites of *culture* and *contact* are central to understanding how the psychological experience emerges. We will, thus, briefly discuss how we conceptualize cultures and contact within the framework and how that aligns with the ABCD structure of the individual experience.

Culture

To discuss the role of cultures, we will look at one last definition. In this framework, we follow the approach refined by Adams and Markus (2004), which defines cultures as cultural patterns:

Definition 3 (Culture)

Culture consists of explicit and implicit patterns of historically derived and selected ideas and their embodiment in institutions, practices, and artifacts; cultural patterns may, on one hand, be considered as products of action, and on the other as conditioning elements of further action. (based on Kroeber & Kluckhohn, 1952, p. 181).

— *as cited in Adams and Markus, 2004; p. 341*

This definition highlights a number of features that are central to our efforts of conceptualizing psychological acculturation. In particular, the definition emphasizes that cultural patterns (1) are dynamically changing over time (i.e., are historically derived), (2) are agentically re-produced (i.e., selected ideas), and (3) dualistically reside both in the individual (i.e., who produces the patterns) as well as the physical and social context (i.e., which embodies and conditions; Adams & Markus, 2004). As such, the definition follows the general tenets that are shared by many theoreticians within the acculturation field

(e.g., see Berry, 2009; Ward & Geeraert, 2016). At the same time, however, in empirical practice models of acculturation have often focused on cultures as static, externalized influences (e.g., see the commonly (mis-)used models of Berry, 1997b, 2006). We argue that affects, behaviors, cognitions, and desires connect the external embodiments and conditionings of cultural patterns with the individual choice of which cultural patterns will be reproduced.

Within the sociological literature, the external social influences of cultures can be divided into formal social facts (e.g., laws, regulations, policies, history, language), informal social facts (e.g., norms, values, beliefs, rituals, customs; also see Herzog, 2018), as well as more material cultural products or artifacts (e.g., food, fashion, architecture, or arts, such as film, music, literature, and fine arts; e.g., see Alexander & Smith, 2001). The content of these external influences often formally or informally embodies expected patterns of behavior (e.g., dress or communication styles), cognition (e.g., sense of race-, class-, gender-, and sexual identities), emotions (e.g., expressions of emotions), and motivations (e.g., virtues and duties).

At the same time, however, affect, behaviors, cognitions, and desires also drive what we consider 'cultures' to be (e.g., Varnum & Grossmann, 2017). Cultural knowledge, values, identities, beliefs, and attitudes are likely the most widely discussed aspects of non-material cultural patterns (i.e., cognitions; e.g., DiMaggio, 1997), several indigenous cultural practices are legally protected as manifestations of culture (i.e., behaviors; e.g., Art. 11 United Nations, 2007), shared emotions are an integral part of culture creation in narratives (i.e., affects; e.g., Ahmed, 2014; Kitayama & Markus, 1994; Smith, 2016; Sundararajan, 2015), and motivational ideals or oughts form the basis of many cultural discussions (i.e., desires; see Markus & Kitayama, 1991).

In the case of psychological acculturation, a migrating individual needs to deal with (at least) two sets of cultural patterns — the heritage cultural patterns and any local cultural patterns (e.g., Ferguson & Bornstein, 2015). The individual will, thus, have to negotiate their individual response to the expectations of the cultural patterns of their new context and their own personally held cultural patterns. These individual responses in affects, behaviors, cognitions, and desires thus impeccably connect internal and external cultural patterns

as they actively evolve (also see the psychological foundations of culture, in Adams & Markus, 2004). In other words, the psychological acculturation experience (i.e., the individual experience of ABCD) captures the adjustment to tension as a result of different patterns of internal, shared, and embodied affects, behaviors, cognitions, and desires. Moreover, studying psychological acculturation in the experience framework then also allows us to reflect on which cultural patterns are in positions of power (Bhatia & Ram, 2001).

Additionally, affect, behavior, cognition, and desire have all been highlighted in the conceptualization of human functioning and adaptation to conflicting cultural patterns — a core outcome for many acculturation researchers (e.g., see Berry, 2006; Maertz et al., 2016; Searle & Ward, 1990; Ward, 2001). Adaptation in such an understanding can include, behavioral adaptions, such as building skills and competencies (e.g., Bevan, 1965), cognitive adaptation, including self-image restorations and dissonance reductions (e.g., Czajkowska, 2017), affective adaptions, such as dealing with feelings of culture shock and homesickness (e.g., Smith & Lazarus, 1990; van Tilburg et al., 1996), as well as desire adaptations, such as regulations of status and affection needs (e.g., Steverink & Lindenberg, 2006). In short, affects, behaviors, cognitions, and desires not only form the fundamental aspects of human experiences but also connect the external and internal cultural patterns in such a way that they showcase the nuances of dynamic, agentic, and adaptive (re-)productions of the cultural patterns that underlie acculturation.

Contact

Beyond the cultural contextualization, it is also important to consider the contacts that drive cultural adaptation. One way of structuring the situational contact contexts is what we will here refer to as the *domains of psycho-social functioning* — the idea that the social experience will take place within different domains in life. Several social-scientific theories have discussed these spheres of life. One famous example is Bronfenbrenner's Ecological systems theory (Bronfenbrenner, 1992), according to which humans get into contact with others, and society at large, through environmental systems that range from

the closest relations (e.g., family or colleagues) to the more remote relationships (e.g., media or societal services). A similar framework was suggested by prominent theorists of the (structural) functionalist traditions with the concept of social institutions (e.g., Turner, 1997). According to these sociological theorists, it is through societal institutions (commonly: family, government, economy, media, education, healthcare, and religion) that cultural patterns are transmitted and maintained (e.g., Durkheim, 1982). Similar ideas for domains of interaction with society and culture have also been proposed within the acculturation literature. Arends-Tóth and van de Vijver (2006b, 2007) have, for example, suggested 15 public and private life domains (e.g., education [public], child-rearing [private]) in which cultural contact takes place. Empirical research in the individual acculturation field has also provided evidence that acculturation processes can develop separately and differently within these contact domains (e.g., Arends-Tóth & van de Vijver, 2003).

Importantly for our framework, these situational domains afford different affects, behaviors, cognitions, and desires. The contact domain and situation structure which experiences are appropriate or even possible (e.g., Cantor, 1994). These situational affordances can be physical, where certain cultural patterns are not possible (e.g., localized ancestral worship Kawano, 2005; Schmidt et al., 2022); formal, where certain cultural patterns are not allowed (e.g., indigenous hunting practices Blaser, 2009); or informal where certain cultural patterns are not wanted (e.g., discrimination of black hair Robinson, 2011). Also, more implicitly, empirical studies have, for example, found that cultural contexts differ in the frequency and variety of situations that afford different types of negative social emotions (Boiger et al., 2013). Situational affordances, thus, interact with cultural norms and patterns to allow for specific acculturation experiences. These situational affordances in a cultural space then also highlight how power over the situation translates into power over the experiences of acculturating individuals (e.g., Guinote, 2008). More broadly, the individual experience of affect, behavior, cognition, and desire as psychological acculturation is embedded within contact structures and captures the situational affordances.

Similarly, affect, behavior, cognition, and desire are also embedded within the literature on inter-group and inter-cultural contact more broadly. How and why people get into behavioral contact with people from other backgrounds has, for example, been linked to group-specific needs, and desires, such as power and acceptance (e.g., Hässler et al., 2021; Shnabel & Nadler, 2008). Similarly, outcomes of these interactions are often governed by inter-group cognitions, such as perceptions of threat or shared identities (e.g., Dovidio et al., 2017; Stephan et al., 2000) and inter-group emotions, including pride, or anxiety (e.g., Iyer & Leach, 2008; Stephan & Stephan, 1992). Affect, behavior, cognition, and desire are, thus, also at the very heart of contact with different cultural contexts.

In short, the individual affect, behavior, cognition, and desire aspects are generally well-equipped to address the prerequisite contextual elements of acculturation. In the next sections, we will focus in on the individual psychological acculturation experience and discuss how each of the psychological aspects emerged out of the empirical and theoretical developments within the field.

3.1.2 Affect, behavior, cognition, and desire within the acculturation literature

Interestingly, the ABC structure is not entirely foreign to the field of acculturation. Ward and colleagues (Masgoret & Ward, 2006; Ward, 2001; Ward & Szabó, 2019) have previously pointed out that theoretical perspectives on acculturation tend to focus on affect, behavior, or cognition. Within the affective tradition, Ward situates the stress and coping literature, behavioral traditions are the cultural learning theories, and social identification theories form the cognitive theories. Sam (2006) has even noted that such a perspective might be useful in structuring the core components of psychological acculturation more broadly. Following Sam's (2006) suggestion, we propose that, once we include desires (i.e., motivational literature), we can build a generalized conceptual framework. That is to say, the full ABCD structure would not only summarize theoretical traditions but would offer a theory-based framework for the conceptual elements because it comprehensively structures the concept based on the fundamental aspects of a culturally embedded contact experience.

Such a framework should structure psychological acculturation at any level of abstraction — from the most abstract theory level to the most applied operationalization level.

Given the centrality of the four aspects to the framework, we will briefly discuss how each of the four aspects are reflected in recent debates within the literature on psychological acculturation. To illustrate how the conceptual ideas are embodied in lived realities, we will additionally provide emblematic quotes from a focus group we conducted as part of the broader project. The focus group discussion is not an empirical part of the framework but rather offers an illustration of the real-world relevance of the individual aspects (the full account of the focus group discussion is available as a separate publication by Kreienkamp et al., 2023g).

Behavior

Behaviors — that is actions and mannerisms — are often the most overtly and externally visible aspect of the human experience. As such, especially social behaviors (e.g., language learning and contacts outside the home) are visible and reciprocal elements that are deeply connected to cultural contacts (e.g., Imai et al., 2016; Legare, 2019; Whiting, 1980).

> Maria:
> [...] *while, of course, you integrate best when you go to work.*
>
> Moderator:
> *Why is that exactly?*
>
> Maria:
> [...] *Because there you have daily contacts with locals.*

Given the overt nature of behaviors and their interconnectedness with cultural patterns, behaviors have also been a prominent aspect in the acculturation literature. Ward and colleagues (2019) in their review have identified cultural learning theories as one key literature tradition that has focused on behavioral aspects of acculturation. They relate these learning theories to the acquisition of effective skills and competences as the behavioral operationalizations (including, verbal and non-verbal communication skills Ward, 2001). Other

examples of behavioral conceptualizations of acculturation (beyond Ward's focus), include civic participation (e.g., voting; Lessard-Phillips et al., 2020), inter-ethnic marriage (e.g., Song, 2009), and media consumption (e.g., Shoemaker et al., 1985).

Cognition

> Yahya:
> [...] *Once I started my education, I felt part of society. [...] That was not the case when I was learning Dutch at the university, at the language school, or at other places before. Only later when I was at school, ... I feel: Okay, now I feel I am really in the Netherlands.*
>
> Joop:
> *Why did you not have that at the language school?*
>
> Yahya:
> *Because I was only a refugee.*

Cognitive aspects, which commonly entail the thinking processes of the human experience, often underlie navigational cultural competencies and social identities in dealing with conflicting cultural patterns (Padilla & Perez, 2003). Language-, social- and communication norms as well as learning about more formal social systems, values, and social rules are examples of how cognitive changes related to bridging social gaps (e.g., Gelfand et al., 2011; Nisbett & Norenzayan, 2002). Similarly, both a break in identity (the struggle of defining oneself in the new environment) as well as the struggle of dealing with a singular (migrant or refugee) identity label and the process of developing a more complex identity narrative towards others are applied examples of how cognitions sit at the forefront of adapting to conflicting cultural patterns (e.g., Verkuyten & Martinovic, 2012).

Given the pertinent connection between cultural patterns and cognitive processes, cognitions have also played a major role in the theoretical acculturation literature. Within the cognitive tradition, Ward and colleagues (2001, 2019) have identified ethnic identity and group perception theories, with a particular

focus on Berry's (1997b) acculturation attitudes. Beyond the theories identified by Ward, the acculturation literature has recently also focused on several other cognitive conceptualizations of psychological acculturation, including cultural values (e.g., Marín & Gamba, 2003) and stereotypes (e.g., Stanciu & Vauclair, 2018).

Affect

> Fariq:
>
> [...] *But for me, the language is very very difficult. And then you think people are not open. And you don't understand because your language isn't that good. And then I maybe don't feel welcomed when I have questions or want to approach them.*

Affect — the human capacity to feel (including emotions and moods; Feldman Barrett et al., 2007) — foreground the importance of the subjective experience as acculturation (Holodynski & Friedlmeier, 2012). Instead of focusing on purely behavioral outcome conceptualizations (e.g., housing, job, education), affective acculturation experiences (e.g., feeling at home, feeling accepted) highlight the individual embeddedness components of healthily adapting in a new social environment (Mesquita et al., 2016).

The functional character of affect and emotion have also been discussed within the conceptual acculturation literature. Ward (2001) in her review of the acculturation traditions, describes the stress and coping literature — especially Berry's concept of acculturation stress (Berry, 1997b) — as the affect component of acculturation. In this tradition, the main constructs that constitute the affective dimension are the psychological and emotional well-being as part of the psychological adaptation process (including, for example, life satisfaction and depression; Ward & Szabó, 2019). However, beyond the theoretical stress literature tradition, there are also more immediate models and measurements of emotional acculturation. There is, for example, a relatively young tradition of 'emotional acculturation' as a distinct concept in which acculturation is understood as the similarity in emotional patterns (see de Leersnyder, 2017, for a review). But also individual emotions, such as 'feeling

accepted' (Jasini et al., 2018), or 'pride' (Suinn et al., 1995) have received attention as discrete conceptualizations of acculturation.

Desire

> Yahya:
> [...] *Yes, they [parents] have control like a boss or a god. And I still had that in Syria but it kind of stopped, ... because I am not gonna be a kind of a slave to my family, ... because I want freedom for myself.*

Desires — the motivational forces of the human experience — often highlight the individual agency and the deeply functional essence of the acculturation processes (Gezentsvey & Ward, 2008). The needs for interactions, to be understood, for purpose, and for identity continuity are not necessarily expected by the dominant group but are intrinsic and fundamental to the health and functioning of the newcomers during the acculturation process (e.g., Anzaldúa, 1987). As deeply internal aspects of the human experience, motivations often also have the potential of fundamentally organizing the manner in which a migrant approaches a new cultural context (Kashima, 2014; Vishkin et al., 2021).

Yet, despite these functional and interconnected properties, few of the past reviews have examined motivation as a distinct aspect of psychological acculturation within the literature or the concept. However, outside of reviews, needs and wants have been discussed more frequently as a conceptual aspect of psychological acculturation. For example, more and more researchers are looking at the motivations for migration in understanding acculturation (Echterhoff et al., 2020; Sandu et al., 2018). Additionally, motivations are more frequently considered as underlying acculturation orientations (Recker et al., 2017), acculturation behavior (Reece & Palmgreen, 2000), and psychological adaptation (Safdar et al., 2003).

3.1.3 Functional embeddedness

Before we move to the application of the framework in the systematic scoping review, we will discuss a number of functional characteristics that allow the

framework to be embedded within real-life experiences and assist in building a deeper theoretical understanding of psychological acculturation.

Aspect distinctiveness

Firstly, while we have introduced the four experience aspects as distinct elements, it is important to note that both in theory and in practice affect, behavior, cognition, and desire are not experienced as distinct entities. This aspect-interconnectedness is also reflected in theories on the aspects. As an example, most affects have a cognitive component just as most cognitions have an affective value. Similarly, motivation is commonly conceived as having both emotional (e.g., desire) and cognitive (e.g., goals) aspects, both of which are often directed towards behaviors (i.e., conation). Muddying the waters further is the difficulty that many operationalizations (and empirical measures) of psychological acculturation also include multiple aspects. Concepts such as satisfaction or distress, which are common measures of acculturation, famously include affective and cognitive components. Yet, despite the interdependence of aspects in theories and lived experience, the four aspects can consistently be identified within experiences and concepts — they remain qualitatively different aspects of the experience. And as such, they offer a pragmatic lens to structure the psychological acculturation concept (Kuhn, 1962). Differentiating the four (needing, feeling, thinking, and doing) qualities of an experience in what we consider psychological acculturation to be, allows us to structure our discussions of past, current, and future theories and measures of psychological acculturation.

Experience content

Secondly, it is important to note that while anyone will have motives, emotions, thoughts, and behaviors, what one needs (e.g., belongingness or independence), feels (e.g., sadness or happiness), thinks (e.g., identification or disinterest), or does (e.g., studying or working) is highly ideographic. It is this ideographic content that makes the framework relevant to such a broad range of migration contexts. Yet, it is the content-free structure — the presence or absence of the basic aspects in conceptualizations of acculturation — that is

transferable across contexts and studies, enabling comparisons and broader conceptual discussion. It should also be noted that, in our view, such a framework does not stand in conflict with cultural or indigenous psychological concerns of an absolutist, or deterministic psychology (e.g., Kim & Park, 2006). In fact, cultural psychologists, like many decolonial researchers, have long argued that the individual embedded and lived experience should gain a more central role in theoretical developments (e.g., ontological turn; Pedersen, 2020).

Process

A final, fundamental property we would like to address in the experience framework is the understanding of psychological acculturation as a dynamic process rather than a static end-product. That psychological acculturation is a process, and that "acculturation occurs when two independent cultural groups come into *continuous first-hand contact over an extended period of time*" (Berry et al., 1989, p. 186) seem to be a generally accepted assumption within the field (e.g., Ward & Geeraert, 2016). Yet, some reviews have pointed out that few empirical studies have actually considered the theoretical implications of migration as a process and even fewer have methodologically followed the trajectories of migrants over time (Brown & Zagefka, 2011; Ward & Szabó, 2019). We believe that the experience framework of psychological acculturation, as it is presented here, is ideally suited to deal with this conceptualization as a process. Philosophers of the phenomenological tradition have long highlighted that a subjective experience can only be understood within the history of past experiences (e.g., Heidegger, 1978). The human experiences are thus scalable and can capture processes of seconds or years and might even relate to generational or future conceptualizations.

As such, the experience structure allows us to integrate, expand, and systematize previous process conceptualizations of psychological acculturation. Working through the many theoretical works within the acculturation literature, we realized that theories focus on one or multiple stages of intercultural contact episodes. This allowed us to integrate theoretical traditions that distinguish between acculturation orientations and later acculturation outcomes (e.g., see

Te Lindert et al., 2008) and associated methodological efforts that organize different assessments around this division (notably Arends-Tóth & van de Vijver, 2006a) with an emerging view that acculturation develops as a series of contact episodes (Maertz et al., 2016). Bringing together several of the terms and approaches used within the literature, we propose to distinguish between (1) acculturation conditions [*ABCDs prior to contact*], (2) acculturation response [*ABCDs during contact*], and (3) acculturation outcome [*ABCDs following the contact*][2].

Importantly, for all three of these steps, different ABCDs can emerge and due to the temporality of these phases, the ABCDs experienced during these three steps are often qualitatively different. As an example, whereas acculturation conditions often focus more on socio-structural and personal expectations, immediate acculturation responses often have a reactive or oppositional character, and acculturation outcomes tend to focus on habitual, reflective, and evaluative experiences in the literature. We discuss these qualitative differences as they are represented in the theoretical literature in more detail during the scoping review below (also see Figure 1 for several example features).

Additionally, by considering the three-stepped process, we can also integrate what we call the 'conditions of change' and the 'conditions of stress' that sit between the three steps. Looking at cultural conflict models (e.g., Robinson, 2019), we can extract a number of conditions based on the presence of differences, evaluations of differences, and external affordances, which determine whether the migrant seeks to change the ABCDs anticipated prior to the contact when they enter the contact (also see Alitolppa-Niitamo, 2004; Grove & Torbiörn, 1985; Masgoret & Ward, 2006; Wood, 2014). Similarly, using stress-adaptation models (e.g., Hajro et al., 2019; Kim, 1988; Sam, 2006), we are able to discern a number of conditions that address when ABCD changes following the contact lead to stress or adaptation outcomes (also see Benet-Martínez & Haritatos, 2005; Berry, 1992; Hajro et al., 2019; Ryan et al., 2008; Salo & Birman, 2015; Wood, 2014). Together, the episodic ABCD approach and the intermittent conditions also highlighted the dynamic,

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[2]It should again be noted that intercultural contact can either be direct in-person contact or indirect contact through media, institutions, or cultural products.

embedded, and circular nature of the cross-cultural contacts at the heart of psychological acculturation (also see Figure 1).

In sum, the conceptual framework suggests that the concept of psychological acculturation is psychologically fundamentally structured into affect, behavior, cognition, and desire aspects. And while each experiential aspect captures part of the concept, only jointly will they comprehensively capture the full psychological acculturation concept. We have also shown that the four experience aspects are all highly relevant to the concept as they capture the dynamic, adaptive, and interactive functionings of contacts with new cultural patterns. We have further emphasized that the experience framework highlights the embedded complexities of real-world migration experiences and that the distinction of the ABCD structure along the dynamics of cultural contacts brings together several theoretical perspectives of the psychological acculturation literature.

In practice, the framework can thus find utility in comparing past literature and interventions (e.g., which conceptual aspects were considered for particularly important findings), can structure future study and intervention designs (e.g., which aspects are relevant to health behaviors), and can advance future theoretical developments (e.g., which experiential aspect organizes the other acculturation aspects for specific outcomes). In the following, we will take first steps at exploring the applied utility of the framework, for organizing the past literature on psychological acculturation.

3.2   The present study

The aim of our empirical efforts presented here is to put our proposed framework to the test. We have lamented that one of the challenges of a heterogeneous field is that it is difficult to assess and compare past literature. As a framework, we have suggested that the psychological aspects of experiences could comprehensively structure our assessment of the literature. We will thus systematically retrieve the past literature on psychological acculturation of first-generation migrants. We chose first-generation migrants specifically to allow for a focused systematic literature search while still maintaining the

Figure 1: Conceptual framework of psychological acculturation with context and experience process. The process diagram shows the elements and examples of the conceptual building blocks. ABCD = affect, behavior, cognition, desire aspects of psychological acculturation.

Heritage Cultural Patterns

Formal	Informal	Physical
- laws	- norms	- food
- history	- values	- fashion
- language	- beliefs	- art
- ...	- ...	- ...

Situation / Life Domain

public/macro ←→ private/micro

- spirituality/religion
- family/home/romantic
- health/care
- administ./legal matters
- work/money/finances
- entertainment/media
- education/school
- transport/travel
- recreation/sport/art/friends
- community/politics

Local Cultural Patterns

Formal	Informal	Physical
- laws	- norms	- food
- history	- values	- fashion
- language	- beliefs	- art
- ...	- ...	- ...

Individual: Newcomer

General	Migration related
- gender	- reason for migration
- age	- migration status
- personality	- age of migration
- ...	- ...

Individual Acculturation Experience over Time

external ←→ internal

affect — desire — cognition — behavior

Individual: Local

General	Migration related
- gender	- migration attitude
- age	- stereotypes
- personality	- contact history
- ...	- ...

Acculturation Condition [ABCD before contact¹]

Anticipated Behaviors
- dress code
- communication style

Anticipated Cognitions
- cultural values
- social identities

Anticipated Affects
- intergroup anxiety
- contempt

Anticipated Desires
- humility virtue
- justice duty

Presence of Difference:
Is contact possible?
Is there contact?
Is there a cultural difference?
Is there an awareness of the difference?
Is the difference situationally relevant?

Evaluation of Difference:
Adverse consequences of adapting?
Beneficial consequences of adapting?
Adverse consequences of maintaining?
Beneficial consequences of maintaining?
Is difference perceived as problematic?
Is the difference perceived as just?
Sufficient self-efficacy?
Sufficient outcome-expectancy?

External Affordances:
Is there a possibility not to change?
Is there a possibility to change?
Support to attain desired outcome?
Possibility to ignore the difference?
Possibility to focus on a different issue?
Possibility to compensate the difference?

Acculturation Response [ABCD during contact²]

Behaviors
- language use
- social withdrawal

Cognitions
- interaction quality
- ethnic identification

Affects
- enjoyment
- apprehension

Desires
- academic goals
- acceptance wish

Conditions of Stress vs. Adaptation:
Is difference perceived as incompatible?
Is the desired outcome possible?
Is the desired outcome attained?
Are there adverse consequences?
Sufficient resources to deal with challenge?

Acculturation Outcome [ABCD after contact]

Behaviors
- political activism
- work performance

Cognitions
- satisfaction with life
- self-esteem

Affects
- distress
- feeling at home

Desires
- belongingness
- competence

Notes:
¹ Normative affects, behaviors, cognitions, and desires of all relevant cultural patterns (e.g., heritage and local).
² Contact can be with a member of the other group but also with media, societal institutions, or cultural products.

broad heterogeneity of acculturation experiences. For all relevant works, we will extract which experiential aspects were considered in the research. We expect that these efforts will provide insights into the perceived importance of desires, affects, cognitions, and behaviors for psychological acculturation. We also expect that this allows us to assess how many experience aspects are usually considered and which aspects are considered jointly. And finally, we aim to compare the understanding of psychological acculturation across different fields to assess the comparative utility.

To apply the framework, we specifically target three bodies of literature that capture the concept of psychological acculturation. Firstly, we will assess the theoretical literature on psychological acculturation. The theoretical literature should offer the broadest, most abstract, and most comprehensive works on psychological acculturation. Coding the aspects considered in these theories should, thus, offer insights into the assumptions on which researchers build their empirical work. Secondly, we will assess psychometric literature developing acculturation measures. As operationalizations of the construct within the empirical literature, validated scales usually focus on a concept in a generalized manner, rather than focusing on aspects only relevant to a specific 'applied' investigation. Coding psychological acculturation measures separately might also aid future considerations of measure selection because we effectively build a database of scales that can be filtered by whether the scale includes measurements of affects, behaviors, cognitions, and desires (see Supplemental Material A). Thirdly and finally, once we have considered the validated scales in particular, we will more generally assess the empirical literature that used measures of psychological acculturation. Capturing operationalizations within empirical studies, allows us to investigate the focus within the empirical literature more broadly, and allows us to compare differences between fields and research subjects.

In short, the main aims of our empirical efforts can be summarized in four main research questions.

RQ 1: How have psychological acculturation experiences been conceptualized within the past literature?

(RQ 1a): What is the relative importance of each of the affect, be-
havior, cognition, desire aspects within past conceptualiza-
tions?

(RQ 1b): Which experience aspects are considered jointly in the con-
ceptualization of psychological acculturation?

(RQ 1c): Which conceptualizations of psychological acculturation
cannot be captured with the ABCD framework?

RQ 2: What are the main differences in the conceptualizations of psy-
chological acculturation experiences across the past theoretical,
psychometric, and empirical literature?

RQ 3: How do conceptualizations of psychological acculturation differ
in terms of affect, behavior, cognition, and desire aspects across
different publication fields?

RQ 4: How is the cultural, individual, and situational context of psy-
chological acculturation conceptualized and addressed in the past
literature? [see Supplemental Material D]

To address these research questions we, specifically, chose a *systematic scoping review*. Such a review is *systematic* because it uses "systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyze data from the studies" (PRISMA guidelines; Moher et al., 2009, p. 1). In practice, this meant that we developed literature search-and data extraction protocols for a structured, transparent, and reproducible review (for the systematic search protocol see Appendix 3.A and for our coding manual see Supplemental Material D; also see Peters et al., 2015). To analyze and summarize the data, we then perform a *scoping analysis* to "map the key concepts underpinning a research area and the main sources and types of evidence available" (Arksey & O'Malley, 2005, p.21). In our case, this meant that we were able to address our broader research questions of how psychological acculturation has been conceptualized within different bodies of past literature and how useful the ABCD separation was in assessing and comparing conceptualizations.

It should also be noted that we consciously chose not to conduct a meta-analysis. We conduct this review exactly because we are worried about comparability across studies, a key requirement of meta-analyses (Pogue & Yusuf,

1998). In our case, we, arguably, do not have a clearly defined concept and exclusions to ensure a cohesive data set would be counterproductive to our efforts. Moreover, a meta-analysis is commonly understood as an analysis of analyses (Glass, 1976). However, since we are interested in a conceptualization (rather than a relationship, a scale metric, or population parameter) a quantitative summary in form of a meta-analysis is not well-suited to answer our research question. Also, a meta-analysis of our own extracted data seems profitless because it would likely mirror a sample size weighted average.

In the following section, we will briefly discuss how we conducted the systematic scoping review and will sequentially analyze the role of experience aspects in the theoretical, psychometric, and empirical literature of psychological acculturation. Please note that all protocols, materials, data, and software code is openly accessible as part of our OSF repository (Kreienkamp et al., 2022d).

3.3 Systematic scoping review

To assess the past empirical and theoretical literature on psychological acculturation, we performed a systematic scoping review. We first read seminal and review works within the field (including, Berry, 1997b, 2003; Rudmin, 2003; Sam & Berry, 2006; Szapocznik et al., 1978; Ward & Szabó, 2019). Based on our reading of the literature, we designed a comprehensive literature search strategy in an iterative fashion. For the empirical work on acculturation, we performed a literature search on March 4th, 2020 and February 14th, 2021, within the "APA PsycINFO" bibliographic databases using the EBSCO*host* provider. The databases also included the PsycARTICLES, PsycBOOKS, and PsycCRITIQUES databases as well ProQuest Dissertations with psychological relevance (for the full information on the search strategy see Appendix 3.A.

Together with past reviews, we used this literature search to identify validated scales as well as empirical works more generally. For the theoretical literature we collected the theories used in the empirical works and performed an additional, more specific, search of the same databases as well as the Web of Science Core Collection using the Clarivate Analytics provider on March 3rd, 2021 (for full information see Appendix 3.A).

From the literature searches we created three separate databases of theoretical, psychometric, and applied empirical works on psychological acculturation. For each literature search, we downloaded all references and abstracts, which two independent coders screened for relevance after duplicate removal — first based on the titles and then based on the abstracts. We downloaded all relevant and available works for full-text coding. For all three types of works, we extracted a range of variables to apply our framework. The full coding process and data extraction are described in the coding manual (Supplemental Material A), as part of the full annotated analyses (Supplemental Material B) as well as in our open science repositories (see Kreienkamp et al., 2022c, 2022d).

3.3.1 Theoretical literature

The most abstract level of our review was concerned with how researchers conceptualized psychological acculturation in their theoretical work. Our theory-specific literature search produced a total of 477 results from which we identified 73 theories. From our review of the empirical literature, we added an additional 19 theories (total N = 92, for exclusion reasons, see Table 2 and for the PRISMA diagram see Figure 3.A.1 panel A. A full table of all theories, with references, and final coding is available in our Supplemental Material C, as well as on our open science repository (see Kreienkamp et al., 2022c, 2022d).

Methods

Dataset   The authors of the 92 included theoretical works self-categorized their contributions as a theoretical conceptualization ($N = 9$), theoretical framework ($N = 26$), theory ($N = 36$), or theoretical model ($N = 21$). Looking at the types of theory building, a majority of proposals were purely theoretical (N = 75) with the remaining theoretical works growing out of qualitative investigations (such as grounded theory approaches; N = 17). A complete and interactive list of the collected theoretical works, including reference- and publication information, as well as our experience aspect codings is available via our acculturation directory app, described in Supplemental Material C.

Table 2: Exclusion Reasons for all Literature Levels

Reason	Theoretical			Psychometric	Empirical		
	Title	Abstract	Full Text	Full Text	Title	Abstract	Full Text
not English	5	1	1	1	1		
not migration	45	3	1		62	42	7
not migrant	24	11	4	1	65	41	6
not acculturation	49	17	16	1	225	116	12
not ABCD	7	1			29	42	5
not theory	20	71	25				
not measured				1		32	35
items not accessible				16			36
thesis not accessible		1		1			33
article not accessible				1			4
book not accessible							4
chapter not accessible				1			2
poster not accessible		1					

Experience aspects   To assess the experience aspects that were considered as part of the theoretical works, two independent coders coded the authors' axioms, theorems, and model elements for self-identified inclusions of affects, behaviors, cognitions, and desires (inter-rater agreements were 96.74% or above and all Cohen's κs were above 0.82, κ_{pooled} = 0.94; for full inter-rater reliability see Supplemental Material B). We only coded explicit mentions by the authors on three different levels. An example of these three levels for affect would be phrases of "mood" or "emotions" (construct level), "anxiety" or "pride" (concept level), and "the migrant feels …" (operationalization level). A list with further examples can be found in Table 1 and our coding protocol is available in Supplemental Material A.

Process   To assess the focus on psychological acculturation as a process or an outcome, we coded whether authors self-identified the theory as a process (e.g., 'process', 'development', 'longitudinal', 'temporal', 'dynamic') or an outcome (e.g., 'static', 'outcome', 'markers', 'consequence').

Results

ABCD prevalence.   Our main goal was to assess the use of the four affect, behavior, cognition, and desire elements within the theoretical conceptualizations of psychological acculturation. Looking at the overall usage of the experience aspects we find that virtually all theoretical works included behavioral aspects (94.57%; e.g., cultural practices, media consumption) and a vast majority considered cognitive aspects (90.22%; e.g., navigation knowledge, ethnic identification). We found considerably fewer mentions of affective (46.74%; e.g., anxiety, pride) and motivational aspects (41.3%; e.g., independence goals, need to belong). But the generally high usage of the aspects, also meant that only about a tenth of the theories focused on a single aspect (6.52%). Interestingly, all theories that considered only one aspect were exclusively focusing on behaviors (N = 5) or cognitions (N = 1). Of the remaining theories, 21 (i.e., 22.83%) considered all four aspects, leaving a majority of theoretical works to considered two aspects (36.96%) or three aspects (33.7%). Among these, the most common combinations of experience aspects were behavioral and cognitive acculturation (28.26%) or behavioral, cognitive, and motivational aspects combined (17.39%; also see Figure 2 and Table 3).

ABCD composition.   Looking at the number of aspects considered together we also see substantial differences in what kind of theories include a certain aspect. Theories that included behaviors considered an average of 1.78 other aspects (*SD* = 0.78), and theories considering cognitions, on average, also included 1.87 other aspects (*SD* = 0.65). Theories that included the more internal aspects of affect or desire showed a considerably higher number of additional aspects considered (affect: *M* = 3.35, *SD* = 0.52; desire: *M* = 3.50, *SD* = 0.36). Thus, most scales measure multiple dimensions of acculturation (*M* = 2.73, *SD* = 0.79; also see Figure 8). Yet, they tend to focus on more external aspects of behavioral and cognitive acculturation, and less on internal aspects of affects and desires. This is also visible in the observation that there were no theories that exclusively focused on emotional or motivational acculturation, while this was the case for both cognitions and behaviors. And if emotional

or desire aspects were considered, they were found in theories that tended to already include a higher number of other experience aspects.

Process.   To assess the process focus of the theoretical works, we assessed whether authors self-identified their works as process or outcome focused. We found that 49 of the 92 coded theoretical works proposed dynamic conceptualizations of psychological acculturation (53.26%). This slight majority is a notably high percentage, considering that past reviews of the acculturation literature have pointed to a small number of studies actually offering dynamic tests of theories (e.g., Brown & Zagefka, 2011; Ward & Szabó, 2019).

Content.   While it is beyond the scope of this paper to comprehensively summarize and integrate the over 90 theoretical works on psychological acculturation, we will briefly discuss how the different types of theoretical works fit within a broader ABCD framework. To this aim, we separate the acculturation process into three functional steps and highlight some works in their use of the affect, behavior, cognition, and desire aspects.

A broader pattern we observed is that theories focused on different phases of the acculturation process. These phases can arguably be organized around the timeline of actual inter-cultural contacts. In essence, we saw three phases describing the affects, behaviors, cognitions, and desires that are (1) normatively expected *prior to the contact* [acculturation conditions], (2) actually experienced *during the contact* [acculturation response], and (3) experienced *after the contact* [acculturation outcome] (also see Figure 1). While it would be beyond the scope of this paper (and likely overly simplified) to summarize all theoretical ideas within the three stages, in the following we briefly highlight a small selection of works that illustrate the use of ABCDs within the experience stages.

Acculturation conditions.   Theoretical works that focused on the experience prior to the actual inter-cultural contact, generally speaking, focused on the socio-structural and personal expectations of the acculturation experience. As an example, Ward and Geeraert (2016) in their contextualized process framework highlight how culturally expected "behaviors, values and identities" (behavior and cognitions; p. 100) have a fundamental influence

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on perceived cultural distance, the intercultural contact, and the ensuing psychological changes, including well-being and emotional distress (affect). They even embed this process further in a series of ecological contexts, highlighting the affordances and conditions of the process. A second example might be the 'acculturation intentions model' (Tartakovsky, 2012), which argues that we should focus on pre-migration attitudes, perceived social norms, and perceived control (i.e., cognitions). Depending on the valence of these pre-migration cognitions, the migrant will then experience "feelings of pride, love, and comfort, [...] or feelings of shame and discomfort" (i.e., affects; p. 86). According to the author, the early cognitions and affects will then become "the main motivational forces that affect their [...] desire to continue living in this country" (i.e., desires; p. 86) and will ultimately determine acculturation intentions and behaviors (i.e., cognitions and behaviors). Tartakovsky also highlights that personal resources, and environmental constraints determine the experienced ABCDs[3]. Both theories exemplify how affects, behaviors, cognitions, and desires were conceptualized prior to the inter-cultural contact and how important environmental conditions are at that time.

Acculturation responses. Theories that included a focus on the acculturation response tended to focus on the affects, behaviors, cognitions, and desires during (or immediately following) the inter-cultural interaction. One good example of this phase comes from the now classic work of Berry (1992), where he divided psychological acculturation into behavioral shifts and acculturation stress. Berry describes behavioral shifts as "changes in behaviour [...] and include values, attitudes, abilities and motives" (i.e., behavior, cognition, desire; p. 70), and acculturation stress is manifested "as lowered mental health status (particularly anxiety, depression), feelings of marginality and alienation" (i.e., affects; p. 75). In Berry's (1992) theorizing, behavioral shifts and acculturation stress jointly form 'psychological acculturation', which follows immediately after the inter-cultural contact. This phase is clearly distinguished from the

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[3]Further examples of theoretical works that include an explicit focus on acculturation conditions are Giles et al. (1977), Kim (1988), Navas et al. (2005), Robinson (2019), Rogler (1994), and Serdarevic and Chronister (2005).

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migrant's adaptation, which follows the behavioral shifts and acculturation stress and in turn includes the famous acculturation strategies[4].

Acculturation outcomes. The third stage of acculturation outcomes are the affects, behaviors, cognitions, and desires that are more long-term and are often experienced after the actual intercultural contact is concluded. One exemplary theory-building effort is arguably that of the 'integrative theory of communication and cross-cultural adaptation' (Kim, 1988). As one of the final theoretical steps Kim (1988) devotes an entire chapter to 'adaptation outcomes', which she begins with the definition of acculturation outcomes: "Gradually [migrants'] habitual patterns of cognitive, affective, and behavioral responses undergo adaptive transformations [...] which enable them to fulfill their various human needs, such as maintaining and enhancing social relationships and providing for channels of self-expression and fulfilment" (affect, behavior, cognition, desire; p. 138)[5]. This focus on how the more immediate contact experiences influence long-term ABCDs, such as well-being, stress, and other adaptation outcomes were a common target of broader theoretical works.

Scope. It is important to mention that many of the theoretical works, including most of the examples above, have focused on process models that span two or more of the three steps (e.g., Arends-Tóth & van de Vijver, 2006a; Berry, 1992; Rogler, 1994; Ward & Geeraert, 2016). Additionally, a majority of the theoretical works we considered offered commentary on the overall construct of acculturation (N = 63) and only a minority of 29 works explicitly targeted a specific part of acculturation (e.g., 7 identity acculturation theories and 4 labor market acculturation theories; for an example see Weinreich, 2009). Moreover, as the examples have already highlighted, for many theoretical conceptualizations of psychological acculturation authors discussed their focus on affect, behavior, cognition, or desire aspects rather explicitly (which was also visible in a high inter-rater reliability; for full coding details see Supplemental Material B).

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[4]Other examples of acculturation response focused theoretical works include Berry (2005), Riedel et al. (2011), Sam and Oppedal (2003), and Ward and Geeraert (2016).

[5]A number of other theoretical works has explicitly focused on acculturation outcomes, including Baird and Reed (2015), Berry (1992), Berry (1998, 2005), Luedicke (2011), Riedel et al. (2011), and Rogler (1994).

A final observation has been that while the inclusion of desire components was generally high within the theoretical literature, the emphasis on desires and motivations was particularly prominent in the grounded theories and other bottom-up works. As an example, Kim and Rousseau (2019) developed a theoretical model based on the reported importance of goals and motivations prior and during migration for down-stream adaptation processes. Similarly, for Mchitarjan and Reisenzein (2015) one key determinant of acculturation "success or failure" are "motivational factors, i.e. the motives, desires, or goals of the minority and majority" (p. 2).

Table 3: Bivariate Association of Aspects for all Literature Levels.

Aspect	Affect	Behavior	Cognition	Desire
Theoretical (*N* = 92)				
Affect	*N* = 43	-0.06	0.09	0.14
Behavior	40	*N* = 87	-0.08	0.10
Cognition	40	78	*N* = 83	0.20
Desire	21	37	37	*N* = 38
Psychometric (*N* = 233)				
Affect	*N* = 117	-0.05	0.22***	0.22***
Behavior	83	*N* = 170	-0.08	-0.10
Cognition	111	146	*N* = 204	0.16*
Desire	46	45	65	*N* = 68
Empirical (*N* = 526)				
Affect	*N* = 259	0.03	0.29***	0.09*
Behavior	210	*N* = 421	-0.10*	-0.02
Cognition	241	336	*N* = 430	0.09
Desire	57	76	86	*N* = 97

Note: Diagonal: Times aspect occurred;
Upper triangle: Phi association;
Lower triangle: Times aspects co-occurred.

3.3.2   Psychometric literature

Based on the systematic scoping review and its coding, the first empirical dataset we assess is a database of scale validations. We bring together the scales suggested in previous reviews, as well as validation studies we identified in our own review. Throughout our literature review, we found five major works

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Figure 2: Psychological Acculturation Aspects within the Theoretical Literature. (A) Bar graph showing the common combinations of the affect, behavior, cognition, desire experience aspects. (B) Bar graph showing the prevalence of each experience aspect within the literature. (C) Bar graph showing how many experience aspects were considered together.
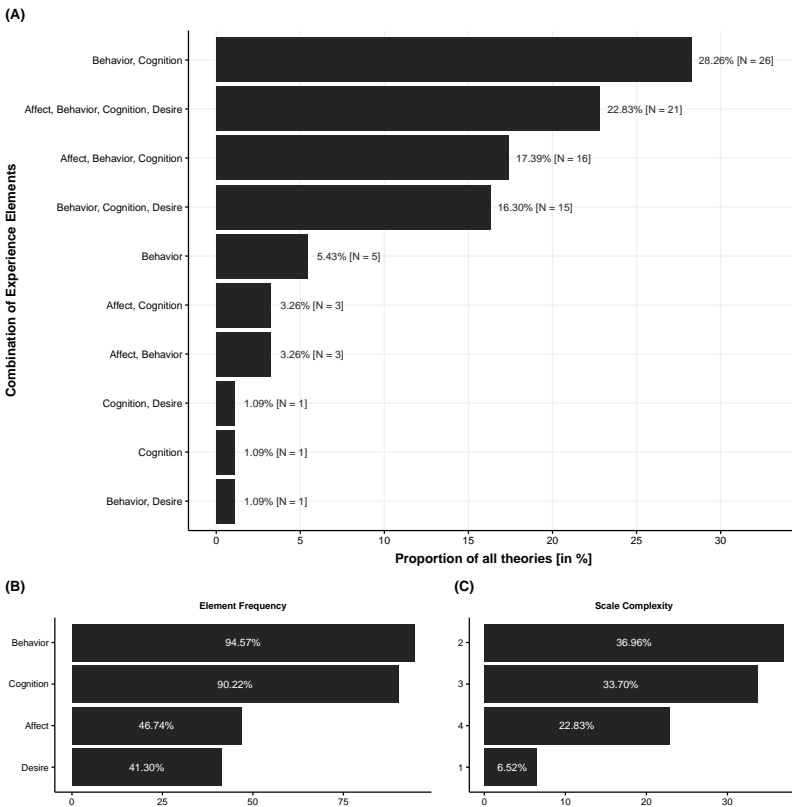
that reviewed the measurement of acculturation (Celenk & Van de Vijver, 2011; Maestas, 2000; Matsudaira, 2006; Wallace et al., 2010; Zane & Mak, 2004). After removal of duplicate scales, we added any scale validation that was present in our own systematic scoping review but not included in the previous reviews. For each measure, we extracted the full item list as well as the item scoring prior to coding. A comprehensive and interactive database of the scales, with all available items, reference- and publication information, as well as our experience elements and -context coding is available in Supplemental Material C (also see Figure 3 for an illustration).

Methods

Dataset   After duplicate removal, these five reviews collected a total of 97 scales. From our own review, we added 159 additional validation studies (total of 256 unique scales). Of these scales, we ultimately had to exclude 23, because they were either not accessible or did not fit the topic of our review (see Table 2). About a quarter of scales (24.22%) included majority group members in their validation studies. The earliest included validation was from 1948 with a majority of scales being validated around the turn of the 21st century and the most recent included validation study was published in 2020.

Experience aspects   We extracted data on the experience aspects by primarily focusing on the measured concepts and their operationalizations (also see Table 1). For each article, we retrieved the items used and coded whether the measure included references to affects, behaviors, cognitions, and desires. Because this concerned the most central aspect of our framework, each manuscript was double-coded and inconsistent codes were resolved after discussion (all inter-rater agreements were 97.85% or above and all Cohen's κs were above 0.95, κ_{pooled} = 0.96; for full inter-rater reliability see Supplemental Material B).

At this stage, we also noted if scales or items measured concepts that relate to multiple experience aspects. As an example, a single item asking about 'satisfaction with the new life' might include emotional and cognitive elements. In this case, we code the manuscript as measuring both emotions and cognitions,

Figure 3: Screenshot of the *Acculturation Directory*. Top: Main table of the included acculturation scales as well as the filter interface. Bottom: Detailed view of selected scale with item, response, sample, and life domain information. A full description of the directory is available in Supplemental Material C and the directory is available at: https://acculturation-review.shinyapps.io/acculturation-directory/.

and noted that these elements are not measured independently. We also noted if the measures do not consider an individual's experiences, such as reporting migration status or length of residency.

Process   To extract an indicator of whether the scales were aimed at psychological acculturation as a process or an outcome, we collected information on assessed migration times (e.g., pre-migration, post-migration) and the validation type (e.g., cross-sectional, longitudinal).

Results

ABCD prevalence.   With our main aim of examining the experience structure within the scales, we examined whether scales included a specific experience element but also examined the used elements in their complex combinations. In terms of general inclusion of elements, most studies included a measure of cognition (87.55%) and behavior (72.53%), whereas only roughly half the studies included a measure of affect (50.21%) and only a fourth of the scales included a measure of desires (29.18%). However, only a minority of scales included only a single aspect. There were only 18 scales that exclusively relied on cognitions (7.73%) and 21 scales that measured only behaviors (9.01%). Yet, inversely, there were also only 35 scales that measured all four aspects (15.02%). Most studies measured two (38.63%) or three (27.9%) aspects. A majority of scales either measured behavioral and cognitive aspects (23.61%) or behavioral, cognitive, and affective elements (19.31%; also see Figure 4 and Table 3).

ABCD composition.   Looking at the number of aspects measured together, we also see substantial differences in what kind of scales include a certain aspect. Scales that included cognitions also measured an average of 1.57 other aspects ($SD = 0.77$), scales measuring behavior, on average, also included 1.62 other aspects ($SD = 0.77$). Scales measuring affect or desire measures included substantially more aspects. Scales that included affect measures also included 2.04 other aspects ($SD = 0.61$) and scales measuring desires even measured an average of 2.31 other aspects per scale ($SD = 0.66$; also see Figure 8).

Thus, most scales measure multiple dimensions (M = 2.39, SD = 0.91), yet they focus on external accessible aspects of psychological acculturation (i.e., behavior and cognition), less of what is considered 'internal' or 'subjective' (i.e., affect and desires). And if affect or desire elements are considered, they often only occur in scales that already include a higher number of other aspects. This is further underscored by the observation that there were only 3 scales that exclusively measured emotional acculturation and not a single scale that exclusively focused on motivational acculturation (while this was the case for both cognitions and behaviors).

Process. To assess the process focus of the scales, we also assessed the migration time the scale validators considered. Except for a single scale that was validated for potential migrants, all scales were validated using cross-sectional data after the migrant arrived in the settlement society. This is in line with observations by previous reviews of the field (e.g., Brown & Zagefka, 2011).

Content. While a discussion of all the topics addressed by the included scales lies beyond the scope of this study, we would like to describe some of the larger patterns authors have focused on. To that aim, we offer illustrations of the patterns we observed during the reading, extraction, and coding of the acculturation scales. We, additionally, ran a machine learning topic modeling procedure on the items of the scales to identify content topics.

A first key observation is that there was considerable diversity between the scales in how many experience aspects and topics were addressed. That might not generally be surprising, considering that the scales had between 1 and 136 items, and included between 1 and 12 life domains (see Supplemental Material C). Additionally, scales were also either more focused on a specific aspect (e.g., 'Asian Value Scale'; Kim et al., 1999; Kim & Hong, 2004) or aimed to capture acculturation more broadly (e.g., 'Asian American Multidimensional Acculturation Scale' Gim Chung et al., 2004). Another trend that we observed was a separation between a factual and counter-factual acculturation (e.g., real vs. ideal, Benet-Martínez, 2006; Navas et al., 2005; Navas et al., 2007). Additionally, while a large number of scales separately assessed ABCDs as

Figure 4: Psychological Acculturation Aspects within the Psychometric Literature. (A) Bar graph showing the common combinations of the affect, behavior, cognition, desire experience aspects. (B) Bar graph showing the prevalence of each experience aspect within the literature. (C) Bar graph showing how many experience aspects were considered together.

(A)

(B)

(C)
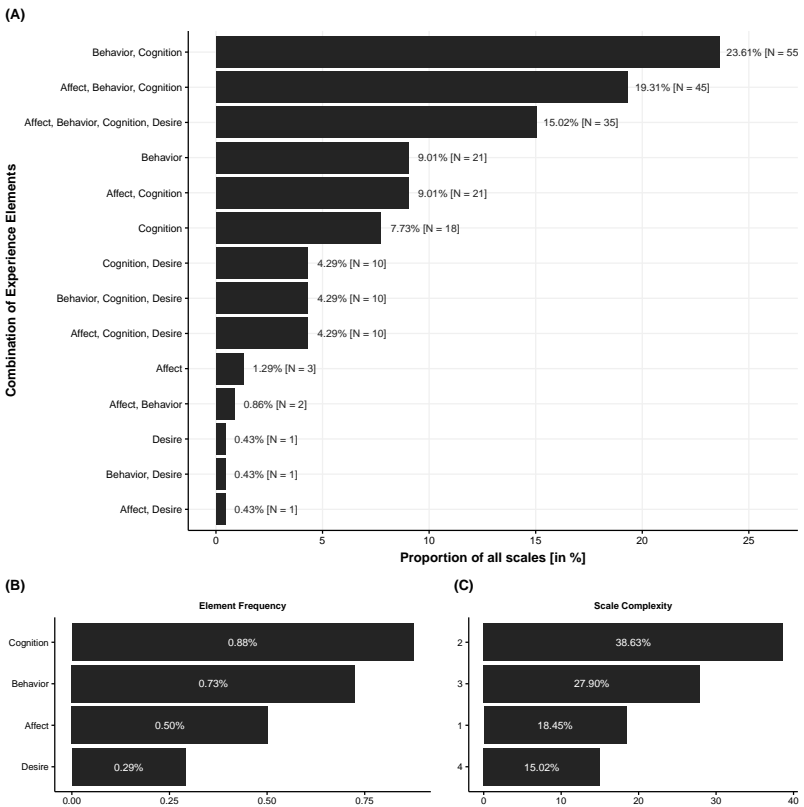
they related to the local and the heritage cultural patterns, we saw a trend towards explicitly asking about different life domains (e.g., family, work, media; Arends-Tóth & van de Vijver, 2007; Kim, 2010; Mancini & Bottura, 2014, also see Supplemental Material D).

When considering the content of the aspects that were included across acculturation scales, the topic modeling analysis offers a number of key insights that mostly align with our reading of the literature. For the topic modeling of the acculturation scales, we particularly used the scale items in a Latent Dirichlet Allocation (LDA) analysis, an unsupervised machine learning method common within the natural language processing literature. The analysis essentially extracts sets of terms that tended to occur together, assuming that scales that measure a specific topic have more words that relate to the topic than scales that measure other topics (we followed the procedures outlined by Schweinberger, 2022, for a full methodological detail see Supplemental Material B).

While we had earlier described that many scales included a measurement of behavioral acculturation, the topic modeling showed that one of the main topics across the scales was language use. This included questions about listening to, reading, and speaking the dominant local language. While there are a few (sub-)scales specifically targeting language use as a conceptualization of acculturation (e.g., Deyo et al., 1985; ICSEY team, 2006), most scales used language as only one of multiple experience aspects. Moreover, the assessment of behavioral language use (and the more cognitive language proficiency) often differentiated between language used at home and outside the home. Similarly, some language assessments were distinguishing between the languages used in different life areas (e.g., media consumption, among friends, at work Birman et al., 2002, for more information see Supplemental Material B). Other behavioral measurements of acculturation included the participation in and celebration of traditions and customs (e.g., Cortés et al., 1994; Rezentes, 1993; Wilson, 2013), clothing (e.g., Ghuman, 2000), food (e.g., Schaefer et al., 2009), and political participation (e.g., Jeong & Kim, 2016; Uslaner & Brown, 2005). One pattern that the topic modeling highlighted was that food related questions were often found in scales targeting the adaptation of Asian migrants (in particular, Vietnamese, Indian, and Korean acculturation scales).

Among the cognitive conceptualizations of acculturation, one key topic that we saw both in the LDA and in our own review process is a strong focus on ethnic identification and cultural identity ratings (e.g., Jadalla & Lee, 2015; Mchitarjan & Reisenzein, 2015). Other important topics were belief- (e.g., Klonoff & Landrine, 2000) and value endorsement (e.g., Duarte, 2020; Kim, 2010; Wolfe et al., 2001), as well as preferences (e.g., Benet-Martínez, 2006; Tull et al., 2003).

Among the affective acculturation measurements, an important distinction was the separation by valence, often either assessing joy and happy (e.g., Cuellar et al., 1995; Phinney, 1992), or anxiety and loneliness (e.g., Perez & Arnold-Berkovits, 2019; Shin & Abell, 1999). A second observation was a particular focus on self-conscious emotions, such as pride and shame (e.g., Suinn et al., 1992; Tsai et al., 2000). A third pattern was that most of the emotional measurements were of social emotions, such as comfort and discomfort (e.g., Stephenson, 2000), or belonging and connectedness feelings (e.g., Harder et al., 2018; Kouli & Papaioannou, 2009).

Most of the motivational acculturation measurements (i.e., desires) were related to wishes and wants for the future (e.g., Ben-Shalom & Horenczyk, 2003; Mancini & Bottura, 2014). However, there was a smaller subset of scales explicitly addressing specific motives, such as transition motives (Mchitarjan & Reisenzein, 2015), motivation for cultural exploration and maintenance (Recker et al., 2017).

It should be noted that with the psychometric literature we saw a larger number of instances where items targeted multiple experience aspects (e.g., enjoyment of wearing traditional clothing, Ozer & Schwartz, 2016) as well as the measurement of concepts that included multiple experience aspects (e.g., satisfaction, Cuellar et al., 1995).

Finally, there were a few additional patterns that were particularly highlighted by the LDA topic modeling. These issues included a focus on navigating everyday life issues (e.g., Harder et al., 2018), and acculturation hassles (e.g., Vinokurov et al., 2002), as well the importance of family and generational differences (e.g., ICSEY team, 2006; Lee, 2004). Similarly, the topics showcased that the validated scales tended to focus on specific cultural pairs,

such as migrants from the former UDSSR in Israel, or Mexicans and East Asians in North America (for more information on the migration context see Supplemental Material D). In addition, please note that we developed an interactive scale directory, where users can explore the content of the included acculturation scales on their own (see Supplemental Material C).

3.3.3   Empirical literature

At the most applied level, we assessed the broader empirical studies. This final database included the largest number of manuscripts and is in theory the application of the theoretical and psychometric literature. The search produced a total of 1,629 results, to which we added 133 articles through contacts with experts in the field and from referenced works within the review. After duplicate removal, title–, abstract–, and full-text screening we coded a total of 526 empirical works (for exclusion reasons see Table 2 and for the PRISMA diagram see Figure 3.A.1 C).

Methods

Dataset   Of the final works we coded, 452 were journal articles, 68 theses, and 6 book chapters. Most studies presented quantitative data (N = 464), mixed methods (N = 39), or qualitative data (N = 20), while the remaining 3 manuscripts were reviews of empirical data. Notably, a majority of the empirical investigations did not share common measures of acculturation — 391 studies used measures that were reported a maximum of five times. A considerable majority of papers with uncommon measures used new or ad-hoc measures of acculturation. Less than a fifth of studies included local majority group members in the study (N = 77, 14.69%). Acculturation most frequently was a predictor variable (N = 285, 54.39%), a dependent variable (N = 148, 28.24%), or a correlation variable (N = 37, 7.06%) in the empirical works. This pattern was mirrored when looking at the focus of the papers, where a majority of the papers had acculturation as their main focus (N = 153, 29.48%), with other bodies of work focusing on health outcomes (N = 163, 31.41%), or inter-group relations (N = 18, 3.47%) as their main outcomes.

The earliest included study was published in 1948, with a strong increase in publications after the year 2000, and a peak of publications in 2012. We provide full descriptions of data extractions and additional information about the data description in Supplemental Material B.

Experience aspects   Extraction of the used experience aspects mirrored the psychometric literature assessment and we primarily focused on the measured concepts and their operationalizations (also see Table 1). The only exception were qualitative studies, which we coded following the same codebook of the theoretical literature. All aspects were coded by two independent coders (all inter-rater agreements were 97.91% or above and all Cohen's κs were above 0.93, κ_{pooled} = 0.97; for full inter-rater reliability see Supplemental Material B) and inconsistencies were resolved after discussion.

Process   To assess the static or dynamic conceptualization of the empirical studies, we again collected information on assessed migration times (e.g., pre-migration, post-migration) and additionally coded the type of data collected and analyzed (e.g., cross-sectional, longitudinal data and data analysis).

Field of publication   For the broader empirical literature, we also collected additional data on the field the studies were published in. To that end, we merged the 'Scimago Journal Ranking Database' (SCImago, 2020) with our database. For all available journal articles, we added information on key journal metrics (incl. H index, impact factor, and data on the field and audiences). This also meant that dissertations, book chapters, and books were excluded from this analysis because data on their publishers is not readily available or unreliable. Additionally, 19 journals were not included in the Scimago database (because they do not have an ISSN identifier or were discontinued before 1996, see Online Appendix B for the missing journals). We ultimately had journal metrics for 425 empirical articles.

To summarize the journal data, we then classified the journal fields into super-ordinate discipline codes. These discipline codes are based in part on the U.S. Department of Education's subject classifications (i.e., CIP, Institute of Education Sciences, 2020), the U.K. academic coding system (JACS 3.0,

Higher Education Statistics Agency, 2013), the Australian and New Zealand Standard Research Classification (ANZSRC 2020, Australian Bureau of Statistics, 2020), as well as the Fields of Knowledge project (Things made Thinkable, 2014). We ultimately classified each journal into one of four mutually exclusive disciplines ('psychology': N = 122, 'multidisciplinary': N = 102, 'medicine, nursing, and health': N = 144, and 'social sciences (miscellaneous)': N = 45. For a full discussion of the classifications, see Supplemental Material B).

Results

We assessed the role of experience aspects in the measurement and then compared differences between fields.

ABCD prevalence.   In terms of the overall frequencies of experience elements, the broader empirical data mirrored that of the psychometric literature. Most studies included a measure of cognition (81.75%) and behavior (80.23%), whereas only about half of all studies included a measure of affect (49.05%) and less than a fifth of the studies included a measure of desires (18.63%). Yet, only 126 studies focused on a single experience aspect ($N_{behavior\ only}$ = 73, $N_{cognition\ only}$ = 47, $N_{emotion\ only}$ = 6). Similarly, only 46 papers included measures of all four experience aspects (8.75%). Most studies measured three (36.12%) or two aspects (31.18%; M = 2.30, SD = 0.86). Different from the scale validations, within the broader empirical works, most works included measures of emotions, behaviors, and cognitions (N = 158, 30.04%), with a further substantial number of articles measuring behaviors and cognitions (N = 107, 20.34%. Also see Figure 5 and Table 3).

ABCD composition.   Looking at the number of aspects measured together, we again see substantial differences in what kind of scales include the individual aspects. Scales that included cognitions measured an average of 1.54 other aspects (SD = 0.68), scales measuring behavior, on average, measured 1.48 other aspects (SD = 0.82), while scales that included affect measured an average of 1.97 other experience aspects (SD = 0.43) and scales measuring desires even

measured an average of 2.27 other experience aspects (*SD* = 0.61; also see Figure 8). Thus, not a single study measured only motivational acculturation (i.e., desires), and measures of desires remained mostly limited to scales that were already measuring many of the other experience aspects. The results exacerbate the pattern found in the scale validations, complex measures and conceptions of acculturation are seen infrequently and external aspects of cognition and behavior remain the focus of most studies.

Process.   To assess the process focus of the broader empirical works, we again assessed when in the migration process the data was collected, and we additionally assessed the type of analysis done by the authors. We found that 512 studies (97.71%) collected data after the arrival of the migrant in the new society. Two studies targeted potential migrants, and 10 studies collected data prior to and following the migration event. Moreover, only 25 studies included longitudinal data analyses of psychological acculturation (4.79%). This observation again underscores the arguments that the acculturation literature has thus far failed to provide data that meaningfully captures migration as a process (e.g., Brown & Zagefka, 2011; Ward & Szabó, 2019).

Content.   When considering the content of the empirical conceptualizations of psychological acculturation, the content largely mirrors that of the psychometric literature, whenever authors used validated acculturation scales. However, there were a few conceptualizations that were favored in empirical practice. One such focus has been that specific acculturation scales were used more frequently. These favored scales including the 'Vancouver Index of Acculturation' (Ryder et al., 2000), the 'Language, Identity, and Behavioral Acculturation Scale', 'Stephenson Multigroup Acculturation Scale' (Stephenson, 2000), as well as scales focusing on Hispanic migrants (Cuellar et al., 1995; Marin et al., 1987).

Another major pattern within the conceptualizations of applied empirical works has been the use of modified, abridged, or shortened versions of established scales (e.g., Green et al., 2014; Im et al., 2009). These scales often used a subset of questions from the validated scales, for example by choosing a

Figure 5: Psychological Acculturation Aspects within the Empirical Literature. (A) Bar graph showing the common combinations of the affect, behavior, cognition, desire experience aspects. (B) Bar graph showing the prevalence of each experience aspect within the literature. (C) Bar graph showing how many experience aspects were considered together.

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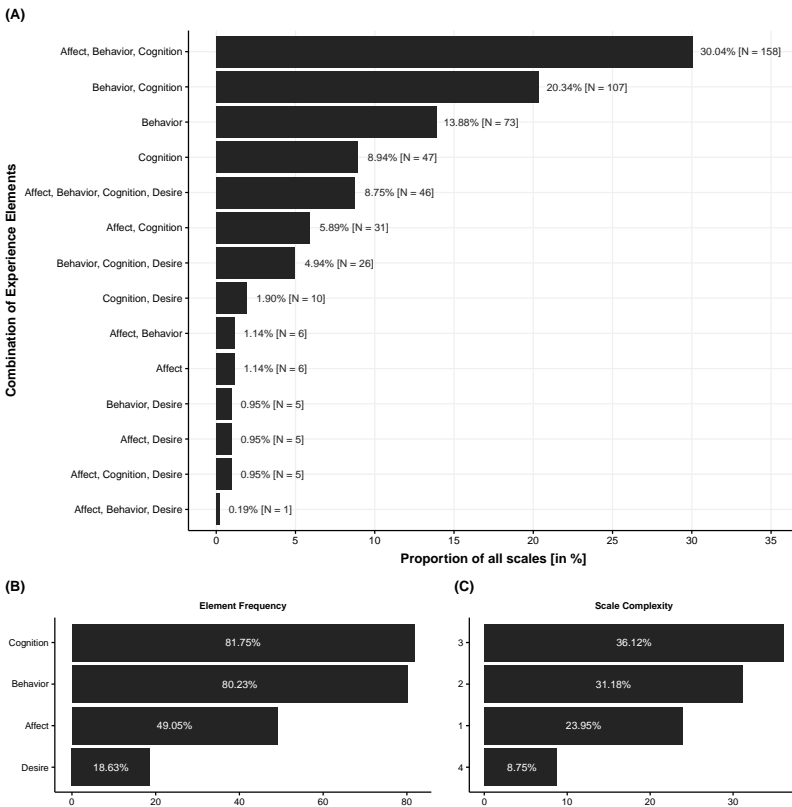
specific aspect only (e.g., media consumption). This is different from the use of 'adapted' scales, where authors usually only replaced the name of the dominant and non-dominant cultural groups to adapt the scale to their context.

An even more extreme version of this pattern has been the observation that a sizable number of empirical studies has used non-validated scales. These measurements were often short (i.e., 1–3 items) and lacked psychometric validation. Common uses were single items on language use, employment status, or cultural identification. It should be noted that for many of these studies acculturation was not a key concept of interest, but rather a covariate or partial outcome variable (for more information on these conceptualizations see Supplemental Material B).

Comparison publication fields.   To further assess the comparative utility of the experience framework, we then assessed differences of experience aspects between academic fields. For the full results, including differences in the methods, and publication types as well as contextual differences in terms of sampling procedures, situational domains, analyses, and cultural contexts see Supplemental Material B.

We first assessed the references to affect, behavior, cognition, and desires separately, for each of the disciplines. We find that for all fields, desires (12.5-28.69% of all measures in the field) and emotions (35.56-62.3%) are the least frequently measured elements and medical journals measure them the least frequently (in proportional terms). Looking at the common cognitive and behavioral elements, the proportions diverge between the fields. While the multidisciplinary field measured behaviors (76.47%) and cognition (82.35%) almost equally often, in the medical and general social science journals behaviors were measured considerably more often than cognitions ($Behavior_{SoSci}$ = 86.67% > $Cognition_{SoSci}$ = 68.89%; $Behavior_{Med}$ = 89.58% > $Cognition_{Med}$ = 69.44%). Inversely, in the psychological journals, cognitions (90.98%) were measured more often than behaviors (68.03%; also see Figure 6A and B.

When looking at differences in how many different experience aspects were measured together and patterns within these aspect-combinations, differences between the fields become increasingly evident (also see Figure 6A and C).

While 'affect, behavior, and cognition' and 'behavior, and cognition' measures are common combinations across all fields, fewer experience aspects were considered in the medical and social science fields. There were statistically significant mean differences between the fields in terms of how many experience aspects were considered (parametric: $F(3, 409) = 5.02$, $p = 0.002$, non-parametric: *Kruskal-Wallis* $\chi^2 = 15.01$, *df* $= 3$, $p = 0.002$, $\eta_p^2 = 0.04$, 95%CI[0.01, 1]). Looking at the mean differences in more detail, empirical works published in psychological journals had significantly higher average aspect counts ($M = 2.5$, $SD = 0.83$) than the medical ($M = 2.1$, $SD = 0.86$) and the general social science journals ($M = 2.04$, $SD = 0.73$; also see Figure 7). The broader patterns described here thus show that different fields diverge in the number and types of acculturation aspects they tend to consider.

3.3.4 Comparing literature levels

As a final step, we aim to compare the three levels of literature we have reviewed (i.e., theoretical-psychometric-empirical). We find that all three bodies of literature focus more readily on the more external aspects of behaviors and cognitions, and less on more internal affects and desires. However, we also see that desires (i.e., motivations) play a more prominent role in the theoretical literature and interest decreases with more applied research (also see Figure 8A). Looking at the combinations of different experience aspects, we find that across all three bodies of literature, a combination of two or three aspects is most common (often including behaviors or cognitions). However, we also find that single aspect conceptualizations are substantially more common in the more applied empirical works, whereas conceptualizations that include all four experience aspects are substantially more common in the more abstract theoretical literature (also see Figure 8B). Yet, we also see that the most undervalued aspects often are considered in works that have already included a larger number of other aspects (also see Figure 8C).

3.4 Discussion

An enormous variety of aspects of our lives are affected by cultures, the psychological changes we experience when we get into continuous first-hand contact

Figure 6: Psychological Acculturation Aspects by academic field.

(A)

(B) Element Frequency
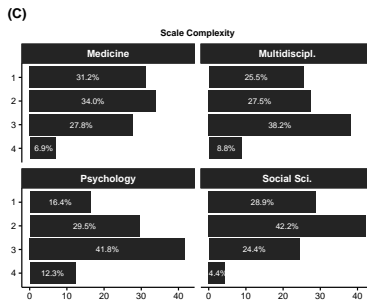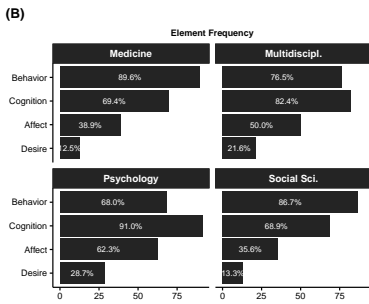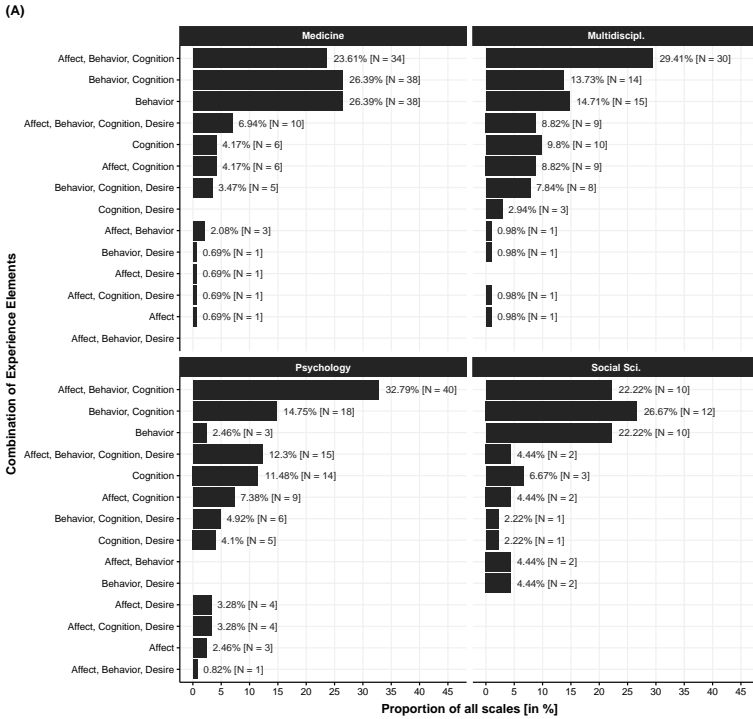
(C) Scale Complexity

Figure 7: Scale Complexity and their proportional occurrences per field. Stacked bar graphs showing how many experience aspects were measured in each academic field. Holm corrected p-values of the mean differences between academic fields displayed above the chart.
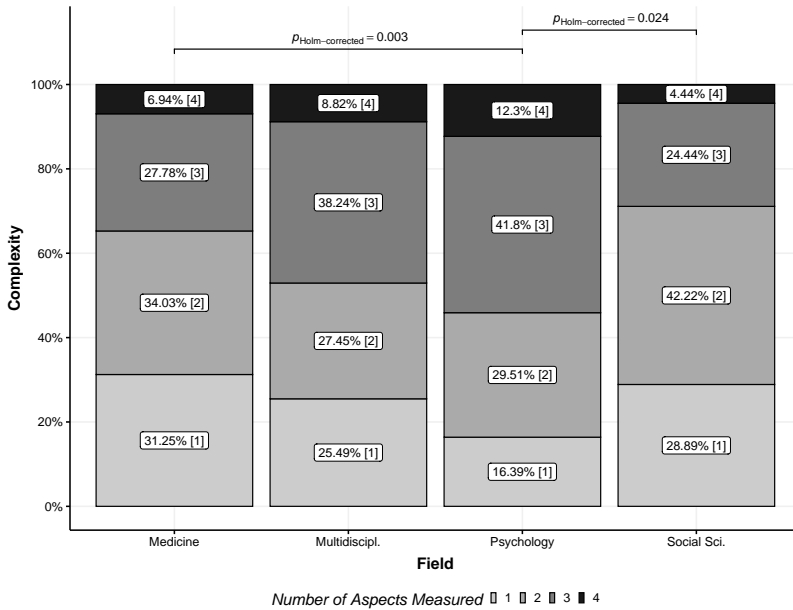
with new cultural patterns (i.e., psychological acculturation) are consequently equally plentiful and diverse. To make sense of past theories and measures of psychological acculturation and to develop new theories and measures, it is thus necessary to build a conceptual framework that allows us to analyze, compare, and understand the individual aspects of psychological acculturation. In this paper, we have proposed that taking the fundamental aspects of the human experience (affect, behavior, cognition, and desire) offers a comprehensive and theory-based structure to the psychological acculturation concept (in both theory and application).

Our investigation has utilized a variety of empirical sources and applications that offer support for the applicability of an experience framework in the acculturation field. Firstly, the ABCD experience framework brings together

Figure 8: Literature Levels.

(A)

(B)

(C)
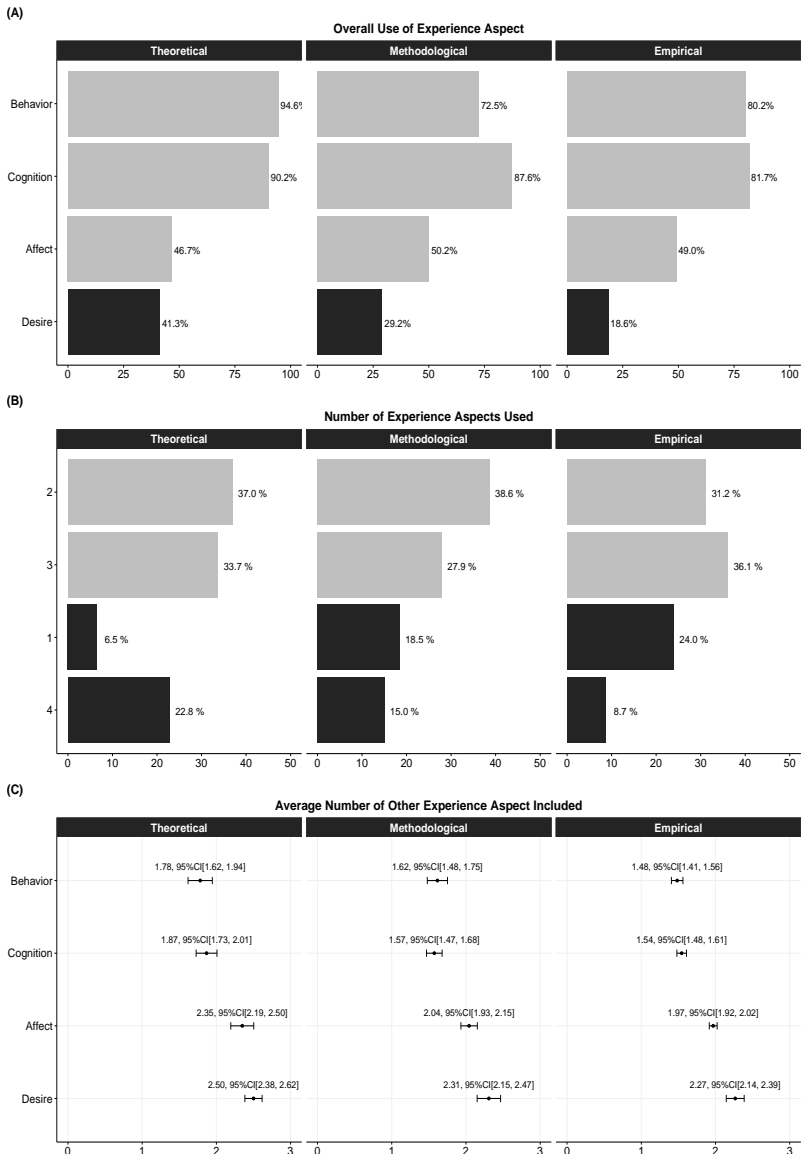
Note that in (C) within each literature body aspects are not mutually exclusive (and thus not independent).

3

and expands on several key developments within the literature on psychological acculturation. By applying the affect, behavior, cognition, and desire structure across abstract and applied levels of conceptualization, we were able to highlight the complexity and embeddedness of the acculturation process while still offering novel structural nuance in the different phases of the contact with new cultural patterns.

And secondly, we also applied the experience-based framework in a systematic scoping review of past theoretical, psychometric, and empirical literature on psychological acculturation. We found that the framework was able to capture a heterogeneous set of theoretical, psychometric, and empirical works. We were able to assess and bring together a broad set of theoretical works and were able to compare conceptualizations between publication fields and across different types of literature. We particularly found that theoretical conceptualizations of psychological acculturation tended to include more ABCD aspects than the psychometric and empirical works, and across all three types of literature, researchers have tended to focus on the more external behaviors and cognitions while the more internal affects and desires have remained understudied, especially in applied empirical works.

From our framework development and systematic scoping review, we thus offer several novel insights, which address past conceptual issues.

1. Our framework highlights that psychological acculturation is based on separate experiences of contact over time. This emphasizes the episodic nature of acculturation, where most of the psychological changes are driven by contact events. This focus on the contact episode allows us to conceptually distinguish experiences at different phases of the contact. We see this in the systematic scoping review, where an episodic and contact-focused condition-response-outcome separation was able to organize the past theoretical literature. Additionally, the framework was able to capture cross-sectional as well as longitudinal studies and was relevant to samples before and following the migration event (including, prospective migrants).

2. Because affect, behavior, cognition, and desire broadly capture the human experience (e.g., Jhangiani & Tarry, 2014), the experience frame-

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work comprehensively captures the psychological aspects of acculturation. The framework, thus, offers a theory-driven structure of the concept and its applications while still providing space for the idiosyncratic complexities of the phenomenon. This meant that in our systematic scoping review application scarcely any studies did not capture any experience aspect (e.g., length of residency, or migration status; also see Table 2) and we were arguably able to make meaningful comparisons across a wide variety of contexts and even fields. In short, the ABCD structure offers a common language that structures the heterogeneity within the literature. The broader structure can help us make sense of the differences between individual studies or competing results and, as a result, lets us talk about and address the most pressing issues within a given idiosyncratic context more transparently.

3. The experience aspects of psychological acculturation highlight a shared humanity across contexts. ABCD structures have been found across cultural contexts because they build on basic human faculties (e.g., Bhawuk, 2011). At the same time, however, the four experience aspects do not prescribe what exactly is being wanted, felt, thought, or done in any given context. The structure instead provides a language to discuss where experiences and psychological mechanisms might be shared or diverging for different contexts. In the scoping review, we were able to assess a wide range of affects, behaviors, cognitions, and desires in acculturation research from more than 315 cultural contexts (see Supplemental Material D).

4. We explain psychological acculturation as a complex phenomenon. Most theoretical works we collected as part of the systematic scoping review conceptualize psychological acculturation as a composite phenomenon that includes multiple aspects of the human experience (affect, behavior, cognition, and desire). This stands in stark contrast to singular research traditions and many empirical operationalizations that have intentionally or unintentionally focused on a single aspect of the psychological acculturation experience (also see Ward, 2001).

3.4.1   New research directions

From both the development of the experience framework of psychological acculturation and its application in the systematic scoping review, we can thus formulate a number of lessons learned that can help guide future work in the field (also see Table 4). We believe that these have a number of broader implications for researchers and practitioners. For advancing future research projects, the systematic scoping review and the conceptual framework can offer future perspectives for (1) the clarity of conceptualizations, (2) the focus of study or intervention, (3) future empirical tests, and (4) new theoretical predictions.

On transfer-ability and comparability.   Our systematic scoping review highlighted a number of transparency- and transferability issues within the field. In some works, the conceptualization and operationalizations of acculturation remained vague and unexplained (for more information on this issue, see Supplemental Material D). Future research should clearly define which experience aspect is focused on and why a particular aspect is (ir)relevant to a specific project. Also more broadly, future research should assess the impact and transfer-ability of sample and measurement decisions, such as recruiting broad categories of migrants (e.g., "Asian", "Spanish-speaking"), the use of ad-hoc and non-validated scales, or the focus on clinical outcomes with non-clinical samples — all of which were common within the empirical literature.

On testing current theories.   We find that theoretical works commonly focus on acculturation as a process that includes multiple experience aspects, while empirical works were considerably more static and narrow in their conceptualization. This gap means that many theoretical models remain empirically untested, and many empirical tests are not accurately embedded within theories. Future research should, thus, consider more longitudinal and multifaceted conceptualizations of acculturation to meaningfully test theoretical models and -predictions in their entirety.

The same static reductionist practices hold true for the conceptualization of culture more broadly. While many theoretical conceptualizations of cultural patterns have pointed to the rich idiosyncrasies of cultural realities, more applied models and empirical studies often fail to capture the multifaceted, interactive, and fluid nature of the cultural patterns migrants (re-)create. Future studies should have a more transparent communication of the cultural patterns involved, and more research is needed for contexts where new cultural patterns emerge or several cultural patterns come into conflict.

A similar gap exists in the focus on specific aspects, where affect and desire conceptualizations are highlighted in theoretical works and more bottom-up qualitative studies but remain relatively absent in empirical quantitative works. Thus, future empirical studies will need to investigate the mechanisms and roles of affective and motivational acculturation.

On novel theoretical predictions. Finally, our framework also opens up the possibility to investigate relationships between individual experience aspects of acculturation and relationships of these aspects with other concepts. Future research could, for example, assess whether a certain aspect precedes another or how one aspect might feed back into another. There are plenty (social) psychological theories that speak to the organization of human experiences and offer meaningful predictions of causal pathways for functional elements. For example, when focusing on acculturation behaviors one prediction model might argue that in response to a given interaction situation, cognitions regulate affect and desire to produce adaptive behaviors (cf., cognitive self-regulation theories; Panadero, 2017; for illustration see Figure 9A). However, a conflicting model might propose that motivations organize cognition and affect, which in turn drive behavior (cf., theory of reasoned goal pursuit; Ajzen and Kruglanski, 2019; also see Figure 9B). It is thus up to future studies to determine which experience aspect causally drives acculturation behaviors. And similar endeavors could help explain emotional, motivational, or cognitive acculturation outcomes. Similarly, the subdivision into experience aspects also allows for more nuanced investigations of these acculturation aspects to other concepts (e.g., does behavioral acculturation have the same impact on health as emotional acculturation?).

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Additionally, because the experience aspects also relate to the structural and embodied aspects of cultural patterns, the aspect separation also allows us to consider contextual affordances. As an example, in most resettlement contexts behavioral acculturation experiences are often much more directly regulated and restricted than motivational, affective, or cognitive acculturation experiences. Laws, policies, and societal interventions that surround occupational or political participation are, for example, often more common than interventions on values, virtues, or emotions (Shafir, 2013). Within concrete resettlement contexts, considering the four aspects can, thus, for example, help understand differential influences of power inequality and acculturation hurdles (Bhatia & Ram, 2001; Khawaja et al., 2019).

More broadly, the framework also integrates many of the prominent models and theories within the acculturation literature (see Figure 1). The individual responses in affects, behaviors, cognitions, and desires give space to the fluid and interconnected nature of cultural patterns by capturing the connection between different patterns of shared, embodied, and internal affects, behaviors, cognitions, and desires. As such the framework is consistent with the generalized frameworks (e.g., Berry, 2005; Cross, 1991) and ecological process models within the field (e.g., Mistry & Wu, 2010; Serdarevic & Chronister, 2005; Ward & Geeraert, 2016). And by differentiating expected ABCDs prior to contact (i.e., acculturation conditions) from experiences ABCDs during contact (i.e., acculturation response) and after the contact (acculturation outcome) the different temporal stages of an episodic contact experience extend and streamline traditional orientation-outcome models (e.g., Arends-Tóth & van de Vijver, 2006a; Te Lindert et al., 2008). In such a process approach cultural conflict models can additionally address conditions of change (e.g., Robinson, 2019) and stress adaptation models can further discern conditions of stress (e.g., Hajro et al., 2019; Kim, 1988; Sam, 2006) between the experience steps. In its structure and approach the framework is also consistent with liminality- (e.g., Baird & Reed, 2015; Loon & Vitale, 2021), and structuralist approaches (e.g., Kemppainen et al., 2020).

In its application, the framework might then address the difficulty of quantitative integration — for example, through meta-analytic reviews. The ABCD

experience framework offers both a filter- as well as a moderator solution for new quantitative integration efforts. For specific relationships (e.g., between psychological acculturation and health-seeking behaviors) quantitative reviewers may choose to only select a specific set of experience aspects (e.g., only behavioral acculturation), and if multiple aspects are considered the ABCD structure offers a meaningful moderator variable.

It is important to note again that distinguishing the four aspects should not reduce the complexity of human experiences. While researchers and lay people can generally identify affect, behaviors, cognitions, and desires as distinct aspects of psychological acculturation, it remains important to consider that they often co-occur in psychological concepts and experiences.

3.4.2 Practical implications

Our framework also offers guidance to practitioners, policymakers, and acculturating individuals.

Facilitating intervention focus. The framework might be of interest to practitioners and policy-makers because it is theory-based and brings together a wide range of past literature. The structured approach might be useful in making clear and informed decisions while still considering the concept in its personal complexity. When considering psychological acculturation practitioners can choose to assess or address emotions and moods (affective acculturation), behaviors and mannerisms (behavioral acculturation), thoughts and cognitions (cognitive acculturation), or needs and desires (motivational acculturation). Whichever selection is made for an application, the framework offers a concise decision-making tool and the review suggests that most theories of acculturation call for a large number of aspects.

Giving agency to the target group. The experience conceptualization of psychological acculturation is inherently a bottom-up approach to the topic. Taking migration experiences as the starting point highlights the considerations for the lived realities of the researched individuals and communities. Scholars

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in the traditions of critical research methods have long highlighted the impor-
tance of including the participants in the research conceptualization process
(e.g., Kovach, 2009). If one uses the experiences of the researched individuals
to guide the study or intervention design, one inevitably emphasizes the agency
and needs of the community — lending relevance and ownership of knowledge
to the community (e.g., Schmidt, 2021). Using the individual experience as
our conceptual foundation reminds us that in clinical and social protection
contexts the recipients are human beings with complex experiences. In its
application, the four experience aspects thus offer a structure for building
humane interventions as well as monitoring and evaluation efforts of such
interventions.

Comprehensive considerations. Our framework itself as well as the sys-
tematic scoping review of the theoretical literature suggest that psychological
acculturation is best captured with all four experience aspects of acculturation
(i.e., wanting, feeling, thinking, and doing). Efforts that aim to monitor,
or address maladaptive acculturation should thus consider the entire broad
acculturation experience. Resettlement organizations aiding new migrants
may, for example, want to monitor cognitive and behavioral acculturation
(e.g, cultural knowledge, or contact behaviors) but should equally consider
motivational or emotional acculturation (e.g., unfulfilled competence needs,
or feelings of loneliness).

Table 4: Synthesis Summary and Future Perspectives.

Critical issues identified	Perspective / Suggestions
1. Theoretical and empirical conceptualizations of psychological acculturation have been diverse and unstructured.	The affect, behavior, cognition, desire distinctions could be used to structure acculturation conceptualizations.
2. Empirical studies focus on cross-sectional outcome conceptualizations while theories predominantly conceptualize culture and psychological acculturation as a process.	In empirical works a stronger focus on longitudinal assessments of acculturation and cultural patterns is needed to congruently test theories.
3. Theories include substantially more experience aspects in their conceptualization than empirical studies.	Empirically, investigations of more acculturation aspects are needed to congruently test theories.
4. There has been little empirical focus on emotional and motivational aspects, even though they are important in theories and qualitative discussions.	To close this gap, empirical studies that investigate affect and desire are needed.
5. Theories have been investigated within individual experience aspects (e.g., behavioral or cognitive orientations), but effects have rarely been compared across aspects.	There is a need to compare the relationship of different experience aspects with other concepts. E.g., does behavioral acculturation have the same impact on health as emotional acculturation?
6. In theoretical and empirical work, experience aspects are commonly considered independently.	There is a need to investigate the relationships between different experience aspects.
7. Psychological and cultural adaptation (as a form of acculturation) have often been conceptualized inconsistently.	Future investigations and interventions could consider functionality and adaptation within each experience aspect.
8. We identified 92 (mostly independent) theoretical works.	Future research should assess the possibility of theoretical synthesis (e.g., Maertz et al., 2016). The experience framework might offer a conceptual lens for such a synthesis.
9. The normative aim of acculturation conceptualizations is often unclear (e.g., does the conceptualization aim to benefit an individual or society?).	There is a need to discuss the normative expectations of acculturation conceptualizations within empirical and theoretical work (e.g., Ager & Strang, 2008).

Table 4 – continued from previous page

Critical issues identified	Perspective / Suggestions
10. The choice of investigated acculturation aspects has often remained elusive in methodological and applied empirical literature.	For replications, comparisons, and theoretical synthesis, research and intervention choices need to be transparent. Which aspect is focused on? Why is an aspect (ir)relevant to the project?
11. Operationalizations and measurements of acculturation are often reported unclearly (especially with ad-hoc measures or non-validated modifications and non-disclosed items).	As long as the field faces conceptual issues, transparency in measurement remains important. Either items or clear content descriptions should be available.
12. The migrant population has often been defined very broadly (e.g., any migrant, Asia, Spanish-speaking, third-world).	Research questions, conceptualizations, and measurements concerning acculturation should be specific to all considered cultural contexts or should be transferable across all considered cultural contexts.
13. Acculturation measures are often validated within specific cultural contexts but are applied within other cultural contexts.	Future research needs to assess the impact of non-validated scales.
14. Empirical work has had a strong focus on clinical outcomes but utilized few clinical samples.	Differences between clinical and non-clinical samples should be assessed where researchers focus on clinical outcomes.

Note. Some issues or suggestions listed here are not discussed in detail as part of the main text to give adequate space to the core conceptual issues.

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Figure 9: Novel Prediction Models with Behavioral Focus.

(A) Input — Output Model
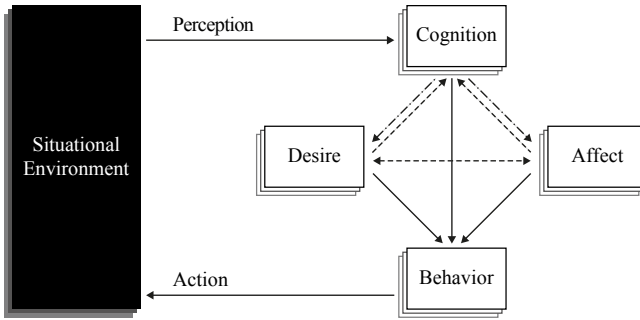
(B) Fundamental Needs Model
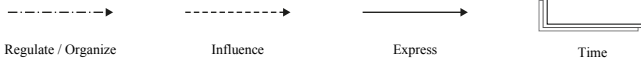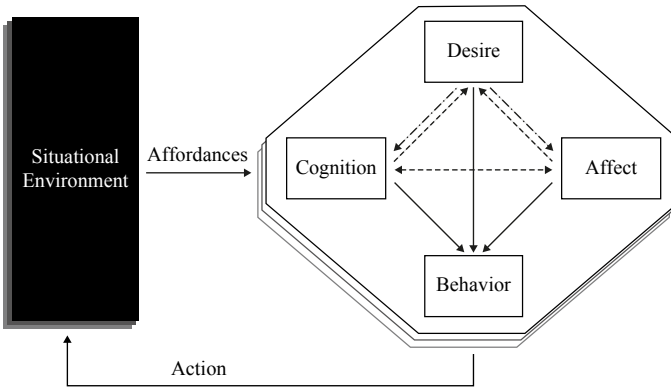
3.4.3   Constraints on generality, positionality, and citations

As with any large-scale conceptual undertaking, the framework and this review study are not without limitations. Notably, the framework exclusively focuses on the psychological acculturation process. This has been the explicit focus of our efforts but this also means that non-psychological aspects such as biological, cultural, or societal changes are not captured directly but only to the extent to which they impact the experiences of the involved people. Future work might want to integrate these different levels of group and individual, body and mind (e.g., Eronen, 2021).

Another point that we have thus far mostly disregarded is the role of the migration context. While we have argued that the framework structure (i.e., the four experience aspects) is relevant across contexts, the lived experiences are often fundamentally influenced by their context and environment. Three major contextual factors often found within the literature are the cultural patterns, the contact situation or life domain, and the interacting individuals. As we already alluded to during the framework development, all of these contextual elements will likely have a profound impact on the experience of affects, behaviors, cognitions, and desires. Cultural patterns, such as laws or norms, individual differences, such as personality or age, but also situational differences in how public or private the acculturation experience is are all likely intermingled with the individual experience aspects. This means that especially within more applied research projects, such contextual considerations will be meaningful predictors of individual and group differences (for a first discussion of these contextual factors within our systematic scoping review, see Supplemental Material D).

Beyond the more methodological constraints, we would also like to briefly address the generality of the samples included in the systematic scoping review. We included 233 studies in the psychometric literature, and 526 studies from the broader empirical literature. While the studies jointly included 43 host societies, and 118 societies of origin (with a total of 315 unique combinations), for both bodies of literature an overwhelming number of studies were conducted in 'western' countries — Western Europe (e.g., The Netherlands, United Kingdom, Germany, Italy, Spain), Australasia (Australia, New

Zealand), Russia, and Israel. As an example, 126 scales were validated for a U.S. American resettlement context, and 324 of the included empirical studies focused on migrants arriving in North America (i.e., U.S. and Canada). When it came to the migrants' country of origin, a majority of studies were indifferent to migrants' background and simply recruited any consenting migrant ($N_{psychometric} = 53$, $N_{empirical} = 108$), or recruited a broad category of migrants (e.g., LatinX or Hispanic: $N_{psychometric} = 22$, $N_{empirical} = 67$; Asian: $N_{psychometric} = 10$, $N_{empirical} = 26$). Among the studies, that recruited participants from specific cultural backgrounds, Mexican, Chinese, and South Korean migrants were recruited most frequently. To address the lack of research on migration to non-western countries, we additionally searched for and included qualitative studies and grounded theories, which unfortunately are often the only works to engage with understudied communities. However, even with these inclusions and additional search strategies, the field remains Western-centric. While we sought to build a conceptual structure that focuses on shared basic capacities, the framework did emerge from the literature and the included studies remain a constraint of the scoping review.

Next to the more formal limitations of scope and methodology, we would like to situate our framework, its application, and its limitations more broadly. For such a reflection, it is essential to expand on how our own beliefs, judgments, and practices have shaped the development of the framework and its application. In the most practical sense, the extensive, multiyear efforts of this project grew out of a research-NGO collaboration and an academic frustration. The conceptual question of what we mean by 'acculturation' and how we should assess it was initially raised during this local collaboration with a refugee resettlement organization. However, trying to make sense of the heterogeneous acculturation conceptualizations within the academic literature to develop more sustainable metrics for practitioners, initially highlighted that we miss an overarching manner in which we make sense of the concept. Additionally, by engaging with stakeholders, we gained a deeper understanding of the experiences and perspectives on psychological acculturation, and the participatory approach facilitated the co-creation of knowledge, where we were able to exchange ideas, identify knowledge gaps, and co-develop approaches that

could inform future work in the field (for a full reflection on the participatory action aspect see Kreienkamp et al., 2023g).

Our approach to this review and the framework was certainly guided by our backgrounds and experiences. The main author has been working with forced migrants for over 10 years in three countries around the world — in refugee resettlement programs under the UNHCR, as a volunteer, language teacher, and integration coach with several smaller and larger migration organizations. Additionally, three of the five authors were first-generation migrants at the time of the writing of this article. Our own, decidedly applied experiences with the importance and diversity of psychological acculturation, have assuredly influenced our research process. Most notable are our choices to take a phenomenological perspective and our focus on the migrant minority perspective in understanding the psychological mechanisms of acculturation. Taking a bottom-up and migrant-centered focus was fundamental to our approach.

Similarly, all five authors have contributed a unique view to this project in terms of their academic background. The author team consists of two social psychologists but also includes a clinical-developmental, and an organizational psychologist, as well as a methodologist and statistician. The team not only exemplifies the diversity of fields that are affected by questions of acculturation but also brought about the basic structure of the framework we suggest. Making sense of the qualitative responses and the past conceptual literature, the ABCD division of the human experience is arguably a multidisciplinary structure that coherently conformed to the bodies of literature we were familiar with prior to the systematic scoping review.

On a more abstract level, we would like to address some of the ontological and epistemological influences that have shaped our approach. Our research question and conceptual framework are fundamentally motivated by our structuralist ontology. Here we follow the stance that others like Berry (2009) have taken, where we argue that affect, behavior, cognition, and desire are basic human capacities. Importantly, in our view, this does not imply cultural determinism or deny cultural and individual diversity. While we argue that everyone has the capacity for emotions, we do not argue that this determines which emotions an individual will feel at any given moment. By extension, the

same holds true for affective acculturation, where we argue for its structural existence but not a culturally universal content. Similarly, the way in which we sought to validate our framework is arguably the result of our own empiricist epistemological background. In particular, we chose to systematically collect past academic literature and extracted conceptual aspects to apply the framework. Thus, while we have included some qualitative review elements, our efforts were mainly deductive and had a hypothesis-testing rather than hypothesis-generating quality in their application.

Finally, we would like to speak to the diversity of the scholars we cite and who form the body of the literature we worked with. To assess the broadest level of structural bias within the work we cite, we used a 'cleanBib' pipeline developed by Zhou et al. (2022). The Python program allowed us to analyze the first/last author pairs in our bibliography entries. The program relies on probabilistic gender (woman vs. man) and ethnicity assignments (White vs. person of color [POC]) based on the authors' names. The predictive validity of both the underlying Gender API (Sebo, 2021) and the name ethnicity predictor has been well-established (Ambekar et al., 2009; Sood & Laohaprapanon, 2018). For both measurements, we excluded self-citations of the first and last authors of this current paper. For the works cited within this manuscript, we found scholars were 22.88% woman(first)/woman(last), 15.29% man/-woman, 15.44% woman/man, and 46.38% man/man. Additionally, our references contain 17.29% POC(first)/POC(last), 14.40% White/POC, 15.75% POC/White, and 52.57% White/White. Compared to the full set of works that were included in the scoping review, our references match the patterns of the theoretical literature.

Interestingly, when we compared the distributions across the three bodies of theoretical, psychometric, and broader empirical literature, we saw that women and people of color were less frequently authors of theoretical literature but were substantially better represented within the psychometric and the empirical literature (e.g., empirical gender: 40.18% woman/woman and 25.68% man/man; ethnicity: 23.72% POC/POC and 34.88% White/White). This might be due to the larger sample sizes or represent a broader inequality within

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the field. Beyond the limitations of the method we employed here[6], it should also be noted that privilege and discrimination are layered, multidimensional, and often intersectional. Important additional markers of such inequalities include access to funding, the journal tier, and the research institution, all of which are readily available for most published works (e.g., Schmidt, 2021). Future research should seek to assess and address the multidimensional and intersectional inequalities within the field more rigorously.

3.4.4   Conclusions

By building on recent developments within the field, we suggest a conceptual framework of psychological acculturation, utilizing the affect-behavior-cognition-desire aspects of human experiences. We showcase the structuring and comparative utility by applying the framework in a systematic scoping review of the past theoretical, psychometric, and empirical literature. We find that the framework is able to comprehensively structure past works (e.g., few articles did not fit the ABCD conceptualization), identify gaps within the literature (e.g., a crucial disconnect between theory and empirical practice), and is able to assist in future theoretical and applied conceptualizations (e.g., novel predictions and interventions). As such, the framework provides a robust starting point and a useful tool for both researchers and practitioners.

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[6]Gender prediction via this method may be limited to the names, pronouns, and social media profiles, which have been used to build the data set. Additionally, the method is unable to account for intersex, non-binary, or transgender individuals. Similarly, the method's predictive accuracy for race and ethnicity may be restricted by the use of names and how well they are represented in the Florida Voter Data. The approach may not account for Indigenous and mixed-race authors or individuals facing ambiguous racial or ethnic identification. Differential biases may also arise due to such ambiguity.

Appendices

Appendix 3.A   Search strategy

To assess the past empirical and theoretical literature on psychological accultur-
ation, we performed a systematic literature review. We first read seminal and
review works within the field (including, Berry, 1997b, 2003; Rudmin, 2003;
Sam & Berry, 2006; Szapocznik et al., 1978; Ward & Szabó, 2019). Based
on our reading of the literature, we designed a comprehensive literature search
strategy in an iterative fashion.

For the empirical work on acculturation, we performed a literature search
on March 4th, 2020, and February 14th, 2021, within the "APA PsycINFO"
bibliographic databases using the EBSCO*host* provider. The databases also
included the PsycARTICLES, PsycBOOKS, and PsycCRITIQUES databases
as well ProQuest Dissertations with psychological relevance. The second lit-
erature search included alternate terms used less frequently to describe what
we mean with psychological acculturation, including "transculturation" and
"cultural transition". Additionally, the second search removed limiter terms
that could have exclude interdisciplinary investigations and focused on human
participants.

For the theoretical literature, we performed an additional, more specific,
search of the same databases as well as the Web of Science Core Collection
using the Clarivate Analytics provider on March 3rd, 2021.

In designing our search strategy, we used an adapted version of the 'SPIDER'
research tool (e.g., Cooke et al., 2012). We utilized the *Evaluation* element
mainly to exclude articles that were not relevant to the search. The exact search
terms used are listed in Table 3.A.1 below.

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Table 3.A.1: Final Search Strategies for Empirical and Theoretical Literature

Element	Search Terms	
	Empirical	Theoretical
Sample	(Immigration OR migration OR migrant OR immigration OR refugee)	same as empirical
Phenomenon of Interest	(acculturation OR enculturation OR transculturation OR assimilation OR "social integration" OR "cultural adaptation" OR "cultural adjustment" OR "cultural transition")	same as empirical
Design	("measurement tool" OR scale OR instrument OR questionnaire OR survey OR definition OR inventory)	TITLE: (theory OR conceptualization OR conceptualisation)
Evaluation	NOT (treatment OR therapy OR intervention OR parent* OR "second generation" OR "third generation" OR "fourth generation")[1]	—
Research type	METHODOLOGY: (quantitative OR qualitative OR "mixed method") AND POPULATION: (Human) AND LANGUAGE: (English)	—

[1] Limiters were determined in an iterative fashion, excluding society-level and medical studies as well as non-migrants.

Figure 3.A.1: PRISMA Diagrams for the Theoretical, Psychometric, and Empirical Literature.

(A) PRISMA Diagram for the Theoretical Literature

Records identified through database searching
(n = 477)

Additional records identified through other sources
(n = 19)

Records after duplicates removed
(n = 413)

Records screened
(n = 413)

Records excluded
[reasons, see Table 2]
(n = 256)

Full-text articles assessed for eligibility
(n = 157)

Full-text articles excluded
[reasons, see Table 2]
(n = 65)

Studies included in quantitative synthesis
(empirical)
(n = 92)

(B) PRISMA Diagram for the Methodological Literature

Records identified through past reviews
(n = 178)

Additional records identified through own review
(n = 158)

Records after duplicates removed
(n = 256)

Full-text articles assessed for eligibility
(n = 231)

Full-text articles excluded
[reasons, see Table 2]
(n = 25)

Scales included in quantitative synthesis
(n = 231)

Scales included in quantitative synthesis
(empirical)
(n = 231)

(C) PRISMA Diagram for the Empirical Literature

Records identified through database searching
(n = 1629)

Additional records identified through other sources
(n = 133)

Records after duplicates removed
(n = 1329)

Records screened
(n = 1329)

Records excluded
[reasons, see Table 2]
(n = 655)

Full-text articles assessed for eligibility
(n = 674)

Full-text articles excluded
[reasons, see Table 2]
(n = 144)

Studies included in quantitative synthesis
(n = 530)

Studies included in quantitative synthesis
(empirical)
(n = 530)

Chapter 4

Need fulfillment during intergroup contact: Three experience sampling studies

Abstract

One challenge of modern intergroup contact research has been the question of when and why an interaction is perceived as positive and improves intergroup relations. We propose to consider the perceived fulfillment of the situationally most relevant need. We conducted three intensive longitudinal studies with recent migrants, to capture their interactions with the majority outgroup ($N_{measurements}$ = 10,297; $N_{participants}$ = 207). The situational need fulfillment mechanism is consistently a strong predictor of perceived interaction quality and positive outgroup attitudes following intergroup interactions. The model is specific to outgroup contact, robust to various need types, and works at least as well as Allport's contact conditions. As one of the first studies to test intergroup contact theory using intensive longitudinal data, we offer insight into the mechanisms of positive intergroup contact during real-life interactions and find situational motivations to be a key building block for understanding and addressing positive intergroup interactions.

Public significance statement: In this paper, we provide evidence that the fulfillment of situational needs during real-life intergroup contacts meaningfully predicts perceived interaction quality and positive outgroup attitudes. Methodologically, this offers testament to the emerging practice of capturing real-life interactions using intensive longitudinal data. Theoretically, our results give weight to motivational fulfillment as a flexible and effective mechanism for understanding positive intergroup contact.

Keywords: Intergroup Contact, Need Fulfillment, Outgroup Attitudes, Interaction Quality, Intensive Longitudinal Data

Data Availability: Materials and software are available at https://janniscodes.github.io/intergroup-contact-needs/ (Kreienkamp et al., 2022a). Protocols, materials, data, and code are available at https://osf.io/pr9zs/?view_only=208a53a1f0ff48dda1c17357328fa578 (Kreienkamp et al., 2022b). The preregistration of Study 3 can be accessed as part of our Open Science Framework repository (Kreienkamp et al., 2021).

Open Science Practices: ⬢ Preregistration+, ⬢ Open Materials, ⬢ Open Data, ⬢ Open Code, ⬢ Open Supplements

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One of the main intergroup societal issues to date, are the struggles of many migrants across the world, hoping to build a new life that includes a positive relationship with the majority group. The intergroup contact hypothesis postulates that prejudice can be reduced and favorable attitudes be increased if members of two groups have frequent and positive contact (e.g., Allport, 1954; Hewstone, 1996; Pettigrew, 1998). Over the past 70 years, a plethora of studies and interventions have shown the general effectiveness of positive intergroup contact (e.g., Pettigrew & Tropp, 2006). However, even though a central assumption of intergroup contact theory is that the contact should be positive, relatively little research has thus far explained when and why people perceive their everyday intergroup interactions as positive.

Importantly, as we still fail to understand when and why an interaction is perceived as positive, substantial theoretical and practical challenges remain. There is now consistent evidence that negative intergroup contacts lead to worse attitudes, prejudice, and reduced future interaction motivation (e.g., Barlow et al., 2012; Graf et al., 2014; Prati et al., 2021). In light of these findings, understanding interaction quality thus sits at the heart of understanding when an intergroup contact is successful (e.g., Allport, 1954; Brown et al., 2007; Tropp et al., 2016). But also in applied settings, policymakers and practitioners are thus far often under-prepared to deal with the occurrences of negative interactions, especially in everyday life contexts. Understanding the psychological mechanisms of when and why interactions are perceived as positive is, thus, an important issue for understanding whether an interaction leads to better intergroup perceptions, especially during everyday interactions.

We propose that one key to understanding how an interaction is perceived is to examine the level of need fulfillment it provided to an individual. As an example, if someone seeks acceptance by their interaction partner, and this need is fulfilled during the interaction, the person should rate the interaction and the group of the interaction partner more favorably. To test this idea, we collected three sets of real-life data from recent immigrants, assessing their daily interactions with majority group members, tracking situational needs, interaction quality, and outgroup attitudes.

4.1   Need mechanism in intergroup contact

Looking at the past literature, we can essentially separate intergroup contact theory research into a two-step problem. Firstly, we need to understand when and why contact becomes a positive contact (contact → positive contact) and, secondly, we need to understand when and why positive contacts drive better intergroup relations (positive contact → better relations; e.g., see Allport, 1954; Hewstone, 1996; Pettigrew, 1998).

In recent years, research has focused on the second step of understanding the psychological processes that explain how positive contacts improve intergroup relations (e.g. see, Paolini et al., 2021). Among others, researchers have explored different forms of social categorizations (Pettigrew, 1998), the salience of social categories (Brown & Hewstone, 2005), intimacy (e.g., Marinucci et al., 2021) and attachment (e.g., Tropp, 2021), threat and intergroup anxiety (e.g., Stephan et al., 2008), as well as knowledge about the other group (Pettigrew & Tropp, 2008). Most recently, researchers have even looked at how empowerment need fulfillment during positive intergroup contact can explain some of the beneficial intergroup effects (Hässler et al., 2021). There is thus, substantial evidence on the psychological mechanisms that explain the effects of positive contact.

Research on the first step of what makes an interaction positive to begin with tends to be much older, and often more static and contextual. The most widely used approach has been the idea that equal status, common goals, collaboration, and structural support during the interaction form Allport's optimal conditions for positive contacts (Allport, 1954; Pettigrew, 1969). Following Allport's original conditions, several additional conditions of optimal contact were proposed, including, stereotype disconfirmation (Cook, 1978) or common language and voluntary interaction (Wagner and Machleit, 1986; for a critical discussion see Pettigrew, 1998). However, despite their prominence in guiding research on this topic, meeting the contact conditions does not seem to be necessary to finding positive effects of intergroup contact (Pettigrew & Tropp, 2006) and more fundamentally, the conditions often do not capture any underlying psychological mechanisms of why an interaction is perceived as positive (e.g., Pettigrew, 1998).

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In this article, we focus on the role of motivation and need fulfillment to understand when and why exactly an interaction is perceived as positive. We propose need fulfillment in particular because needs are a fundamental aspect of the human experience that governs a significant number of emotional, cognitive, and behavioral facets (Kreienkamp et al., 2023h; Kruglanski et al., 2002). Importantly, need fulfillment has particularly been highlighted in explaining the success of (close) relationships, psychosocial functioning, as well as reducing conflict between groups — all of which are essential to positive intergroup interactions.

On an individual psychological level, there is a long tradition of using need fulfillment to explain what drives human adaptation and social relations. From the early works of Maslow (1943) and Lewin (1926) to more recent works by Ryan and Deci (2017) or Steverink and Lindenberg (2006), the fulfillment of needs have been considered a driver of psychosocial functioning. Most relevant to our proposal here, within experience sampling studies need fulfillment has been found to explain variations in well-being during daily interactions (Downie et al., 2008) and has been found to be important in understanding the success of close relationships (e.g., see Knee & Browne, 2023). In short, an extensive body of scholarly work underscores the significance of need satisfaction in fostering favorable social relationships and social functioning.

Beyond the individual relations literature, need fulfillment has recently also seen application as a psychological mechanism in the intergroup relations literature. Social identity theory has focused on the role of self-esteem needs in understanding how people navigate intergroup contexts (e.g., Abrams & Hogg, 1988). In the study of conflict and reconciliation, addressing differential needs of victims and perpetrators (i.e., the need for power and the need for morality respectively) increased willingness to reconcile (Shnabel & Nadler, 2008). And similarly, addressing a relevant need for identity continuity among refugees in Turkey bolstered resilience in the face of discrimination experiences (Çelebi et al., 2017). In short, an increasing amount of literature is emphasizing the significance of need satisfaction in understanding intergroup dynamics.

It is thus not surprising that Dovidio and colleagues propose that: "To achieve truly constructive intergroup relations, it is important that intergroup exchanges meet the psychological needs of both majority- and minority-group members." (Dovidio et al., 2017, p. 6). A call that has thus far remained unanswered when it comes to the basic tenet that need fulfillment underpins positive and constructive interactions.

One reason why motivational considerations might have remained absent from the intergroup contact literature is that there is an overwhelming number of individual motives or goals that might be relevant to a person during an intergroup interaction. Researchers considering the motivational content would, thus, either test few hyper-specific needs that might not be transferable to other intergroup contexts or they may need to assess a broad and diverse range of motives. However, while the specific need content differed within the different lines of research, what unites most motivational researchers is a focus on fulfilling the situationally relevant needs of people. This motivational experience of need fulfillment, thus, brings many of the diverse need content theories together and offers a common psychological mechanism for understanding positive intergroup contact.

Here it is important to briefly define what exactly we mean by need fulfillment and how it differs from need content theories. With motivation and need fulfillment, we specifically mean the psychological experience of addressing an active and relevant need during the interaction. For our purposes, we define a need as:

Definition 1 (Need)

A tension or deficiency in the organism that elicits a (non-specific) motivational force organizing affect, cognition, and behavior to reduce this unsatisfactory situation, which is to some extent necessary for the individual's overall well-being.

> *— based on Dweck (2017), Hull (1943), Kruglanski et al. (2002), Lewin (1938), McClelland (1987), Ryan and Deci (2017), and Steverink and Lindenberg (2006)*

The psychological experience of need fulfillment is, thus, distinct from the content of the need (i.e., the motive or goal). The content could, for example, include physical motives (such as safety or hygiene) but also psychosocial motives (such as acceptance or competence; e.g., see Pittman & Zeigler, 2007). The experience of needing is a more general process that arises when any important motive is thwarted or situationally active and relevant (Gollwitzer & Wicklund, 1985; Leander et al., 2020; Lewin, 1926). It is this perceived needing and the perceived fulfillment of needs that we focus on in this article. This is not to imply that considering specific motives is irrelevant to contact situations, but instead, we propose that the psychological experience of perceived need fulfillment is a core mechanism in understanding interaction quality perceptions, well-being, and outgroup attitudes.

To test such a proposal, we can rely on adaptive and responsive survey designs that allow a tailored approach based on the participants' inputs (e.g., Tourangeau et al., 2017). In particular, we propose to ask the participants to report their main goal during the interaction in a short open-ended question (i.e., name the situationally relevant need content), and with reference to their own response, the participants can then indicate how much this need was fulfilled during the interaction (i.e., need fulfillment mechanism). Such an adaptive approach allows us to take the initial step of testing whether situational need fulfillment indeed generally predicts perceived interaction quality, well-being, and positive outgroup attitudes independent of need content.

4.2 Intergroup contact in daily life

While we have argued that a need fulfillment mechanism is relevant to intergroup contact generally, its flexible and broad applicability might be ideally suited to address the pressing issue of understanding natural intergroup contacts outside the lab. Investigations of such 'real-life interactions' often suffer from the difficulty that past intergroup contact research has either focused on the mechanisms of individual interactions in artificial lab studies (sometimes referred to as the intergroup interaction literature) or has focused on longer-term recall self-reports of natural interactions (commonly referred to as the

intergroup contact literature; also see Pettigrew & Tropp, 2006). MacInnis and Page-Gould (2015) have even pointed out that these two approaches tend to find conflicting effects — where individual interactions (in the lab) have more negative effects and recall of real-world contact patterns have more positive effects for intergroup relations. We, thus, miss data following people in their diverse daily interactions and investigating the psychological mechanisms of contacts, especially as they compound over time. Even with extended intervention studies, the most fine-grained data available is usually limited to pre-post-control designs. It should be noted that there is an emerging body of literature looking at longitudinal effects with panel studies (e.g., Bracegirdle et al., 2023; Górska & Tausch, 2023). However, such studies still ask participants to recall their interactions of weeks, months, or years.

However, the lack of longitudinal real-world data is in stark contrast to many of the theoretical advances that have focused on the dynamic nature of intergroup relations (e.g., Pettigrew, 1998), as well as the original contact hypothesis, which focused on daily interactions (Allport, 1954). As a result, prominent researchers in the field have long called for longitudinal (Pettigrew, 1998, 2008; Pettigrew & Tropp, 2011) and real-life experience-sampling data outside the lab (ESM MacInnis & Page-Gould, 2015; McKeown & Dixon, 2017). Such data would be able to capture real-life interactions that include interaction-specific mechanism information close to the actual experience[1].

In the past, such data collections were often unfeasible because they were either physically impractical or too expensive. However, recent technological developments allow us to easily collect experience sampling data on mobile devices (e.g., Keil et al., 2020) or using web-based applications (e.g., Arslan et al., 2020). At the same time, analytical methods for such more complex data have become more readily available, making the analyses more approachable (e.g., see O'Donnell et al., 2021). Given these technological and methodological developments, we were able to collect three independent studies of extensive real-life data following the daily intergroup interactions of recently arrived migrants with the majority-group members.

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[1]Additionally, such experience-sampling data can be collected close to the intergroup interactions and would, thus, largely mitigate recall biases. Moreover, because data is nested within participants, experience-sampling data often allows capturing large amounts of high-quality data with relatively few participants (Shiffman et al., 2008).

4.3   The present research

Using three independent sets of intensive longitudinal data (Studies 1–3), the aim of this paper is essentially threefold. We (1) seek to test the basic ideas of the contact theory within real-world experience sampling data. We (2) aim to test the situational need fulfillment mechanism within the real-world data. And we (3) seek to ensure the stability, robustness, and embeddedness of our results.

Firstly, for the general contact hypothesis test, our study is among the first to test the fundamental tenets of intergroup contact and Allport's conditions in real-life intensive longitudinal data. Translating the contact hypothesis into intensive longitudinal data is not a trivial task, as past research traditions have used two fundamentally different approaches. While lab studies have tended to focus on the effect of a single positive interaction, cross-section studies have primarily investigated the frequency of positive interactions more generally. Intensive longitudinal data allows us to investigate both. We can test whether having a specific type of interaction vs. not having an interaction improves intergroup relations, but we can also use the participant's 30-day contact reports to test whether participants with more positive interactions tend to benefit more from intergroup contact. Testing both approaches to the contact hypothesis allows us to go beyond a replication of the basic theory but could disentangle individual- from aggregated contact effects and would allow for a direct comparison with both bodies of literature.

We test the basic contact hypothesis within and across the three studies. In particular, we assess the effect of individual interactions within each study using a multilevel model, but to avoid power limitations, we test the collective effect of contact frequency and -quality after the individual studies, across all participants.

H1: Based on the most general understanding of the contact hypothesis, an increase in frequency and quality of contact should jointly account for more favorable outgroup attitudes within and across intensive longitudinal data.

The test of Allport's conditions is notably restricted to measurements that report on outgroup interactions because Allport's conditions and interaction quality ratings cannot meaningfully be measured or imputed if participants did not have an interaction. Focusing on the interactions in detail, we use a multilevel regression model to test whether interactions that are higher in the fulfillment of Allport's conditions predict more favorable outgroup attitudes. We would also expect that such interactions are perceived as higher in interaction quality.

H2: Based on the literature about Allport's optimal contact conditions, intergroup interactions that are higher in equal status, common goals, collaboration, and structural support should predict more favorable outgroup attitudes due to more positive interaction quality perceptions within the intensive longitudinal data.

Once the general contact hypothesis is established within the ESM data, our second main aim is to test our main theoretical proposal that the fulfillment of situational needs is meaningfully related to more positive outgroup attitudes following intergroup interactions. As our main proposal is concerned with the mechanisms of successful intergroup contact, we again focus on outgroup interaction reports. Within a multilevel model, we expect interactions that are higher in situational need fulfillment to be perceived as more positive, and as a result that these interactions also predict more positive outgroup attitudes. We also expect the needs mechanism to work at least as well as Allport's conditions. We particularly expect part of Allport's contact conditions to be a static set of situational needs so that the situational need fulfillment should explain some of the same variance in outgroup attitudes.

H3: Based on our proposal, intergroup interactions with higher situational need fulfillment should predict more favorable outgroup attitudes due to more positive interaction quality perceptions within the intensive longitudinal data. We also expect situational need fulfillments to work at least as well as Allport's optimal contact conditions in predicting outgroup attitudes.

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Our third main aim is to ensure that our results are robust, stable, and ecologically valid. To test the robustness of our need-fulfillment mechanism we test whether the need mechanism is indeed specific to outgroup interactions and whether the process could be explained by a smaller set of fundamental psychological needs instead. We additionally, assess the need fulfillment mechanism in predicting individual well-being benefits and check whether different types of needs or interactions change the main results. We present the full robustness analyses in Appendix 4.B. To test the stability and reliability of our results, we utilize forest plots and meta-analytic estimates for our main analyses. To assess the embeddedness of our situational needs, we use an exploratory topic model for the participants' free-text entries and compare the extracted content topics with themes commonly found within the motivational literature.

Before turning to individual studies, we would like to address a number of conceptual, practical, and methodological considerations. One key decision for our studies has been to focus on the minority experience during the contact. While the same mechanisms should hold for the experience of members in high-power groups, there is substantially more research available that focuses on the experience of the majority group, and minority perspectives are historically often understudied (e.g., Dovidio et al., 2017). At the same time, however, minority groups are often underprivileged and research is direly needed to understand the more prevalent experiences of stress and health issues among minorities (e.g., Alvidrez et al., 2019).

A second non-trivial aspect of translating the intergroup contact hypothesis into intensive real-world data was the choice of the outcome variable. For our main analyses, we chose outgroup attitudes — the positive or negative evaluation of the other group. We chose outgroup attitudes mainly because they are the most common outcome considered within the intergroup contact literature (e.g., Paolini et al., 2021; Pettigrew & Tropp, 2006). As the methodology is relatively new to the field, we sought to first replicate (and then extend) the most reliable effects of the contact hypothesis within the ESM data. Outgroup attitudes are, however, not without controversy, especially for minority group members. Positive outgroup attitudes can increase harmony

and reduce the willingness to support social change among the disadvantaged in some cases — even in the face of injustice (e.g., Dixon et al., 2012; Saguy et al., 2009). While a recent review found the effect to be less conclusive for longitudinally collected data and less consistent for positive interactions (rather than interactions generally), the backfire effect remains an important possibility for the present data (see Reimer & Sengupta, 2023). In order to ensure at least a direct benefit to the minority group members, we also assess the effect of the need fulfillment mechanism on well-being as the dependent variable as part of our robustness analyses below.

In terms of methodological considerations, it is important to note we tested most of our hypotheses using multilevel regression models, where measurement occasions (level 1) were nested within participants (level 2). This approach is tolerant to missing data and uneven case numbers within participants. Furthermore, we use a hierarchical modeling approach and report the final model in-text (Snijders & Bosker, 2012, for the full modeling process see Supplemental Material E). Secondly, statistical power estimations for intensive longitudinal- and multilevel models are notoriously difficult due to the complex covariance structures. However, our participant- and measurement numbers are among the largest sample sizes found within the intensive longitudinal literature (e.g., aan het Rot et al., 2012). Additionally, power simulations after the first study indicated that our data were sufficiently powered for even small effect sizes (see Supplemental Material F). In particular, we found that even our smallest effects of interest would be detectable with 22 participants and 24 measurements per person (assuming the effect sizes of Study 1 and focusing on a power of .8 with a .05 alpha level; see Supplemental Material F for the full analyses). We only increased the participant sample sizes in Studies 2 and 3 to allow for between-participant effects across studies and more complicated trajectory analyses, which are not necessary for the hypotheses tested here.

Finally, for our most comprehensive study (Study 3) we preregistered both the hypotheses as well as the analysis plan (available at Kreienkamp et al., 2021). All studies received ethical approval from University of Groningen and none of the data has been published elsewhere. The detailed hypotheses and analysis plan are available in Appendix 4.A. The full surveys, code, and materials

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are available in our open science repository (including a complete codebook; Kreienkamp et al., 2022b). Additionally, the fully annotated analyses are available in Supplemental Material E, Supplemental Material F, and Supplemental Material G.

4.4 Study 1

Based on our main hypotheses, the aim of our first study was to specifically test the general contact hypothesis, the influence of situational need fulfillment, and perceived interaction quality during intergroup contacts. To this aim, we recruited recent migrants to the Netherlands for an intensive longitudinal survey. Data were collected from May 5th through June 6th, 2018 (and all participants started the study within the first two days). Correlations and descriptive statistics of the included variables are available in Table 1 and Table 2 (full data description is available in Supplemental Material E).

4.4.1 Methods

Participants

After receiving ethical approval from the University of Groningen, we recruited 23 non-Dutch migrants using the local paid participant pool. Participants reported on their interactions for at least 30 days with two daily measures (capturing the morning and afternoon). With this design, we aimed at getting 50–60 measurements per participant ($M = 53.26$, $SD = 16.72$, *total N* = 1,225). This is a common number of measurements found in experience sampling studies and offers sufficient power to model processes within and between participants (e.g., aan het Rot et al., 2012). Participants were compensated for their participation with up to 34 Euros – each two Euros for pre- and post-questionnaire and 50 Euro cents for every experience sampling measurement. The sample consisted of relatively young, educated, and western migrants from the global north ($M_{age} = 24.35$, $SD_{age} = 4.73$, 19 women, 15 students). The sample accurately describes the largest groups of migrants in the region (see Masked for Peer Review, 2015, for a recent report on the largest migrant

groups and see Supplemental Material E for a full overview of the demographic composition, including country of origin).

Procedure

The study itself consisted of three main parts, an introductory pre-measurement, the daily experience sampling measurements, and a concluding post-measurement. After giving informed consent, participants filled in an online pre-questionnaire assessing demographics and general information about their immigration. Over the next thirty days, participants were invited twice a day (at 12pm and 7pm) to reflect upon their interactions, situational need fulfillments, and current attitudes towards the Dutch outgroup. General compliance was high (85.90% of all invited surveys were filled in)[2]. The response rates were approximately equal during mornings ($n = 621$) and afternoons ($n = 604$) and most measurements were completed within four hours of the invitation. After the final day of experience sampling measurements, participants were invited to fill in a longer post measurement survey that mirrored the pre-measurement. All key variables for this study were part of the short experience sampling surveys.

Materials

Intergroup contact   To test the prerequisite effect of intergroup contact, every experience sampling measurement started with the question "*Did you meet a Dutch person this morning [/afternoon]? (In person interaction for at least 10 minutes)*". Our participants recorded between 2–51 interactions with Dutch outgroup members ($M = 31.71\%$, $SD = 19.88\%$ of the individuals' experience sampling measurements; 387 of all 1,225 experience sampling responses) Two participants only recorded two experience sampling measurements each and none of these included outgroup contacts. These participants are removed from any analyses that focus on outgroup contacts.

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[2]Two participants completed only two days (among the others, participation was 93.70%). These two participants also reported no outgroup contacts. These participants are removed from any analyses that focus on outgroup contacts.

Need fulfillment   Irrespective of whether participants had an interaction with Dutch people or not, everyone answered a short series of questions on situational need fulfillment. However, whereas participants with interactions reported on the need fulfillment during the interaction, people without interactions with Dutch people judged the past daytime period in general. To assess the fulfillment of needs, we included two types of need measurement: (1) the situational need and (2) general self-determination theory needs.

For the situational need, we asked participants in an open-ended text field: "*What was your most important goal [during the interaction / this morning / this afternoon]?*". Then, with reference to the text entry, we asked how much this situational need was fulfilled during the interaction or the past daytime period: "*[The interaction / You] fulfilled your goal: [-previous text entry-]*" on a continuous slider scale ranging from strongly disagree (-50) to strongly agree (+50). The self-determination theory need measurements were collected for robustness analyses and are described in Appendix 4.B.

Perceived interaction quality   To assess ratings of the perceived interaction quality, participants rated the statement "*Overall the interaction was ...*" on two continuous slider scales measuring pleasantness (from unpleasant (-50) to pleasant (+50)) and meaningfulness (from superficial (-50) to meaningful (+50)). The items formed a coherent concept within the participants (r_{within} = 0.54, p < .001). We adapted the from Downie et al. (2008), who validated the approach.

Outgroup attitudes   At the end of every experience sampling measurement, we asked all participants about their current attitudes towards the Dutch. To assess the momentary outgroup evaluation we used the common feeling thermometer: "How favorable do you feel towards the Dutch?" (Lavrakas, 2008). Participants then rated their attitude on a continuous slider scale from "very cold – 0" through "no feeling – 50" to "very warm – 100". Both the question phrasing as well as the tick labels were consistent with large-scale panel surveys (e.g., DeBell et al., 2010).

Table 1: Full Sample: Correlation Table and Descriptive Statistics

Variable	Correlations				Descriptives				
	Sit. Need	Quality	Attitudes NL	Allport	Grand Mean	Between SD	Within SD	ICC(1)	ICC(2)
Study 1									
Sit. Need		0.37***	0.11***		77.95	14.68	20.83	0.29	0.96
Quality	0.46*		0.50***		67.00	9.26	17.43	0.23	0.83
Attitudes NL	-0.18	0.19			71.49	12.91	8.11	0.70	0.99
Study 2									
Sit. Need		0.21***	0.08***		84.87	9.17	20.33	0.15	0.89
Quality	0.61***		0.09***		74.51	11.24	16.59	0.29	0.92
Attitudes NL	0.03	0.02			67.26	18.64	9.40	0.80	0.99
Study 3									
Sit. Need		0.37***	0.10***	0.42***	83.57	8.02	17.14	0.18	0.92
Quality	0.51***		0.08***	0.56***	76.62	12.42	16.98	0.34	0.96
Attitudes NL	0.06	0.08		0.23	64.77	14.37	10.88	0.66	0.99
Allport	0.64***	0.54***	0.04*		86.74	7.08	11.87	0.25	0.95
Across Studies									
Sit. Need		0.29***	0.10***		83.66	9.75	19.35	0.19	0.92
Quality	0.52***		0.11***		74.47	11.75	16.82	0.31	0.94
Attitudes NL	0.04	0.02			66.88	16.76	9.81	0.75	0.99

Note: Sit. = situational, Attitudes NL = Attitudes towards the Dutch, ICC = Intraclass Correlation Coefficient;

Upper triangle: Within-person correlations;

Lower triangle: Between-person correlations;

*** p < .001, ** p < .01, * p < .05

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Table 2: Intergroup Contact Sample: Correlation Table and Descriptive Statistics

Variable	Correlations				Descriptives				
	Sit. Need	Quality	Attitudes NL	Allport	Grand Mean	Between SD	Within SD	ICC(1)	ICC(2)
Study 1									
Sit. Need		0.37***	0.27***		82.20	12.42	17.66	0.33	0.90
Quality	0.40		0.55***		67.00	9.26	18.24	0.23	0.84
Attitudes NL	-0.03	0.21			72.46	13.62	9.50	0.68	0.98
Study 2									
Sit. Need		0.23***	0.16***		86.86	11.20	15.87	0.14	0.58
Quality	0.23		0.29***		67.08	12.54	16.54	0.24	0.73
Attitudes NL	0.17	0.06			70.41	17.13	9.87	0.72	0.96
Study 3									
Sit. Need		0.34***	0.24***	0.37***	84.84	9.27	13.00	0.30	0.91
Quality	0.52***		0.29***	0.56***	71.95	14.97	16.71	0.43	0.95
Attitudes NL	0.23	0.33**		0.40***	68.24	13.72	11.23	0.63	0.98
Allport	0.60***	0.44***	0.23***		80.87	10.87	12.14	0.42	0.95
Across Studies									
Core Need		0.30***	0.21***	0.23***	85.65	10.75	15.14	0.26	0.84
Quality	0.37***		0.32***		68.78	13.31	16.79	0.34	0.89
Attitudes NL	0.13	0.09			69.86	15.64	10.34	0.69	0.97

Note: Sit. = situational, Attitudes NL = Attitudes towards the Dutch, ICC = Intraclass Correlation Coefficient;
Upper triangle: Within-person correlations;
Lower triangle: Between-person correlations;
*** $p < .001$, ** $p < .01$, * $p < .05$

4.4.2   Results

Contact hypothesis

Using a multilevel regression, we find that having an outgroup contact is indeed associated with significantly more positive outgroup attitudes (b = 2.48, t(1,200) = 4.37, p < .001, *95%CI* [1.37, 3.59]), even after controlling for having an interaction with a non-Dutch (which did not relate to outgroup attitudes independently). Additionally, while multilevel regressions are generally robust against unequal cell sizes, we correct for inequalities by using centered predictors and reintroducing the means as level two predictors (Yaremych et al., 2021; for full results see Table 3, Figure 2, and Supplemental Material E)[3]. Thus, in our first data, we find initial evidence that outgroup contacts show a positive effect on outgroup attitudes within real-life data.

Situational need fulfillment

The main proposal of our article is that the success of an outgroup contact might be explained by whether or not the contact fulfilled the person's situational need. This should, in turn, be reflected in higher perceived contact quality and more positive outgroup attitudes. We sequentially test whether the fulfillment of the situational need during an interaction is (1) related to more positive outgroup attitudes, (2) higher perceived contact quality, and (3) whether the variance explained by the situational need is subsumed by the perceived contact quality if considered jointly. We find that in the multilevel models, the fulfillment of situational needs during outgroup contacts was associated with more positive outgroup attitudes (random slopes model; b = 0.17, t(365) = 2.93, p = 0.004, *95%CI* [0.06, 0.29]) and also related to higher perceived contact quality (random intercept model; b = 0.37, t(365) = 7.73, p < .001, *95%CI* [0.28, 0.47]). Moreover, when we consider the influences of situational need fulfillment and contact quality on outgroup attitudes jointly, we find that the two predictors share a large part of the variance explained in

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[3]Interestingly, adding random slopes to this model did not explain additional variance. This is unusual and might indicate that the effect is very consistent across participants. However, the small number of participants, or other measurement issues provide an alternative explanation, which is why we offer a combined data set analysis as part of our stability analyses.

outgroup attitudes, so that perceived contact quality showed a strong effect on outgroup attitudes (random slopes model; b = 0.24, t(364) = 4.33, p < .001, *95%CI*[0.13, 0.35]) and only little unique variance is still explained by situational need fulfillment (b = 0.05, t(364) = 0.94, p = 0.348, *95%CI*[-0.05, 0.14], also see Figure 1-A). We thus find support for our hypotheses and can conclude that in this data set the fulfillment of situational needs had a significant influence on outgroup attitudes. Additionally, this effect seemingly addresses the same variance that is accounted for by perceived contact quality.

4.5   Study 2

The aim of Study 2 is similar to Study 1, as we again test the general contact hypothesis, the influence of situational need fulfillment, and perceived contact quality during intergroup contacts. However, in this second study we collected a substantially larger sample of international students who recently arrived in the Netherlands and also improved the study design (e.g., pop-up explanations described later). The survey method again offers a large body of ecologically valid data on need satisfaction in real-life intergroup contact situations as these students will likely interact with the Dutch majority outgroup on a daily basis. Data were collected from November 19th, 2018, through January 6th, 2019. Correlations and descriptive statistics of the included variables are available in Table 1 and Table 2.

4.5.1   Methods

Participants

We recruited 113 international students using a local participant pool. We specifically targeted non-Dutch students, who had recently arrived in the Netherlands. Participants reported on their interactions for at least 30 days, with two daily measures (capturing the morning and afternoon). With this design, we again aimed at receiving 50–60 measurements per participant (M = 43.94, SD = 15.00, *total N* = 4,965). As with the previous study, this should offer sufficient power to model processes within participants and will lend

stronger weight to between-participant results. Participants were compensated for their participation with partial course credits — depending on their participation. The sample consisted of relatively young migrants, who were mostly from the global north (M_{age} = 20.24, SD_{age} = 2.12, 84 women). The sample fairly accurately describes the local population of international students (see Supplemental Material E for additional demographic information).

Procedure

The study procedure mirrored the setup of Study 1 and consisted of pre-, experience sampling-, and post-measurements. The participants were invited for experience sampling measurements twice a day (at 12pm and 7pm) for 30 days. General compliance was high (70.87% of all invited surveys were filled in). The response rates were approximately equal during mornings (n = 2,608) and afternoons (n = 2,357). All key variables for this study were part of the short experience sampling surveys.

Materials

Intergroup contact   To measure intergroup contacts, every experience sampling measurement started with the question "*Did you meet a Dutch person this morning [/afternoon]? (in-person interaction for at least 10 minutes)*". Participants were additionally offered a pop-up explanation: "With in-person interaction, we mean a continued interaction with another person (potentially in a group) that lasted at least 10 minutes. This interaction should be offline and face-to-face. It should include some form of verbal communication and should be uninterrupted to still count as the same interaction. Any individual interaction can last minutes or hours. If there were multiple interaction partners, we would like you to focus on the person who was most important to you during the interaction.". The participants recorded between 1–43 interactions with Dutch majority people (M = 20.70%, SD = 17.31% of the individual's experience sampling measurements; 935 of all 4,965 experience sampling responses).

Need fulfillment   For the situational need, we asked participants in an open-ended text field: "*What was your main goal [during the interaction with -X- / this morning / this afternoon]?*" (where -X- was dynamically replaced with the name of the interaction partner). Participants could additionally click on a pop-up explanation: "Your main goal during an interaction can vary depending on the interaction. It could be to connect with friends, to find or provide help, to achieve academic ambitions, work on your fitness, work for a job, or simply to get a coffee, just as well as many other concrete or abstract goals that are important to you at the moment. It really depends on your subjective experience of the interaction.". Then, with reference to the text entry, we asked how much this situational need was fulfilled during the interaction or the past daytime period: "*During your interaction with -X- [this morning / this evening] your goal (-previous text entry-) was fulfilled.*" on a continuous slider scale ranging from strongly disagree (1) to strongly agree (100). See Table 1 and Table 2 for descriptive statistics.

Perceived interaction quality   The ratings of the perceived contact quality were identical to Study 1 (item correlation: r_{within} = 0.39, p < .001).

Outgroup attitudes   As in Study 1, attitudes towards the Dutch majority outgroup were again measured using the feeling thermometer.

4.5.2   Results

Contact hypothesis

We tested the most general contact hypothesis, as we did for Study 1. We find that having an outgroup interaction is indeed associated with significantly more positive outgroup attitudes within the participants (random slopes model; b = 2.83, t(4,850) = 3.57, p < .001, *95%CI*[1.28, 4.38]), even after controlling for having an interaction with a non-Dutch person (which did not relate to outgroup attitudes independently). We again added the participant means back into the model. We find that in this data set participant-level outgroup contact proportions were also a positive predictor of outgroup attitudes (b = 26.55, t(110) = 2.90, p = 0.004, *95%CI*[8.61, 44.46]). The relative number

of non-outgroup interactions showed no such effect (for full results see Table 3, Figure 2, as well as Supplemental Material E). Thus, in our second data set, we also find that outgroup contacts show a positive effect on outgroup attitudes at the moment. We additionally find an average between-participant effect of the relative number of interactions participants had.

Situational need fulfillment

We again sequentially tested the situational need model, as we did for Study 1. We find that in the multilevel models, the fulfillment of situational needs during outgroup contacts was associated with more positive outgroup attitudes (random slopes model; $b = 0.13$, $t(826) = 4.18$, $p < .001$, $95\%CI[0.07, 0.19]$) and also predicted higher perceived interaction quality (random slopes model; $b = 0.29$, $t(826) = 5.43$, $p < .001$, $95\%CI[0.19, 0.40]$). Additionally, if we consider the influences of situational need fulfillment and interaction quality on outgroup attitudes jointly, we again find that much of the explained variance is shared by the predictor variables, so that perceived interaction quality remains a strong predictor (random slopes model; $b = 0.16$, $t(825)$ = 5.93, $p < .001$, $95\%CI[0.11, 0.21]$) and only little unique variance is still explained by situational need fulfillment ($b = 0.06$, $t(825) = 2.47$, $p = 0.014$, $95\%CI[0.01, 0.11]$; also see Figure 1-B and Table 4 for full results). These results are consistent with the results in Study 1. We, thus, find support for our hypotheses that the fulfillment of situational needs had a significant influence on perceived interaction quality and outgroup attitudes.

4.6   Study 3

The aim of this final study is to extend the previous studies by additionally testing Allport's conditions in an intensive longitudinal design and to compare the predictive powers of Allport's conditions and the situational need fulfillment. For this study, we specifically recruited international medical students because they represent a particular group of migrants who face structural requirements to integrate and interact with Dutch majority outgroup members on a daily basis. As part of their educational program, the migrants are required to take

language courses and interact with patients as part of their medical internships and medical residency. The intensive longitudinal survey method again offers a large body of ecologically valid data on need satisfaction in real-life intergroup contact situations. Data were collected from November 8th, 2019, to January 10th, 2020. The full preregistration is available at Kreienkamp et al. (2021). Correlations and descriptive statistics of the included variables are available in Table 1 and Table 2.

4.6.1   Methods

Participants

We recruited 71 international medical students using contacts within the University Medical School. We specifically targeted non-Dutch students, who had recently arrived in the Netherlands. Participants reported on their interactions for at least 30 days, with two daily measures (capturing the morning and afternoon). With this design, we aimed at getting 50–60 measurements per participant (M = 57.85, SD = 20.68, *total N* = 4,107). As with the previous studies, this offered sufficient power to model processes within participants. Participants were compensated in the same manner as during Study 1. The sample consisted of relatively young migrants (M_{age} = 22.68, SD_{age} = 3.10, 59 women). The sample fairly accurately describes the local population of young international medical professionals (see Supplemental Material E for additional demographic information).

Procedure

The study procedure mirrored the setup of studies one and two, and included the same pre-, experience sampling-, and post-measurement phases. The participants were invited for experience sampling measurements twice a day (at 12pm and 7pm) for at least 30 days. General compliance was high (85.92% filled in at least 31 experience sampling surveys or more). The response rates were approximately equal during mornings (n = 2,092) and afternoons (n = 2,015). All key variables for this study were part of the short experience sampling surveys.

Materials

Intergroup contact The measurement of intergroup contacts was identical to Study 2. The participants recorded between 1–71 interactions with Dutch outgroup members (M = 42.22%, SD = 19.96% of the individuals' experience sampling measurements; 1,702 of all 4,107 experience sampling responses).

Need fulfillment The measurement of the situational need and its fulfillment was identical to Study 2.

Allport's conditions We measured how much each of the interactions ful-filled Allport's conditions of optimal contact using a common short scale com-prised of four attributes (Al Ramiah & Hewstone, 2012; Islam & Hewstone, 1993; Voci & Hewstone, 2003). In particular, we asked participants to rate how much the interaction had equal status ("*The interaction with [name interac-tion partner] was on equal footing (same status)*"), a common goal ("*[name inter-action partner] shared your goal ([free-text entry interaction situational need])*"), support of authorities ("*The interaction with [name interaction partner] was voluntary*"), and intergroup cooperation ("*The interaction with [name interac-tion partner] was cooperative*"). We create a mean-averaged index of Allport's conditions in response to past findings indicating that the conditions are best conceptualized jointly and as functioning together rather than as fully inde-pendent factors (Pettigrew & Tropp, 2006, p. 766). For full psychometric information, see Supplemental Material E.

Perceived interaction quality The ratings of the perceived contact quality were identical to Study 1 and 2 (item correlation: r_{within} = 0.46, p < .001).

Perceived interaction quality The ratings of the perceived interaction qual-ity were identical to Study 1.

Outgroup attitudes Attitudes towards the Dutch majority outgroup were again measured using the feeling thermometer, as in studies one and two.

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4.6.2   Results

Contact hypothesis

In a multilevel regression, we find that having an outgroup interaction was again associated with significantly more positive outgroup attitudes within the participants (random slopes model; b = 5.57, t(3,834) = 6.52, p < .001, *95%CI*[3.90, 7.23]), even after controlling for having a non-Dutch interaction (which did not relate to outgroup attitudes independently; for full results see Table 3 and Figure 2).   Thus, in our third data set, we find that the within-person contemporaneous effect of intergroup contact was consistent across all three studies.

Situational need fulfillment

We tested the situational needs model analogous to the previous studies. We find that the fulfillment of the situational need during outgroup contacts was associated with more positive outgroup attitudes (random slopes model; b = 0.19, t(1,601) = 5.29, p < .001, *95%CI*[0.12, 0.27]) and also predicted higher perceived interaction quality (random slopes model; b = 0.45, t(1,605) = 9.32, p < .001, *95%CI*[0.36, 0.54]).   Additionally, once we consider the influences of situational need fulfillment and interaction quality on outgroup attitudes jointly, we find that perceived interaction quality is a substantially stronger predictor (random slopes model; b = 0.16, t(1,600) = 7.03, p < .001, *95%CI*[0.11, 0.20]) and the unique variance explained by situational need fulfillment was roughly half of its original effect size (b = 0.12, t(1,600) = 3.61, p < .001, *95%CI*[0.06, 0.19]; also see Figure 1-C and Table 4 for full results).   As with the previous two studies, these results indicate that in this data set outgroup attitudes were significantly predicted by the fulfillment of situational needs and the results suggest that this explained variance is shared with perceived interaction quality.

Allport's conditions

We tested the impact of Allport's conditions in the same manner as we tested our situational needs model. In the multilevel models, we find that the ful-

fillment of Allport's Conditions during outgroup contacts was associated with more positive outgroup attitudes (random slopes model; $b = 0.22$, $t(1,601) = 5.86$, $p < .001$, $95\%CI[0.15, 0.29]$) and also predicted higher perceived interaction quality (random slopes model; $b = 0.62$, $t(1,605) = 9.60$, $p < .001$, $95\%CI[0.49, 0.74]$). Moreover, when we considered the influences of Allport's Conditions and interaction quality on outgroup attitudes jointly, we found that perceived interaction quality was a substantially stronger predictor (random slopes model; $b = 0.16$, $t(1,600) = 6.56$, $p < .001$, $95\%CI[0.11, 0.21]$) and the unique variance explained by Allport's Conditions was less than half of its original effect size ($b = 0.11$, $t(1,600) = 3.54$, $p < .001$, $95\%CI[0.05, 0.18]$; also see Table 4). These results indicate that in this data set the fulfillment of Allport's conditions had a significant influence on outgroup attitudes and this effect is, likely, related to the effect of perceived interaction quality.

Compare fulfillment of situational need and allport's conditions

To test whether Allport's conditions or the situational need fulfillment were better at predicting outgroup attitudes, we first assessed relative model performance indices (i.e., Akaike information criterion, and Bayesian information criterion), and then consider the two predictors in a joint model to see whether the two approaches predicted the same variance in outgroup attitudes. When comparing the model selection indices, we found that the fulfillment of the situational need indeed performed slightly better than the model using Allport's conditions ($AIC_{SituationalNeed}$ 12632.02 < 12651.59 $AIC_{Allport}$, and $BIC_{SituationalNeed}$ 12664.55 < 12684.12 $BIC_{Allport}$). Additionally, when considering the predictors jointly, we find that both significantly predict outgroup attitudes with similar-sized regression parameters (random slopes model; Allport's Conditions: $b = 0.16$, $t(1,600) = 4.92$, $p < .001$, $95\%CI[0.09, 0.24]$, Situational Need: $b = 0.14$, $t(1,600) = 3.85$, $p < .001$, $95\%CI[0.08, 0.17]$; also see Table 4). This indicates that, although both Allport's conditions and the situational need fulfillment seem to (in part) relate to perceived interaction quality, they explain different aspects of the variance in outgroup attitudes and do not constitute one another.

Table 3: Intergroup General

	Study 1		Study 2		Study 3	
	B	β	B	β	B	β
Within Participants [multilevel linear regression] (Effect Size = β)						
(Intercept)	74.12*** [56.74, 91.49]		67.05*** [57.37, 76.73]		60.36**** [46.45, 74.27]	
Outgroup Interaction	2.48*** [1.37, 3.59]	1.07 [0.59, 1.54]	2.83*** [1.28, 4.38]	0.11 [0.07, 0.16]	5.57**** [3.90, 7.23]	0.21 [0.15, 0.27]
Non-Outgroup Interaction	0.44 [-0.67, 1.55]	0.16 [-0.32, 0.63]	0.02 [-0.76, 0.79]	0.01 [-0.03, 0.05]	0.36 [-0.48, 1.19]	0.02 [-0.02, 0.05]
Outgroup Interaction Mean	0.99 [-26.61, 28.59]	1.65 [-4.27, 7.57]	26.53** [8.61, 44.46]	0.00 [-0.03, 0.03]	14.14 [-2.19, 30.48]	0.00 [-0.03, 0.03]
Non-Outgroup Interaction Mean	-4.82 [-30.26, 20.63]	-1.08 [-7.02, 4.86]	-8.32 [-22.98, 6.35]	0.00 [-0.03, 0.03]	-2.75 [-20.00, 14.50]	0.00 [-0.03, 0.03]
$R^2_{marginal}/R^2_{conditional}$	0.009 / 0.722		0.050 / 0.818		0.049 / 0.717	
Between Participant [aggregated linear regression] (Effect Size = $\eta_{partial}$)						
(Intercept)			68.24**** [65.30, 71.18]			
Sum Contact NL			0.51** [0.12, 0.89]; $\eta_{partial}$ = 0.03			
Average Quality Outgroup Interaction			0.27* [0.03, 0.50]; $\eta_{partial}$ = 0.05			
Study (1)			2.50 [-4.86, 9.85]; $\eta_{partial}$ = 0.00			
Study (3)			-2.97 [-7.67, 1.72]; $\eta_{partial}$ = 0.01			
Sum Contact NL X Average Quality Outgroup Interaction			-0.01 [-0.03, 0.00]; $\eta_{partial}$ = 0.01			
Sum Contact NL X Study (1)			-0.38 [-1.14, 0.37]; $\eta_{partial}$ = 0.00			
Sum Contact NL X Study (3)			-0.45 [-0.91, 0.02]; $\eta_{partial}$ = 0.02			
Average Quality Outgroup Interaction X Study (1)			0.07 [-0.76, 0.90]; $\eta_{partial}$ = 0.00			
Average Quality Outgroup Interaction X Study (3)			-0.01 [-0.35, 0.33]; $\eta_{partial}$ = 0.00			
$R^2/R^2_{adjusted}$			0.118 / 0.076			

Note:

**** $p < .0001$, *** $p < .001$, ** $p < .01$, * $p < .05$;

For the within participant regressions (upper group), the variables marked "Mean" indicate the re-introduced participant means (level two), which are also standardized across participants.

Table 4: Theoretical Test: Situational Need Fulfillment and Allport's Conditions

coef	Quality		Attitude			
	B	Beta	B	Beta	B	Beta
Study 1: Needs						
(Intercept)	67.16**** [62.99, 71.34]		72.50**** [66.74, 78.26]			
Situational Need	0.37**** [0.28, 0.47]	0.39 [0.30, 0.48]	0.05 [-0.05, 0.14]	0.12 [0.00, 0.24]		
Quality			0.24** [0.13, 0.35]	0.45 [0.31, 0.59]		
$R^2_{marginal}$ / $R^2_{conditional}$	0.103 / 0.333		0.068 / 0.858			
Study 2: Needs						
(Intercept)	67.46**** [65.17, 69.76]		70.69**** [67.52, 73.85]			
Situational Need	0.29**** [0.19, 0.40]	0.20 [0.10, 0.31]	0.06* [0.01, 0.11]	0.09 [0.01, 0.17]		
Quality			0.16**** [0.11, 0.21]	0.22 [0.13, 0.30]		
$R^2_{marginal}$ / $R^2_{conditional}$	0.054 / 0.343		0.024 / 0.780			
Study 3: Needs						
(Intercept)	72.20**** [68.71, 75.70]		68.32**** [65.10, 71.54]			
Situational Need	0.45**** [0.36, 0.54]	0.31 [0.24, 0.37]	0.12**** [0.06, 0.19]	0.10 [0.04, 0.16]		
Quality			0.16**** [0.11, 0.20]	0.24 [0.18, 0.31]		
$R^2_{marginal}$ / $R^2_{conditional}$	0.063 / 0.517		0.039 / 0.706			
Study 3: Allport						
(Intercept)	72.23**** [68.75, 75.72]		68.36**** [65.14, 71.58]			
Allport	0.62**** [0.49, 0.74]	0.40 [0.33, 0.47]	0.11** [0.05, 0.18]	0.11 [0.05, 0.17]		
Quality			0.16**** [0.11, 0.21]	0.23 [0.16, 0.29]		
$R^2_{marginal}$ / $R^2_{conditional}$	0.111 / 0.591		0.041 / 0.699			
Study 3: Needs & Allport						
(Intercept)					68.33**** [65.05, 71.61]	
Situational Need					0.13**** [0.08, 0.17]	0.12 [0.05, 0.18]
Allport					0.17**** [0.09, 0.24]	0.17 [0.11, 0.23]
$R^2_{marginal}$ / $R^2_{conditional}$					0.086 / NA	

Note:
**** $p < .0001$, *** $p < .001$, ** $p < .01$, * $p < .05$

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Figure 1: Partial Regression Diagrams of Situational Needs Model

(A) Study 1:
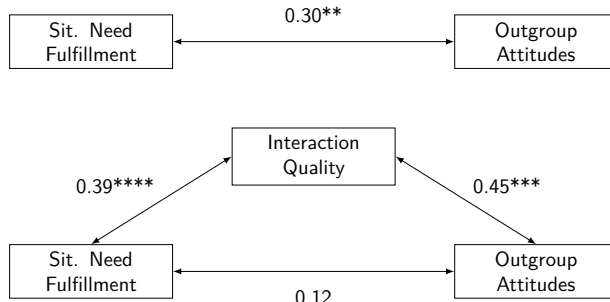
(B) Study 2:
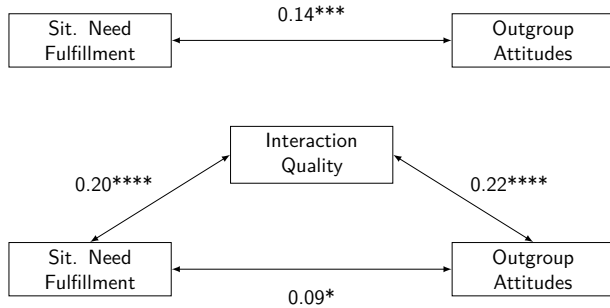
(C) Study 3:
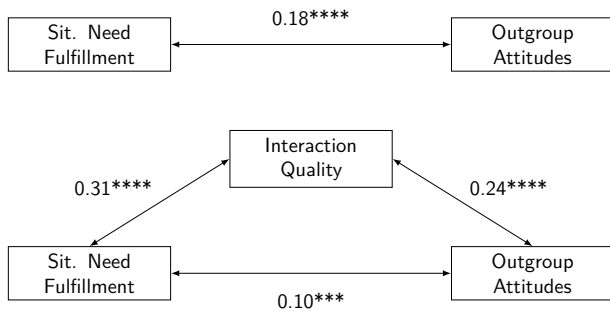
Note: Coefficients are standardized (partial) regression coefficients. Statistical significance markers are based on the unstandardized regression results (as presented in Table 4). Note that we do not test a mediation model. The diagram only illustrates the included concepts and partial regression parameters; **** $p < .0001$, *** $p < .001$, ** $p < .01$, * $p < .05$

4.7 Stability, robustness, and embeddedness across studies

Beyond the individual results of the three studies, we conducted a number of additional analyses to test the broader cross-study claims, account for alternative models, and contextualize our results. Jointly, these stability, robustness, and embeddedness analyses seek to strengthen our confidence in the results.

4.7.1 Stability

We ran two analyses that tested the stability of our results. We first assess the consistency of the results reported in the three studies and use a meta-analytic approach to gauge the general effect sizes. The second stability analysis we conduct seeks to assess the extent to which the within person contemporaneous effects extend to an aggregated version that mirrors the many cross-sectional recall studies.

Consistency

We first assessed the stability of our main analyses across the three studies. Plotting the effect sizes of each parameter of interest in a forest plot, as well as the average meta-analytic effect, shows that for the basic contact hypothesis test outgroup contact had a strong and consistent effect on outgroup attitudes. Interactions with non-outgroup members consistently had no meaningful effect on outgroup attitudes (Figure 2). While this would be expected from the general intergroup contact literature, this is not a trivial finding. Being among the first to assess the contact hypothesis using real-life intensive longitudinal data, we extend cross-sectional findings to individual-level assessments. When looking at the fulfillment of situational needs during intergroup contacts, we find that the motivational mechanism is consistently a meaningful predictor of interaction quality perceptions and outgroup attitudes (see Figure 3 A and B). We also see that the effect of situational need fulfillment on outgroup attitudes is strongly reduced when modeled together with interaction quality perceptions, supporting our assertion that interaction quality and need fulfillment

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share the same variance explained in outgroup attitudes (see Figure 3-C). Note that this joint effect is not meant to resemble a mediation analysis. Particularly, since the data is non-causal, and because multicollinearity and potential third variables could result in similar results.

Aggregated analysis

A second stability test is checking whether the within person effects translate to a broader aggregated between subjects effect, which would mirror common cross-sectional practices. During the main analyses, we have thus far shown that participants held more positive outgroup attitudes following intergroup contacts and that perceived interaction quality was associated with more positive outgroup attitudes following an intergroup contact. We have, however, not brought the two quantity and quality elements of the contact hypothesis together in a single analysis. To jointly test the effects of contact frequency and average interaction quality, we ran a linear regression model where average outgroup attitudes were predicted by the number of interactions and the average interaction quality ratings of all participants across the three studies. We did so while controlling for the possible effects of study-specific differences. To include the study-membership as a control variable, we used the student sample (Study 2) as the reference group because it was both the largest and the most homogeneous study. Looking at the overall model, we found that the model predicted 11.84% of the variance in average outgroup attitudes ($F(9, 189)$ = 2.82, p = 0.004, R^2 = 0.12). Looking at the individual effects, we found that only the number of outgroup interactions has a clear association with average outgroup attitudes (b = 0.51, $t(189)$ = 2.61, p = 0.010, *95%CI*[0.12, 0.89]). The average interaction quality perceptions had a much smaller effect (b = 0.27, $t(189)$ = 2.24, p = 0.026, *95%CI*[0.03, 0.50]), and importantly we found no interaction effect at all. In short, the effect of interaction frequency did not depend on the average interaction quality.

Figure 2: Contact Hypothesis

Meta Analysis: Forest Plot [Parametric]
(Contact Hypothesis — Mixed Effects Regression)

Predictors by study	Semi-Partial Correlation [95% CI]
Non-Outgroup InteractionM_gmz	
Study 1	-0.01 [-0.07, 0.05]
Study 2	-0.00 [-0.03, 0.03]
Study 3	0.00 [-0.03, 0.03]
▶ Random Effect	-0.00 [-0.02, 0.02]
Non-Outgroup Interaction	
Study 1	0.02 [-0.04, 0.07]
Study 2	0.00 [-0.02, 0.03]
Study 3	0.02 [-0.02, 0.05]
▶ Random Effect	0.01 [-0.01, 0.03]
Outgroup InteractionM_gmz	
Study 1	0.02 [-0.04, 0.07]
Study 2	-0.00 [-0.03, 0.03]
Study 3	0.00 [-0.03, 0.03]
▶ Random Effect	0.00 [-0.02, 0.02]
Outgroup Interaction	
Study 1	0.13 [0.07, 0.18]
Study 2	0.07 [0.04, 0.10]
Study 3	0.11 [0.08, 0.14]
▶ Random Effect	0.10 [0.06, 0.13]

-0.1 -0.05 0 0.05 0.1 0.15 0.2

Semi-Partial Correlation Coefficient

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Note: Summary of mixed models results of the contemporaneous contact effects. Random effects meta-analytic results are presented for completeness.

Figure 3: Situational Need Fulfillment

Figure 3: Situational Need Fulfillment — Meta Analysis: Forest Plot Situational Need Fulfillment [Parametric]
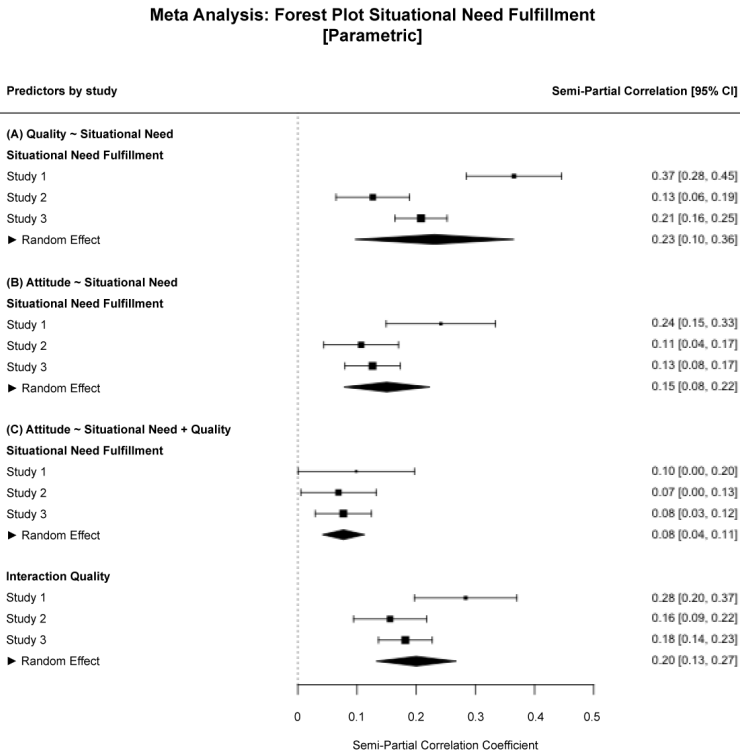
Note:
(a) Situational Need Fulfillment predicting Interaction Quality.
(b) Situational Need Fulfillment predicting Outgroup Attitudes.
(c) Situational Need Fulfillment and Interaction Quality predicting Outgroup Attitudes.
General: Random effects meta-analytic results are presented for completeness.

4.7.2 Robustness

To check for spurious relationships, we test three additional models. These three models assess whether the effect is indeed specific to intergroup contact, whether the need fulfillment effect is affected by whether the contact was planned or accidental, and whether the motivational mechanism also holds for direct well-being benefits for the minority members. We describe the full methods and results for the robustness analyses in Appendix 4.B. We use a two-staged analysis approach for the robustness analyses. We first test the model 'globally' — across the three studies — in a three level multilevel regression (i.e., measurements nested within participants, and participants nested within studies). Only in a second step do we check for study-specific idiosyncrasies.

Contact specific

To ensure that the situational need fulfillment is outgroup contact specific, we return to the full sample of intensive longitudinal measurements and test whether there is an interaction effect of outgroup contact (vs. no outgroup contact) and situational need fulfillment. We expected that the effect of situational need fulfillment on outgroup attitudes is specific to outgroup interactions and not merely due to a more need-fulfilled life in general. Both in the global test, as well as in the individual studies, we consistently find a significant and meaningful interaction effect of outgroup interaction and situational need fulfillment, indicating that situational need fulfillment is specifically a powerful predictor of outgroup attitudes during intergroup contacts. When assessing the individual studies independently, we additionally find a strong main effect of contact as well as a smaller main effect of situational need fulfillment, qualifying the contact-specific relationship (see Appendix 4.B for full results). In sum, we thus find that at the effect of situation need fulfillment on outgroup attitudes is particularly important for outgroup interactions (rather than need fulfillment in general).

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Interaction intent

To test whether the need mechanism was affected by whether the interaction was accidental or planned, we ran an exploratory moderation analysis using the participants' ratings of how much they perceived the interaction as 'accidental'. It should be noted that, in order to keep the ESM surveys short, we asked our participants to focus on the most important interaction (i.e., "*The following questions will be about the interaction you consider most significant.*"; emphasis as in original). This was also reflected in a relatively low mean and consistent right skew of the 'accidental' item. Nonetheless, there remained a substantial variance in the item, and we continued with the moderation analysis. We found that both in the overall test and in all studies individually, situational need fulfillment remained a strong predictor of outgroup attitudes, even when accounting for differences in whether the interaction was accidental (rather than planned). Moreover, in none of the analyses did we see a moderation effect of interaction intent nor did we find a main effect of interaction intent. There is, thus, consistent evidence that the need fulfillment mechanism was not meaningfully different for more accidental interactions.

Well-being outcome

Given the well-established criticism that more positive outgroup attitudes might not always be beneficial for minority group members (e.g., Reimer & Sengupta, 2023), we conducted an additional exploratory analysis assessing the effect of need-fulfilling outgroup interactions on reported well-being. Experienced well-being is a common indicator of health and an important life quality measurement in itself, especially for migrants or other minority groups (e.g., Bhugra et al., 2011). We find that the results with well-being as the outcome variable mirror our main results in effect size and interpretation. The results are consistent across and within studies and, thus, add weight to the importance of considering the need fulfillment experiences when it comes to outgroup interactions.

4.7.3 Embeddedness

To embed our results further, we also considered the content and types of needs that participants reported during the study. For these embeddedness analyses, we first assessed the self-reported motives of the participants and then also control the commonly considered self-determination theory needs.

Contact need content

We used the qualitative data from the participants' self-identified situational needs to contextualize the results of our main analysis. However, because our participants jointly reported on thousands of intergroup contacts, it would not have been feasible to analyze these qualitative responses in a traditional qualitative content analysis. We instead relied on recent machine learning advances within the natural language processing domain. For our analysis, we used the BERT language model. BERT (Bidirectional Encoder Representations from Transformers) was developed by Google in 2018 and today forms a key element of many natural language processing workflows. In its essence, BERT is a framework that allows users to codify every word in relation to every other word within a large set of documents. We extracted 47 topics from the 2,983 interaction goal free-text entries (after duplicate removal) — a relatively large number of topics. The higher number of topics allowed us to retain more of the smaller topics and leaves a relatively low number of 308 free-text entries unclassified (10.33%). A full write-up of the topic modeling process is available in Supplemental Material G.

In terms of the content of the topics, we find that a number of topics are primarily task-oriented, where participants hope to increase their study, research, presentation, or work performance. Opposing the task- and work-oriented needs, are a wide variety of leisure-related needs wishes, like relaxation and entertainment. Additionally, some clusters were primarily relationship-oriented, so that participants sought contact with outgroup members for intimate and casual social contact in itself. Similarly, socializing and celebrations were also explicit social needs (incl., parties). This also included a subtopic of spiritual, religious, and otherwise transcendental needs (incl. meditation, prayer, religious

services). Among the leisure-oriented topics was also a set of contact goals that were specifically migration-specific (e.g., wish to learn about culture, politics, and language) or were concerned with informational needs more generally (e.g., seeking answers, bureaucratic information). A similar set of topics was specifically geared towards a wish to experience cultural products (e.g., music, theater, food) or had travel-related goals in their interactions with the majority group members. In sum, almost all extracted topics fall into broader or narrower need concepts that are commonly discussed within the need fulfillment literature (e.g., Orehek et al., 2018) and offer insight into a core aspect of the migration experience that has remained broadly under-explored (Kreienkamp et al., 2023h)[4].

Need types

To ensure that our results are not impacted by differences in the reported goals and motives, we additionally coded the topics we extracted during the topic modeling on two dimensions of how much they reflect a practical and a psychological goal-directedness. We chose practical and psychological needs specifically as our dimensions to mirror our instructions to the participants and to account for differences in the types of needs that participants commonly reported. With practical motives, we refer to specific, tangible goals or tasks that participants aimed to accomplish during the interaction. These instrumental goals are usually observable, concrete, and often centered on external outcomes, such as acquiring resources, completing tasks, and addressing immediate challenges (e.g., Oduntan & Ruthven, 2019). With psychological motives, we refer to underlying motives or desires that are more abstract and relate to personal fulfillment and well-being. In contrast to practical needs, psychological needs delve into the subjective and internal aspects of human experiences. These needs pertain to emotions, social connections, and cognitive processes, reflecting individuals' quest for personal growth, well-being, and thriving in social

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[4]It should be noted that these topic models are not without limitations, especially because they depend on a small set of hyperparameters that determine the characteristics of the embedding, dimension reduction, clustering, and core term extraction. The authors have also inspected a major subset of the free-text responses manually and believe that the topics described here accurately represent the broader content.

relationships (e.g., Dweck, 2017). Note that with this approach any particular motive can include a practical and/or a psychological goal-directedness but can also be classified as not having any goal at all. See Supplemental Material H for the detailed coding protocol, including instructions for the coders. We found high inter-rater reliability for the two independent coders, who coded all 47 topics. The codings revealed considerable variance, which allowed us to add the two dimensions back to each of the reported interaction motives and assess the effects of the goal-directed character.

We found that neither in the overall analysis nor within any of the individual studies did different types of motives impact the positive effect of situational need fulfillment on interaction quality perceptions and outgroup attitudes. Situational need fulfillment ratings remained the only reliable predictor of outgroup attitudes, when controlling for practical and psychological goal-directedness as well as their interaction effect with the need fulfillment itself. This result underscores the importance of the experience of perceived need fulfillment (i.e., the perception that one got what one needed), rather than the type of need or the content of the need (i.e., the exact motive).

Specific psychological needs

Finally, to ensure that a much simpler model of three fundamental psychological needs might not account for the same effect, we compared our situational need fulfillment measurement to the commonly studied self-determination theory needs (autonomy, relatedness, competence). Within the overall model we found that across the studies, situational need fulfillment remained a strong predictor of outgroup attitudes, even after controlling for the three self-determination theory need. Additionally, within this overall analysis, none of the self-determination theory needs independently predicted outgroup attitudes to a statistically significant extent (despite a similar effect size of relatedness). When looking at the individual studies, we again saw that situational need fulfillment remained a consistent predictor of outgroup attitudes. However, across all three studies, the fulfillment of relatedness motives also emerged as a consistent predictor of outgroup attitudes. Additionally, in the larger studies 2 and 3 competence

fulfillment was also related to more positive outgroup attitudes. None of the autonomy fulfillment effects reached statistical significance. In short, we find that across our samples, relatedness fulfillment (and to a smaller extent competence fulfillment) are instrumental in understanding when an outgroup contact leads to more positive outgroup attitudes. Importantly, even when considering these effects, situational need fulfillment remains a strong and consistent predictor of outgroup attitudes.

Overall, we find that our situation need fulfillment model is consistent across samples and contexts, and that the need fulfillment effect is robust to a wide variety of alternate explanations.

4.8   Discussion

The main aim of this project was to test the basic tenets of the intergroup contact hypothesis and Allport's optimal conditions in real-life intensive longitudinal data as well as to test whether the fulfillment of situational needs meaningfully predicts positive interaction perceptions and outgroup attitudes.

When considering the results of the three studies, we found mixed results for the basic intergroup contact hypothesis. To replicate the two common approaches to the contact hypothesis, we looked at both the within-person effects of individual outgroup interactions (mimicking the analysis of lab studies) and the joint effect of interaction frequency and average interaction quality between participants (mimicking the cross-section literature). For the effect of individual interactions, we find that having an outgroup interaction (vs. not having an interaction) was associated with more favorable outgroup attitudes. Similarly, we find that within outgroup interactions, the interaction quality was meaningfully associated with more favorable outgroup attitudes. Yet, considering interaction frequency and average interaction quality jointly was only possible on the aggregated between-participant level. Surprisingly, here we found independent effects of interaction frequency and average interaction quality ratings, but no interaction effect. The absence of this aggregate effect could indicate the possibility that cross-sectional data may (1) present a mixture of effects within and between subjects (Hamaker et al., 2020), or (2) suffer

from recall biases (e.g., where participants undervalue times without outgroup interactions during retrospective evaluations).

Interestingly, this effect is also inconsistent with the observations and theorizing of MacInnis and Page-Gould (2015), who observed that individual interactions showed negative effects on intergroup relations and the aggregate of past intergroup contacts showed positive effects on intergroup relations. There are, however, two important differences in our data compared to the past literature assessed by MacInnis and Page-Gould. Firstly, what MacInnis and Page-Gould called the intergroup interaction literature, has particularly focused on artificial lab studies where study participants meet a stranger from the outgroup. In our real-world data, such synthetic and controlled interactions are arguably less relevant. Secondly, what MacInnis and Page-Gould called the intergroup contact literature, has looked at long-term recall self-reports — where participants are asked to recall the quantity and average quality of intergroup contacts over the past month or year (MacInnis & Page-Gould, 2015). The mental aggregation of such long-term recall surveys is substantially different from the aggregation we did based on the close-to-event reports (Shiffman et al., 2008). To truly compare our results to MacInnis and Page-Gould (2015) theorizing, future studies should, thus, also collect a long-term recall report that mirrors the questions asked during intergroup contact studies.

Our results should also be considered within the emergent literature of panel studies testing the within-person effects of contact on a number of outcomes. Such studies have a different level of resolution and timescale, as they usually collect three to five waves in multi-week, -month, or -year intervals. Importantly to our results, several recent studies have predominantly found a lack of within-person effects in the context of group affiliations and dynamics over varying timescales. Specifically, a number of studies reported no significant within-person effects for either minority or majority group members across intervals ranging from 2–6 months to multi-year assessments, with a focus on outgroup solidarity and attitudes (Bracegirdle et al., 2023; Friehs et al., 2023; Özkan et al., 2023; Sengupta et al., 2023). However, contrasting this trend, Górska and Tausch (2023) discovered a within-effect for the majority, indicating that cross-group friendships over three two-week intervals were associated

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with future collective action intentions within participants. These studies again highlight that we need studies that bridge the gap between daily close-to-event measurements of natural interactions and longer-term recall studies, even when these longer-term recalls are collected over multiple measurement occasions.

It should also be noted that the inconsistencies with past research might in part be a data artifact (e.g., because most people reported substantially more measurements during which they did not have an outgroup interaction). There is also a possibility that statistical power was a concern given our sample was relatively small with 207 participants and the effect of interest is an amplification interaction effect. However, if we assume an effect size of $r = -.21$ for the effect of positive intergroup contacts (see Pettigrew & Tropp, 2006) our sample size should be at the threshold of 80% power with a .05 alpha level (sensitivity analysis in G*Power: $f^2 = 0.04$) — even more so if we consider the higher quality data we get from aggregating many real-world reports with less recall bias.

Next, using the data from our third study, we find that Allport's conditions are related to higher interaction quality perceptions and more positive outgroup attitudes. When we consider interaction quality and Allport's conditions jointly, we find that interaction quality ratings assumed a larger part of the shared variance in outgroup attitudes. We thus find first evidence that Allport's conditions of optimal contact are also relevant to the daily interactions recent migrants have in their interactions with majority group members.

Finally, when looking at the results regarding the importance of situational need fulfillment, we find that in all three intensive longitudinal data sets, the fulfillment of situational needs during intergroup contacts predicts higher interaction quality perceptions, more positive outgroup attitudes, as well as higher well-being. We also find that in all three studies, need fulfillment and perceived interaction quality likely shared a large part of the variance they explained in outgroup attitudes (when considering partial regression coefficients in a joint model). We would like to reiterate here that we specifically did not seek to test a mediation-style model. Even though the shared explained variance was predicted in our pre-registration based on a theoretical model, and the pattern was stable across the three studies, it is important to note that the data is

none-causal; the effect might alternatively be driven by an unobserved third variable or by multicollinearity.

We, additionally, find that need fulfillment is an important predictor even when taking basic fundamental psychological needs or Allport's conditions into account. In fact, our situational needs measure predicted outgroup attitudes at least as good as Allport's conditions and consistently explained more variance than commonly measured psychological needs. In most cases, the situational need even took over the variances previously explained by the self-determination theory needs (see Appendix 4.B). We thus find strong evidence that within everyday life interactions of recent migrants with majority outgroup members, the perception that one's interaction-specific needs are fulfilled offers a meaningful and flexible predictor of interaction quality, outgroup attitudes, and well-being.

4.8.1 Limitations

While we believe that a need fulfillment mechanism should be relevant to any inter-group contact, our samples focused on a minority- and (voluntary) migrant perspective. Without additional evidence, it thus remains difficult to judge whether motivational effects will generalize to other migrant groups (e.g., forced migrants), other intergroup contexts (e.g., gender-, religious-, or sexual orientation groups), or to majority groups and their outgroup attitudes. We sought to replicate our results in three studies with different types of migrants, but the fact remains that all three studies had slightly more women than men participating and were younger and more educated samples overall. While the samples were representative of the migrant group to the focus region, the generalizability of the sample is restricted by its characteristics. We know of no research suggesting that in other contexts, need fulfillment would be less relevant, but future research may extend our findings to build an even broader understanding of need fulfillment in intergroup contacts. Researchers may even seek to explore the role of need fulfillment in real-world interactions more broadly (also see Downie et al., 2008).

A second limitation lies in our methodology. While intensive longitudinal data is close to real-life events, this method comes at the expense of longer

and more robust scales. Long and repetitive scales are often not feasible in intensive longitudinal methods because of the increased burden to the participants. To circumvent this shortcoming, we have ensured that the measures we used were, whenever possible, based on past validations. However, the circumstance remains that intensive longitudinal data often does not allow the same scrutiny of measurement reliability as single–shot cross-sectional data sets. An additional methodological question lies in the unexplored potential of the longitudinal aspects of our data. For our research questions, we have focused on contemporaneous effects within the data set, yet future investigations should seek to extend the mechanism to developmental trajectories within and between participants.

A third limitation lies in the outcome variable we chose. As we have focused on outgroup attitudes to ensure comparability to the past literature of the contact hypothesis and to replicate the most reliable patterns within ESM data (Pettigrew & Tropp, 2006). However, especially for disadvantaged minority members, positive outgroup attitudes may entail negative downstream consequences such as a reduced endorsement of social change — even in the face of injustice (e.g., Dixon et al., 2012). We have additionally tested our need-fulfillment mechanism for well-being reports to test the direct benefits of the mechanism to lived realities. However, we are among the first to collect intensive longitudinal data on the experience of minority migrants, and it remains an open empirical question whether the more positive outgroup attitudes following need-fulfilling interactions might ironically exacerbate inequalities for the disadvantaged group (also see Reimer & Sengupta, 2023).

Finally, our conceptualization of situational needs has been focused on the most essential test of a motivational mechanism. This comes at the expense of specificity in the situational motives (i.e., we have not explored whether different individual motives have stronger effects on interaction quality and outgroup attitudes). Such an investigation would be possible with the adaptive measurement we used (e.g., by looking at the differential effects of the clustered motives) but would not have been relevant to our theory–focused research question. Identifying cases where a specific minority faces a common need frustration could be instrumental in addressing systemic challenges. Future re-

search may, thus, explore which situations activate or threaten specific motives (e.g., Gollwitzer & Wicklund, 1985; Leander et al., 2020) and which exact motives are most important in different intergroup contexts.

4.8.2   Implications

Despite these limitations, we can nonetheless draw a number of implications for other researchers and practitioners — ranging from the benefits of longitudinal data to theoretical implications. A first implication concerns the feasibility and usefulness of intensive longitudinal data for intergroup contact research and the broader field of social psychology. While setting up an intensive longitudinal study is not easy, we believe the efforts to be similar to a sizable cross-sectional data collection (i.e., for a longitudinal or a high-quality cross-sectional data set with over 3,000 intergroup interactions captured and over 10,000 data points in total). Intensive longitudinal data, thus, opens up the possibility to explore research questions that focus on real-life phenomena outside the lab or focus on phenomena that depend on changes and influences over time. In the context of intergroup contact research, we are among the first to answer calls to test intergroup contact mechanisms using extended real-life data (e.g., MacInnis & Page-Gould, 2015; Pettigrew & Tropp, 2011). In doing so, we not only collected an unprecedented amount of real-life data, but our consideration of intensive longitudinal data may present new inconsistencies in how participants perceive and cognitively aggregate their past interactions with other groups — which may suggest large-scale recall biases or conflations of within and between participant effects in conventional cross-section studies.

A broader theoretical implication relates to the role of situational motivation in intergroup contacts. Our results offer a first promising test of a psychological mechanism of need fulfillment in intergroup contact. While our results are tentative given their novelty within the field, they were highly consistent across studies and may offer new theoretical avenues. Experiences of need fulfillment are a facet of the human experience that has thus far been underemphasized in the intergroup contact literature. This stands in stark contrast to the many cognitive (e.g., Brown & Hewstone, 2005; Pettigrew, 1998) and emotional aspects investigated within the field (e.g., Stephan et al., 2008). Future research may,

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therefore, be able to integrate broader theoretical frameworks of intergroup contact (e.g., motivations guiding cognition and affect, which in turn drive behavior. cf., theory of reasoned goal pursuit; Ajzen and Kruglanski, 2019. Also see Kreienkamp et al., 2023h).

Additionally, situational motivations in intergroup contact also offer promising avenues for practitioners and policy-makers. Intergroup contact theory is among the most implemented psychological theories (e.g., Al Ramiah & Hewstone, 2012; Pettigrew & Tropp, 2006; Reimer et al., 2021). Given our findings that need fulfillment in everyday intergroup contacts was at least as powerful as Allport's conditions in predicting outgroup attitudes, considerations of people's needs offer a substantially more immediate mechanism to address. In cases where some or all optimal contact conditions are not possible to be fulfilled, needs offer an even more compelling alternative (e.g., where equal status is contextually not possible or in cases where people help despite a lack of institutional support). Additionally, our conceptualization of situational needs offers a clear opportunity for practitioners and interventions. Instead of addressing needs as a one-size fits all solution (e.g., simply focusing on competence needs), one may at times ask outgroup interaction partners what they need during an interaction. This is not to say that we should not explore which motives tend to be relevant to specific groups in specific intergroup contact contexts. Rather, during interventions for which data on important need contents are not available or infeasible to collect, a flexible and reactive approach of inquiring momentary intergroup contact needs might be more fruitful.

4.8.3   Conclusion

In sum, we used intensive longitudinal methodologies to capture real-life interactions of recent migrants with the majority outgroup. Our three studies showcase the feasibility and utility of such data to test intergroup contact theory. We provide evidence that the fulfillment of situational needs during real-life intergroup contacts meaningfully predicts perceived interaction quality and positive outgroup attitudes. Our results point to motivational needs as an understudied aspect of intergroup contact that is important in understanding

when and why an interaction is perceived as positive and will lead to more positive outgroup attitudes.

4

Appendices

Appendix 4.A   Hypotheses and analysis plan

In this appendix, we present the expanded hypotheses and their associated analysis plan. Given the nested structure of much of our data, we test many of our hypotheses using a multilevel approach, where y_{ti} denotes the response at measurement occasion t ($t = 1, ..., T_i$; level 1) for individual i ($i = 1, ..., n$; level 2). All multilevel assumptions are tested as follows (e.g., for random slopes model with j within-person predictors):

$$\text{Level 1 Variance: } e_{ti} \sim \mathcal{N}(0, \sigma^2) \tag{4.1}$$

$$\text{Level 2 Variance: } \begin{bmatrix} u_{0i} \\ \vdots \\ u_{ji} \end{bmatrix} \sim \mathcal{N}\left(\begin{bmatrix} 0 \\ \vdots \\ 0 \end{bmatrix}, \begin{bmatrix} \tau_{00}^2 & & \\ \vdots & \ddots & \\ \tau_{j0} & \cdots & \tau_{jj}^2 \end{bmatrix} \right) \tag{4.2}$$

For our main aims we sequentially focus on four sets of models to test and validate our hypotheses:

4.A.1   1. Contact hypothesis in intensive longitudinal data.

Within the individual studies, we begin by testing the most basic assumption of the intergroup contact hypothesis, that outgroup attitudes should be more positive after outgroup interactions but not after non-outgroup interactions. For this, we use multilevel regression analyses, predicting outgroup attitudes from outgroup interaction and non-outgroup interaction dummy variables. We also include the participant means as level two predictors to fully disentangle within- (level 1) and between-participant (level 2) effects of intergroup contact (e.g., Snijders & Bosker, 2012, Section 4.6).

Hypothesis 1 (H1): *Based on the most general understanding of the contact hypothesis, positive intergroup contacts should be associated with more favorable outgroup attitudes across intensive longitudinal data.*

Hypothesis 1a (H1a): *Outgroup attitudes should be more positive after an intergroup interaction compared to a non-outgroup interaction.*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i} OutgroupInteraction_{ti} +$
$$\beta_{2i} NonOutgroupInteraction_{ti} + e_{ti}$$

Level 2: $\beta_{0i} = \gamma_{00} + \gamma_{01} MeanOutgroupInteraction_i +$
$$\gamma_{02} MeanNonOutgroupInteraction_i + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + u_{1i}$$

$$\beta_{2i} = \gamma_{20} + u_{2i}$$

(4.3)

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We then seek to test the full contact hypothesis by investigating intergroup contacts and perceived interaction quality jointly. To do so, we conduct a linear regression using person-level aggregated data from all three studies. In particular, we aggregate the number of outgroup interactions participants had, their average interaction quality perceptions, as well as their average outgroup attitudes. This approach has three main benefits: (1) Interaction quality ratings are only available if participants had an interaction, and the aggregation deals with this structural missingness. (2) Using the participant-level data from all three studies, we avoid potential power issues. (3) This analysis mimics the analyses conducted within the cross-section literature, where participants are asked to recall how many interactions they had over a one-month period, how positive these interactions were, and what their general attitudes towards the outgroup are.

Hypothesis 1b (H1b): *Participants with more intergroup interactions should have more favorable outgroup attitudes.*

$$r_{(ContactFrequency_i, \, AverageQuality_i)} > 0 \qquad\qquad (4.4)$$

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Hypothesis 1c (H1c): *Participants with more intergroup interactions should have more favorable outgroup attitudes depending on the average interaction quality.*

$$AverageAttitude_i = \beta_0 + \beta_1 ContactFrequency_i +$$
$$\beta_2 AverageQuality_i +$$
$$\beta_3 ContactFrequency_i *$$
$$AverageQuality_i$$

(4.5)

We additionally control for the participant's study membership.

Because this analysis uses the data from all three studies, the results of this analysis are presented in the 'Robustness, Stability, and Embeddedness across Studies' section.

4.A.2 2. Need fulfillment during intergroup contact.

The main proposal of this manuscript has been the assertion that the fulfillment of situational needs during an interaction will be associated with more positive interaction quality perceptions and, ultimately, more positive outgroup attitudes. Thus, for the main set of analyses, we focus on the reported outgroup interactions only. For each study, we will use multilevel regressions to test the main three assertions of our proposal (mirroring the basic steps of a traditional mediation analysis).

Hypothesis 2 (H2): *Based on our proposal, intergroup interactions with higher situational need fulfillment should predict more favorable outgroup attitudes due to more positive interaction quality perceptions.*

Hypothesis 2a (H2a): *Situational need fulfillment during outgroup interactions should predict more positive outgroup attitudes.*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i} SitNeedFulfill_{ti} + e_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\qquad \beta_{1i} = \gamma_{10} + u_{1i}$

(4.6)

Hypothesis 2b (H2b): *Situational need fulfillment during outgroup interactions should also predict higher perceived interaction quality.*

Level 1: $InteractionQuality_{ti} = \beta_{0i} +$

$$\beta_{1i}SitNeedFulfill_{ti} + e_{ti}$$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

(4.7)

Hypothesis 2c (H2c): *The effect of situational need fulfillment on outgroup attitudes should be reduced when considered together with perceived interaction quality.*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i}SitNeedFulfill_{ti} +$

$$\beta_{2i}InteractionQuality_{ti} + e_{ti}$$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

$\beta_{2i} = \gamma_{20} + u_{2i}$

(4.8)

4

4.A.3   3. Allport's conditions in intensive longitudinal data.

Within the third study, we formally measure all of Allport's optimal contact conditions. We use multilevel regression models to test whether the fulfillment of Allport's conditions in real-life data predicts more positive outgroup attitudes and higher perceived interaction quality, using the same approach as for the situational need fulfillment above.

Hypothesis 3 (H3): *Based on Allport's optimal contact conditions, intergroup interactions with equal status, common goals, collaboration, and structural support should predict more favorable outgroup attitudes due to more positive interaction quality perceptions.*

Hypothesis 3a (H3a): *Higher fulfillment of Allport's conditions during outgroup interactions should predict more positive outgroup attitudes.*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i}Allport_{ti} + e_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

(4.9)

Hypothesis 3b (H3b): *Higher fulfillment of Allport's conditions during outgroup interactions should also predict higher perceived interaction quality.*

Level 1: $InteractionQuality_{ti} = \beta_{0i} + \beta_{1i} Allport_{ti} + e_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$ (4.10)

$\quad\quad \beta_{1i} = \gamma_{10} + u_{1i}$

Hypothesis 3c (H3c): *The effect of higher fulfillment of Allport's conditions on out-group attitudes should be reduced when considered together with perceived interaction quality.*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i} Allport_{ti} +$

$\quad\quad\quad\quad\quad\quad \beta_{2i} InteractionQuality_{ti} + e_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$ (4.11)

$\quad\quad \beta_{1i} = \gamma_{10} + u_{1i}$

$\quad\quad \beta_{2i} = \gamma_{20} + u_{2i}$

We then compare the effect of Allport's contact conditions with our situational need fulfillment by comparing the model fit statistics of the two individual models and by adding both concepts to a joint multilevel regression model, to see whether the two approaches explain the same variance in outgroup attitudes.

Hypothesis 4 (H4): *Based on our proposal, the fulfillment of the situational need should predict outgroup attitudes at least as well as Allport's conditions.*

Hypothesis 4a (H4a): *The need model (H2a) should predict more variance in out-group attitudes than the model based on Allport's conditions (H3a).*

$AIC_{KeyNeedModel} < AIC_{AllportModel}$

$BIC_{KeyNeedModel} < BIC_{AllportModel}$ (4.12)

Hypothesis 4b (H4b): *The effect of situational need fulfillment on outgroup attitudes should persist even when taking other Allport's conditions into account. Thus, the effect of situational need fulfillment on outgroup attitudes should remain strong even after controlling for Allport's conditions.*

$$\text{Level 1: } Attitude_{ti} = \beta_{0i} + \beta_{1i}SitNeedFulfill_{ti} +$$
$$\beta_{2i}Allport_{ti} + e_{ti}$$
$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \tag{4.13}$$
$$\beta_{1i} = \gamma_{10} + u_{1i}$$
$$\beta_{2i} = \gamma_{20} + u_{2i}$$

4.A.4   4. Robustness, stability, and embeddedness

Within the final set of analyses, we look at the broader picture of our results and leverage the data from all participants to contextualize our results.

Robustness within studies   To build further confidence in the effect of situational need fulfillment during outgroup interactions, we conduct two additional robustness analyses for each study.

Firstly, to check for the role of alternate psychological needs, we add the fulfillment of self-determination theory needs (i.e., competence, autonomy, and relatedness) to the multilevel regression. We then also compare the model with models that predicts outgroup attitudes from self-determination theory need fulfillments or situational need fulfillments only.

> **Hypothesis 5 (H5):** *The effect of situational need fulfillment on outgroup attitudes should persist even when taking other fundamental psychological needs into account. Thus, the effect of situational need fulfillment on outgroup attitudes should remain strong even after controlling for autonomy, competence, and relatedness fulfillment during the interaction (cf., self-determination theory).*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i} SitNeedFulfill_{ti} +$

$\qquad \beta_{2i} Autonomy_{ti} +$

$\qquad \beta_{3i} Competence_{ti} +$

$\qquad \beta_{4i} Relatedness_{ti} + e_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\qquad \beta_{1i} = \gamma_{10} + u_{1i}$

$\qquad \beta_{2i} = \gamma_{20} + u_{2i}$

$\qquad \beta_{3i} = \gamma_{30} + u_{3i}$

$\qquad \beta_{4i} = \gamma_{40} + u_{4i}$

$$(4.14)$$

To ensure that the situational need fulfillment is outgroup contact specific, we return to the full sample of intensive longitudinal measurements within each study and test whether there is an interaction effect of outgroup contact (vs. no outgroup contact) and situational need fulfillment. We expect that the effect of situational need fulfillment is specific to outgroup interactions and not merely due to a more need-fulfilled life in general.

Hypothesis 6 (H6): *The effect of situational need fulfillment on outgroup attitudes should be specific to intergroup interactions and not be due to need fulfillment in general. Thus, the effect of situational need fulfillment on outgroup attitudes should be stronger for intergroup interactions than for ingroup interactions.*

Level 1: $Attitude_{ti} = \beta_{0i} + \beta_{1i} SitNeedFulfill_{ti} +$

$\qquad \beta_{2i} OutgroupInteraction_{ti} +$

$\qquad \beta_{3i} KeyNeedFulfill *$

$\qquad OutgroupInteraction_{ti} + e_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\qquad \beta_{1i} = \gamma_{10} + u_{1i}$

$\qquad \beta_{2i} = \gamma_{20} + u_{2i}$

$\qquad \beta_{3i} = \gamma_{30} + u_{3i}$

$$(4.15)$$

The results of the robustness analyses are presented in Appendix 4.B to allow for a more concise presentation of our main hypotheses in the main text.

Stability across studies   We assess the stability of our main analyses. We use forest plots (including meta-analytical estimates) to visualize the direction and effect sizes of our three studies.

> **Hypothesis 7 (H7):** *The effects of our main hypotheses and robustness analyses should be consistent across studies.*

Embeddedness of code needs   We, finally, use the qualitative data from the participants' self-identified situational needs to contextualize our results. We leverage machine learning to extract a topic model of the free-text entries across the three studies. We describe the extracted topics and themes and compare them to the need contents usually found and measured within the psychological literature. Full methodological details and visualizations are available in Supplemental Material G.

> *This analysis is data-driven and exploratory. As such, the analysis has no associated hypothesis.*

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Appendix 4.B Robustness analyses

In this appendix, we present the empirical details of our additional robustness analyses. These analyses are specifically designed to check for alternative models and contextualize our results. We (1) check whether situational need fulfillment is indeed outgroup contact specific. For this analysis, we return to the full sample of intensive longitudinal measurements and test whether there is an interaction effect of outgroup contact (vs. no outgroup contact) and situational need fulfillment. We expect that the effect of situational need fulfillment is specific to outgroup interactions and not merely due to a more need-fulfilled life in general. We then check (2) whether the need mechanism is relevant to both planned and accidental outgroup interactions, and (3) extends to the more individual-focused experience of well-being. In a final set of analyses, we (4) check whether the need fulfillment mechanism is relevant to different types of need content (i.e., motives) and (5) remains relevant even when accounting for the fulfillment of fundamental psychological needs (i.e., self-determination theory needs: competence, autonomy, and relatedness).

As with the main analyses, full surveys are available in our OSF repository (Kreienkamp et al., 2022b) and the full data description is available in Supplemental Material E. Correlations and descriptive statistics of the included variables are available in Table 1 and Table 2.

4.B.1 Additional materials

In addition to the measurement of whether or not participants had an intergroup interaction and their situational need fulfillment, we also included a number of variables that allowed us to assess the robustness of our results.

Specific psychological needs

In addition to the intergroup contact dummy and situational need reported in the main text, we included a common measure of three self-determination theory needs (see Downie et al., 2008). The measurement was identical in all three studies. The items were introduced either by "*During the interaction:*" or

"*This morning [/afternoon]:*" and measured autonomy ("*I was myself.*"), competence ("*I felt competent.*"), and relatedness (without intergroup contact "*I had a strong need to belong*"; with intergroup contact: "*I shared information about myself.*" and "*The other(s) shared information about themselves.*"). All items were rated on a continuous slider scale from very little (-50) to a great deal (+50).

Interaction intent

To assess whether an interaction was accidental (vs. planned), we asked participants with a single item to report the extent to which "The interaction with -X- was accidental". The respondents were asked to report this context variable for all interactions they reported on using a continuous slider ranging from "not at all" (0), through "very little" (33) and "somewhat" (66), to "a great deal" (100). In all studies, the scale showed a right skew (*mean* = 29.60, *sd* = 33.68).

Goal-directedness

To assess whether the need content (i.e., the motives) would impact the effect of the need fulfillment experiences, we manually coded the topics we extracted during the topic modeling on two dimensions of how much they reflect a practical and a psychological goal-directedness. We chose practical and psychological needs specifically as our dimensions to account for differences in the types of needs that participants commonly reported. With practical motives, we refer to specific, tangible goals or tasks that participants aimed to accomplish during the interaction. These instrumental goals are usually observable, concrete, and often centered on external outcomes, such as acquiring resources, completing tasks, and addressing immediate challenges (e.g., Oduntan & Ruthven, 2019). With psychological motives, we refer to underlying motives or desires that are more abstract and relate to personal fulfillment and well-being. In contrast to practical needs, psychological needs delve into the subjective and internal aspects of human experiences. These needs pertain to emotions, social connections, and cognitive processes, reflecting individuals' quest for personal growth, well-being, and thriving in social relationships (Dweck, 2017). Note that with this approach any particular motive can include a practical and/or a psychological goal-directedness but can also be classified as not having any goal at all.

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The full coding protocol we developed with examples for each of the codes is available in our Supplemental Material H. After an initial training, each of the two coders independently coded the 47 topics on the two dimensions, using one of three options each (i.e., 0 = no goal, 1 = vague goal, 2 = clear goal). Inter-rater reliability assessments showed that for both the practical as well as the psychological needs, agreement was not optimal using the three answer options (agreement practical = 0.72%, agreement psychological = 0.78%). However, most disagreements were, if a need was present, whether that need was vague (1) or concrete (2). We, thus, collapsed these two categories, making the ratings binary (need absent vs. need present). With the simpler coding, inter-rater agreement for practical needs (0.93%) and the psychological need (0.96%) were much more reliable. Using Cohen's κ as our measure of inter-rater reliability, we find that both the practical need coding (*Cohen's* κ = 0.80, 95%CI[0.58, 1.00]) as well as the psychological need coding (*Cohen's* κ = 0.86, 95%CI[0.67, 1.00]) were very good. We thus proceeded with this collapsed coding. After resolving coder disagreements and merging the codings back to the free-text responses, we found that a majority of responses showed both a practical as well as a psychological need (57.95%) and only few responses had no goal at all (1.03%) with the remaining 41.02% having either a practical or a psychological need only (see Supplemental Material E for more detailed tables and visualizations).

Well-being

We measured experienced well-being using a visual analog scale adapted from Davies et al. (2022). Participants were asked to respond to the question "How do you feel right now?" using a continuous visual slider ranging from "very sad"(-100) to "very happy" (100). The well-being ratings were generally normally distributed (*mean* = 64.80, *sd* = 19.25).

4.B.2 Results

To build further confidence in our results, we assessed a number of additional models that might offer alternative explanations. We will discuss the results in sequential order — in every case first considering a global test of the model across the three studies and only then assessing whether the global three-level regression model suppresses any important person-level variations within the studies.

Contact specific

We begin our robustness analysis by testing whether the effect of situational need fulfillment is specific to an actual outgroup contact, rather than need fulfillment in general. For this, we analyzed the generalized situational need fulfillment (either during a contact or about the daytime in general) and tested whether the effect differed during experience sampling measurements with and without outgroup contacts. We start this test by assessing the effect across all three studies, using a three-level hierarchical model, where measurements are nested within participants, and participants are nested within studies. In this overall model, we found no main effect of situational need fulfillment (random slopes model, grand-mean standardized to account for all levels of variance; $b = 0.62$, $t(3.187) = 2.89$, $p = 0.058$, $95\%CI[\ 0.20,\ 1.03]$) but a significant interaction effect of situational need fulfillment and outgroup contact ($b = 2.44$, $t(4,663.172) = 8.62$, $p < .001$, $95\%CI[\ 1.89,\ 3.00]$; also see Table 4.B.3). While the three-level hierarchical model can be sensitive to scaling issues, this already indicates that it is not situational need fulfillment in general — but only situational need fulfillment during an outgroup contact that predicts more positive outgroup attitudes.

To ensure that the results are not affected by scaling issues (e.g., study-level variances suppressing person-level variances) or a similar Simpson's paradox, we additionally assess the model within each of the three studies. Within each of the three studies, the effects are more pronounced so that we also see a significant effect of situational need fulfillment (all $b > 0.06$, all $p < 0.005$) as well as outgroup contact itself (all $|b| > 1.81$, all $p < 0.034$) but the interaction

effect consistently remains the most reliable predictor of outgroup attitudes (all $|b| > 0.06$, all $p < 0.002$, also see Table 4.B.3). There is thus consistent evidence that need fulfillment relates to outgroup attitudes for outgroup contacts in particular, but not need fulfillment in general.

Interaction intent

Secondly, to assess whether the need fulfillment mechanism affected by whether the interaction was accidental or planned, we ran an exploratory moderation analysis using the participants' ratings of how much they perceived the interaction as 'accidental'. It should be noted that we asked our participants to focus on the most important interaction (i.e., "*The following questions will be about the interaction you consider most significant.*"; emphasis as in original). We again start our analysis approach by assessing the model across all three studies, using a three-level hierarchical model. In this overall model, we retain the main effect of situational need fulfillment (random slopes model, grand-mean standardized to account for all levels of variance; $b = 2.87$, $t(7.979) = 7.32$, $p < .001$, $95\%CI[\ 2.10, 3.64]$) but neither contact intent nor the moderation effect affect the results (all $|b| < 0.27$ and all $p > 0.225$; see Table 4.B.3 for full results).

We again sought to ensure that the results were not affected by scaling issues by additionally assessing the interaction intentionality model within each of the three studies. Within each of the three studies, the effect of situational need fulfillment became even clearer (all $|b| > 0.13$, all $p < 0.006$). But in none of the studies, neither outgroup contact intention nor the moderation effect explained a significant amount of variance in outgroup attitudes (all $|b| < 0.03$ and all $p > 0.073$; also see Table 4.B.3). There is thus consistent evidence that need fulfillment is related to outgroup attitudes, even when taking the intentionality of the interaction into account — at least in our three samples and with a focus on the most significant interactions.

Well-being outcome

Thirdly, to build a stronger case for the relevance of need fulfillment to minority group members, we exploratorily assessed the effect of need fulfilling outgroup

interactions on self-reported well-being. We, thus, re-ran our main analysis but substituted the outgroup attitudes outcome with situational well-being. As with the previous robustness analyses, we begin with a global three-level hierarchical model (across the three studies). We find that need fulfillment during outgroup contacts, indeed, has a similar effect on experienced well-being (random slopes model, grand-mean standardized to account for all levels of variance; $b = 3.50$, $t(4.219) = 6.33$, $p = 0.003$, $95\%CI[\,2.42, 4.58]$). We found the same result when we assessed each of the three studies individually. In each of the studies, situational need fulfillment during the outgroup interaction was related with higher well-being ratings by the participants (random slopes model, centered within participants; all $|b| > 0.10$, all $p < 0.009$). We, thus, find consistent and meaningful evidence that need fulfilling outgroup interactions also relate to higher everyday well-being.

Need types

Fourthly, to assess the role of different types of motives reported by our participants, we added our coding of practical and psychological goal-directedness as additional predictors to our base model. We thus had situational need fulfillment predicting outgroup attitudes, while also accounting for whether the reported motives were capturing practical and/or psychological motives. We again ran a global model, across the three studies first. We found that situational need fulfillment remains a core predictor of outgroup attitudes (random slopes model, grand-mean standardized to account for all levels of variance; $b = 2.27$, $t(48.194) = 2.72$, $p = 0.009$, $95\%CI[\,0.63, 3.90]$), even after accounting for different types of motives. None of the motive types nor the moderation effects reached statistical significance within the overall analysis (all $|b| < 1.45$ and all $p > 0.073$; see Table 4.B.3 for full results).

When looking at the individual studies, we again saw that the effect of situational need fulfillment remained the only clear effect (all $|b| > 0.14$, all $p < 0.015$). Additionally, in none of the studies, neither motive type dummies nor the moderation effect explained a significant amount of variance in outgroup attitudes (all $|b| < 1.53$ and all $p > 0.144$; also see Table 4.B.3). We, thus, find

consistent evidence that need fulfillment is related to outgroup attitudes, even when taking the type of need into account — at least in our three samples.

Specific psychological needs

In a final step, we checked whether during the interaction the situational need remains a meaningful predictor even when taking other fundamental psychological needs into account. We again take a two-step approach, starting with cross-study global three-level test and then assessing the effects within the individual studies. Within the overall model we find that across the studies situational need fulfillment remained a strong predictor of outgroup attitudes, even after controlling for the three self-determination theory need (random slopes model, grand-mean standardized to account for all levels of variance; b = 1.88, $t(2.702)$ = 4.75, p = 0.022, $95\%CI$[1.11, 2.66]). Within this overall analysis, none of the self-determination theory needs independently predicted outgroup attitudes to a statistically significant extent (all p > 0.093). However, some of the effect sizes were largely comparable to that of the situational need fulfillment (all $|b|$ < 2.10, particularly that of relatedness fulfillment; see Table 4.B.3 for full results).

When looking at the individual studies, we again saw that situational need fulfillment remained a consistent predictor of outgroup attitudes, even after accounting for the self-determination theory need (all $|b|$ > 0.06, all p < 0.030). However, across all three studies the fulfillment of relatedness motives also emerged as a consistent predictor of outgroup attitudes (all $|b|$ > 0.06, all p < 0.001). Additionally, in the larger studies 2 and 3 competence fulfillment was also related to more positive outgroup attitudes (study 2: b = 0.05, $t(841.8)$ = 2.43, p = 0.015, $95\%CI$[0.01, 0.10], study 3: b = 0.06, $t(30.20)$ = 2.62, p = 0.013, $95\%CI$[0.01, 0.10]). None of the autonomy fulfillment effects reached statistical significance, nor did the competence fulfillment during study 1 (see Table 4.B.3 for the full results). In short, find that across our samples, relatedness fulfillment (and to a smaller extent competence fulfillment) are instrumental in understanding when an outgroup contact leads to more positive outgroup attitudes. Importantly, even when considering these effects, situational need fulfillment remains a strong and consistent predictor of outgroup attitudes. In

some cases, we even find that situational need fulfillment takes on some of the variance that would otherwise be explained by the self-determination theory needs (see Supplemental Material E).

4.B.3   Conclusion

Across the wide variety of robustness analyses, we thus find that the experience of need fulfillment is a robust and flexible predictor of positive outgroup attitudes even when accounting for a range of other and even alternate predictors. However, we also find that the situational need fulfillment mechanism does not account for all need-related variance in outgroup attitudes. Notably, the fulfillment of relatedness (and to some extent competence) needs explained additional variance in outgroup attitudes. Nonetheless, the situational need fulfillment remained extremely reliably a situational predictor of outgroup attitudes.

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Table 4.B.1: Full Sample: Correlation Table and Descriptive Statistics

Variable	Sit. Need	Competence	Autonomy	Relatedness	Accidental	Quality	Attitudes NL	Grand Mean	Between SD	Within SD	ICC(1)	ICC(2)
Study 1												
Sit. Need		0.36***	0.31***	0.05			0.11***	77.95	14.68	20.83	0.29	0.96
Competence	0.68***		0.45***	0.09**			0.14***	62.10	13.72	20.89	0.28	0.95
Autonomy	0.54***	0.72***					0.12***	72.17	12.09	15.15	0.38	0.97
Relatedness	0.01	-0.14	-0.05				0.14***	55.29	14.59	23.29	0.28	0.95
Attitudes NL	-0.23	-0.20	0.19	-0.06				71.49	12.91	8.11	0.70	0.99
Study 2												
Sit. Need		0.24***	0.15***	0.17***	-0.11***	0.22***	0.08***	84.87	9.17	20.33	0.15	0.89
Competence	0.55***		0.45***	0.35***	-0.05*	0.36***	0.11***	72.55	14.47	21.17	0.30	0.95
Autonomy	0.62***	0.69***		0.34***	-0.16***	0.42***	0.05**	82.59	11.21	16.06	0.32	0.95
Relatedness	0.34***	0.62***	0.52***		-0.09***	0.52***	0.10***	61.21	13.36	28.74	0.17	0.90
Accidental	-0.49***	-0.22*	-0.32***	-0.07		-0.24***	0.03	25.09	14.62	29.13	0.17	0.85
Quality	0.54***	0.68***	0.59***	0.61***	-0.33***		0.09***	74.51	11.24	16.59	0.29	0.92
Attitudes NL	0.12	0.07	-0.07	-0.12	0.02	0.09***		67.26	18.64	9.40	0.80	0.99
Study 3												
Sit. Need		0.27***	0.31***	0.20***	-0.10***	0.37***	0.10**	83.57	8.02	17.14	0.18	0.92
Competence	0.48***		0.55***	0.39***	-0.14***	0.38***	0.06**	77.45	11.49	18.92	0.26	0.95
Autonomy	0.57***	0.78***		0.51***	-0.16***	0.54***	0.01	83.76	9.72	15.87	0.28	0.96
Relatedness	0.22	0.51***	0.48***		-0.13***	0.50***	-0.04*	63.44	13.34	28.85	0.17	0.92
Accidental	-0.50***	-0.24*	-0.27*	-0.04		-0.21***	0.02	24.73	14.98	28.51	0.21	0.92
Quality	0.39***	0.54***	0.59***	0.53***	-0.02			76.62	12.42	16.98	0.34	0.96
Attitudes NL	0.11	0.12	0.11	0.20	0.02	0.13		64.77	14.37	10.88	0.66	0.99
Across Studies												
Sit. Need		0.31***	0.28***	0.22***	-0.14***	0.32***	0.14***	83.81	7.85	20.24	0.11	0.92
Competence	0.49***		0.55***	0.41***	-0.11***	0.43***	0.11***	73.38	11.52	22.25	0.18	0.95
Autonomy	0.56***	0.71***		0.44***	-0.16***	0.51***	0.09***	82.36	9.35	16.98	0.21	0.96
Relatedness	0.25*	0.56***	0.50***		-0.12***	0.52***	0.08***	61.55	10.73	29.45	0.11	0.91
Accidental	-0.47***	-0.23*	-0.34***	-0.01		-0.22***	-0.01	24.56	12.38	29.70	0.12	0.89
Quality	0.39***	0.57***	0.54***	0.57***	-0.02		0.17***	75.46	9.44	17.85	0.19	0.93
Attitudes NL	-0.04	0.04	-0.06	-0.14	0.11	0.00		66.58	14.46	13.25	0.49	0.99

Note: Interaction Intent and Interaction Quality were only measured for outgroup interactions in Study 1.
Sit. = situational, Attitudes NL = Attitudes towards the Dutch, ICC = Intraclass Correlation Coefficient;
Upper triangle: Within-person correlations; Lower triangle: Between-person correlations;
*** $p < .001$, ** $p < .01$, * $p < .05$

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Table 4.B.2: Outgroup Interaction Sample: Correlation Table and Descriptive Statistics

Variable	Correlations							Descriptives				
	Sit. Need	Competence	Autonomy	Relatedness	Accidental	Quality	Attitudes NL	Grand Mean	Between SD	Within SD	ICC(1)	ICC(2)
Study 1												
Sit. Need		0.33***	0.26***	0.19***	0.03	0.35***	0.28***	81.91	12.67	17.86	0.33	0.89
Competence	0.84***		0.50***	0.27***	0.06	0.41***	0.26***	65.96	13.49	18.88	0.31	0.88
Autonomy	0.59***	0.86***		0.24***	0.01	0.36***	0.27***	72.00	10.02	15.12	0.28	0.86
Relatedness	0.27	0.16	0.22		0.19***	0.53***	0.40***	51.41	14.50	23.85	0.23	0.84
Accidental	-0.01	0.14	0.05	-0.15		-0.05	0.11	28.41	21.39	26.79	0.36	0.91
Quality	0.41	0.23	0.21	0.36	0.01		0.57***	65.89	7.94	18.51	0.13	0.72
Attitudes NL	-0.02	-0.26	0.05	0.20	0.21	0.38		72.56	13.97	9.73	0.66	0.97
Study 2												
Sit. Need		0.23***	0.12***	0.18***	-0.12***	0.22***	0.16***	86.86	11.20	15.87	0.14	0.58
Competence	0.45**		0.48***	0.32***	-0.03	0.38***	0.19***	73.23	13.95	16.81	0.27	0.76
Autonomy	0.48***	0.60***		0.24***	0.03	0.36***	0.15***	78.58	14.07	14.24	0.40	0.85
Relatedness	-0.21	0.41**	0.24		0.10*	0.46***	0.22***	60.30	17.35	26.14	0.19	0.67
Accidental	-0.60***	-0.18	-0.27*	0.21		-0.16***	-0.01	33.86	23.37	29.88	0.28	0.77
Quality	0.26	0.47***	0.52***	0.50***	-0.24		0.29***	67.08	12.54	16.54	0.24	0.73
Attitudes NL	0.18	0.24	0.09	-0.10	-0.10	0.09		70.41	17.13	9.87	0.72	0.96
Study 3												
Sit. Need		0.23***	0.26***	0.15***	-0.05*	0.35***	0.24***	84.84	9.27	13.00	0.30	0.91
Competence	0.53***		0.52***	0.33***	-0.09**	0.31***	0.20***	75.94	12.23	17.21	0.29	0.91
Autonomy	0.57***	0.79***		0.43***	-0.07**	0.46***	0.20***	79.07	12.88	15.26	0.36	0.93
Relatedness	0.12	0.40***	0.40***		0.00	0.43***	0.20***	59.62	19.26	23.45	0.34	0.93
Accidental	-0.46***	-0.27*	-0.29*	0.04		-0.16***	-0.05*	29.13	17.94	30.37	0.26	0.89
Quality	0.48***	0.58***	0.62***	0.47***	-0.06		0.29***	71.95	14.97	16.71	0.43	0.95
Attitudes NL	0.24	0.32**	0.31**	0.35**	-0.12	0.32**		68.24	13.72	11.23	0.63	0.98
Across Studies												
Sit. Need		0.28***	0.24***	0.16***	-0.12***	0.30***	0.21***	85.92	9.31	15.80	0.17	0.85
Competence	0.46***		0.53***	0.33***	-0.07***	0.38***	0.18***	73.91	11.29	18.17	0.19	0.87
Autonomy	0.55***	0.69***		0.36***	-0.05**	0.44***	0.20***	79.05	11.31	15.33	0.28	0.91
Relatedness	0.01	0.34**	0.26*		0.03	0.45***	0.22***	59.81	15.05	26.21	0.18	0.85
Accidental	-0.40***	-0.21	-0.36***	0.10		-0.15***	-0.04*	29.66	18.06	30.09	0.17	0.85
Quality	0.36***	0.45***	0.50***	0.41***	-0.13		0.31***	69.78	11.31	17.77	0.24	0.89
Attitudes NL	0.06	0.24*	0.07	0.02	0.03	0.05		69.69	13.63	12.67	0.43	0.95

Note: Sit. = situational, Attitudes NL = Attitudes towards the Dutch, ICC = Intraclass Correlation Coefficient;
Upper triangle: Within-person correlations; Lower triangle: Between-person correlations;
*** $p < .001$, ** $p < .01$, * $p < .05$

Table 4.B.3: Robustness Analyses

	Overall B	Overall β	Study 1 B	Study 1 β	Study 2 B	Study 2 β	Study 3 B	Study 3 β
Contact specific								
(Intercept)	65.76** [49.86, 72.04]		71.60*** [66.33, 76.86]		68.22*** [64.95, 71.49]		65.17*** [62.00, 68.34]	
Situational Need	0.62 [-13.92, 14.10]	0.01 [-0.44, 0.45]	0.09** [0.04, 0.14]	0.21 [0.13, 0.28]	0.06*** [0.04, 0.08]	0.13 [0.08, 0.17]	0.11*** [0.08, 0.14]	0.13 [0.09, 0.17]
Outgroup Interaction	3.59 [-20.13, 7.99]	-0.60 [-1.74, 0.53]	1.81* [0.25, 3.37]	0.28 [0.05, 0.50]	2.88** [1.35, 4.40]	0.23 [0.16, 0.31]	5.41*** [3.72, 7.10]	0.37 [0.27, 0.48]
Situational Need X Outgroup Interaction	2.44*** [0.09, 0.14]	0.01 [0.01, 0.01]	0.13*** [0.07, 0.18]	0.32 [0.19, 0.45]	0.06** [0.02, 0.10]	0.14 [0.06, 0.22]	0.17*** [0.12, 0.21]	0.19 [0.12, 0.26]
$R^2_{marginal}$ / $R^2_{conditional}$	0.000 / 1.000		0.017 / 0.727		0.005 / 0.818		0.037 / 0.712	
Interaction Intent								
(Intercept)	70.14*** [62.53, 65.97]		71.43*** [65.57, 77.29]		70.40*** [67.36, 73.45]		68.16*** [64.95, 71.36]	
Situational Need	2.87*** [8.58, 8.95]	0.02 [-1.22, 1.25]	0.17** [0.06, 0.29]	0.42 [0.26, 0.58]	0.13*** [0.07, 0.20]	0.25 [0.12, 0.37]	0.19*** [0.12, 0.26]	0.24 [0.15, 0.32]
Interaction Accidental	0.12 [-9.82, 9.92]	0.00 [-1.07, 1.07]	0.03 [0.00, 0.06]	0.13 [0.02, 0.24]	0.01 [-0.02, 0.03]	-0.02 [-0.09, 0.05]	-0.01 [-0.04, 0.01]	-0.02 [-0.08, 0.03]
Situational Need X Interaction Accidental	-0.27 [0.00, 0.00]	0.00 [0.00, 0.00]	0.00 [0.00, 0.06]	0.00 [-0.11, 0.11]	0.00 [0.00, 0.00]	-0.01 [-0.08, 0.07]	0.00 [0.00, 0.00]	-0.04 [-0.09, 0.02]
$R^2_{marginal}$ / $R^2_{conditional}$	0.000 / 1.000		0.135 / NA		0.015 / 0.728		0.021 / 0.687	
Well-being Outcome								
(Intercept)	65.25** [28.58, 63.85]		61.34*** [55.56, 67.12]		67.18*** [64.66, 69.70]		63.63*** [60.85, 66.41]	
Situational Need	3.50** [16.18, 16.62]	0.01 [-1.33, 1.35]	0.25** [0.10, 0.40]	0.31 [0.17, 0.46]	0.10** [0.04, 0.16]	0.17 [0.11, 0.23]	0.20*** [0.11, 0.29]	0.17 [0.10, 0.25]
$R^2_{marginal}$ / $R^2_{conditional}$	0.000 / 1.000		0.054 / 0.541		0.008 / 0.348		0.017 / 0.375	
Need Type								
(Intercept)	69.40*** [50.54, 64.07]		73.09*** [66.87, 79.31]		70.37*** [67.24, 73.51]		68.18*** [64.77, 71.60]	
Situational Need	2.27** [0.09, 0.21]	0.01 [-0.82, 0.84]	0.14* [0.03, 0.26]	0.29 [0.12, 0.46]	0.14** [0.06, 0.21]	0.15 [0.04, 0.26]	0.19*** [0.08, 0.29]	0.18 [0.08, 0.29]
practical need	0.01 [-4.82, 7.25]	-0.11 [-1.00, 0.78]	-0.04 [-2.76, 2.69]	-0.06 [-0.33, 0.20]	0.80 [-1.22, 2.82]	0.17 [0.01, 0.32]	-0.99 [-2.85, 0.86]	-0.02 [-0.16, 0.12]
psychological need	1.45 [-8.48, 4.45]	-0.13 [-1.11, 0.84]	1.53 [-3.66, 6.73]	0.08 [-0.28, 0.43]	1.50 [0.98, 3.98]	0.13 [-0.03, 0.30]	1.25 [-0.42, 2.93]	0.10 [-0.04, 0.24]
Situational Need X practical need	-0.23 [-0.08, 0.05]	0.00 [0.00, 0.00]	0.01 [-0.13, 0.15]	-0.12 [-0.36, 0.12]	-0.02 [-0.15, 0.10]	-0.04 [-0.23, 0.14]	-0.05 [-0.18, 0.08]	0.03 [-0.11, 0.18]
Situational Need X psychological need	0.67 [-0.03, 0.11]	0.00 [0.00, 0.01]	-0.10 [-0.31, 0.11]	-0.02 [-0.33, 0.29]	0.04 [-0.07, 0.15]	0.04 [-0.13, 0.21]	0.04 [-0.11, 0.19]	-0.06 [-0.22, 0.10]
$R^2_{marginal}$ / $R^2_{conditional}$	0.078 / NA		0.046 / NA		0.017 / 0.760		0.018 / 0.696	
Specific Psychological Needs								
(Intercept)	70.93** [41.14, 58.40]		71.54*** [65.79, 77.28]		70.75*** [67.59, 73.90]		68.66*** [65.53, 71.82]	
Situational Need	1.88* [5.45, 5.68]	0.01 [-1.13, 1.15]	0.10* [0.02, 0.18]	0.27 [0.11, 0.43]	0.06** [0.02, 0.10]	0.14 [0.06, 0.22]	0.14*** [0.07, 0.21]	0.18 [0.09, 0.26]
Autonomy	0.78 [-8.61, 8.70]	0.01 [-1.15, 1.16]	0.05 [-0.12, 0.23]	0.12 [-0.02, 0.26]	0.05 [-0.01, 0.09]	0.05 [-0.03, 0.13]	0.04 [0.00, 0.08]	0.05 [-0.03, 0.12]
Competence	0.95 [-3.70, 3.78]	0.00 [-1.11, 1.11]	0.05 [-0.16, 0.26]	0.02 [-0.21, 0.25]	0.05* [0.01, 0.10]	0.06 [-0.03, 0.15]	0.06* [0.01, 0.10]	0.09 [0.02, 0.16]
Relatedness	2.10 [-4.04, 4.19]	0.01 [-1.20, 1.22]	0.10*** [0.06, 0.14]	0.29 [0.17, 0.41]	0.06*** [0.03, 0.09]	0.16 [0.09, 0.24]	0.06*** [0.02, 0.09]	0.10 [0.02, 0.19]
$R^2_{marginal}$ / $R^2_{conditional}$	0.176 / NA		0.061 / 0.860		0.025 / 0.747		0.041 / 0.702	

Note:
**** $p < .0001$, *** $p < .001$, ** $p < .01$, * $p < .05$

Chapter 5

A gentle introduction and application of feature-based clustering with psychological time series

Abstract

Psychological researchers and practitioners collect increasingly complex time series data aimed at identifying differences between the developments of participants or patients. Past research has proposed a number of 'dynamic measures' that describe meaningful developmental patterns for psychological data (e.g., instability, inertia, linear trend). Yet, commonly used clustering approaches are often not able to include these meaningful measures (e.g., due to model assumptions). We propose feature-based time series clustering as a flexible, transparent, and well-grounded approach that clusters participants based on the dynamic measures directly using common clustering algorithms. We introduce the approach and illustrate the utility of the method with real-world empirical data that highlight common ESM challenges of multivariate conceptualizations, structural missingness, and nonlinear trends. We use the data to showcase the main steps of input selection, feature extraction, feature reduction, feature clustering, and cluster evaluation. We also provide practical algorithm overviews and readily available code for data preparation, analysis, and interpretation.

Keywords: time series analysis, feature-based clustering, intensive longitudinal data, ESM

Open Science Practices: ⬡ Open Materials, ⬡ Open Data, ⬡ Open Code, ⬡ Open Supplements

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Recent years have seen a striking increase in the number and variety of research studies that follow participants' everyday experiences and collect real-world psychological time series (e.g., Hamaker & Wichers, 2017). These intensive longitudinal data sets come with different sources of heterogeneity, where researchers have to consider differences across large numbers of participants, time points, and variables (e.g., Cattell, 1966; Wardenaar & de Jonge, 2013). However, despite its complexity, researchers are often interested in precisely this complexity and wish to understand how people differ in their developments across several variables (e.g., Ernst et al., 2021). Researchers and practitioners are, for example, asking: "Do the symptoms of different patients develop in contrasting ways?" (Monden et al., 2015) or "How do migrants differ in the development of their self-reported needs as they arrive in a new country?" (Kreienkamp et al., 2023h). There is, thus, a clear need for analysis techniques that identify between-subject differences in developmental patterns for psychological data.

Recently, one promising way of identifying between-subject developmental patterns has been *time series clustering* — the idea of inductively grouping participants based on similarities of their time series (Ariens et al., 2020). This analysis type essentially seeks to capture comparable within-person developments — such as whether a variable remains stable over time, consistently increases, or exhibits cyclical patterns — and then groups the persons based on these patterns (Liao, 2005)[1]. Time series clustering, thus, crucially depends on identifying meaningful summaries of the time series developments, which can be used to compare participants (Aghabozorgi et al., 2015).

Fortunately, past conceptual and empirical works in the experience sampling (ESM) literature have collected a number of meaningful aspects of psy-

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[1]It should be noted in some cases the time series do not need to be summarized and can be compared directly. Such analyses are however only possible with highly regular and controlled data, such as EEG data (Huang & Jansen, 1985), or when clustering variables within the person rather than identifying differences between persons (Haslbeck & Ryan, 2022). Multivariate data from intensive psychological survey studies, as we discuss here, are seldomly directly comparable across persons (e.g., Faloutsos et al., 1994). We provide a broader embedding of the current methods for psychological time series in the discussion section.

chological time series[2]. Such aspects can be indicative of adaptive and maladaptive developments within the individual, can identify crucial transitions, or more generally help understand a psychological time series. Important aspects might include concerns over whether a symptom consistently stays at a certain level without much variability, or whether some emotions develop together. For many of the most important developmental aspects, researchers have assembled numeric measures that capture these patterns. These summary statistics are often called "dynamic measures", "principles of change", or "dynamic features" of the psychological time series (Dejonckheere et al., 2019; Krone et al., 2018; Kuppens & Verduyn, 2017). Most research groups working on these time series features have proposed an overlapping number anywhere between four and twelve key features relevant to psychologists (Dejonckheere et al., 2019; Wang et al., 2006). Each of these time series features not only captures a distinct aspect of psychological time series but also holds conceptual value — inertia, for example, describes a resistance to change that can be indicative of psychological maladjustment (Kuppens et al., 2010) or a higher within-person variability can signal an erratic state (Myin-Germeys et al., 2018).

Yet, despite this diversity of meaningful time series features in psychology, most clustering of ESM data has only focused on a small and restrictive selection of time series characteristics. Thus far, the most common approach has been to cluster participants based on person-specific model parameters — notably intercepts and slopes from vector autoregression models (VAR; e.g., Ariens et al., 2020; Bulteel et al., 2016; Stefanovic et al., 2022). While such model parameters have the advantage of being familiar to researchers in the field, they are often restricted to autocorrelations and cross-lagged partial correlations (e.g., Bringmann & Eronen, 2018) — only two of the many potentially important time series features. Additionally, the validity of model parameters is traditionally restricted by the assumptions of the particular statistical model.

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[2]In psychology, intensive longitudinal data collection methods are often referred to as experience sampling method (ESM), ecological momentary assessment (EMA), or ambulatory assessment (AA) studies. While the terms come from different conceptual backgrounds, they share a focus on collecting data over an extended period of time to capture people's behaviors and experiences as they vary over time and in response to different situations and events. In this article, we will use the experience sampling (ESM) term as it has the strongest footing within the clustering literature.

To take the common VAR model as an example, the model explicitly assumes that the time intervals between measurements are consistent (i.e., equidistant measurement assumption), it does not allow for missing values, and it assumes that means or variances do not change over time (i.e., stationarity assumption; Lütkepohl, 2005). These assumptions, however, stand in contrast to types of data researchers commonly collect to address important questions of erratic, and context-specific phenomena (Hamaker & Wichers, 2017; Helmich et al., 2020; Kivelä et al., 2022; Myin-Germeys et al., 2018). Model parameters might, thus, not always accurately capture the time series and are often restricted in the time series features they capture.

Recent efforts to address the shortcomings of model parameters for time series clustering have primarily proposed more complicated models, which either seek to relax specific assumptions (e.g., den Teuling et al., 2021) or include additional time series features (e.g., see Gates et al., 2017; Krone et al., 2018). In this manuscript, we instead, propose to directly cluster based on important and relevant time series features. Adequately named *feature-based time series clustering*, such an approach has been a common procedure in digital phenotyping (Loftus et al., 2022) and the broader machine learning literature (Maharaj et al., 2019). As such, the analysis has been applied to a variety of data, including analyses of astronomical, meteorological, and aviation pathways, biological and medical developments, as well as energy and finance patterns (Aghabozorgi et al., 2015). We argue that for psychological time series data, feature-based clustering offers a flexible approach, fewer strict assumptions, easy and intuitive analysis, as well as meaningful psychological interpretability.

In the sections below, we seek to provide a practical introduction to the method. To do so, we illustrate the utility of the method with real-world ESM data. We use this data to discuss which psychological time series features are well-suited for a clustering approach, introduce the individual analysis steps, and provide practical guidance on common algorithms and analysis code.

5.1   Data used for illustration

To illustrate the functioning and utility of feature-based time series clustering with psychological ESM data, we apply the clustering process to a recent set of studies that collected data on migration experiences. Researchers have recently started using ESM data to follow the daily interactions of migrants with cultural majority groups. We have seen both new technologies to capture such interactions (e.g., Keil et al., 2020) as well as an increase in empirical studies that assess the well-being of migrants (e.g., Hendriks et al., 2016) and their intergroup contact (e.g., Doucerain et al., 2023).

This type of research comes as a response to a long-standing theoretical tradition highlighting the dynamic and developmental nature of cultural adaptation (e.g., Berry, 1986). Importantly, such developmental trajectories are often difficult and stressful (Ward & Geeraert, 2016) — so that some may have an adaptive trajectory while others face a more difficult and grievous trajectory (Kim, 2017). Prominent reviews within the migration literature have, thus, called for more longitudinal (e.g., Ward & Szabó, 2019) and real-world data (e.g., McKeown & Dixon, 2017). By the same token, there is a crucial need to distinguish (mal-)adaptive clusters within these developmental trajectories and to relate these clusters to individual differences and contextual variables to make them understandable (e.g., Choi et al., 2009).

At the same time, conceptual works on cultural adaptation have highlighted the multidimensional perspective necessary to understand migration experiences. A recent scoping review has particularly highlighted that cultural adaptation is best understood as a joint process of motivational, affective, cognitive, and behavioral aspects (e.g., Kreienkamp et al., 2023h). The data on migration experiences are, thus, explicitly multidimensional, mirroring the increase in complex data within the ESM literature (Wardenaar & de Jonge, 2013).

In short, the data on migration experience we are using for this illustration, address a pressing societal issue of identifying and understanding diverging trajectories. And importantly for our illustration, the migration ESM research, also, exemplifies the real-world data issues that ESM data commonly face, including a multivariate conceptualization with event-specific missingness patterns (also see Appendix 5.A for an expanded discussion of the current challenges within ESM data that are addressed within the data).

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Matching these requirements, the data set we use consists of three studies that followed migrants who had recently arrived in the Netherlands in their daily interactions with the Dutch majority group members (for the data set see Kreienkamp et al., 2023a). After a general migration-focused pre-questionnaire, participants were invited twice per day to report on their (potential) interactions with majority group members for at least 30 days. The short ESM surveys were sent out at around lunch (12pm) and dinner time (7 pm). After the 30-day study period, participants filled in a post-questionnaire that mirrored the pre-questionnaire. Participants received either monetary compensation or partial course credits based on the number of surveys they completed.

The original studies included 207 participants (N_{S1} = 23, N_{S2} = 113, N_{S3} = 71) with a total of 10,297 ESM measurements. Each of the studies focused on recently arrived first-generation migrants, and each study included a number of idiosyncratic variables relevant for the broader research collective. For our empirical example, we focus on the variables that were collected during the ESM surveys and were available in all three studies. Variable selection and preparation are described as part of the illustration below, but for additional methodological details about the study setup see Kreienkamp et al. (2023a). Each study was approved by the ethics board of the university of origin and all participants gave informed consent.

5.2 Analysis steps and application

To introduce and illustrate the feature-based clustering analysis, we will follow the conceptual steps of the procedure in sequential order and discuss key issues for each step. To do so, we will follow the common separation that has structured feature-based clustering into four main steps (Räsänen & Kolehmainen, 2009; Wang et al., 2006). (1) The selection and preparation of the input variables, (2) the extraction of the time series features that describe the time series, with an optional feature reduction step if there are too many data points for the clustering algorithms, (3) the actual clustering of the time series features, and (4) the evaluation and interpretation of the clusters. While this

is a common conceptual separation of procedural elements, it is important to note that these steps are a general outline, and the specific details of the analysis will depend on the nature of the data and the research question being addressed. Nonetheless, the conceptual nature of these steps allows us to introduce the major elements of the analysis. We also provide a conceptual overview that can be used alongside this section in Figure 1.

Figure 1: Flowchart Feature-Based Time Series Clustering in Psychology
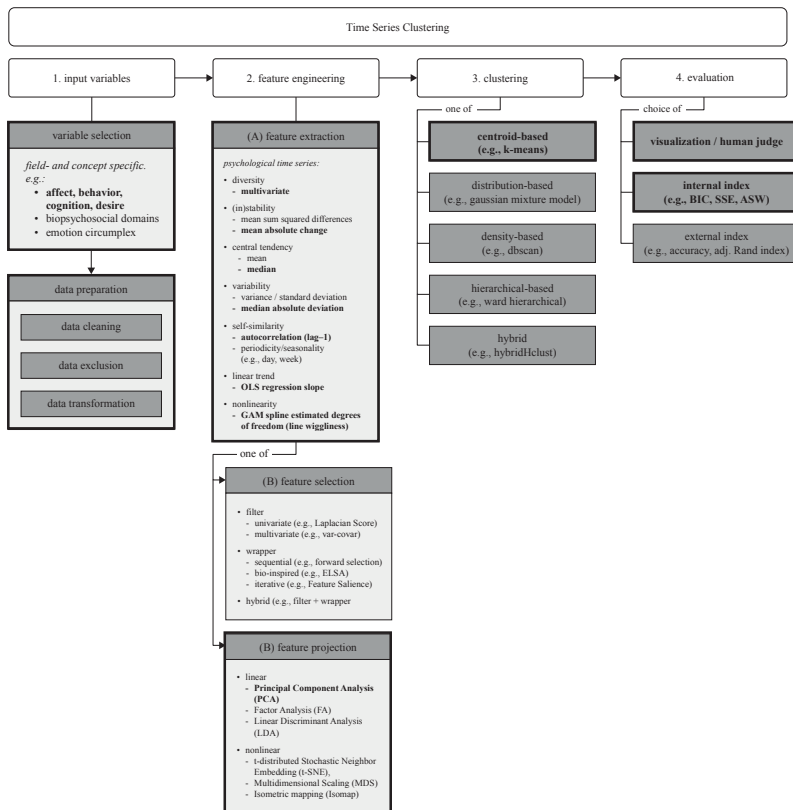
Note: Choices selected for illustration in this manuscript are marked in bold.

5.2.1 Input variables

Time series clustering starts with the selection and preparation of the variables of interest. While the selection will necessarily be field- and concept-specific, there are a few conceptual and methodological issues that should be considered. Conceptually, the included variables should adequately capture the concept of interest and should be meaningful to the understanding of the time series. One of the advantages of feature-based clustering is that it is inherently adept at accommodating multi-variate concepts — a common aim in ESM research. There are, for example, calls that emotion dynamics should be assessed with a repertoire of positive and negative emotions (e.g., Dejonckheere et al., 2019), many health developments are captured within the biopsychosocial domains (e.g., Suls & Rothman, 2004), and migration experiences are fully captured with affect, behavior, cognition, and desire measurements (e.g., Kreienkamp et al., 2023h). At the same time, however, the added number of variables can become a methodological concern. Not only can redundant and irrelevant variables diminish the quality of the analyses, but with intensive longitudinal data the number of data points compounds across participants, measurement occasions, and variables so that additional variables can make many of the following steps substantially more difficult (also see Figure 2).

Figure 2: Exemplary Flowchart of Data Points in Feature-Based Time Series Clustering

Original Data		**Feature Extraction**		**Feature Reduction**		**Feature Clustering**	
participants	100	participants	100	participants	100	clusters	1–5
* variables	10	* feature set	80	* reduced feature set	12		
* measurements	60	↳ *variables * features*	*10*8*				
total data points	**60,000**	**total data points**	**8,000**	**total data points**	**1,200**		
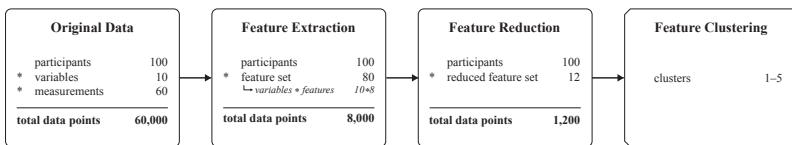
Note:
The presented number of participants, variables, and measurement occasions are somewhat arbitrary but generally represent common sample sizes found within the literature. Also, the number of extracted clusters is presented for illustrative purposes only.

For our illustration, we include 12 variables that were measured as part of the ESM surveys in all three studies and captured information about the participant's interactions, as well as cognitive-, emotional-, and motivational

self in relationship with the majority group (see Table 1 for an overview). We chose these aspects in particular because (1) the interaction-specific information exemplified the structural missingness issue of modern ESM data and (2) the motivational, emotional, and cognitive experience offered a diverse conceptualization of migration experience (beyond behavioral measurements) that is becoming more common in the literature (Kreienkamp et al., 2023h). The breadth of the included variables also showcases the utility of the method for a growing body of literature that considers heterogeneous and complex concepts. As a result, the number of included variables is also on the higher end for psychological concepts and additionally allows us to showcase the efficiency benefits of the method and offers a reasonable use case for the optional feature reduction step.

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Once the important variables have been selected, the data needs to be prepared for the analysis steps. Importantly, this not only means validating and cleaning the data (e.g., re-coding, removing duplicate or unwanted measurements) but also making the time-series comparable. Two important steps are making the time-frames and response scales comparable across participants — for example, by choosing a time frame that is common to most participants and standardizing the participants' responses ('data exclusion' and 'data transformation' in Figure 1; also see Liao, 2005).

In our illustration data set, the studies differed substantially in the maximum length of participation ($\max(t_{S1}) = 63$, $\max(t_{S2}) = 69$, $\max(t_{S3}) = 155$). This was likely due to the option to continue participation without compensation in the latter study. To make the three studies comparable in participation and time frames, we iteratively removed all measurement occasions and participants that had more than 45% missingness (which was in line with the general recommendation for data that might still need to rely on imputations for later model testing Madley-Dowd et al., 2019). This procedure led to a final sample of 157 participants, who jointly produced 8,132 measurements. Importantly, both the participant response-patterns and the time frame were now substantially more comparable ($\max(t_{S1}) = 61$, $\max(t_{S2}) = 60$, $\max(t_{S3}) = 67$). Full methodological details are available in Supplemental Material I, but basic item information, descriptives, and correlations are also available in Table 2.

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Table 1: Variable Selection

Variable	Question	Aspect	Contact Specific		unspecific
			ESM	Interaction Only	
Int: Accidental	The interaction with -NAME- was accidental.	cognition	✓		
Int: Cooperative	The interaction with -NAME- was cooperative.	cognition	✓		
Int: Meaningful	Overall, the interaction with -NAME- was: Superficial — Meaningful	cognition	✓		
Int: Need Fulfillment	During your interaction with -NAME- your goal (-GOAL-) was fulfilled.	needs	✓		
Int: Need Fulfillment Partner	-NAME- helped fulfill your goal (-GOAL-)	needs	✓		
Int: Partner Attitude	At the moment, how favorably do you feel towards -NAME-	cognition	✓		
Int: Quality	Overall, the interaction with -NAME- was: Unpleasant — Pleasant	cognition	✓		
Int: Representative	The interaction with -NAME- was representative of the Dutch.	cognition	✓	✓	
Int: Voluntary	The interaction with -NAME- was voluntary.	cognition	✓	✓	
Need Fulfillment	During this -morning/afternoon- your goal (-GOAL-) was fulfilled.	needs	✓	✓	
Outgroup Attitude	At the moment, how favorably do you feel towards the Dutch.	cognition		✓	✓
Well-Being	How do you feel right now? very sad — very happy	emotion		✓	✓

Note:

All items used a continuous slider and were rescaled to a range of 0–100.

Table 2: Correlation Table and Descriptive Statistics

	Int: Accidental	Int: Voluntary	Int: Cooperative	Int: Representative	Int: Meaningful	Int: Quality	Int: Need Fulfil.	Int: Need Fulfil. Partner	Attitude Partner	Daytime Core Need	Outgroup Attitude	Well-being
Correlations												
Int: Accidental		-0.16	-0.18	0.05	-0.08	-0.08	-0.33**	-0.22*	-0.03	-0.25*	-0.02	0.18
Int: Voluntary	-0.14***		0.60***	-0.07	0.07	0.39***	0.15	0.14	0.38***	0.08	0.21*	-0.06
Int: Cooperative	-0.14***	0.28***		0.15	0.36***	0.65***	0.41***	0.52***	0.44***	0.24*	0.24*	-0.08
Int: Representative	0.00	0.07**	0.12***		0.09	0.12	-0.08	-0.06	0.12	-0.01	0.41***	-0.05
Int: Meaningful	-0.19***	0.21***	0.29***	0.01		0.64***	0.07	0.17	0.42***	0.07	-0.04	-0.05
Int: Quality	-0.09***	0.32***	0.39***	0.06**	0.44***		0.40***	0.31**	0.63***	0.21	0.21*	0.10
Int: Need Fulfillment	-0.08***	0.18***	0.26***	0.10***	0.17***	0.32***		0.64***	0.08	0.64***	0.14	0.33***
Int: Need Fulfillment Partner	-0.11***	0.21***	0.32***	0.08***	0.20***	0.32***	0.52***		0.10	0.51***	0.11	0.08
Attitude Partner	-0.05	0.30***	0.30***	0.03	0.41***	0.58***	0.23***	0.26***		-0.13	0.55***	0.11
Daytime Need Fulfillment	-0.06*	0.11***	0.17***	0.02	0.16***	0.17***	0.15***	0.14***	0.10***		0.05	0.15
Outgroup Attitude	-0.03	0.14***	0.16***	0.15***	0.20***	0.31***	0.19***	0.22***	0.37***	0.09***		0.25**
Well-being	-0.05*	0.16***	0.17***	-0.03	0.22***	0.32***	0.15***	0.14***	0.26***	0.20***	0.24***	
Descriptives												
Grand Mean	39.10	80.08	79.55	64.65	61.16	79.85	85.42	78.52	80.59	76.48	66.84	74.82
Between SD	31.14	20.61	18.41	21.12	24.62	17.05	16.01	21.53	16.33	21.63	18.54	15.97
Within SD	28.72	19.27	17.43	19.92	22.32	16.37	18.63	20.02	15.81	22.26	9.45	12.86
ICC(1)	0.21	0.29	0.27	0.35	0.31	0.25	0.18	0.26	0.25	0.20	0.77	0.52
ICC(2)	0.90	0.93	0.93	0.89	0.94	0.92	0.91	0.92	0.91	0.92	0.99	0.98

Note:

"Int." = interaction.

Upper triangle: Between-person correlations;

Lower triangle: Within-person correlations;

*** p < .001, ** p < .01, * p < .05

5.2.2   Feature extraction

Armed with a relevant selection of key variables, the main aim of the feature extraction is to describe the most important and meaningful aspects of a time series. In its most general approach, feature extraction can include any numeric summary of the time series (e.g., Maharaj et al., 2019). Given this flexibility, a staggering variety of time series features have been proposed across different disciplines. For example, Wang et al. (2006) proposed 9 structural characteristics (also see Fulcher et al., 2013), Adya et al. (2001) collected 28 features relevant for forecasting, and a commonly used software package for feature extraction 'tsfresh' allows users to extract a total of 794 features of a time series (Christ et al., 2018).

However, not all time series features might be relevant to psychological time series or any particular research question. For example, a psychologist interested in well-being might not necessarily be interested in the exact time point after which 50% of the summed well-being values lie (i.e., relative mass quantile index) or how much different sine wave patterns within the well-being data correlate with one another (i.e., cross power spectral density). Instead, we advocate that we look at time series features that have a strong backing within the ESM literature and offer meaningful interpretability.

Fortunately, past works offer valuable discussions of time series features in psychological research. To understand emotion dynamics, Kuppens and Verduyn (2017) originally proposed four dynamic features: (1) within-person variability, (2) co-variance or intraclass coefficient (ICC), (3) inertia or autocorrelation, and (4) cross-lagged correlations. These features were then extended by Krone et al. (2018), adding (5) innovation variance, and (6) mean intensity. Krone et al. (2018) even built a parametric model to tentatively cluster study participants. From a slightly different perspective Dejonckheere et al. (2019) later added three additional features for psychological time series: (7) instability (8) interdependence (i.e., network density), and (9) diversity (i.e., Gini coefficient; also see Wendt et al., 2020)[3].

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[3]It should be noted that also within the psychological literature, alternative summaries have been proposed, including measurement distribution, nonlinear developments, or categorical states. As an example, Kiwuwa-Muyingo et al. (2011) proposed to extract clinically meaningful states for medical adherence data and suggests these states as meaningful time series features.

Some of the time series features found in the psychological literature are not necessarily well suited to summarize feature-based clustering, and some key conceptual features are not well represented in the literature. In particular, covariances and cross-lagged correlations often produce a large number of parameters and might not necessarily summarize the existing data enough (Ernst et al., 2021). Others, such as network density parameters, used to summarize variable interdependence, might not always be meaningful for psychological data (Bringmann et al., 2019). At the same time, linear and nonlinear trends are not captured within the psychological feature literature because the features are often developed for stationary models (e.g., Krone et al., 2018).

Thus, while the final selection of time series features should always be driven by the research questions and field-specific conventions, for our illustration we chose six time series features that relate to common psychological research questions and recent works within the field: (1) central tendency, (2) variability, (3) instability, (4) self-similarity, (5) linear trend, and (6) nonlinearity. An overview of the selected time series features, their substantive interpretations, and mathematical operationalizations is available in Table 3. For each of the six time series features, we selected a mathematical representation that was appropriate for our type of data. We provide a brief introduction of each feature below. Beyond the operationalizations we chose for our case study, we collected the R-functions we created for the analyses as an R package that automatically extracts and prepares a large selection of the time series feature operationalizations presented in Table 3. All functions are available as part of the package GitHub repository (see the `featureExtractor()` function; Kreienkamp et al., 2023f) and are annotated as part of our tutorial-style illustration (see Supplemental Material I).

Central tendency. The central tendency refers to the statistical measures that represent the "typical" or "average" of a set of data. The most common measures of central tendency are the mean, median, and mode (Weisberg, 1992). As a familiar statistic from probability theory, the central tendency sits at the heart of many fundamental questions about psychological time series. Researchers might, for example, be interested in whether "Over a one-month period, are some people happier than others?"

Table 3: Examples of Features for Psychological Time Series.

TS Feature	Substantive Interpretation	Examples	Further Reading
Central Tendency	Average level of the experience across the entire measurement period.	– mean – median – mode	Bringmann and Eronen (2018); Weisberg (1992)
Variability	Describes the average deviation from the central tendency across the entire measurement period.	– standard deviation – variation coefficient	Helmich et al. (2020); van de Leemput et al. (2014)
(In)stability	Describes the average change between two consecutive measurements of the experience.	– MSSD – mean absolute change – Ix instability index	Kivelä et al. (2022); Wichers et al. (2019)
Self-similarity	Describes how much experiences carry over to future measurements. This includes resistance to change (i.e., carries over to the next measurement) and periodic returns (e.g., self-predictive on a daily or weekly basis).	– autocorrelation – fourier coefficients – continuous wavelet transform	Epskamp et al. (2018); Kuppens et al. (2010)
Linear Trend	Describes upwards or downwards linear trend of the experience reports.	– OLS regression slope – piecewise lin. reg. slope	Gottman et al. (1969); Oravecz et al. (2016)
Nonlinearity	Describes the nonlinear structure of the time series. This includes measures that indicate the deviation from a linear trend as well as nonlinear model parameters.	– GAM spline edf – bicoherence metrics – Langevin polinomial coefficient	Caro-Martín et al. (2018); Bringmann et al. (2017)

Note. The presented features and operationalizations are neither exhaustive nor necessary for feature-based clustering.

For the central tendency feature of our illustration, we chose the robust *median*, which can avoid potential issues with non-normally distributed time series responses or outliers (Weisberg, 1992). To calculate the *median* (M), we let X_{ij} be the ordered list of values from the time series of variable j for participant i. The calculation depends on whether the number of measurements in a time series n is odd or even.

$$M(X_{ij}) = \begin{cases} X\left[\frac{n+1}{2}\right] & \text{if } n \text{ is odd} \\ \frac{X\left[\frac{n}{2}\right]+X\left[\frac{n}{2}+1\right]}{2} & \text{if } n \text{ is even} \end{cases} \tag{5.1}$$

Variability.   Variability captures the degree to which a set of data differs from the central tendency, and is sometimes also referred to as the dispersion or spread of the data (Weisberg, 1992). In time series analyses, variability is conceptually important because information about the distribution and diversity of the data has been found to be indicative of worse psychological states (Helmich et al., 2021; Myin-Germeys et al., 2018). Person-level differences of ESM measurements have, for example, been associated with higher levels of psycho-pathological recurrences among depression patients (Timm et al., 2017). As such, psychological researchers and practitioners are often empirically interested in between-person differences in variability. Researchers on polarization and radicalization might for example ask: "Are people settled in their attitudes towards migrants, or do they vary across the measurement period?"

For our illustration data, we chose to capture the time series variability with the *Median Absolute Deviation* (MAD), where we calculate the *median* (M; calculated as in Equation 5.1) for the absolute deviations of measurement x at time point t for participant i and variable j from the median of that time series X. We again chose the robust statistic because the Median-based measure is less affected by non-normal distributions and extreme values or outliers compared to other measures of variability like the standard deviation (Weisberg, 1992)

$$MAD(X_{ij}) = M(\left|x_{ijt} - M(X_{ij})\right|) \tag{5.2}$$

Instability. Instability captures the average change between two consecutive measurements (Ebner-Priemer et al., 2009). While instability is conceptually related to the variability feature, variability does not take into account temporal dependency, whereas instability looks at the 'jumpy-ness' of the data over time. In other words, variability reflects the range or diversity of values in a time series data, while instability reflects the fluctuation or inconsistency in a time series data over time (Trull et al., 2008). For example, if a person has rapid and extreme changes in mood their mood is highly unstable, while if a person's mood responses span a wide range over the entire study period, their mood is highly variable (Jahng et al., 2008). Within psychological time series, instability measurements have especially been important in the research of borderline personality disorder (Trull et al., 2008) and suicidality (Kivelä et al., 2022), but also in understanding early warning signals more generally (Wichers et al., 2019). Conceptually, the instability feature, thus, relates to a broad range of research questions, including: "What is the nature of the identification changes in those who start working in a new country?" or "Do strong daily fluctuations in self-esteem reflect the process of identity formation in adolescents?"

For our data, we chose the *mean absolute change* (*MAC*; e.g., Barandas et al., 2020; Ebner-Priemer et al., 2009), which looks at the average absolute difference of two consecutive measurements x at time points t and $t-1$, for each time series X of participant i and variable j.

$$MAC(X_{ij}) = \frac{1}{n-1} \sum_{t=2,...,t} |x_t - x_{t-1}| \qquad (5.3)$$

Another common measurement of instability is the *Mean of the Squared Successive Differences* (*MSSD*), which is often preferred where differences in magnitude are more important than the frequency of those changes, for example, when big shifts in time series are considered more impactful or when outliers are meaningful and need to be taken into account (Chatfield, 2003).

Self-similarity. Self-similarity in time series data refers to the property of a time series to exhibit similar patterns of behavior over different time scales

(D'Mello & Gruber, 2021). That is, self-similarity describes how much a measurement carries over to future measurements. One important self-similarity in psychological time series is *inertia* — how much a measurement carries over to its next measurement (Kuppens et al., 2010; Suls et al., 1998). If inertia is high, a development tends to stay in a certain state. Because high inertia is resistant to change, in emotion dynamics, high inertia of negative affect has been found to be indicative of under-reactive systems and to be characteristic of psychological maladjustment (Kuppens et al., 2010). In a similar vein, high inertia in negative affect at baseline was even predictive of the initial onset of depression (Kuppens et al., 2012). Conceptually, inertia is more broadly connected to research questions such as: "Do patients stay in a negative mood for several measurements?" or "Do migrants stay with their language practice for several days at a time?"

For our illustration case, we chose the commonly used autocorrelation or autoregression with a lag-1 to capture the inertia. High autocorrelation values can indicate high levels of inertia, while low autocorrelation values may indicate a more unpredictable or volatile time series (Dejonckheere et al., 2019). The lag–1 autocorrelation $r_{ij,1}$ looks at the average correlation between a measurement x and the preceding measurement x_{t-1} for the time series X of participant i and variable j with n measurements.

$$r_{ij,1} = \frac{\sum_{t=2}^{n}(x_{ijt} - \overline{x}_{ij})(x_{ij,t-1} - \overline{x}_{ij})}{\sum_{t=1}^{n}(x_{ijt} - \overline{x}_{ij})^2} \tag{5.4}$$

Where $\overline{x}_{ij}$ is the mean of the time series x_{ij}, calculated as:

$$\overline{x}_{ij} = \frac{1}{n}\sum_{t=1}^{n} x_{ijt} \tag{5.5}$$

Linear trend. In non-stationary time series, a linear trend can be observed when there is a consistent increase or decrease in the data over time (Nyblom, 1986). For psychological time series, researchers have, for example, pointed out the importance of linear trends in interpersonal communications (Vasileiadou & Vliegenthart, 2014), and emotion dynamics (Oravecz et al., 2016). Theoretically, linear trends are often considered the simplest way of assessing whether

a psychological theory of change is appropriate (Gottman et al., 1969). In empirical practice, linear trends are, thus, commonly exemplified by research questions such as "Do patient symptoms improve consistently?" or "Does worker productivity decline continuously?"

For the variables in our illustration data set, we chose an overall linear regression slope to capture the linear trend. The regression slope b_{ij} provides the average change from one time point t to the next across all measurements x of a time series X of participant i and variable j. The specific form of the OLS slope formula we provide below calculates b_{ij} as the sum across all time points of the product of the deviation of time t from its mean $\bar{t}$ and the deviation of x_{ij} from its mean $\bar{x}_{ij}$ at each time point, divided by the sum across all time points of the square of the deviation of time from its mean $(\sum(t - \bar{t})^2)$. Intuitively, the formula captures the rate of change of variable x_{ij} with respect to time. This slope will indicate how the variable x_{ij} changes over time, controlling for its mean value and the mean of time. If the slope is positive, x_{ij} increases over time; if it's negative, x_{ij} decreases over time.

$$b_{ij} = \frac{\sum(t - \bar{t})(x_{ijt} - \bar{x}_{ij})}{\sum(t - \bar{t})^2} \tag{5.6}$$

Nonlinearity.   Changes in psychology are not always linear, instead, nonlinearity is a common feature of psychological time series (Hayes et al., 2007). As an example, episodic disorders, such as depression, are most likely best described as non-linear systems (Hosenfeld et al., 2015). Similarly, patients in recovery from depression showed sudden changes in the improvement of depression (Helmich et al., 2020). But also, substance abuse (Boker & Graham, 1998) or attitude changes rarely develop linearly (van der Maas et al., 2003). Conceptually, researchers might have research questions about the type of the development: "Is the development of well-being a nonlinear process?" as well as the shape and structure of the development: "How many spikes in well-being did a migrant experience?"

We summarized the nonlinear trend with the *estimated degrees of freedom* of an empty GAM spline model. The *edf* summarizes the *wiggliness* of a spline trend line (Wood, 2017). The degrees of freedom of a spline model are

primarily determined by the number of knots and the order of the spline. For instance, a cubic spline with k knots has $k+3$ degrees of freedom (Faraway, 2016). However, in a penalized spline framework, which is commonly used for GAMs, the effective degrees of freedom can be less than $k+3$. This is because the model employs a smoothing parameter to control the trade-off between the complexity (flexibility) of the model and its fit to the data, thereby penalizing overly complex models and potentially reducing the effective degrees of freedom (Marx & Eilers, 1998). Intuitively then, an edf of 1 would be equivalent to a linear relationship (i.e., one linear slope parameter), whereas a higher edf (particularly an edf > 2) is indicative of a non-linear trend. The estimated degrees of freedom are commonly based on a concept called 'effective degrees of freedom' and can be represented as the trace tr (i.e., the sum of the diagonal elements) of the smoother matrix S, a symmetric matrix that maps from the raw data to the smooth estimates (Wood, 2017).

$$edf = tr(S) \tag{5.7}$$

Beyond our main features of interest, we also extracted the participant's number of completed ESM measurements to ensure that the clusters are comparable in that regard (i.e., to exclude spurious explanations for the cluster assignments). After the feature extraction, we found that about 1.40% of the extracted features are missing across the 72 features per participant. This might, for example, happen if participants do not have two subsequent measurements with outgroup interactions, so that an autocorrelation with lag-1 cannot be calculated for the contact-specific variables. The small number of missing values indicates that the feature-based approach indeed largely avoids the structural missingness issue. However, even the few missing values can be an issue for some feature reduction or feature clustering algorithms. We, thus, impute the missing feature values with a single predictive mean matching imputation using the MICE library (Buuren & Groothuis-Oudshoorn, 2011). Note again that with this procedure, we only need to impute an extremely small number of missing values, as most feature calculations can use the available data instead.

It is important to reiterate that the six selected time-series features are in no way exhaustive or imperative. Both using a more data-driven approach

to the selection of time series features or selecting entirely different aspects to summarize the time series are legitimate options (e.g., see Heylen et al., 2016). Our choice seeks to offer a practical toolbox of time series features that are common and meaningful to psychological research questions and practice, but are also easy to extract and summarize a broad range of developments without asserting strict assumptions.

5.2.3   Feature reduction

Once a meaningful set of time series features has been extracted for each variable and participant, the total number of data points sometimes remains too large for the desired clustering algorithm. As an example, a relatively common scenario would include 10 variables of interest, where eight time series features are extracted, resulting in 80 features per participant (with a common sample size of 100 participants that would result in a total of 8,000 data points in this hypothetical example). We offer an illustration of the compounding numbers of data points in Figure 2. The difficulty of finding stable clusters for data with a large number of dimensions is sometimes termed the 'dimensionality curse' (e.g., Altman & Krzywinski, 2018).

To deal with this dimensionality issue, two main approaches have been proposed — feature selection and feature projection (e.g., Erdogmus et al., 2008). While feature selection refers to the process of identifying and selecting a subset of relevant features from the original feature set (Alelyani et al., 2014), feature projection refers to the process of transforming the original feature set into a new feature set of lower dimensionality (Carreira-Perpiñán, 1997). In general, feature selection procedures have the benefit that they retain the interpretable feature labels directly and immediately indicate which features were most informative in the sample. Feature projection methods, on the other hand, have been popular because they are efficient, widely available, and applicable to a wide range of data types. We provide an overview of the common approaches, an intuitive introduction to common methods, and exemplar algorithms in Table 4.

For our own illustration data, we chose a feature projection method to reduce the dimensionality of our extracted features. We particularly chose the

Table 4: Examples of Feature Reduction Approaches and Methods.

Approach	Method	Intuitive Description	Algorithm Examples
Selection	filter	Features are selected individually or jointly based on selection criteria. One common selection criterion is the amount of information and (unique) variance a feature captures. Univariate methodologies are able to identify irrelevant features (i.e., because features do not capture much information), multivariate methods additionally allow removing redundant features (i.e., because features capture the same information Yu & Liu, 2004).	– univariate filter (e.g., Laplacian Score) – multivariate filter (e.g., variance-covariance)
	Wrapper	Wrapper methodologies run models with different feature combinations and compare performance. Because the selection process is essentially a search problem, this method is computationally intensive. Traditionally wrappers have used forward selections or backward eliminations, but recently alternative approaches have been proposed based such as ant colony and swarm intelligence paradigms (e.g., see Tang et al., 2014).	– sequential (e.g., forward selection) – bio-inspired (e.g., ELSA) – iterative (e.g., feature salience)
	Hybrid	Hybrid selection methodologies combine filter and wrapper methodologies to avoid the shortcomings of the individual methods. An initial filter step selects candidate features (efficiency) and a subsequent wrapper ensures high performance (effectiveness; e.g., Alelyani et al., 2014).	– filter + wrapper (e.g., Calinski-Harabasz Index)
Projection	linear	Linear dimensionality reduction methodologies use linear transformations of the original data to stretch and shift the data in such a way that the data can be 'projected' to a lower dimensional space without loosing too much information. These methods are well-established, tend to be fast, and usually do not need much conceptual input from the user (Cunningham & Ghahramani, 2015).	– Principal Component Analysis (PCA) – Factor Analysis (FA) – Linear Discriminant Analysis (LDA)
	nonlinear	Nonlinear dimensionality reduction methods also seek to map high-dimensional data to a lower-dimensional space. However, nonlinear methods have been developed to preserve the local and global structure of more complex multidimensional patterns (e.g., Lee & Verleysen, 2007).	– t-distributed Stochastic Neighbor Embedding (t-SNE) – Multidimensional Scaling (MDS) – Isometric mapping (Isomap)

Note. The presented dimensionality reduction methods and -approaches are neither exhaustive nor necessary for feature-based clustering. Notable additional approaches are 'embedded selection methods' that filter as part of the model estimation procedure (e.g., mixture models) and 'network-based projection methods' that use neural networks to reduce dimensions (e.g., autoencoders).

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feature projection method for its broad applicability. We, specifically, selected the commonly used *principal component analysis* (PCA). Some of the more tailor-made feature selection algorithms can be more accurate in reducing the feature dimensionality and might retain feature importance information more directly, depending on the specific data structure. However, PCAs have the distinct benefit that they are well-established within the psychometric literature (Jolliffe, 2011) and can broadly be applied to a wide variety of studies in an automatized manner (Abdi & Williams, 2010). As our aim is to present a general illustration that can also be adopted across use cases, we present the workflow using a PCA here but we encourage users to consider more specialized methods as well.

To use the PCA with our extracted time series features, we first standardize all features across participants to ensure that all features are weighted equally. We then enter all 72 features into the analysis. The PCA uses linear transformations in such a way that the first component captures the most possible variance of the original data (e.g., by finding a vector that maximizes the sum of squared distances Abdi & Williams, 2010; Jolliffe, 2002). The following components will then use the same method to iteratively explain the most of the remaining variance, while also ensuring that the components are linearly uncorrelated (Shlens, 2014). In practice, this meant that the PCA decomposed the 72 features into 72 principal components, but now (because of the uncorrelated linear transformations) the first few principal components will capture a majority of the variance. We can then decide how much information (i.e., variance) we are willing to sacrifice for a reduced dimensionality. A common rule of thumb is to use the principal components that jointly explain 70–90% of the original variance (i.e., cumulative percentage explained variance; e.g., Jackson, 2003). For our illustration, we select the first 27 principal components that explain 80% of the variance in the original 72 features (reducing the dimensionality by 62.50%). For the extracted principal components, we save the 27 principal component scores for each participant (i.e., the participants' coordinates in the reduced dimensional space; PC-scores).

We would like to comment on two practical matters when using principal components — the amount of dimensionality reduction and the interpretation

of the principal components. As for the expected dimensionality reduction, given its methodology, PCAs tend to 'work better' at reducing dimensions with (highly) correlated variables (e.g., Jolliffe, 2002). Thus, with a set of very homogeneous variables and features users will need fewer principal components to explain a large amount of variance, while a more diverse set of variables and features will tend to require more principal components to capture the same amount of variance (e.g., Abdi & Williams, 2010). Our 27 principal components are still a relatively high number of variables, but this is not surprising as we chose a diverse conceptualization and a diverse set of time series features. As for interpretability, PCA allows users to extract information on the meaning of the principal components. In particular, because the principal components are linear combinations of the original features, users can extract the relative importance of each feature for the extracted principal components (i.e., the eigenvectors). While this can be useful in understanding the variance in the original data or help with manual feature selection, we use the PCA purely to reduce the dimensionality for the clustering step. Instead of relying on the principal components, we use the original features of interest to interpret the later extracted clusters. We particularly advocate for such an approach if all original features are considered meaningful in understanding the time series and users would like to retain the features for interpretation (irrespective of the features' importance).

5.2.4 Feature clustering

For the actual clustering of the time-series features, the main aim is to organize participants into groups so that the features of participants within a group are as similar as possible, while the features of people in different groups are as different as possible (Liao, 2005). The crux of clustering is, thus, to have clearly defined and effective measurements of (dis)similarity. Most of the clustering algorithms used today use some form of distance measurement to optimize group assignment (or similarity measurement for qualitative features; see Aghabozorgi et al., 2015). While others have produced excellent overviews of the many clustering approaches available (e.g., Xu & Tian, 2015), the more readily available approaches suitable for most time series feature data can, broadly speaking, be categorized as based on (1) centroids, (2) distributions,

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(3) density, (4) hierarchies, or (5) a combination thereof (see Table 5 for an overview; also see Jain et al., 1999, for a broader review).

There is, unfortunately, no one-size-fits-all solution to clustering and users will usually have to make an informed decision based on the structure of their data as well as an appropriate weighing of accuracy and efficiency. We provide a short intuitive explanation for common approaches, together with some of their characteristics and example algorithms in Table 5. For our own illustration, we have chosen the centroid-based k-means clustering. Although k-means sacrifices some level of accuracy, it offers certain advantages. We specifically chose k-means because it is an extremely efficient method that works well with large participant- and feature numbers without making too many restrictive assumptions about the shape of the clusters (Jain, 2010). K-means is also well-established within the research community and has been readily implemented in many statistical software packages (Hand & Krzanowski, 2005). Additionally, many of the feature selection methods have specifically been designed for the well-established k-means algorithm (e.g., Boutsidis et al., 2010). As such, the k-means offers a good starting point for many psychological researchers, and the method should be generalizable across a relatively wide variety of projects.

During the k-means clustering itself, the analysis seeks to minimize the total within-cluster variation. The analysis is designed to optimize the clustering of the feature data into k groups, where k is a pre-defined number of clusters. We used the Hartigan and Wong algorithm, which is a widely used algorithm in k-means clustering (Hartigan & Wong, 1979). The algorithm starts by randomly separating the data points into k clusters, and then iteratively updates the assignment of each point to the nearest cluster center until convergence. To do so, the Hartigan and Wong algorithm specifically calculates the within-cluster variation (W) of cluster C_i as the summed squared Euclidean distances of the feature x to the closest cluster centroid μ_i:

$$W(C_i) = \sum_{x \in C_i} (x - \mu_i)^2 \qquad (5.8)$$

Table 5: Common Clustering Approaches.

Approach	Description	Characteristics	Examples
centroid-based	Chooses a pre-defined number of potential cluster centers in the feature space and assigns participants to the closest center. Then, iteratively, moves the centers until a convergence criterion is met (e.g., all distances to centers minimized).	⊕ simple and efficient ⊕ no assumptions ⊕ well implemented ⊖ complex shapes ⊖ initial values and outliers	– k-means – PAM
distribution-based	Assumes that the data points belong to one of several specific distributions (e.g., Gaussian distributions). Data points that fit to a distribution-based expectation are given a higher probability of belonging to that distribution. We can then iteratively check with which model parameters the data points best fit within a given number of distributions.	⊕ probabilistic ⊕ well-supported ⊖ time intensive ⊖ distribution and parameter	– GMM – DBCLASD
density-based	Assumes that clusters are regions where several data points are relatively close together (i.e., high density). Based on what is considered a dense region (e.g., radius of a region and minimum number of points the radius), points can be either be assigned to one of the clusters or be considered too far away from a dense region.	⊕ efficient ⊕ no shape assumption ⊕ do not assign outliers ⊖ uneven densities ⊖ high dimensionality	– DBSCAN – OPTICS
hierarchy-based	Builds a hierarchy of cluster by step-wise combining the closest two clusters (bottom-up; agglomerative) or top down, dividing the data into smaller clusters that maximize distances (top-down; divisive).	⊕ flexible number of clusters ⊕ no shape assumption ⊕ small number of cases ⊖ no reversal of assignments	– Chameleon – CURE
hybrid	Usually combines different approaches, which combine the strength of the complementary approaches. Oftentimes, the combination also increases efficiency.	⊕ avoids individual shortcomings ⊖ less readily available	– DD-means – hybridHclust

Note. The presented clustering approaches and algorithms are neither exhaustive nor necessary for feature-based clustering. Notably, recently innovations have been made based on graph-, fractal-, swarm-, and quantum theory (for a more in-depth review see Xu & Tian, 2015).

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By summing the within-cluster sum of squares from all k clusters, we can then derive the total within-cluster sum of square $WCSS$:

$$WCSS = \sum_{i=1}^{k} W(C_i) = \sum_{i=1}^{k} \sum_{x \in C_i} (x - \mu_i)^2 \qquad (5.9)$$

It is this $WCSS$ that becomes the objective function to be minimized, by iteratively moving features from one cluster to another (Hartigan & Wong, 1979). In particular, the algorithm (1) calculates the cluster centroids of the initial partitioning, (2) checks whether any feature has a centroid that is closer than that of the currently assigned cluster (3) updates the centroids based on any reassigned features, and then iterates between steps two and three until $WCSS$ is minimized (i.e., locally optimal convergence) or a maximum number of iterations is reached (Jain, 2010). Given the iterative nature of the algorithm, the initial partitioning is often important because the algorithm might arrive at a suboptimal clustering where the $WCSS$ cannot be further reduced by moving any feature to another cluster, despite a better solution existing (i.e., a local minimum; Timmerman et al., 2013). It is, therefore, often recommended running the k-means clustering with several different starting positions.

In our case, we entered the participants' PC-scores from the feature reduction step into the k-means algorithm. Because we did not know the underlying number of clusters within our sample, we calculated the cluster solutions for $k = \{2, \dots, 10\}$. To avoid local minima, we used 100 random initial centroid positions for each run. Each of the 9 cluster solutions converged within the iteration limit. In the next step, we will then evaluate which of the extracted cluster solutions offers the best fit with the data.

5.2.5   Cluster evaluation

Now that the participants have been assigned to their respective clusters based on the similarity of their time series features, the final evaluation step consists of two main elements, (1) evaluating the performance of the clustering analyses to choose an optimal solution and then (2) interpreting the extracted clusters conceptually.

Performance

Performance evaluation often means assessing the accuracy, stability, and separation or purity of the clustering (Keogh & Kasetty, 2003). Importantly, any evaluation of the results depends on the research questions, the data, and the methods used. However, broadly speaking, evaluation methods can be categorized based on whether the true cluster labels are known or not (Saxena et al., 2017). If true class labels are known, the cluster assignments can be compared to the true class labels — using measures such as the F-measure, adjusted Rand index, mutual information, and normalized mutual information (i.e., external evaluation; e.g., Liao, 2005). However, if the true cluster assignments are unknown, as with our psychological time series, the quality of the clusters is assessed based on the characteristics of the data itself, such as separation and homogeneity of the clusters, or goodness of fit indices (i.e., internal evaluation; e.g., Aghabozorgi et al., 2015).

In our own illustration example, we used the `cluster.stats()` function from the `fpc` R package, which calculates a wide variety of internal cluster validity statistics for each of the extracted clustering solutions. With real-world data, no single evaluation measure is likely perfect, and different measures may produce different results depending on the characteristics of the data and the research question being addressed (Kittler et al., 1998). It is therefore important to consider a variety of evaluation measures and to carefully interpret the results in the context of the specific analysis (Vinh et al., 2009). We found that across most indices, the analysis with $k = 2$ clusters performed the best. Three commonly reported indices we would like to highlight are the comparison of within clusters sum of squares, the average silhouette score, and the Calinski-Harabasz index. The first statistic we looked at was the total within-cluster sum of square $WCSS$ (see also Equation 5.9). While the within-cluster variation will naturally decrease with (more) smaller clusters, we observed that the decrease in $WCSS$ was largest until $k = 2$ after which the decrease was much smaller. This method is also sometimes referred to as the 'elbow method' (Syakur et al., 2018). We then looked at a second, commonly used measure, the average silhouette score. This statistic measures the degree to which each time feature data point is similar to other points within the same

cluster, compared to points in other clusters (Rousseeuw, 1987). In our case, the $k = 2$ solution maximized the silhouette coefficient ($s_2 = 0.09$). Finally, the Calinski-Harabasz index assesses the compactness and separation of the clusters by assessing the ratio of the sum of between-clusters dispersion and of inter-cluster dispersion for all clusters — thus, the higher the score the better the performances (Calinski & Harabasz, 1974). In our case, the $k = 2$ solution also showed the highest Calinski-Harabasz index ($CH_2 = 16.38$; a full table of all extracted validity statistics is available in Supplemental Material I)[4]. In the final $k = 2$ solution, the k-means analysis also assigned a relatively even number of participants to cluster 1 ($n_{C_1} = 76$) and cluster 2 ($n_{C_1} = 80$).

Interpretation

The interpretation of feature-based time series clustering in psychology involves understanding the meaning and implications of the obtained clusters. In order to make sense of the clustering results, we here focus on three general aspects of the results (Kaufman & Rousseeuw, 1990). (1) Assessing differences between the clusters in the original time series features, (2) comparing the clusters based on prototype developments, (3) comparing the clusters based on between-person differences that were not included in the initial clustering.

In short, we find that the feature-based clustering discerned two meaningfully different groups of participants. We find an adaptive group (cluster 1) that reports higher well-being and more positive outgroup attitudes (*median*) that are also stable over time (*MAD*, *MAC*) and tend to increase over the 30 day test period (*linear trend*). This group also reported consistently more meaningful, need-fulfilling, and cooperative outgroup interactions (*median*). This group with overwhelmingly positive experiences stands in contrast with a more detrimental group (cluster 2). This cluster, on average, reported much less positive, less meaningful, and less fulfilling interactions and interaction

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[4]It is important to note that another commonly assessed aspect of the evaluation is determining the stability and robustness of the clusters (Berkhin, 2006). This can be assessed by evaluating the sensitivity of the clusters to different feature sets or clustering algorithms, or by using techniques such as bootstrapping to assess the uncertainty of the clusters (Vinh et al., 2009). Especially when comparing different clustering algorithms, one common index is the Bayesian information criterion (BIC), where a lower BIC indicates that a model is more representative of the data (van de Schoot et al., 2017).

patterns (*median*). This group also reported less positive outgroup attitudes, lower well-being, and more discrimination experiences (*median*). At the same time, for members of this detrimental cluster (cluster 2) conditions seemed to deteriorate over time (*linear trend*), and there was generally less consistency in the experiences they were able to have (*MAC*, *MAD*, *edf*).

To identify these patterns, we first inspect the clusters based on the average values of features (see Figure 3A; Kennedy et al., 2021). We see that for some variables the features are generally stronger in separating the clusters. We, for example, see that the item on '*how cooperative the interaction was*' distinguishes the two clusters across almost all seven features (except for the *auto-correlation*, see Figure 3A). Compare this to the '*outgroup attitudes*' item where the differences between the clusters are much smaller for almost all features. We then inspect the clusters with a focus on the features (see Figure 3B). While this is the same data as for the variable focus, we can see more clearly that some features are better at distinguishing the clusters across variables. For example, *MAD* and *median* distinguish the two clusters across almost all variables (except for the item on interaction representativeness). These two features stand in contrast to features, such as the *lag-1 auto correlations*, which showed much smaller differences between the two clusters (see Figure 3B). Taking these two perspectives together, we can also focus on individual features or variables in particular. We, for example, see a strong difference in the average well-being, where participants in cluster 2 showed a much lower median well-being over the time series. At the same time, in terms of stability, both groups have virtually identical average *MAC* statistics for well-being (see Figure 3A). There are, thus, variables and features that distinguish the clusters better than others and a combination of variables and features lets us explore meaningful group differences in more detail. In our case, we see that the central tendency, variability, and linear trend are best at distinguishing a group with mainly positive experiences (cluster 1) from a group with a more negative experience (cluster 2). We also see that our clusters line up with the past literature on the importance of focusing on simpler and more meaningful statistics (Bringmann & Eronen, 2018; Eronen & Bringmann, 2021).

Figure 3: Cluster Group Comparisons based on Features and Variables
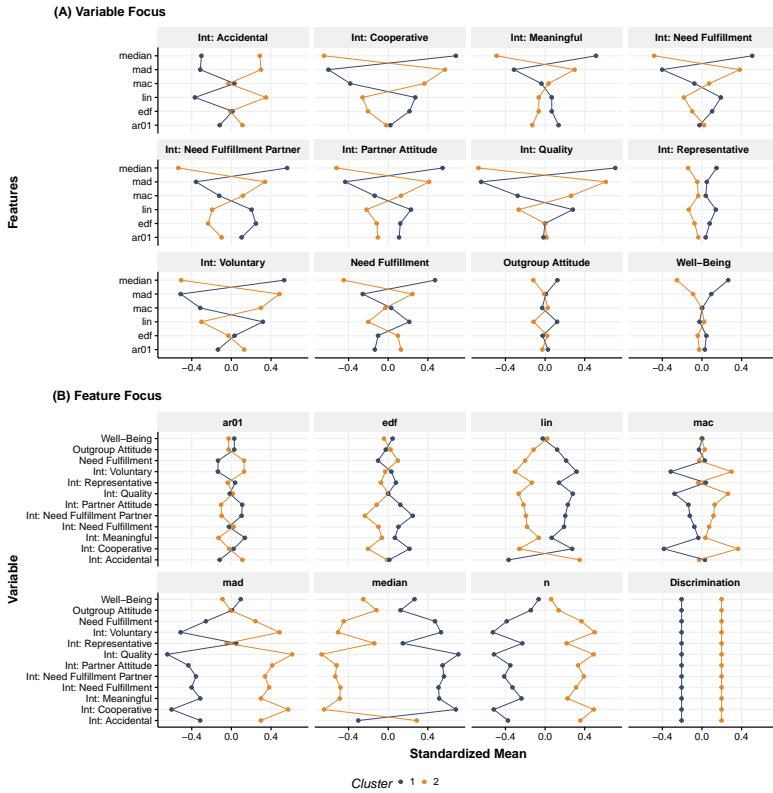
Note:
"Int." = outgroup interaction. Within the "(B) Feature Focus" subplot, the 'n' and 'Discrimination' comparison variables were not part of the original time series clustering.

In the second step, we look at the prototypical trajectories of the clusters. For k-means clustering it is often recommended to use the average over time of the responses within the cluster (see Figure 5; Niennattrakul & Ratanama-hatana, 2007)[5]. Immediately striking are the mean differences, where participants in cluster 1 had more meaningful and fulfilling outgroup interactions and also consistently reported more voluntary and cooperative interactions but fewer accidental and involuntary interactions. The same cluster (cluster 1) also reported an increase in need-fulfilling interactions over the 30-day period and an increase in interactions that were representative of the outgroup. Whereas the other cluster (cluster 2) showed a decrease in voluntary, cooperative, and positive interactions over the 30 days. This 'deterioration' cluster (cluster 2) also saw a decrease in general need fulfillment and experienced well-being over the 30 days (see Figure 5B). We also see that while interaction representative-ness, outgroup attitudes, and well-being are relatively stable for both clusters, the deteriorating cluster (cluster 2) also showed substantially higher variability and instability on most of the other variables (also see Figure 5A).

Finally, we can also assess the clusters across other individual difference variables (e.g., Monden et al., 2022). This out-of-feature comparison allows us to check for data artifacts, as well as check whether the developmental clusters are associated with important social markers and individual differences. To illustrate artifact checks, we added the number of ESM measurements into the comparison and find that the participants in the deterioration cluster (cluster 2) on average completed slightly more ESM surveys in general and reported on more intergroup interactions in particular (see *n* in Figure 3B). In our data exclusion procedures, we ensured that the general time frame and completion rates are similar for all participants and indeed the numbers in ESM measurements generally are largely similar (e.g., see *n* for well-being and outgroup attitudes). However, the difference in the reported number

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[5]It is important to note, however, that direct comparability can be a concern, and often times some subset selection or nonlinear alignment is necessary (e.g., Gupta et al., 1996). Additionally, finding cluster prototypes is often substantially easier with embedded clustering methods because in many cases a cluster-level model is estimated as part of the expectation–maximization procedure (e.g., den Teuling et al., 2021) or *S-GIMME* (e.g. Lane et al., 2019). For medoid-based clustering algorithms, a common approach is simply using cluster medoid as the prototype (Kaufman & Rousseeuw, 1990).

of interactions might indicate either a clustering artifact or a meaningful difference. The higher average number of interactions in cluster 2 could, for example, indicate a clustering artifact if variances are substantially larger due to the larger samples (e.g., restriction of range in the smaller sample Kogan et al., 2006). In our case, this seems less likely because one out of four variables did not differ in terms of the MAD (i.e., our selected measurement of the time series variance; see Figure 4 for an illustration). At the same time, however, the difference in the number of experienced interactions might also indicate a meaningful difference, where the deteriorating cluster (cluster 2) on average reported more outgroup interactions (*difference* = 1.03, *t*(150.83) = 7.50, *p* < .001, *95%CI* [0.76, 1.30]), but these interactions were less voluntary (*difference* = -1.04, *t*(108.89) = -7.71, *p* < .001, *95%CI* [-1.31, -0.77]), less meaningful (*difference* = -1.00, *t*(136.40) = -7.16, *p* < .001, *95%CI* [-1.28, -0.73]), and less positive (*difference* = -1.38, *t*(152.31) = -11.94, *p* < .001, *95%CI* [-1.61, -1.15]). Thus, while more research is needed for a conclusive test, our data seems to suggest that the differences in reported interactions are a meaningful difference between the clusters. Such a finding would also be in line with past research highlighting the role of negative intergroup interactions in explaining intergroup relations (e.g., Barlow et al., 2012; Graf et al., 2014; Prati et al., 2021).

To further illustrate the utility of assessing out-of-feature individual differences, we also compare the two samples in terms of the participants' self-reported discrimination experiences in the Netherlands (measured during the post-measurement). When looking at the group comparison, we find that participants in the deteriorating cluster (cluster 2) reported substantially higher levels of everyday discrimination (*difference* = 0.40, *t*(151.71) = 2.56, *p* = 0.011, *95%CI* [0.09, 0.71]; Figure 3B). Thus, both intensive longitudinal (e.g., the sum of specific ESM measurements) and cross-sectional variables (e.g., general discrimination differences) that were not included in the original clustering step can be used to explore and understand the cluster differences in more detail.

This cluster separation, then, has a number of empirical and practical applications. Firstly, the clusters are descriptive. With tens of variables, hundreds

Figure 4: Cluster comparison of Median Absolute Deviation for all variables
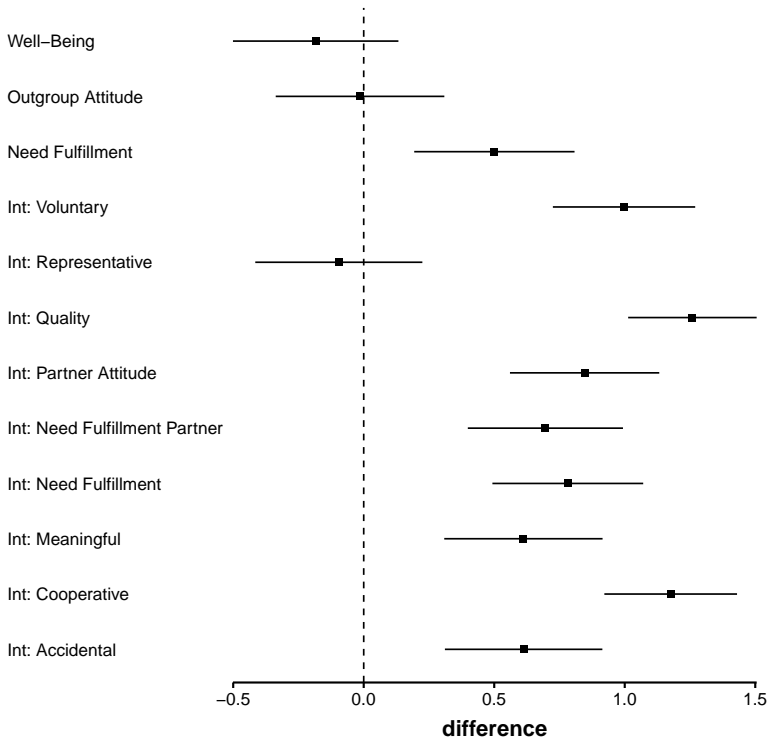
of participants, and thousands of measurements, singular descriptive statistics are often not able to capture the complex patterns that describe the data set. The feature-based clustering offers some direct insight into the complexity within the data set. In our empirical example, we, for example, see that participants are meaningfully distinguished by a combination of high (vs. low) central tendency, variability, and linear trend. Secondly, the clusters identify important groups. The adaptive and deteriorating groups offer starting points for empirical exploration as well as practical interventions. Researchers can start probing what exactly distinguishes the two groups further and generate

new bottom-up hypotheses. Practitioners in the resettlement field can use the group separation to identify individuals in need of assistance and can explore contextual factors that might contribute to the difficulties some might face. In our illustration, we, for example, found that participants in the deteriorating cluster (cluster 2) reported less need fulfilling interactions over time. Thirdly, the feature-based approach is flexible and meaningful. We were able to use a wide range of time series features that have been central in the ESM literature and were able to use them directly to identify meaningful groups. For our empirical illustration we, among others for example, chose to focus on whether participants differed in their average well-being (i.e., *median*), how much their well-being would vary over time (i.e, *MAD*), and whether their well-being would on average increase or decrease over time (i.e., *linear trend*). Alternatively, for others cyclical patterns might be more important — for example, whether well-being was higher on weekends. Importantly, in any case, we did not need to translate these dynamic features into probabilistic inference models (e.g., VAR models) to cluster the participants.

5.3   Discussion

The purpose of this article was to introduce feature-based time series clustering as an amenable and transparent approach to understanding between-person differences in developmental patterns of psychological time series data. Rather than relying on person-specific model parameters, which can be restrictive and assumption-bound, we argue for the more flexible and theoretically grounded approach of directly clustering on relevant features of the time series data. By leveraging the rich array of dynamic measures, our approach offers the advantages of flexibility, fewer strict assumptions, and improved interpretability, thus potentially enriching our understanding of heterogeneous psychological processes in intensive longitudinal studies.

To illustrate the practical utility of the approach, we applied the method to real-world empirical data that highlight common ESM issues of multivariate conceptualizations, structural missingness, and nonlinear trends (e.g., Ariens et al., 2020). With the real-world data, we followed a stepwise approach to

Figure 5: Cluster Group Comparisons over time
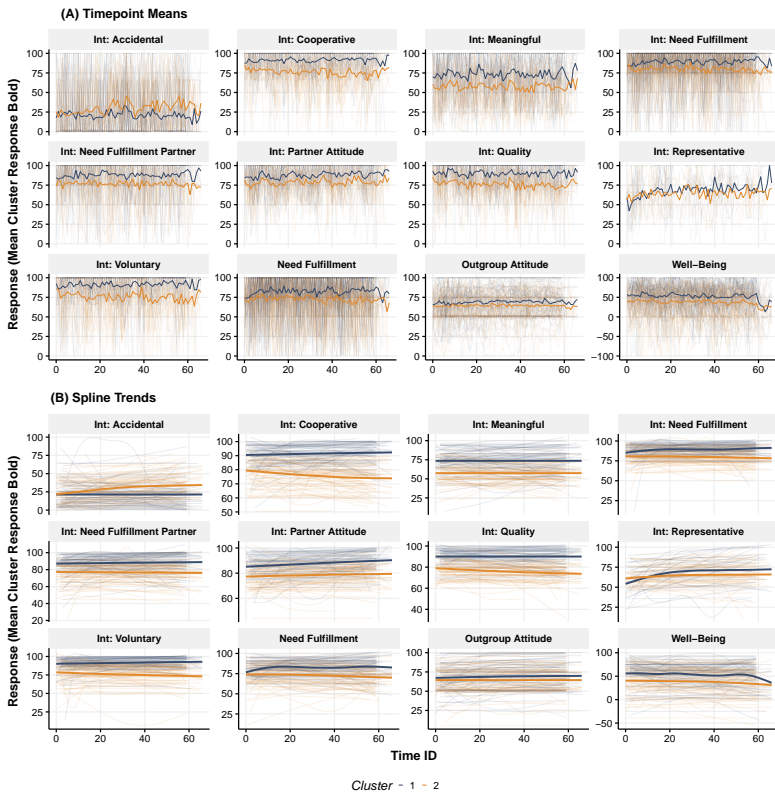
Note:

Subplot (A) displays the variable cluster means at every measurement occasion. Subplot (B) shows the GAM spline for each cluster across the measurement occasions. The thinner lines present all individual time series.

discuss key issues during input selection, feature extraction, feature reduction, feature clustering, and cluster evaluation. Within this step-wise approach, our article shows that feature-based clustering offers an excellent fit for psychological research, as both the time series features and the analysis steps are well established within the field, and statistical packages are readily available. Time series features (such as means or linear trends) are not only easy to extract, but also hold conceptual meaning for psychological data and can be chosen to address specific research questions (also see Table 3).

Importantly, we show that feature-based clustering is not only approachable but provides interpretable and transparent insights about the grouped patterns. For our example of migration experiences, the method was useful to discern adaptive from more stressful experiences and helped to contextualize divergent experiences. We found that some variables, such as interaction quality perceptions or need fulfillment, were particularly important in distinguishing the groups (see Figure 3A). Similarly, we found that the central tendency (*median*), variability (*MAD*), and linear trend (*slope*) were the most impactful dynamic features in discerning the trajectory clusters (see Figure 3B). Jointly these two approaches allowed us to identify a cluster that had generally positive and improving experiences while the other cluster had more negative and deteriorating experiences. We were even able to further contextualize the results with out-of-feature comparisons, where we found that the group with the more difficult experiences also reported substantially more discrimination experiences during the post-test (see, e.g., Figure 3B). In short, the feature-based approach allowed us to identify directly interpretable and meaningful groups, where we transparently know what data input the clusters are based on.

5.3.1   Limitations

While feature-based time series clustering offers a promising approach to understanding psychological time series data, it is not without limitations. In particular, feature-based clustering has both usability- and robustness limitations across its multiple steps.

In terms of convenience, each of the steps requires users to make an informed decision about the method and algorithm. These additional steps of

decision-making and transparency increase the initial barrier to entry. We hope that our empirical illustration, the sample code, and the custom functions offer a relatively generalizable and simple procedure, but clustering, unfortunately, does not offer a universal one-size-fits-all solution.

In terms of methodological robustness, the variety of methods in each of the steps also brings with it the potential for inconsistent results between methods (e.g., Bastiaansen et al., 2019). A different set of variables, time series features, or a different clustering algorithm, might have resulted in substantially different cluster assignments. While the variety and diversity of methods are helpful in finding options even for more complex types of data, different algorithms often offer different results (e.g., Keogh & Lin, 2005). And even when patterns produce robust clustering solutions across algorithms, individual methods might still have their idiosyncratic shortcomings (Xu & Tian, 2015).

As an illustration, the choice of time series features to extract from the time series data is a critical step that can significantly influence the results of the clustering process. In the current example, we chose to extract time series features such as means, autocorrelations, and linear trends, which are psychologically and conceptually meaningful in interpreting our time series clusters. However, this selection is not exhaustive and may not capture all relevant aspects of the time series data. For example, we did not consider attributes like periodicity or spectral density, which could shed light on the data's cyclical patterns. The choice of time series features largely hinges on the researcher's specific research question and assumptions about the data, thereby injecting a level of subjectivity into the process. Similar challenges arise with the choice of the clustering algorithm or the cluster illustration. These challenges are not unique to feature-based clustering, rather they are common to all clustering approaches (Horne et al., 2020; Liao, 2005). However, it is important to remember that multi-stepped data-driven approaches are particularly vulnerable to the impact of the researchers' degrees of freedom.

One potential remedy to many of the limitations of feature-based clustering lies in transparently and reproducibly reporting the decisions for each of the analysis steps. In our own description of the method, we have provided a range of options and motivated our own choices to facilitate the transparency of the individual steps and decision moments. Beyond the structures proposed here,

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van de Schoot et al. (2017) have proposed an extensive checklist for latent trajectory studies. Most of their recommendations and reporting guidelines also apply to feature-based clustering, and could even offer a template for researchers who want to preregister their analysis procedures (also see Kirtley et al., 2021).

5.3.2   Implications

Notwithstanding the limitations, we believe that feature-based clustering offers exciting new potential for researchers and practitioners assessing psychological time series.

For researchers, the feature-based time series clustering approach offers a number of compelling implications. The flexibility and interpretability mean that feature-based time series clustering can be applied to a wide range of data types and research questions. The method can be used to contextualize preexisting groups by extracting their time series features and comparing a data-driven approach with existing group labels. Furthermore, the feature-based approach can also be used as an exploratory, descriptive, or predictive approach to intensive longitudinal data. By reducing the complexities of ESM data to important and meaningful patterns, a bottom-up approach can aid in the creation of more embedded theories and interventions, or simply in describing the often complex and heterogeneous data researchers collect during ESM studies.

Looking ahead, the feature-based time series clustering approach opens up new avenues for future research. While the approach has shown promise in dealing with the challenges of dimensionality, missingness, and time scales, there is potential for further refinement and expansion of the approach. To showcase the exciting potential for future methodological integrations, we will briefly consider the broad range of alternative approaches to time series clustering (see Figure 6).

For instance, given that the approach does not assume the stationarity restrictions of many model-based approaches, future research can now more easily integrate many of the (non-)linear trend features. Research on capturing nonlinear trends has been growing over the past years, and there are

exciting possibilities to bring these developments to ESM data (Bringmann et al., 2023). For example, bicoherence metrics, polynomial-, and differential equation parameters may be used to capture the type and structure of nonlinear developments (e.g. shape-based approaches in Figure 6; see also Caro-Martín et al., 2018; Mayor et al., 2022). New time series features capturing nonlinear structures would add to the under-studied (non-)linear trend features of psychological processes and the associated ESM data.

Beyond the direct academic use, the feature-based time series clustering approach also addresses practical and applied uses. For practitioners, the approach offers a practical and grounded method for dealing with the challenges of complex and messy data from multiple patients, customers, or users. Not only does the approach directly deal with dimensionality, missingness, and time scales in the time series, but the interpretability and transparency aspects offer particular utility in applied settings, where the costs of misspecification are high. Additionally, the approach is also more readily accessible to practitioners who may not have extensive training in complex data analysis techniques. We provide practical algorithm overviews and readily available code for data preparation, analysis, and interpretation. The ability to identify and interpret meaningful patterns in time series data can have significant implications for practice, particularly in fields such as clinical, organizational, or social psychology, where understanding individual differences and developmental patterns can inform interventions and decision-processes.

In conclusion, we show that feature-based time series clustering can effectively reduce the complexities of psychological time series data to important and meaningful patterns. It does so with more flexibility, versatility, and less strict assumptions than many of the commonly used approaches to date. As such, the feature-based time series clustering approach addresses key challenges in the field and aids researchers and practitioners in describing and exploring patterns across participants. We hope that the method adds to the methodological toolkit of ESM researchers and promotes the creation of more embedded methods, theories, and interventions.

Figure 6: Time Series Clustering Taxonomy

	raw data		representation			
	in-time-based	transform-based	shape-based	model-based	feature-based	iterative-based (embedded)
raw data	X	X	X	X	X	X
transformation		X				
representation			X	X	X	X
clustering	X	X	X	X	X	
example				$Y_t=\alpha+\beta_1 Y_{t-1}+\beta_2 Y_{t-2}+\cdots+\epsilon_t$	$\bar{x}$ σ^2 $\bar{l}_k$ $\sum |x_{t+1}-x_t|$ θ_1 $\vdots$	
algorithm	LKMA	DTW	DFT	VAR	tsfresh	GBTM
notes	⊖ low interpretability ⊖ ignore temporal order ⊖ sensitive to noise ⊖ same interval [in-time] ⊖ same length (no missing) [in-time] ⊖ sensitive to offset [in-time]		⊖ poor fit with few observations ⊖ poor fit if assumptions violated [model, embedded] ⊖ dangerous if model fit is poor (e.g., over- or under fitting) [model, embedded] ⊖ often assumes the same parametric distribution [embedded] ⊖ slower with complex models [embedded]			
	⊕ no shape assumed ⊕ fast modeling ⊕ readily available software ⊕ algotrithms established in the field		⊕ reduced dimensional space ⊕ more acurate then raw ⊕ fast modeling ⊕ readily available software ⊕ robust to missing data ⊕ varying intervals ⊕ varying lengths ⊕ often scaleable performance (e.g., model fitted once) ⊕ relatively few observations per trajectory ⊕ high interpretability [model, feature, embedded] ⊕ allows use of domain knowledge [model, feature, embedded] ⊕ distinct cluster trajectories [embedded] ⊕ good for prediction [embedded]			

based on: Aghabozorgi et al., 2015; den Teuling et al., 2021; and Liao, 2005

Note: The taxonomy only exemplifies some of the basic differences between a number of common time series clustering approaches. As such, the taxonomy and the notes are neither exhaustive nor complete in distinguishing different approaches. Additionally, terms and labels are used inconsistently across different types of literature and are chosen to avoid overlapping labels.

Appendices

Appendix 5.A   ESM data challenges and promises

5.A.1   Promises

Time series clustering has a number of conceptual use cases with psychological data. Prime among them is the ability to reduce the time, variable, and person complexity by extracting and organizing participant-level structures. These reduction and structuring qualities can be essential in detecting phenomena and extracting more abstract functional principles (Eronen & Bringmann, 2021). These phenomena and principles can be meaningful differences that distinguish participants in different clusters, as well as important patterns, trends, and relationships that participants share within a cluster (e.g., Schrodt & Gerner, 2000). Once distinct groups and patterns have been identified, researchers can examine the extent to which these within-group and between-group structures are associated with other variables of interest, such as personality traits, demographic characteristics, or other psychological constructs (e.g., Monden et al., 2022). By detecting meaningful and robust structures and patterns, time series clustering can, thus, be used to inform the development of robust theories as well as targeted interventions and therapies for individuals, for example, with mood disorders and other psychological conditions (e.g., Borsboom et al., 2021; Eronen, 2020).

However, while clustering can be incredibly useful, arriving at these clusters critically depends on two core challenges. First, time series need to be made comparable in order to identify key (dis)similarities and second, comparable (dis)similarities need to be accurately distinguishing into different groups (e.g., Aghabozorgi et al., 2015). In practice, most psychological time series cannot

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be compared based on the raw data itself. This is the case because in most cases the raw time series include too many data points — sometimes referred to as the dimensionality curse (e.g., Altman & Krzywinski, 2018) — and, more importantly, individual time points are oftentimes not directly comparable between participants in psychological data and would lead to misspecifications (e.g., Faloutsos et al., 1994). While such issues can be avoided with transformations for highly regular, controlled, and comparable time series such as EEG data (e.g., Huang & Jansen, 1985), most ESM researchers are usually not interested in directly comparing individual timepoints between participants but are interested in developmental patterns and relationships.

As a result, most psychological time series are summarized via a numerical representation and these numerical summaries are then comparable and used to cluster participants (e.g., Timmerman et al., 2013; see Figure 6). Ideally, the representations that summarize the original time series data should (1) capture the original data accurately without loosing too much information, and (2) should be conceptually meaningful (van der Maaten et al., 2009). Extracting accurate and meaningful representations of the time series can be essential for understanding what goes into the clustering algorithm (i.e., assists with explainability) and can be crucial in making sense of the final cluster output (i.e., assists with interpretability; e.g., Kennedy et al., 2021).

5.A.2   Challenges

We will briefly consider which challenges modern ESM data introduce and what qualities are called for in an extension of the clustering repertoire. We particularly highlight issues of dimensionality, non-equidistant or missing measurements, an interest in non-stationary trends, as well as inconsistent/diverse time scales.

Concerning dimensionality issues, especially more abstract psychological experiences often need a wider variety of measurements to be captured adequately. Today, few clinical conditions are captured with a single symptom measure (e.g., Cramer et al., 2016), emotions are rarely assessed in isolation (e.g., Reitsema et al., 2022), and socio-cultural experiences are now widely considered to be multimodal (e.g., Kreienkamp et al., 2023h). This also means

that modern analysis techniques increasingly need be able to accommodate an increased focus on multivariate developments. At the same time, however, an increase in the number of considered variables tends to come at the expense of computational load for model estimations, and clustering models may not converge (the aforementioned dimensionality curse; Altman & Krzywinski, 2018). A modern time series clustering technique should consequently be able to summarize and structure multivariate phenomena without running into computational load issues.

Another common type of data are measurement regiments that collect data in irregular time intervals (i.e., non-equidistant measurements). Common are, for example, procedures where participants are asked to respond at random times throughout the day (i.e., signal-contingent) or following specific natural events of interest (i.e., event-contingent; see Myin-Germeys et al., 2018; Shiffman et al., 2008). Under such conditions data tends to violate the equidistance assumption that is expected by many time series models (Hamaker & Wichers, 2017). Smaller issues of non-equidistant data can be avoided with transformations (e.g., dynamic time warping, Berndt & Clifford, 1994) or newer modeling procedures (e.g., continuous-time models; de Haan-Rietdijk et al., 2017) but for many analyses, including some cluster approaches, non-equidistant measurements remain a prevalent issue.

Structural missingness remains an even more strenuous challenge. Structural missingness occurs when data is missing because it logically cannot be collected (as opposed to probabilistically missing data; Little & Rubin, 2020; McLean et al., 2017). Often, however, researchers might want to include variables in their models that are not available under all conditions. Follow-up and event-contingent questions are a common example in ESM studies. Researchers, for example, ask about the frequency, intensity, or duration of symptoms — but only if a symptom was present (Kivelä et al., 2022). Such approaches become specifically critical in cases of sensitive questions such as questions about suicidal ideation or other potentially trauma-inducing questions (e.g., Glenn et al., 2022). The most common practice for structurally missing data is to either exclude the variable or any measurement that has no

structurally missing data (e.g., Lavori et al., 2008)[6] — neither option suits a research question that wishes to include variables with common structural missingness, such as event-specific or follow-up questions. In short, new clustering approaches should be able to deal with structurally missing data in order to address modern ESM data.

When it comes to studying developmental trajectories, psychological researchers are often also interested in nonstationary processes because they are more representative of the complex, dynamic patterns of the human mind. In psychology, nonstationary processes are typically used to study phenomena such as cognitive development (Quartz & Sejnowski, 1997), decision-making (Ratcliff et al., 2016), and emotion dynamics (Bringmann et al., 2018). These processes are often characterized by changes in the underlying statistical properties of the data over time, such as changes in the mean or variance (Molenaar et al., 2009). Especially when considering changes in mean levels, researchers are often interested in nonlinear changes because they describe human functioning better. For example, in decision-making people might switch between choices (Ratcliff et al., 2016), or patients reducing medication might experience mood swings (Helmich et al., 2020). Similarly, psychologists are often also interested in how variances change over time. This is especially the case because several changes in an individual's variance have been found to be indicative of critical changes, including depression relapses and symptom shifts more generally (e.g., Schreuder et al., 2020; Wichers et al., 2020). There is, thus, also a need for time series clustering algorithms that capture nonstationary processes, including nonlinear trends.

Psychological time series often exhibit complex patterns and relationships that can change over different time scales. For example, a time series of daily mood ratings may show a weekly pattern, with higher ratings on the weekends and lower ratings during the week. At the same time, the series may also exhibit a longer-term trend, with overall mood levels increasing or decreasing over the course of several months or years (e.g., Ram et al., 2014). These different time scales can be studied separately or in combination, using different statistical

[6]This is the case because the most commonly used models require complete data (Schafer & Graham, 2002) and structurally missing data cannot be imputed as it logically does not exist (e.g., Lavori et al., 2008).

techniques and modeling approaches (Bertenthal, 2007; Jeronimus, 2019). Different time scales can become an even more difficult issue when different variables in a model develop on different time scales (Bringmann et al., 2022). Different time scales are thus also a concern clustering approaches should be able to address.

It is this background of the common challenges of current ESM data, upon which we propose to consider feature-based clustering. The flexibility of using a wide variety of time series features that represent the important developmental patterns allows users to circumvent many of the issues with multi-dimensionality, non-equidistant or missing measurements, non-stationary trends, as well as diverse time scales.

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Chapter 6

General discussion

I began this thesis by asking you to imagine when you would consider a migrant adjusted to a new cultural environment. I then immediately highlighted three problems with this request. Firstly, what do we mean by cultural adaptation? Given that virtually all parts of our lives are permeated by culture, what part of our lives should we consider? And more importantly, how can we organize the sea of different aspects that researchers and practitioners have focused on? Secondly, what are key psychological mechanisms of this cultural adaptation? Even when we know which aspects to focus on, how are the aspects connected, and how can they help us understand when people have an easier or a harder time in inter-cultural relations? And thirdly, complicating matters further, migrant experiences are not static and commonly unfold outside of controlled lab settings. So, once we have a conceptual and theoretical lens, how can we best capture cultural adaptation in the real-world and over time?

Each of these complicating questions comes at a real cost for researchers, policymakers, resettlement practitioners, and migrants. The conceptual unclarity has led to conflicting results (Snauwaert et al., 2003), as well as difficulties comparing and integrating past studies (Taft, 1981). As a result, it becomes difficult to propose new research and intervention projects. Theoretical unclarity has prevented us from addressing the worsening attitudes, prejudice, and reduced interaction motivation that result from negative intergroup interactions migrants experience in their everyday life (e.g., Barlow et al., 2012; Graf et al., 2014; Prati et al., 2021). Methodologically, the lack of ways to deal with the messy real world and (intensive) longitudinal data, has meant that we have been restricted to static images of cultural adaptation (Ward & Szabó, 2019) and have been under-prepared to ask questions about the different developmental trajectories people follow (e.g., Ernst et al., 2021; Monden et al., 2015).

The aim of this dissertation is, thus, to build a fuller picture of the migration complexity and to offer first solutions for the conceptual heterogeneity (i.e., organizing conceptual parts; Chapter 2 and Chapter 3), the theoretical unclarity (i.e., testing psychological mechanisms; Chapter 4), and methodological challenges (i.e., capturing diverging developments; Chapter 5) of the migration experiences. With these aims, we address the concept of acculturation in particular (especially, Chapter 2 and Chapter 3) but our contributions explicitly

seek to go beyond the acculturation literature. Our theoretical work looks at motivation in intercultural contact, as such we specifically work on developing new insights for both intergroup contact theory, and motivated cognition processes (see Chapter 4). Similarly, in our methodological work, we aim to introduce methodological innovations that are central to the experience sampling literature at large and the challenges of clustering of intensive longitudinal data in particular (see Chapter 5).

6.1   The research findings

To address the conceptual, theoretical, and methodological aims, I conducted a number of empirical undertakings, which form the empirical chapters of this dissertation. Each of the four empirical chapters approached the topic from a slightly different angle and added a unique set of findings to the overall picture.

Chapter 2, as the first empirical chapter of this dissertation, aimed to explore the experiences of refugees and migrants from a bottom-up and practically embedded perspective. To that aim, I began the thesis project with a qualitative focus group discussion, where we deliberated on what it means to adapt in a new cultural context — across different domains of the resettlement process. The focus group discussed a wide host of aspects and issues they face in their everyday life. It was my goal to immerse myself in the stories and narratives of the participants, to give space to the diverse perspectives, and to then identify commonalities in the psychological experiences.

A psychological structure that re-emerged throughout the cyclical process of the content analysis was a separation along the distinct qualities of wanting, thinking, feeling, and doing experiences. The affect, behavior, cognition, and desire parts of acculturation. This ABCD of acculturation provided a shared understanding of the different aspects involved in the migration experience, and it helped in organizing different experience aspects.

The structure particularly emerged because participants discussed a harsh contrast between more external and visible behavior and cognition aspects (e.g., language learning, or cultural knowledge) and the more internal but often overlooked affect and desire aspects (e.g., feeling at home, or being competent).

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This ABCD structure also re-emerged because the four aspects also organized the common acculturation challenges with corresponding ABCD aspects. External challenges include dealing with the majority group's expectations, while internal challenges include conflicting cultural needs or identity issues.

Overall, the findings of my first empirical chapter suggest that the ABCD structure is a useful framework for understanding the complexity of the migration experience. The ABCD aspects give space to the breadth of acculturation experiences and provide a comprehensive structure to talk about the concept more meaningfully. Yet, despite the fundamental human nature of the affects, behaviors, cognitions, and desires, it remained open whether the ABCD structure would lend itself to a broader conceptual framework that can help address the conceptual heterogeneity of psychological acculturation.

In **Chapter 3**, I thus sought to develop a formal conceptual framework. To do so, I sought to embed the ABCD structure within the literature. This allowed me to delineate the contextual and procedural functioning of such a framework, and then test the relevance of the framework by applying it in a systematic analysis of the past literature.

When I reviewed the current state of the literature, I found that the ABCD structure is extremely well-positioned to build the foundation of a full conceptual framework. Not only is a reduced ABC distinction already used to delineate three different lines of theoretical perspectives (Ward, 2001), but each of the full affect–behavior–cognition–desire aspects has a rich body of literature associated with it. What is more, is that the ABCD distinction is also crucial in understanding culture (Adams & Markus, 2004) and cultural contact (Durkheim, 1982), two essential prerequisites of psychological acculturation. Because the ABCD structure is so embedded within the concepts of culture and contact, I was arguably able to embed the psychological ABCD of acculturation in a border cultural contact context and develop a process model of the ABCD within an episodic intercultural contact (see Figure 1).

Once I had established a theoretical foundation and structure of the ABCD framework, I set out to test the applicability of the framework within the past literature on psychological acculturation. To assess whether the framework would indeed be a functional tool across different levels of conceptualization,

I conducted a systematic review of the theoretical, psychometric, and applied empirical literature on psychological acculturation. With the theories, measurement tools, and operationalizations extracted from over 800 works, my collaborators and I coded which ABCD aspects each of the conceptualizations considered. Together with a number of additional sample-, study-, and analysis information we extracted, I was able to conduct a formal scoping analysis to map how psychological acculturation has been conceptualized within different bodies of past literature and how useful the ABCD separation was in assessing and comparing conceptualizations.

I find that in many regards, the results of the systematic scoping review mirrored the sentiment of the focus group discussion in Chapter 2. Whereas the theoretical conceptualizations are often rich and multidimensional, in empirical practice past research projects have often focused on less complex conceptualizations and have commonly neglected the more internal aspects of affects and desires. I additionally find that, on average, psychological journals had significantly more complex conceptualizations than the medical and the general social science journals. As such, the scoping review showed the ABCD framework was able to structure and compare the past literature across theoretical, psychometric, and applied empirical conceptualization levels.

Taken together, the affect, behavior, cognition, and desire distinction was indeed well embedded within the literature, was able to comprehensively structure past works, and identified gaps within the literature. I thus ended Chapter 3 with a call for research using the framework to make more nuanced theoretical and methodological advances (e.g., novel predictions and interventions; for a full list of lessons learned, see Table 4 in Chapter 3).

Chapter 4, is one possible answer to our own call for theoretical development in migration research. I, particularly focused on the motivational basis (i.e., desires) in what makes intercultural contacts (i.e., behaviors) more positive and drives more positive outgroup attitudes (i.e., affect, cognition). To that end, I zoomed in on the individual everyday interactions migrants have with the new cultural groups when they resettle. In particular, I collected three real-world intensive longitudinal data sets in which migrants self-reported on their interaction-specific need fulfillments, interaction perceptions, and

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consequent outgroup attitudes and well-being. I propose that situational need fulfillment — that is the satisfaction of a situationally active need — would explain when and why an intergroup interaction would be perceived as positive and would be related to more positive adaptation and intergroup relations.

Across the over 10,000 measurements totaling 30+ days of data from roughly 200 migrants showed extremely stable effects of need fulfillment. Within the interaction contexts, need fulfillment was associated with more positive interaction perceptions, more positive outgroup attitudes, as well as higher well-being. Importantly, this finding comes at a time when we have little knowledge about what makes outgroup interactions positive and drives their positive outcomes. In fact, our proposed need-based mechanism performed at least as well as the current gold standard — Allport's optimal contact conditions — with much fewer restrictions and while offering insights into a psychological mechanism.

To test the need-based mechanism, I used a novel adaptive item, letting participants self-report what their situational motive was and how much this motive was fulfilled (during the interaction). This approach allowed me to further explore the content of the reported needs and assess the importance of psychological and practical motive dimensions. In short, the analyses showed no difference in the effect for more psychological or more practical needs. This would indicate that it really is about the perceived need fulfillment (i.e., the motivational mechanism), rather than the content of that specific need (i.e, the motive content) that drives interaction perceptions, outgroup attitudes, and well-being. This point was further underpinned when I compared the situation need fulfillment to the commonly considered self-determination theory needs (i.e., autonomy, competence, and relatedness). Except for relatedness, the situational need fulfillment consistently accounted for the other psychological needs and explained considerably more variance in the outcome variables.

In short, our results of Chapter 4 not only highlight the feasibility and impact of using intensive longitudinal real-world data in migration research, but crucially develop a resistant theoretical mechanism of intercultural contact. The results point to motivational needs as an understudied aspect of intergroup contact that is important in understanding when and why an interaction is

perceived as positive and will lead to more positive outgroup attitudes and higher well-being. Importantly however, what this study did not do was look at the temporal developments of these interactions nor did it differentiate who of the migrants had an easier or a more difficult time adjusting in the Netherlands.

In **Chapter 5**, I thus take the final, most complex step and look at multiple experience aspects as they develop over time. To deal with the multiplicative complexity of many different people, variables, and measurements, I look towards the time series clustering literature, which seeks to reduce the complexity by grouping participants based on shared developmental patterns. To deal with the characteristics of messy ESM data and the inflexibility of existing ESM-specific clustering model, I bring together recent developments within the experience sampling literature and time series clustering approaches used in the broader machine learning literature. In particular, I propose that the so-called 'dynamic features' of psychological time series fit perfectly with the flexibility of 'fature-based time series clustering'.

To find key indicators that describe important real-world developmental patterns, I turned towards the theoretical and methodological advances in the ESM literature and the emotion dynamics literature in particular. Researchers in the field have collected a number of numeric measurements that are indicative of adaptive and maladaptive developments within the individual, can identify crucial transitions, or more generally are helpful in understanding a psychological time series. These numeric summaries are often called dynamic measures or dynamic features, and importantly have been validated to be meaningful and interpretable in psychological data. The features can include measurements such as instability, inertia, or linear trend statistics — each of which have been linked to key developmental differences between individuals, such as "Over a one-month period, are some migrants happier than others?", "Do strong daily fluctuations in identification reflect better adjustments at work?", or "Is the development of migrant well-being a nonlinear process?"

In the chapter, I use six dynamic features I consider crucial for migrant developments (see Table 3) and apply them to twelve variables I collected across the three ESM samples of Chapter 4 (see Table 1). The twelve variables provide a wide range of acculturation aspects across the most underrepresented ABCD

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aspects, and the six dynamic features capture some of the key developmental questions of adaptation. Additionally, the combination of variables and dynamic features also exemplifies a number of challenges that past approaches of ESM time series clustering have struggled to address. In particular, the combination includes systematic missingness, as well as non-linear, and non-invariant developmental elements.

Based on the literature on feature-based time series clustering, I introduced an adapted clustering pipeline for psychological ESM data and analyze the data we collected with the recent migrants in the Netherlands. I found that the method is flexible, computationally light, and that software packages for all steps are readily available. In terms of the clusters that resulted from our analysis, I found two diverging groups of migrants in our data. One group that has a stable, positive, and improving experience and one that has an unstable, more negative, and worsening experience. I was further able to relate the two groups to developments within and outside the clustering. As an example, the group with the more difficult trajectory reported less voluntary and cooperative interactions and also reported more everyday discrimination (see Figure 3).

In short, I find that feature-based time series clustering is an effective method to simplify the intricate nature of psychological time series data into significant and insightful patterns. The method offers greater adaptability, versatility, and operates with fewer rigid assumptions compared to many prevalent techniques currently in use. Additionally, I identified two distinct developmental groups and I was able to further contextualize these cluster differences to explain the developmental differences.

Taken together, the results of this dissertation offer a comprehensive exploration of the migration experience, delving deep into the nuances of the acculturation process. Starting with a qualitative approach in **Chapter 2**, we uncovered the ABCD structure – affect, behavior, cognition, and desire – as fundamental dimensions shaping migrants' experiences. **Chapter 3** further embedded this structure within the academic literature, highlighting its resonance with existing theories and its capability to structure past research on psychological acculturation, revealing gaps and offering a clearer direction for future inquiries. **Chapter 4** then offers a real-world examination of the pivotal

role that motivational needs play in shaping positive intergroup interactions and migrants' overall well-being. Lastly, **Chapter 5** introduces a novel methodological approach to decipher the complex temporal dynamics of migrants' experiences, revealing distinct developmental trajectories. Collectively, these chapters illuminate the multifaceted nature of migration, emphasizing the crucial interplay of motivational, cognitive, behavioral, and affective elements in the journey of acculturation. Successful adaptation is not solely about assimilating into a new culture but requires a harmonious synchronization of these elements, aided by a fostering environment that recognizes and caters to the ever-changing psychological needs of migrants.

6.2 Synthesis of findings: The three-dimensional data story

The empirical chapters of the dissertation offer a rich tapestry of insights into the migration experience, each from its unique vantage point. By weaving these insights together, we can derive a more holistic understanding of the psychological and cultural adaptation processes migrants undergo. This section seeks to integrate the findings from different chapters, presenting a cohesive understanding of migration experiences and the psychological and cultural adaptation processes migrants undergo.

By synthesizing the findings across chapters, an emergent insight becomes apparent. The acculturation process, as revealed by the research I presented, is not merely a singular linear trajectory but a dynamic interplay of various psychological and cultural elements. A structured summary of the joint insights in the following integrative statement:

Synthesis Statement

Acculturation encompasses [1.] a range of conceptually distinct variables (notably the ABCD distinction), which are [2.] intricately interlinked by theory and [3.] manifest in distinct temporal patterns over time.

This is to say that (1) acculturation is complex — only with a multivariate approach can we capture the full migration experience. However, this complexity is not arbitrary. Rather, the multiple variables that jointly account for migration experiences can be organized using the *affect, behavior, cognition, desire* aspects framework I propose (see Chapter 2 and Chapter 3). The variables are also (2) theoretically linked. Despite the complexity, the different aspects of acculturation are not disjointed. Instead, our work on need fulfillment in intercultural contacts shows that within behavioral interactions, motivational desires are linked to affective evaluations and cognitive outgroup perceptions (see Chapter 4). And finally, (3) acculturation is dynamic — it is not a static end-state but rather an ongoing process. Importantly, despite the added complexity, the developments are not inscrutable. I showcase that we can focus on key markers to distill a number of distinct trajectories from the many variables that develop within all migrants (see Chapter 5).

The synthesis statement, thus, offers hope to the despair it lays out. At face value, I advocate for tripling the complexity of our data. I advocate that we should consider many different persons, variables, and time points at the same time. However, I also propose that there are ways of breaking down these complexities by asking: What are the important aspects? How are the aspects connected? And how can we find meaningful patterns over time? Each of these questions helps unravel a different layer of the complexity. In essence, the thesis shows that we can holistically capture intricate psychological processes, while also creating a more streamlined approach to understanding and analyzing data.

It is important to note that the complexity I highlight is not new. Many theoreticians and methodologists have long advocated for the consideration of a three-fold data structure (e.g., see Fisher et al., 2018; Wardenaar & de Jonge, 2013). But also within all of the theoretical fields that this dissertation touches, researchers have called for a more multidimensional and dynamic perspective. Researchers in the fields of acculturation (Ward & Szabó, 2019), intergroup contact (Paolini et al., 2021), motivation (Kruglanski et al., 2002), adaptation (Perrot et al., 2023) have all underscored the interconnectedness of various factors and the dynamic nature of these processes. A multifaceted approach not

only lends depth to our understanding but also offers a more comprehensive answer to an ongoing call within the fields.

This dissertation presents a three-dimensional solution space that resonates with the three-fold data structure — encompassing the 'individual', 'variable', and 'measurement occasion'. Let us briefly dissect how the present work illuminates these three dimensions.

Individual Dimension: The complexity of acculturation can easily become overwhelming when considering the vast heterogeneity of individual experiences. However, through the lens of Chapter 2 and Chapter 5, the dissertation offers clarity by highlighting distinct differences between individuals. While Chapter 2 delineates varied migrant experiences, Chapter 5 categorizes individuals into discernible groups based on shared trajectories. In essence, these chapters offer a roadmap to navigate the intricate terrain of individual experiences.

Variable Dimension: Grappling with the numerous variables that shape the migrant experience can be similarly daunting. In Chapter 2 and Chapter 3 I focus on offering structures to the variable space by clarifying and organizing these variables along the ABCD dimensions. However, the true complexity lies not just in understanding each variable in isolation, but in recognizing their interconnectedness. This is the focus of Chapter 4, drawing clear connections between different variables, thereby transforming a web of factors into a comprehensible network of relationships.

Measurement Occasion Dimension: Acculturation is not a static phenomenon; it's a dynamic process that evolves over time. This temporal aspect introduces another layer of complexity. Chapter 4 tackles this complication by utilizing multiple measurement occasions while still focusing on individual occasions rather than all temporal effects. Meanwhile, Chapter 5 extracts meaningful patterns from these occasions, providing a structured framework to understand changes and developments over time. Instead of a blur of changing experiences, the reader is presented with structured timelines of migrant evolution.

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In sum, this dissertation takes the immense complexity of acculturation and, within as well as across chapters, offers structured, comprehensible insights within the three-dimensional 'data space' — working towards a three-dimensional solution space. The aim is not to oversimplify, but to provide structured clarity in the face of multifaceted intricacies.

6.3   Theoretical implications

The empirical endeavors undertaken in this dissertation build on the premise that understanding migration demands a multi-faceted approach. The multi-dimensional, multi-method, and multi-level approaches together with the resulting findings and synthesis offer a number of implications for the scholarly dialogue in the fields of acculturation, intergroup contact, motivation, and ESM. This section expounds on the implications of the findings, nestling them in the heart of existing theoretical terrain.

6.3.1   Intergroup contact: Going beyond optimal conditions

Allport's (1954) optimal conditions for positive intergroup contact emphasize institutional support, equal status, common goals, and intergroup cooperation. However, findings from Chapter 4 underline the paramount importance of situation-specific need fulfillment in shaping intercultural interactions. The situational and motivational aspects of this finding have a number of implications for the theoretical understanding of intergroup contact.

Firstly, our research shows that a static set of contact conditions should be complemented by a more flexible set of human aspirations. The original set of optimal contact conditions has remained the gold standard in the field (Allport, 1954; Pettigrew, 1969) despite not being a necessary condition for the positive effects of intergroup contact (Pettigrew & Tropp, 2006). The same is true for later expansions of contact conditions that have, for example, added stereotype disconfirmation (Cook, 1978) or common language and voluntary interaction (Wagner & Machleit, 1986). Pettigrew (1986) had already pointed out that static conditions might not address the underlying psychological mechanisms needed to understand what actually causes an interaction to be positive.

Considering the fulfillment of needs that are situationally relevant and actively dissatisfied offers a flexible but more importantly a psychological explanation of why someone perceives an interaction as positive.

Beyond perceived interaction quality, a situational needs perspective might also extend to other, more indirect, mechanisms of intergroup contact. In particular, the situational need fulfillment idea dovetails with Pettigrew's (1998) work, suggesting that friendships between groups can reduce prejudice. In this light, the satiation of specific situational needs might emerge as a pivotal element in fostering such friendships, ultimately driving positive perceptions and attitudes towards outgroups. Similarly, relevant need fulfillment might also alleviate anxiety and foster intergroup warmth, fitting within the prominent intergroup anxiety theory (Stephan & Stephan, 1992).

Secondly, our research speaks to the ongoing question of whether intergroup contact shows a stronger effect within participants or between participants. This is not merely a statistical technicality, but rather a question of whether intergroup contact actually works for everyone and at all stages of an intergroup relationship. Past research studies had observed that individual intergroup interactions showed negative effects on intergroup relations, and the aggregate of past intergroup contacts showed positive effects on intergroup relations (MacInnis & Page-Gould, 2015). Our multilevel analysis in Chapter 4 seems to suggest the opposite pattern when we consider experience sampling data of a cultural minority group. We find a much stronger positive effect for within-person effect of intergroup contact. Our data differs from the past data considered by MacInnis and Page-Gould in several crucial ways, including the fact that we collected real-world data that is not directly comparable to artificial lab studies, and we aggregated close-to-event reports rather than letting the participant recall a mental aggregate of the last month or so (also see Shiffman et al., 2008). Regretfully, we did not ask our participants to evaluate their interaction numbers and quality after the study period. Our intuition is that part of the paradox described by MacInnis and Page-Gould is due to human recall biases and motivated cognitions. However, to truly compare our results to MacInnis and Page-Gould (2015) theorizing, future studies should also collect a long-term recall report that mirrors the questions asked during intergroup contact studies.

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Additionally, as a broader implication of the approach I have taken in Chapter 4, the methods and results of that chapter strongly underline how relevant a longitudinal approach is to intergroup contact. Not only is the collection of such data more feasible than ever (Arslan et al., 2020; Keil et al., 2020; O'Donnell et al., 2021), but addresses a long-standing call for more process evidence to test our process theories (e.g., MacInnis & Page-Gould, 2015; McKeown & Dixon, 2017; Pettigrew, 1998, 2008; Pettigrew & Tropp, 2011). In fact, such an approach is in line with Allport's original theorizing about the optimal conditions of continuous everyday interactions (see Allport, 1954). As such, I am among the first to test the intergroup contact hypothesis in intensive longitudinal data, and I am convinced that such data allows us to address the full developmental models of the intergroup contact theory (Pettigrew, 1998).

6.3.2 Motivation: Need fulfillment as the fulcrum

The findings from this dissertation also offer insights that significantly extend and refine our understanding of motivation, especially in the context of migration and acculturation. The presented results not only integrate seamlessly into the broader motivation literature but also provide compelling reasons to reconsider some foundational assumptions of content importance, dynamism, and interactive social character of motivation.

Self-Determination Theory (SDT) has been the de facto benchmark of motivation content theorizing (Ryan & Deci, 2017). Yet, while SDT emphasizes universal needs, findings from Chapter 4 introduce a subtle dynamism, emphasizing situational need fulfillment over static psychological needs. This could be viewed in consonance with older models that have pointed to cases where contextual motivations influence situational motivations (Vallerand, 1997). By underscoring the significance of dynamic situational needs in shaping migrant interactions, the dissertation echoes the essence of motivation as being situationally responsive and not merely trait-bound. Similarly, the dynamic characteristic also emphasizes that studying motivation at a single point in time might not be sufficient; continuous or longitudinal assessments, as employed

in Chapter 4 and Chapter 5, are essential to capture the nuances of human motivation.

Another implication results for the importance of the need content. In Chapter 4, I show that motivation is not necessarily about pre-defined, universal needs (e.g., autonomy, competence, and relatedness Ryan & Deci, 2017). Instead, situation-specific needs, which can be either psychological or practical, play a critical role in defining migrants' experiences, attitudes, and well-being. This indicates that the literature needs to re-focus on a dynamic and context-sensitive motivated state. It seems that ultimately we should focus more on the motivational driving force — perceived needing — instead of whether the content of a need is universal and ever-present or not (also see Gollwitzer & Wicklund, 1985; Leander et al., 2020; Lewin, 1926).

A final implication that can be drawn from the empirical studies of this dissertation is that we should not underestimate the relevance of motivation in real-life scenarios. The importance of considering real-world interactions, as highlighted in all four empirical chapters, underscores the need for motivation studies to go beyond controlled lab environments. Real-world assessments can lead to findings that are more ecologically valid and can provide richer insights into the multifaceted nature of motivation (also see Downie et al., 2008; Knee & Browne, 2023).

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6.3.3   ESM: A renewed methodological paradigm

The dissertation's extensive exploration into the multifaceted nature of the experiences also holds significant implications for the literature on the Experience Sampling Method (ESM). The method generally emphasizes real-time data collection to capture an individual's experiences as they naturally unfold in their environment. Our research speaks to several of these issues explicitly.

Firstly, theoreticians in the ESM literature have long advocated for aligning ESM with theoretical constructs (Bolger et al., 2013). The ABCD structure of acculturation experiences, identified and tested in Chapter 2 and Chapter 3 offer an ideal match for this call. If ESM researchers seek to theorize about and measure the full human experience, the work presented here indicates that the consideration of affect, behavior, cognition, and desire would offer

such a comprehensive lens (also see Cottam, 2010; Hogg & Vaughan, 2005; Jhangiani & Tarry, 2014). This becomes especially important in a field where many ESM researchers have traditionally focused only on a single aspect, such as emotion dynamics (e.g., Krone et al., 2018). Moreover, by taking theoretical frameworks from qualitative constructs and applying them in real-time data scenarios, Chapter 5 echoes the sentiment that ESM can embrace such multivariate complexity and is able to bridge between abstract theory and tangible empirical data.

Secondly, Chapter 5 also speaks directly to the trend in ESM literature of continually refining the process of data analysis, seeking to extract the most relevant patterns (Ernst et al., 2021; Intille, 2007). The introduction of feature-based clustering extends this conversation, providing a simple and flexible approach to analyze the many dynamic aspects validated within the ESM literature (e.g., Dejonckheere et al., 2019; Krone et al., 2018; Kuppens & Verduyn, 2017). With pioneering works like that of Csikszentmihalyi and Larson (1987) laying the foundation for ESM, there has always been a demand for innovative data-handling techniques. The feature-based time series clustering offered here provides a fresh methodological perspective, addressing the intricate nature of ESM data — a challenge often alluded to but not always systematically addressed in traditional methodologies (e.g., see Hamaker & Wichers, 2017; Helmich et al., 2020; Kivelä et al., 2022; Lütkepohl, 2005).

Thirdly, the evolving ESM literature has continually recognized the richness of real-time data (Shiffman et al., 2008). By employing ESM in migration research, Chapter 4 and Chapter 5 validating the claims of previous studies that advocate for ESM's applicability in diverse scenarios. In the process, a wider application of ESM to non-clinical challenges opens the door to more granular understandings of many experiences that have traditionally been restricted to cross-sectional global assessments or static snapshots.

6.3.4 Acculturation: Embracing a dynamic ABCD framework

Given our focus on migrant experiences, many of the above implications come together in the implications for our understanding of psychological accultur-

ation. Through a series of methodologically diverse and rigorous empirical chapters, this research has a number of implications for our conceptualization of acculturation, its theorizing, and the study of migration more broadly.

Building on Ward's delineation of theoretical perspectives in acculturation, the introduction of the ABCD structure (affect, behavior, cognition, and desire) as a full conceptual framework offers a more exhaustive perspective. Ward and Leong (2000) traditionally underscored the isolated theoretical traditions found within the acculturation literature. The ABCD structure, emerging from Chapter 2 and formalized in Chapter 3, elucidates the intricacies in this separation, juxtaposing visible behavioral and cognitive processes with more intangible affects and desires. Crucially, it presents a nuanced lens to view acculturation — not merely as a linear trajectory but as a confluence of various psychological experiences. Such a framework challenges categorizations like "integration" or "assimilation" and necessitates considering the fluid interplay of what is wanted, felt, thought, and done in the acculturative journey.

The ABCD distinction also speaks to the traditional separation of acculturation strategies. While Berry et al. (1989) laid out four primary acculturation strategies, Chapter 3 and Chapter 4 speak towards a more fluid understanding. Echoing Rudmin (2003), the emphasis on multidimensional trajectories underscores that individuals do not always fit neatly into predefined boxes but rather have complex psychological experiences based on context, time, and personal history (also see Christ et al., 2013; Phalet & Baysu, 2020).

In terms of the theoretical mechanisms of cultural adaptation, the findings from Chapter 2 and Chapter 4 suggest that internal motives play a crucial role in the adaptation process. In Chapter 3 we show that motives are important to acculturation theories yet remain underrepresented in psychological models and empirical practice (e.g., see Vishkin et al., 2021). We find that the experience of need fulfillment is a robust and flexible predictor and extends the foundational theories by suggesting that individual motivations can potentially shape and be shaped by group dynamics in more intricate ways than previously posited. Moreover, Chapter 4 shows that the situational need fulfillment in the new context drives a number of adaptation outcomes, including outgroup perceptions and well-being.

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Beyond the conceptual and theoretical impact, the use of experience sampling data has also meant that I had to consider acculturation as it plays out in real-world contexts, and dynamically develop over time. When it comes to contextual factors, segmented assimilation theory (Portes & Zhou, 1993) posited varying acculturative outcomes based on societal structures and contexts. Similar sentiments were voiced by researchers working on forced migration (Birman et al., 2014) and researchers seeking to understand the measurement of acculturation (van de Vijver & Phalet, 2004). The framework in Chapter 3 and the applied findings in Chapter 4 reinforce the centrality of environmental factors in driving acculturation. By recognizing these external influences, we reiterate that individual processes of acculturation cannot be fully understood in isolation from the broader structural contexts.

The life-course perspective (Elder, 1994) emphasizes the temporal nature of immigrant experiences. In all four of the empirical chapters, I have emphasized the crucial importance of a developmental perspective to acculturation. In Chapter 3 the phenomenological perspective highlights that subjective experience can only be understood within the history of past experiences (e.g., Heidegger, 1978) and as a result in the framework I explicitly propose to distinguish between (1) acculturation conditions [*ABCDs prior to contact*], (2) acculturation response [*ABCDs during contact*], and (3) acculturation outcome [*ABCDs following the contact*] (also see Figure 1). This perspective is further underpinned in Chapter 5, where employing feature-based time series clustering operationalizes my temporal emphasis, suggesting that acculturation is neither static nor uniform. Instead, individuals traverse multiple pathways, sometimes looping back, highlighting the non-linear and evolving nature of cultural adaptation.

Taken together, in this dissertation I employ a multi-dimensional lens to delve deep into the complexities of migration, presenting a number of implications for multiple academic fields. Primarily, the introduced ABCD framework (affect, behavior, cognition, and desire) brings fresh perspectives to acculturation theories, arguing for a more holistic view of migrant experiences, rather than rigid categorizations. This enriched understanding, which combines real-world data with deep theoretical insights, challenges, and augments

established paradigms, suggesting a more nuanced approach to studying and comprehending migration. Furthermore, the research underscores the need to view intergroup contact through a dynamic lens, emphasizing situational need fulfillment over traditional static conditions. On motivation, the findings advocate for a shift towards situational dynamics, challenging long-held beliefs about universal static needs. The employment of the Experience Sampling Method (ESM) in the study reinforces its value, highlighting its potential to bridge theoretical constructs with real-world experiences.

6.4   Practical implications

This dissertation, through its empirical undertakings, adds layers of clarity to our understanding of the migration experience, from the intricate inner workings of individuals to the broader societal contexts. The implications of the research findings are wide-ranging and are particularly pertinent for migrants, policymakers, and organizations aiding migrants.

6.4.1   Organizations working with migrants

Organizations working directly with migrants are strategically positioned to benefit from a nuanced understanding of the acculturation process. This dissertation's findings, especially those from Chapter 2, underscore the importance of viewing acculturation through the ABCD structure — distinguishing the experience along the affect, behavior, cognition, and desire aspects. In practical terms, this means going beyond simply facilitating linguistic or skills-based integration. Organizations should consider to holistically address migrants' emotional experiences (affect), behavioral adjustments (behavior), cognitive understanding (cognition), and internal motivations (desire) throughout their adaptation journey.

One immediate application of the findings from Chapter 4 concerns the importance of need fulfillment in migrants' intercultural interactions. Organizations should craft programs and initiatives that not only facilitate positive encounters between migrants and the majority population but also emphasize satisfying the psychological needs of the migrants. Recognizing that these

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needs are not always overt or strictly utilitarian, these programs should be adaptive, with room for self-reported situational motives. This aligns with the wider literature that stresses the significance of acknowledging the subjective experiences of migrants, rather than imposing a one-size-fits-all approach (Adams & Markus, 2004).

Furthermore, findings from Chapter 4 and Chapter 5 provide organizations with an important method to monitor and evaluate the progress of their interventions. Using intensive longitudinal data collection methods, like the Experience Sampling Method (ESM), could allow migrant support organizations to capture the real-world experiences of migrants[1]. This allows for timely interventions when challenges arise. Additionally, organizations could gain crucial insights into the diverse trajectories migrants undertake during their adaptation. By employing the feature-based time series clustering method, organizations could track and identify the different developmental paths migrants are on. This enables targeted support, especially for those on more unstable, negative, and deteriorating paths. By recognizing and addressing the unique challenges faced by different subgroups, organizations can enhance the effectiveness of their interventions, aligning with broader goals of ensuring successful and positive integration for all migrants (Ward, 2001).

6.4.2   Policymakers

The ABCD structure emerging from Chapter 2 and further contextualized in Chapter 3 underscores the multifaceted nature of the migrant experience. Policymakers need to recognize that the journey of acculturation is not limited to overt behavior changes (e.g., language acquisition) or cognitive assimilation (e.g., navigational knowledge). The deeper, often overlooked dimensions of affect (e.g., emotional acculturation) and desire (e.g., motivational acculturation) play pivotal roles in shaping a migrant's adaptation process. For instance, ensuring migrants have access to language training is vital, but it is equally important to address the emotional and motivational challenges they face.

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[1] Please note that also in organizational contexts informed and voluntary consent is not only a legal and ethical requirement but is likely essential to the development of a trustful and productive relationship with migrant clients (Hernández et al., 2013).

Creating public spaces where migrants can discuss facets of their experiences might not only improve navigational and cultural knowledge, but sharing stories can provide a sense of solidarity and shared understanding (e.g., Ahmed, 2014; Smith, 2013).

The findings from Chapter 4 emphasize that situational motivations in intergroup contact also offer promising avenues for practitioners and policy-makers. Intergroup contact theory is among the psychological theories that have seen most policy implementation (e.g., Al Ramiah & Hewstone, 2012; Pettigrew & Tropp, 2006; Reimer et al., 2021). Our research reveals that satisfying daily intergroup contact needs is comparable, if not more influential, than Allport's conditions in shaping attitudes towards outgroups. Addressing these needs becomes a pivotal tool, especially when certain optimal contact conditions, such as equal status, are contextually unattainable or in cases where people help despite a lack of institutional support. Furthermore, our delineation of situational needs opens doors for actionable interventions. Instead of a blanket approach to needs (for instance, simply focusing on competence needs), it might be beneficial to directly consult outgroup interaction partners about their specific needs during interactions. While it remains important to understand the motivations relevant to certain groups in specific contexts, in situations where data on important need contents are not available or infeasible to collect, a flexible and reactive approach of inquiring momentary intergroup contact needs might be more fruitful.

The distinct developmental trajectories identified in Chapter 5 offer crucial insights for targeted policymaking. Not all migrants follow a uniform path of adjustment and adaptation. As such, a one-size-fits-all policy approach is likely to be ineffective. Policymakers might need to rely on more intense longitudinal data in cases where migrants face difficulties. Recognizing the variability in migrant experiences, as showcased by data across the chapters, will enable policymakers to craft more nuanced and effective strategies that cater to the unique challenges and strengths of different migrant groups.

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6.4.3 Migrants

For migrants themselves, I hope that the ABCD structure can work as a roadmap. Recognizing the four domains might help migrants articulate their experiences and challenges more comprehensively. As the discussants in Chapter 2 pointed out, the contrast between visible behaviors like language learning and deeper, more internal feelings of belonging or competency can sometimes create a dissonance in the migrant's self-perception. By being conscious of this ABCD framework, migrants can better grasp the entirety of their psychological journey, seeking support or thriving in areas they might have previously overlooked. The literature, too, echoes this sentiment, emphasizing the nuanced interplay of various aspects of acculturation and the importance of addressing each domain for a wholesome adaptation experience (Durkheim, 1982; Ward, 2001).

Moreover, the insights from Chapter 4 about the critical role of situational need fulfillment might empower migrants to take proactive steps in their intercultural interactions. While it is by no means the sole responsibility of a migrant to talk about the goals of an interaction or one's needs when entering an intercultural interaction, knowledge of the motivational mechanisms might at the very least assist in the assessment of a situation. More broadly, by understanding the significance of meeting situational needs — regardless of whether they are psychological or practical — migrants can actively seek interactions that are fulfilling and satisfying. Especially because this doesn't merely enhance the quality of the intercultural contact but also fosters positive outgroup attitudes and overall well-being. That being said, I am also acutely aware that many migrants often do not have the power to avoid non-fulfilling interactions or communicate their needs in such cases.

In conclusion, the journey of migration is a complex tapestry of affects, behaviors, cognitions, and desires. To navigate this journey successfully requires not only an understanding of these interwoven threads, but also a compassionate and strategic approach that respects and caters to the unique needs of every migrant. This dissertation provides a comprehensive roadmap, illuminating the multifaceted nature of migration. It is now the collective responsibility of migrants, policymakers, and supporting organizations to apply this knowl-

edge in the real world, ensuring that migration becomes not just a journey of physical displacement but a voyage towards fulfillment, growth, and mutual understanding.

6.5 Limitations and future directions

Every empirical endeavor carries limitations, and the present dissertation is no exception. A rigorous acknowledgment of these limitations not only ensures the transparency of our scientific endeavors but also provides fertile ground for future research directions. It is important to keep in mind that this dissertation only offers one possible line of research to a complex and diverse phenomenon. As such, I want to briefly address important considerations of the sample, the time scales, the mechanism focus, and the methodological restrictions.

6.5.1 Sample representativeness

One of the salient limitations in our research design pertains to the composition of our samples. Throughout this dissertation, the empirical chapters, specifically Chapter 4 and Chapter 5, heavily draw from three samples that predominantly comprised young voluntary migrants. While we recruited a variety of international students, expats, and medical professionals, it left out the unique experiences and challenges faced by forced migrants — individuals who, due to conflict, persecution, or environmental disasters, did not have the luxury of choice in their migration journey. We had initially planned to conduct a large-scale study following the experiences of forced migrants together with our societal partner Humanitas Groningen. Unfortunately, the study of intercultural contact was severely impacted by Covid-19 lockdowns, and we missed a window during which the study would have been feasible.

The distinction between forced and voluntary migration is not merely a bureaucratic or semantic one, but has deep-seated implications for the psychological experiences of the migrants. Forced migrants often confront distinct challenges compared to their voluntary counterparts, such as heightened levels of trauma, stronger feelings of loss, and more complex identity negotiations (Porter, 2007; Tyrer & Fazel, 2014). Moreover, the nature of their migration —

often sudden, unplanned, and under duress — may result in varying degrees of cultural bereavement, alienation, and stress, potentially altering the dynamics of their acculturation process (Eisenbruch, 1991). By focusing on voluntary migrants, our study might have inadvertently missed the depth and complexity of these nuanced psychological experiences.

In particular, our ESM studies mainly included young migrants (mainly in their mid-20s), and in the student sample in particular, migrants often came from culturally close Western countries. We have taken considerable steps to collect several different migrant groups, yet the samples we reached might be considerably different from the experiences of older migrants, other cultural groups, or people with other resettlement statuses. This limitation is somewhat offset by how consistently I find many of the core structures also within Chapter 2 and Chapter 3, but future work will need to make sure that especially the psychological mechanism of Chapter 4 and the clusters in Chapter 5 are transferable to other migrant- and intergroup contexts.

Furthermore, when considering the ABCD structure of acculturation, it is plausible that forced migrants may prioritize or weigh these dimensions differently. For instance, the affective and cognitive aspects might be more pronounced due to the trauma and displacement experienced, while desires and behaviors could be intricately linked to their unique resettlement conditions and survival needs. Although the framework was developed based on the narratives of forced migrants in Chapter 2 and our review in Chapter 3 has shown the applicability to forced migrants, our studies into the ABCD dynamics have been limited to the experiences of voluntary migrants. Future research should extend the dynamic assessment to forced migrants to provide assistance to those migrants, who are often the most under-served in societies.

On a similar note, while the overall dissertation captures several different samples of migrants and refugees, the findings primarily represent the experiences of migrants in the Netherlands (with the exception of the systematic scoping review in Chapter 3). Global migration is vast and intricate, with each host country and migrant group presenting unique challenges and dynamics. Future studies should endeavor to replicate and extend these findings across diverse geographic and sociopolitical contexts. Including different groups in

future endeavors can also offer a more comprehensive view, shedding light on both shared and unique challenges, thus enhancing the generalizability and applicability of the findings across diverse migrant populations.

6.5.2 Time scales

A prominent, yet often overlooked, element in the investigation of migration experiences is the role of time scales. The temporal dimensions in which the adaptation processes unfold are pivotal, not just for theoretical clarity but also for practical and intervention-based understandings. In Chapter 4 and Chapter 5, the deployment of intensive longitudinal data provided insights into the midterm, everyday nuances of migrants' experiences. These meso-level temporal observations provide a lens into the daily ebbs and flows of acculturation, highlighting the dynamic interplay between situational needs and consequent perceptions, attitudes, and well-being. Yet, as invaluable as this fine-grained approach is, it only captures a slice of the temporal spectrum pertinent to the migration journey (in our case data from around 30–60 days). As Berry (1997a) noted, acculturation is not a single timescale phenomenon but a continuous process that also develops over years, decades, and even generations.

Although long-term time scales are not the focus of this dissertation, the contrasting approaches between Chapter 4 and Chapter 5 highlight the difficulties even within an ESM approach. While Chapter 4 focuses directly on the individual events, Chapter 5 adopted a broader temporal lens, integrating data over more extended periods and allowing the examination of developmental trajectories. Using feature-based time series clustering, the developmental patterns of adaptation became discernible, revealing key dynamics that might be obscured in shorter time frames. This approach resonates with the wider literature that underscores the importance of understanding migration not just as a momentary event, but as an unfolding temporal narrative (Sam & Oppedal, 2003). However, both immediate events and long-term processes are instrumental in shaping migrants' psychological experiences, and a holistic approach to migration research would necessitate the consideration of multiple

time scales, ranging from immediate situational dynamics to lifelong trajectories. Recent developments in the digital phenotyping literature have made great strides in detecting the time scales on which the most crucial developments take place (Langener et al., 2023). Future undertakings may thus combine migrant data on multiple time scales ranging from seconds to years and extract the most crucial time scales researchers and practitioners need to consider.

6.5.3 Theory and mechanisms

Also when it comes to our conceptual and theoretical contributions, our approaches are certainly not without limitations. A first theoretical limitation is that although in Chapter 2 and Chapter 3 we highlight the importance of considering the full ABCD conglomerate, our own empirical investigations in Chapter 4 and Chapter 5 have a prominent emphasis on the internal aspects of cognition and desire. These understudied aspects were the main focus of our work, and we explicitly advocate in Chapter 3 for specialized research to focus only on relevant aspects (as long it remains transparent). However, this does mean that our theoretical tests do not capture the full acculturation experience. Future researchers may, thus, extend our theoretical mechanism to include more explicitly emotional aspects and future clustering approaches may want to collect data on the four aspects in a more balanced manner.

Also our situational need-based mechanism of intergroup contact is not without alternate approaches. Despite the valuable insights garnered from the need-based mechanism highlighted in Chapter 4, it is important to consider other influential theoretical traditions in migration research. This arguably becomes especially important when we consider how our need-based mechanism might relate to later downstream variables that explain the positive effects of positive contact (e.g., Schäfer et al., 2022). We know much more about the mechanisms once an interaction is positive and future research will need to consider how the need fulfillment mechanism relates to social cognitions such as warmth and competence perceptions (Cuddy et al., 2008; Fiske et al., 2007), social categorizations (Pettigrew, 1998), or threat and intergroup anxiety (e.g., Stephan et al., 2008; van Zomeren et al., 2007; Wölfer et al., 2019) but also other social factors such as intimacy (e.g., Marinucci et al.,

2021) and attachment (e.g., Tropp, 2021) or even the likelihood of future contacts (Prati et al., 2022). Ultimately, it will be paramount to integrate these disparate theoretical traditions to foster a holistic theoretical understanding of the migration experience.

6.5.4 Methodological restrictions

In reflecting on the ambitious and comprehensive journey that this dissertation embarked upon, it also becomes evident that while significant strides have been made in understanding migration through various prisms, there are specific methodological considerations to be addressed. Throughout the dissertation but especially in the introduction, Chapter 2, and Chapter 3 we have spent significant time reflecting on our own positionality and this holds true for the research cycles of all empirical works I presented here (Kreienkamp et al., 2020). Especially the qualitative analysis in Chapter 2 and Chapter 3 might be expanded upon by future research that approaches the challenges from a different angle, such as the perspective of the majority group.

In the later chapters, where we collected our own quantitative data, I have particularly relied upon the experience sampling method. This data sits at the core of my theoretical proposal in Chapter 4 as well as our methodological advances in Chapter 5. There are a number of core restrictions to this data. Firstly, the intensive longitudinal aspect of the ESM data means that we have often relied on short forms of scales or have used single-item measurements. While we have used validated scales and items wherever possible, the short questionnaires often come at the expense of reliability (especially, over time). Future works might want to validate our needs mechanism using longer scales, for example in less frequent panel survey studies. Secondly, while intensive longitudinal data has the benefit of allowing for lagged and cross-lagged effects (including our considerations in Chapter 5) the data and analyses remain correlational. Future investigations — especially of the situational need mechanism — can take our results as a blueprint for multi-method investigations. Especially the experimental manipulation of situationally relevant needs seems promising to me in further understanding the psychological intergroup contact mechanisms.

Similarly, the new method introduced in Chapter 5 offers a promising way to decipher the temporal dynamics of migrants' experiences. Yet, the features selected were based on theoretical and methodological precedents. Expanding the pool of dynamic features, and testing alternative clustering algorithms, might yield even richer and varied insights into migrant trajectories. Additionally, while the method showed promising adaptability and versatility, it remains a relatively novel application within the field of psychological ESM data. As such, its direct comparison with existing methodologies used in experience sampling and time series analysis is warranted. It would be invaluable for future research to conduct side-by-side comparisons, rigorously juxtaposing the results from feature-based time series clustering with more traditional methods, such as group-based trajectory modeling or time-varying effect mixture modeling (e.g., den Teuling et al., 2021). Such endeavors would not only bolster the validity and credibility of the feature-based approach but also help delineate the contexts and research questions for which this method might be particularly suited or unsuited.

Taken together, while the focus was primarily on voluntary migrants in the Netherlands, future research may extend the ESM studies to forced migrants and wider global perspectives. Similarly, while the current temporal scope captured daily nuances, there is a clear potential to expand the study to broader lifelong trajectories in the future. Theoretically, our need-based model has laid groundwork for future integrations that consider the full experience breadth. Methodologically, our adoption of feature-based time series clustering heralds new opportunities, even as we acknowledge the importance of comparing it with traditional methods. These identified areas for enhancement not only underscore our commitment to transparent research but also shine a light on the myriad promising avenues for future investigations into migration experiences.

6.6   Concluding remarks

The aim of this dissertation was to build a fuller picture of migration complexity and to offer first solutions for the conceptual heterogeneity, the theoretical unclarity, and methodological challenges of capturing migration experiences.

Throughout the empirical chapters, I delved deep into the nuances of the acculturation process. I proposed an affect, behavior, cognition, and desire (ABCD) structure for psychological acculturation based on the focus group discussion with societal stakeholders, which I then formally developed and validated in a systematic scoping review. With a conceptual structure at hand, I then zoomed in on the daily intercultural contacts of migrants and showed that situational need fulfillments in ESM studies offer a potent psychological mechanism for when and why an outgroup is perceived as positive. I show that the mechanism consistently drives positive intergroup relations and adaptation outcomes — even outperforming the current gold standards of Allport's optimal contact conditions and self-determination need fulfillment. With both a conceptual and theoretical backdrop established, I introduce a novel methodological approach to decipher the complex temporal dynamics of migrants' experiences, revealing distinct developmental trajectories using the clustering of meaningful time series features. Together, the empirical chapters offer first solutions to the immense complexity of considering differences between people, variables, and time points. These findings have a number of implications and future potential for researchers and practitioners interested in acculturation, intergroup contact, motivation, and experience sampling studies. But above all, this thesis shows that "acculturation encompasses a range of conceptually distinct variables (notably the ABCD distinction), which are intricately interlinked by theory and manifest in distinct temporal patterns over time."

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Supplemental Material A

Ch3 – Coding protocol

DOCUMENTATION: CODING PROTOCOL

For: 'The Migration Experience: A Conceptual Framework and Systematic Scoping Review of Psychological Acculturation'

Created by Jannis Kreienkamp (✉ j.kreienkamp@rug.nl) **on February 20, 2021**
Laura F. Bringmann
Raili F. Engler
Peter de Jonge
Kai Epstude

Last edited November 30, 2023

Protocol purpose:
This protocol document lays out detailed information for coders of the (included) manuscripts. This document serves as an instructive manual to the coders and documents the operationalizations of the coded variables. The systematic review produced three literature databases that aim to capture the status quo of the (1) theoretical, (2) methodological, and (3) empirical literature on psychological acculturation. The coding procedures (i.e., data extraction) for each dataset are documented in the following document protocol.

THEORETICAL LITERATURE

1 Bibliographic Information

Code: *Theory* [Bibliographic Information]

What is the name of the theory?

Whenever possible record the name of the theory chosen by the authors themselves.

character string

Code: *Source* [Bibliographic Information]

Add the full APA 7 formatted citation of the theoretical manuscript that is being coded.

Example format: Author, A. A., & Author, B. B. (Year). Title of the work. Source where you can retrieve the work. DOI (or URL) if available.

character string

Code: *CitationKey* [Bibliographic Information]

Add BibTeX citation key for the theoretical manuscript.

The citation key can be found in the bibliography manager (either in the shared Mendeley Library or the 'references.bib' file.)
Example format: Author2019

character string

KEYWORDS

Psychological Acculturation

Experience Framework

Systematic Review

- -

Coding Protocol Documentation

Datasets

DATASETS

Theoretical [*N* = 93] ●●●○○○○
Methodological [*N* = 233] ●●●●○○○
Empirical [*N* = 526] ●●●●●●●

THEORY DATASET

Dataset Sheet	
Dataset Theoretical Acculturation Literature	
Instances Per Dataset 93 unique manuscripts	
Motivation	
Original Authors	Kreienkamp, Bringmann, Engler, de Jonge, Epstude
Original Use Case	collection of theoretical works
Original Funding	None
Composition	
Sample or Complete	Sample
Missing Data	9.7% not included
Sensitive Information	author information
Collection	
Sampling Strategy	systematic review (see search strategy)
Ethical Review	not applicable
Author Consent	not applicable
Cleaning and Labeling	
Cleaning Done	Yes
Labeling Done	Yes
Uses and Distribution	
Notable Uses	this systematic review
Other Uses	openly accessible for further analysis
Distribution	available on DataVerse and GitHub
Maintenance and Evolution	
Corrections or Erratum	None
Methods to Extend	CC BY-NC 4.0
Replicate Maintainers	Jannis Kreienkamp
Types of theoretical works	*% of manuscripts**
theory 36 manuscripts	38.7%
framework 26 manuscripts	28%
model 22 manuscripts	23.7%
conceptualization 9.7%	
As identified by the author(s) of the theoretical manuscripts (also see 'FrameworkTheoryModel' code).	
* Based on final dataset after screening.	

2   Screening

Code: *MissingABCD*   [Screening]

Whether the experience aspects (affect, behavior, cognition, and desire) are coded.

- coded .... [0]
- missing .... [1]

Code: *NoteMissing*   [Screening]

If experience aspects (affect, behavior, cognition, desire) not coded, provide the reason for missing coding.

- not English .... [1]
- not migration .... [2]
- not migrant .... [3]
- not acculturation .... [4]
- not ABCD .... [5]
- not theory .... [6]
- thesis not accessible .... [7]
- article not accessible .... [8]
- book not accessible .... [9]
- chapter not accessible ..... [10]
- poster not accessible ...... [11]

Code: *Comment*   [Screening]

Any necessary comments of the coder.

This can include additional information about the format and content of the theoretical work, as well as information on the missingness or accessibility.

character string

Missingness Explanations	
#	Examples / Explanation
1	manuscript is in a language other than English.
2	rural-urban, second generation
3	focus on dominant group
4	purely descriptive studies and replications in migrant populations. E.g., mental health of migrant group in general.
5	migration status, length of residence
6	only discusses theory of others.
7	not accessible via library services
8	not accessible via library services
9	not accessible via library services
10	not accessible via library services
11	not accessible via library services

3   Theory Information

Code: *Summary*   [Theory Information]

A short summary of the theoretical work.

This summary ideally includes the sections that were relevant to the experience aspect (affect, behavior, cognition, desire) coding.

character string

S

Code: *FrameworkTheoryModel*   [Theory Information]
Type of theoretical work, as identified by the author.
Please code the term that is being used by the author(s).

- conceptualization . . . . [1]
- framework . . . . [2]
- theory . . . . [3]
- model . . . . [4]

- -

Code: *GeneralAspect*   [Theory Information]
Whether the theoretical work is about acculturation in general or whether it conceptualizes a particular aspect of acculturation.
Is acculturation in general being considered or do the authors focus on a single aspect of acculturation, such as theories on labor market integration.

- general . . . . [1]
- aspect . . . . [2]

- -

Code: *Target*   [Theory Information]
If aspect is targeted, what is the target of the theoretical work?
Example aspects might be theoretical works that exclusively focus on labor market integration or identity development.

_____
character string

- -

4   Experience

Code: *Affect*   [Experience]
Whether the theoretical conceptualization included affect.
To identify whether the author(s) included affective experiences in their theoretical conceptualization, you can examine the author(s)' theoretical axioms, theorems, and model elements for self-identified mentions of affect. Please consider affect at the following three levels of abstraction:
Aspect: *the authors might refer to 'affect' or 'affective' directly.*
Construct: *the authors might refer to affective constructs such as 'emotion' or 'mood'.*
Concept: *the authors might refer to affective concepts such as individual emotions, including 'pride' or 'loneliness'.*
Operationalization: *the authors might also include affective conceptualizations in their descriptions of experiences, such as 'a person feels' or 'a person enjoys'.*

Selected Affect Concept Examples:
- loneliness
- feeling at home
- satisfaction with life
- pride
- comfortableness
- joy
- ease
- well-being
- worry
- trust

- included . . . . [1]
- not included . . . . [–]

- -

Code: *Behavior* [Experience]

Whether the theoretical conceptualization included behavior(s).

To identify whether the author(s) included behavioral experiences in their theoretical conceptualization, you can examine the author(s)' theoretical axioms, theorems, and model elements for self-identified mentions of behaviors. Please consider behaviors at the following three levels of abstraction:
Aspect: *the authors might refer to 'behavior' or 'behavioral' directly.*
Construct: *the authors might refer to behavioral constructs such as 'activities' or 'habits'.*
Concept: *the authors might refer to behavioral concepts, such as 'language use' or 'media consumption'.*
Operationalization: *the authors might also include behavioral conceptualizations in their descriptions of experiences, such as 'a person does' or 'a person works'.*

- included . . . . [1]
- not included . . . . [–]

Selected Behavior Concept Examples:
- language use
- civic participation (voting, ...)
- performance (work, ...)
- media consumption
- education
- peer contacts
- food consumption
- cultural habits (holidays ...)
- delinquency
- marriage

Code: *Cognition* [Experience]

Whether the theoretical conceptualization included cognition(s).

To identify whether the author(s) included cognitive experiences in their theoretical conceptualization, you can examine the author(s)' theoretical axioms, theorems, and model elements for self-identified mentions of cognitions. Please consider cognitions at the following three levels of abstraction:
Aspect: *the authors might refer to 'cognition' or 'cognitive' directly.*
Construct: *the authors might refer to cognitive constructs such as 'knowledge' or 'memories'.*
Concept: *the authors might refer to cognitive concepts, such as 'cultural values' or 'ethnic identification'.*
Operationalization: *the authors might also include cognitive conceptualizations in their descriptions of experiences, such as 'a person thinks' or 'a person prefers'.*

- included . . . . [1]
- not included . . . . [–]

Selected Cognition Concept Examples:
- ethnic identification
- cultural values
- acculturation orientation
- preferences (food, friends, ...)
- knowledge
- importance ratings
- inner thought language
- perceived obligations
- beliefs
- stereotypes

Code: *Desire* [Experience]

Whether the theoretical conceptualization included desire(s).

To identify whether the author(s) included motivational experiences in their theoretical conceptualization, you can examine the author(s)' theoretical axioms, theorems, and model elements for self-identified mentions of desires. Please consider desires at the following three levels of abstraction:
Aspect: *the authors might refer to 'desire' or 'motivational' directly.*
Construct: *the authors might refer to desire constructs such as 'needs' or 'goals'.*
Concept: *the authors might refer to desire concepts, such as 'belonging' or 'competence'.*
Operationalization: *the authors might also include motivational conceptualizations in their descriptions of experiences, such as 'a person wants' or 'a person needs'.*

- included . . . . [1]
- not included . . . . [–]

Selected Desire Concept Examples:
- competence
- independence
- self-coherence
- belonging
- achievement
- justice
- growth
- respect
- acceptance
- identity continuity

S

5 Data Collection

Code: *SourceType*   [Data Collection]

Whether the theoretical conceptualization is based on theoretical reasoning or empirical investigations.

Is the theoretical reasoning focused on past theoretical work or do the authors build a theoretical conceptualization based on (qualitative) investigations (e.g., grounded theory).

- theoretical . . . . [1]
- empirical . . . . [2]

6 Focus

Code: *Time*   [Focus]

Whether the conceptualization of acculturation is dynamic or static.

Do the authors self-identify the theory as a dynamic process (e.g., 'process,' 'development,' 'longitudinal,' 'temporal,' 'dynamic') or a static outcome (e.g., 'static,' 'outcome,' 'markers,' 'consequence')

- static . . . . [1]
- dynamic . . . . [2]

METHODOLOGICAL LITERATURE

1 Bibliographic Information

Code: *Scale*   [Bibliographic Information]

What is the name of the scale?

Whenever possible record the name of the scale chosen by the authors themselves.

character string

Code: *Source*   [Bibliographic Information]

Whether the scale was added as part of one of the past methodological reviews or through our own review of the empirical literature.

Indicate whether the scale was included in one or multiple of the past methodological reviews or was added from our own review.

- Celenk2011 . . . . [1]
- Matsudaira2006 . . . . [2]
- Wallace2010 . . . . [3]
- own review . . . . [4]

METHODS DATASET

Dataset Sheet

Dataset Methodological Acculturation Literature	
Instances Per Dataset 233 scales from 256 unique manuscripts	

Motivation	
Original Authors	Kreienkamp, Bringmann, Engler, de Jonge, Epstude
Original Use Case	collection of acculturation measures
Original Funding	None

Composition	
Sample or Complete	Sample
Missing Data	7.54% not accessible + see Screening–Coded
Sensitive Information	author information

Collection	
Sampling Strategy	systematic review (see search strategy)
Ethical Review	not applicable
Author Consent	not applicable

Cleaning and Labeling	
Cleaning Done	Yes
Labeling Done	Yes

Uses and Distribution	
Notable Uses	this systematic review
Other Uses	openly accessible for further use
Distribution	available on DataVerse and GitHub

Maintenance and Evolution	
Corrections or Erratum	None
Methods to Extend	CC BY-NC 4.0
Replicate Maintainers	Jannis Kreienkamp

Code: *CitationKey* [Bibliographic Information]

Add BibTeX citation key for the theoretical manuscript.

The citation key can be found in the bibliography manager (either in the shared Mendeley Library or the 'references.bib' file.)
Example format: Author2019

character string

Code: *APACite* [Bibliographic Information.]

Add the full APA 7 formatted citation of the theoretical manuscript that is being coded.

Example format: Author, A. A., & Author, B. B. (Year). Title of the work. Source where you can retrieve the work. DOI (or URL) if available.

character string

Code: *DOI* [Bibliographic Information]

Add Digial Object Identifier (DOI).

The doi can be found in the bibliography manager (either in the shared Mendeley Library or the 'references.bib' file.)
Example format: 10.prefix/suffix

character string

2 Screening

Code: *Coded* [Screening]

Whether the experience aspects (affect, behavior, cognition, and desire) are coded.

- missing .... [0]
- coded .... [1]

Code: *MissingNote* [Screening]

If experience aspects (affect, behavior, cognition, desire) not coded, provide the reason for missing coding.

- not English .... [1]
- not migration .... [2]
- not migrant .... [3]
- not acculturation .... [4]
- not ABCD .... [5]
- not measured .... [6]
- items not accessible .... [7]
- thesis not accessible .... [8]
- article not accessible .... [9]
- book not accessible .... [10]
- chapter not accessible ..... [11]
- poster not accessible ...... [12]

Missingness Explanations

#	Examples / Explanation
1	manuscript is in a language other than English.
2	rural-urban, second generation
3	focus on dominant group
4	purely descriptive studies and replications in migrant populations. E.g., mental health of migrant group in general.
5	migration status, length of residence
6	only discusses theory of others.
7	not accessible via library services
8	not accessible via library services
9	not accessible via library services
10	not accessible via library services
11	not accessible via library services
12	not accessible via library services

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Code: *Comment* [Screening]

Any necessary comments by the coder.

This can include additional information about the format and content of the theoretical work, as well as information on the missingness or accessibility.

character string

3 Scale Information

Code: *Item* [Scale Information]

Extract all available items of the scale.

List all items of the scale as they are presented in the manuscript. If scoring is inconsistent consider adding basic scoring information to the items. Please number the items for clarity.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

... . _____

N. _____
character string

Code: *NItem* [Scale Information]

Number of items in the scale.

The total number of items should match the highest numbering in the 'Item' variable. If that is not the case please explain in the 'Note' section.

___ . ___ ___
numeric

Code: *NSubScales* [Scale Information]

Number of sub-scales identified by the authors.

If multiple sets of sub-scales are proposed please elaborate in the 'Note' section.

___ ___
numeric

Code: *ResponseRange*   [Scale Information]
Number of response options.

If multiple response ranges are used please specify in the 'Note' section.

___ ___ ___
numeric

- -

Code: *ResponseRangeAnchors*   [Scale Information]
List the anchors associated with the reported the response range.

If multiple sets of anchors are used please specify in the 'Note' section.
Example format for range {-2, 2}:

-2: very negative _____

-1: negative _____

0: neutral _____

1: positive _____

2: very positive _____
character string

- -

Code: *Note*   [Scale Information]
Any necessary coder comments about the scale.

Any notes on the scale, including the structure of the scale (e.g., names of the sub-scales).

_____
character string

- -

4   Experience

Code: *Affect*   [Experience]
Whether the scale includes affect.

To identify whether the author(s) included affective experiences in their scale, you can examine the scale description, the (sub-)scale labels, as well as items for self-identified mentions of affect. Please consider affect at the following three levels of abstraction:
Aspect: the authors might refer to 'affect' or 'affective' directly.
Construct: the authors might refer to affective constructs such as 'emotion' or 'mood'.
Concept: the authors might refer to affective concepts such as individual emotions, including 'pride' or 'loneliness'.
Operationalization: the authors might also include affective conceptualizations in their items, such as 'I feel ...' or 'I enjoy ...'.

- included . . . . [1]
- not included . . . . [–]

Selected Affect Concept Examples:
- loneliness
- feeling at home
- satisfaction with life
- pride
- comfortableness
- joy
- ease
- well-being
- worry
- trust

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- -

Code: *Behavior*   [Experience]

Whether the scale includes behavior(s).

To identify whether the author(s) included affective experiences in their scale, you can examine the scale description, the (sub-)scale labels, as well as items for self-identified mentions of behaviors. Please consider behaviors at the following three levels of abstraction:
Aspect: *the authors might refer to 'behavior' or 'behavioral' directly.*
Construct: *the authors might refer to behavioral constructs such as 'activities' or 'habits'.*
Concept: *the authors might refer to behavioral concepts, such as 'language use' or 'media consumption'.*
Operationalization: *the authors might also include behavioral conceptualizations in their items, such as 'I do …' or 'I speak …'.*

- included . . . . [1]
- not included . . . . [–]

Selected Behavior Concept Examples:
- language use
- civic participation (voting, …)
- performance (work, …)
- media consumption
- education
- peer contacts
- food consumption
- cultural habits (holidays …)
- delinquency
- marriage

Code: *Cognition*   [Experience]

Whether the scale includes cognition(s).

To identify whether the author(s) included affective experiences in their scale, you can examine the scale description, the (sub-)scale labels, as well as items for self-identified mentions of cognitions. Please consider cognitions at the following three levels of abstraction:
Aspect: *the authors might refer to 'cognition' or 'cognitive' directly.*
Construct: *the authors might refer to cognitive constructs such as 'knowledge' or 'memories'.*
Concept: *the authors might refer to cognitive concepts, such as 'cultural values' or 'ethnic identification'.*
Operationalization: *the authors might also include cognitive conceptualizations in their items, such as 'I think …' or 'I prefer …'.*

- included . . . . [1]
- not included . . . . [–]

Selected Cognition Concept Examples:
- ethnic identification
- cultural values
- acculturation orientation
- preferences (food, friends, …)
- knowledge
- importance ratings
- inner thought language
- perceived obligations
- beliefs
- stereotypes

Code: *Desire*   [Experience]

Whether the scale includes desire(s).

To identify whether the author(s) included affective experiences in their scale, you can examine the scale description, the (sub-)scale labels, as well as items for self-identified mentions of desires. Please consider desires at the following three levels of abstraction:
Aspect: *the authors might refer to 'desire' or 'motivational' directly.*
Construct: *the authors might refer to desire constructs such as 'needs' or 'goals'.*
Concept: *the authors might refer to desire concepts, such as 'belonging' or 'competence'.*
Operationalization: *the authors might also include motivational conceptualizations in their items, such as 'I want …' or 'I need …'.*

- included . . . . [1]
- not included . . . . [–]

Selected Desire Concept Examples:
- competence
- independence
- self-coherence
- belonging
- achievement
- justice
- growth
- respect
- acceptance
- identity continuity

Code: *TypeComplexity* [Experience]

Type of aspect combination [if multiple experience aspects included].

If more than one experience aspect was coded, please specify how the multiple aspects were included. The scales might include the aspects either independently as parts of the acculturation conceptualization or as part of a scale or proxy measure that includes multiple experience aspects.

- complex concept . . . . [1]
- complex scale . . . . [2]
- independent . . . . [3]
- review . . . . [4]
- not applicable . . . . [N/A]

5 Data Collection

Code: *Measurement* [Data Collection]

Levels of measurement.

Identify the measurement level of the scales. Are the items (or at least the resulting scale) measured as a continuous dimension or is the resulting measure a classification into groups. Indicate 'categorical' even if there is an order to the groups. Select 'both' if a the measure includes both continuous and categorical measures.

- continuous . . . . [1]
- categorical . . . . [2]
- both . . . . [3]

6 Focus

Code: *domainScale* [Focus]

Situational focus of the scale.

To identify the author(s) situational focus in their scale, you can examine the scale description, the (sub-)scale labels, as well as items for self-identified mentions of life domains.

- spirituality/religion . . . . [1]
- home/family . . . . [2]
- health/care . . . . [3]
- administrative/legal matters . . . . [4]
- entertainment/media . . . . [5]
- work/money/finances . . . . [6]
- education/school . . . . [7]
- transport/travel . . . . [8]
- recreation/sport/art/friends . . . . [9]
- community/politics . . . . [10]

Complexity Explanations

#	Examples / Explanation
1	focused on a concept that includes multiple aspects (e.g., satisfaction, distress)
2	aspects included as parts of a scale
3	aspects measured as independent conceptualizations of acculturation
4	aspects included as part of a review of multiple conceptualizations
N/A	only one aspect was included

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7   Sample

Code: *Sample*   [Sample]

The sample recruited by the authors.

Please specify the sample requirements of the authors. If non are provided use the code 'general' to indicate that the general population of migrants was targeted.

---

character string

- -

Code: *MigrationTime*   [Sample]

When in the migration process acculturation was assessed?

Please specify whether the authors considered one or multiple time-points in the migration process. And if multiple are assessed, please specify which time-points were included.

- potential . . . . [1]
- pre . . . . [2]
- post . . . . [3]
- pre & post . . . . [4]
- N/A . . . . [5]

- -

Code: *IncludesMajority*   [Sample]

Whether members of the dominant group in the host society were considered.

Please specify whether members of the dominant group in the host society were included for the scale validation.

- no . . . . [0]
- yes . . . . [1]

- -

Code: *HostCountry*   [Sample]

Country or countries of settlement considered for validation.

Please specify the host country or countries that were included in the validation. This country is usually the country of settlement for the migrant group. If no country is focused on in particular, please use the code 'any' to indicate that any host country was allowed as part of the sampling strategy.

---   ,   ---   ,   ---

character string   character string   character string

- -

Code: *OriginCountry*   [Sample]

Country or countries of origin considered for validation.

Please specify the origin country or countries that were included in the validation. These countries usually the country of origin for the migrant group. If no country is focused on in particular, please use the code 'any' to indicate that migrants from any country were included as part of the sampling strategy.

---   ,   ---   ,   ---

character string   character string   character string

- -

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EMPIRICAL LITERATURE

1   Bibliographic Information

> **Additional Bibliographic Data**
>
> A range of additional bibliographic data fields is available in the dataset. These fields include the 'type of publication', 'year of publication', 'author names', 'title', 'abstract', 'DOI', 'duplicate filters', as well as a range of publisher information. These fields are generated during the literature search by the bibliographic database and don't need any input from the coders. Additional information on the format and content of these fields is available in the 'Codebook'.

Code: *CitationKey*   [Bibliographic Information]

Add BibTeX citation key for the empirical manuscript.

The citation key can be found in the bibliography manager (either in the shared Mendeley Library or the 'references.bib' file.)
Example format: Author2019

character string

2   Screening

Code: *TitleScreening*   [Screening]

Whether manuscript should be excluded during title screening.

- excluded . . . . [0]
- included . . . . [1]

Code: *TitleNote*   [Screening]

If excluded during 'TitleScreening', provide the reason for exclusion.

- not English . . . . [1]
- not migration . . . . [2]
- not migrant . . . . [3]
- not acculturation . . . . [4]
- not ABCD . . . . [5]
- not measured . . . . [6]
- items not accessible . . . . [7]
- thesis not accessible . . . . [8]
- article not accessible . . . . [9]
- book not accessible . . . . [10]
- chapter not accessible . . . . . [11]
- poster not accessible . . . . . . [12]

EMPIRICAL DATASET

Dataset Sheet

Dataset Empirical Acculturation Literature
Instances Per Dataset 526 empirical studies from 1329 unique manuscripts

Motivation

Original Authors	Kreienkamp, Bringmann, Engler, de Jonge, Epstude
Original Use Case	collection of empirical works
Original Funding	None

Composition

Sample or Complete	Sample
Missing Data	13% not accessible
	(6% items & 5% theses not accessible)
	+ see Screening
Sensitive Information	author information

Collection

Sampling Strategy	systematic review (see search strategy)
Ethical Review	not applicable
Author Consent	not applicable

Cleaning and Labeling

Cleaning Done	Yes
Labeling Done	Yes

Uses and Distribution

Notable Uses	this systematic review
Other Uses	openly accessible for further analysis
Distribution	available on OSF and GitHub

Maintenance and Evolution

Corrections or Erratum	None
Methods to Extend	CC BY-NC 4.0
Replicate Maintainers	Jannis Kreienkamp

Types of publications	% of manuscripts*
journal articles 452 manuscripts	85.9%
theses 68 manuscripts	12.9%
book chapters 1.1%	

* Based on final dataset after screening.

Missingness Explanations

#	Examples / Explanation
1	manuscript is in a language other than English.
2	rural-urban, second generation
3	focus on dominant group
4	purely descriptive studies and replications in migrant populations. E.g., mental health of migrant group in general.
5	migration status, length of residence
6	only discusses theory of others.
7	not accessible via library services
8	not accessible via library services
9	not accessible via library services
10	not accessible via library services
11	not accessible via library services
12	not accessible via library services

S

Code: *AbstractScreening*   [Screening]

Whether manuscript was excluded during abstract screening.

- excluded . . . . [0]
- included . . . . [1]

Code: *AbstractNote*   [Screening]

If excluded during 'AbstractScreening', provide the reason for exclusion.

- not English . . . . [1]
- not migration . . . . [2]
- not migrant . . . . [3]
- not acculturation . . . . [4]
- not ABCD . . . . [5]
- not measured . . . . [6]
- items not accessible . . . . [7]
- thesis not accessible . . . . [8]
- article not accessible . . . . [9]
- book not accessible . . . . [10]
- chapter not accessible . . . . . [11]
- poster not accessible . . . . . . [12]

Missingness Explanations

#	Examples / Explanation
1	manuscript is in a language other than English.
2	rural-urban, second generation
3	focus on dominant group
4	purely descriptive studies and replications in migrant populations. E.g., mental health of migrant group in general.
5	migration status, length of residence
6	only discusses theory of others.
7	not accessible via library services
8	not accessible via library services
9	not accessible via library services
10	not accessible via library services
11	not accessible via library services
12	not accessible via library services

Code: *Downloaded*   [Screening]

Whether full manuscript–text was downloaded.

If this was not possible, please describe steps taken in the 'Comment' code.

- not downloaded . . . . [0]
- downloaded . . . . [1]

Code: *MissingABCD*   [Screening]

Whether experience aspects were coded in full text.

Does the empirical study consider (i.e., measure) psychological acculturation? Please focus particularly on the measurement of acculturation, e.g., scale description, the (sub-)scale labels, as well as items.

- coded . . . . [0]
- missing . . . . [1]

Code: *NoteMissing*   [Screening]

If excluded during full-text analysis, provide the reason for exclusion.

- not English . . . . [1]
- not migration . . . . [2]
- not migrant . . . . [3]
- not acculturation . . . . [4]
- not ABCD . . . . [5]
- not measured . . . . [6]
- items not accessible . . . . [7]
- thesis not accessible . . . . [8]
- article not accessible . . . . [9]
- book not accessible . . . . [10]
- chapter not accessible . . . . . [11]
- poster not accessible . . . . . . [12]

Missingness Explanations

#	Examples / Explanation
1	manuscript is in a language other than English.
2	rural-urban, second generation
3	focus on dominant group
4	purely descriptive studies and replications in migrant populations. E.g., mental health of migrant group in general.
5	migration status, length of residence
6	only discusses theory of others.
7	not accessible via library services
8	not accessible via library services
9	not accessible via library services
10	not accessible via library services
11	not accessible via library services
12	not accessible via library services

Code: *Comment* [Screening]

Any necessary comments of the coder.

This can include additional information about the format and content of the theoretical work, as well as information on the missingness or accessibility.

character string

---

3 Experience

Code: *Affect* [Experience]

Whether the studies included affect.

To identify whether the author(s) included affective experiences in their study of acculturation, you can examine the study description, the methods section, the (sub-)scale labels, as well as items for self-identified mentions of affect. Please consider affect at the following three levels of abstraction:
***Aspect:** the authors might refer to 'affect' or 'affective' directly.*
***Construct:** the authors might refer to affective constructs such as 'emotion' or 'mood'.*
***Concept:** the authors might refer to affective concepts such as individual emotions, including 'pride' or 'loneliness'.*
***Operationalization:** the authors might also include affective conceptualizations in their operationalizations, such as 'I feel ...' or 'I enjoy ...'.*

- included .... [1]
- not included .... [–]

Selected Affect Concept Examples:
- loneliness
- feeling at home
- satisfaction with life
- pride
- comfortableness
- joy
- ease
- well-being
- worry
- trust

Code: *Behavior* [Experience]

Whether the studies included behavior(s).

To identify whether the author(s) included affective experiences in their study of acculturation, you can examine the study description, the methods section, the (sub-)scale labels, as well as items for self-identified mentions of behaviors. Please consider behaviors at the following three levels of abstraction:
***Aspect:** the authors might refer to 'behavior' or 'behavioral' directly.*
***Construct:** the authors might refer to behavioral constructs such as 'activities' or 'habits'.*
***Concept:** the authors might refer to behavioral concepts, such as 'language use' or 'media consumption'.*
***Operationalization:** the authors might also include behavioral conceptualizations in their operationalizations, such as 'I do ...' or 'I speak ...'.*

- included .... [1]
- not included .... [–]

Selected Behavior Concept Examples:
- language use
- civic participation (voting, ...)
- performance (work, ...)
- media consumption
- education
- peer contacts
- food consumption
- cultural habits (holidays ...)
- delinquency
- marriage

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Code: *Cognition*   [Experience]

Whether the studies included cognition(s).

To identify whether the author(s) included affective experiences in their studies, you can examine the study description, the methods section, the (sub-)scale labels, as well as items for self-identified mentions of cognitions. Please consider cognitions at the following three levels of abstraction:
Aspect: *the authors might refer to 'cognition' or 'cognitive' directly.*
Construct: *the authors might refer to cognitive constructs such as 'knowledge' or 'memories'.*
Concept: *the authors might refer to cognitive concepts, such as 'cultural values' or 'ethnic identification'.*
Operationalization: *the authors might include cognitive conceptualizations in their operationalization, such as 'I think ...' or 'I prefer ...'.*

- included . . . . [1]
- not included . . . . [–]

Selected Cognition Concept Examples:
- ethnic identification
- cultural values
- acculturation orientation
- preferences (food, friends, ...)
- knowledge
- importance ratings
- inner thought language
- perceived obligations
- beliefs
- stereotypes

Code: *Desire*   [Experience]

Whether the studies included desire(s).

To identify whether the author(s) included affective experiences in their study, you can examine the study description, the methods section, the (sub-)scale labels, as well as items for self-identified mentions of desires. Please consider desires at the following three levels of abstraction:
Aspect: *the authors might refer to 'desire' or 'motivational' directly.*
Construct: *authors might include desire constructs such as 'needs' or 'goals'.*
Concept: *authors might refer to desire concepts, such as 'belonging' or 'competence'.*
Operationalization: *the authors might include motivational conceptualizations in their study, such as 'I want ...' or 'I need ...'.*

- included . . . . [1]
- not included . . . . [–]

Selected Desire Concept Examples:
- competence
- independence
- self-coherence
- belonging
- achievement
- justice
- growth
- respect
- acceptance
- identity continuity

Code: *TypeComplexity*   [Experience]

Type of aspect combination [if multiple experience aspects included].

If more than one experience aspect was coded, please specify how the multiple aspects were included. The study might include the aspects either independently as parts of the acculturation conceptualization or as part of a scale or proxy measure that includes multiple experience aspects.

- complex concept . . . . [1]
- complex scale . . . . [2]
- independent . . . . [3]
- review . . . . [4]
- not applicable . . . . [N/A]

Complexity Explanations

#	Examples / Explanation
1	focused on a concept that includes multiple aspects (e.g., satisfaction, distress)
2	aspects included as parts of a scale
3	aspects measured as independent conceptualizations of acculturation
4	aspects included as part of a review of multiple conceptualizations
N/A	only one aspect was included

4   Data Collection

Code: *empirical*   [Data Collection]

Whether the manuscript presented empirical conceptualization(s) of acculturation.

Please specify whether the authors collected (observable) data as part of their investigation.

- empirical . . . . [1]
- non-empirical . . . . [0]

Code: *Method*   [Data Collection]

Type of empirical data collected.

If empirical data was collected, what kind of data was collected or discussed by the author(s)?

- quantitative ....[1]
- qualitative ....[2]
- mixed method ....[3]
- meta-analysis ....[4]
- review ....[5]

Code: *MeasureDefinition*   [Data Collection]

Name of the scale used or the concepts measured as proxies.

Please specify the name of the measurement tool (e.g., scale) used by the authors. If the scale is not yet in the scale database, please look up the validation of the scale and add it to the database. Do the same for proxy measures of acculturation.

character string

Code: *MeasurementLevels*   [Data Collection]

Levels of measurement.

Identify the measurement level of the empirical scales. Are the items (or at least the resulting scale) measured as a continuous dimension or is the resulting measure a classification into groups. Indicate 'categorical' even if there is an order to the groups. Select 'both' if a measure includes both continuous and categorical measures.

- continuous ....[1]
- categorical ....[2]
- both ....[3]

5   Focus

Code: *term*   [Data Collection]

Acculturation term used by authors.

Please note which term the author(s) used to refer to "psychological acculturation" (i.e., "changes an individual experiences as a result of being in contact with other cultures").

character string

Code: *domainPaper*   [Data Collection]

Focus concept of the manuscript.

Please specify the main focus of the manuscript. The focus is often clearest in the dependent variable within the model or analysis but should also be clearly stated within the title, abstract, or introduction. The focus could be 'acculturation' but it could also be something else (that might, for example, be predicted by acculturation; e.g., depression).

character string

Acculturation Term Examples:
- acculturation
- enculturation
- transculturation
- assimilation
- integration
- social integration
- cultural adaptation
- cultural adjustment
- cultural transition

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Code: *domainScale* [Focus]

Situational focus of the acculturation conceptualization.

To identify the author(s) situational focus in their conceptualization of psychological acculturation, you can examine the manuscript for self-identified mentions of life domains. Please place a particular focus on the study description, as well as the methodology, including scale descriptions, the (sub-)scale labels, and the items themselves.

- spirituality/religion .... [1]
- home/family .... [2]
- health/care .... [3]
- administrative/legal matters .... [4]
- entertainment/media .... [5]
- work/money/finances .... [6]
- education/school .... [7]
- transport/travel .... [8]
- recreation/sport/art/friends .... [9]
- community/politics .... [10]

6 Sample

Code: *Sample* [Sample]

The sample recruited by the authors.

Please specify the sample requirements of the authors. If non are provided use the code 'general' to indicate that the general population of migrants was targeted.

character string

Code: *MigrationTime* [Sample]

When in the migration process acculturation was assessed?

Please specify whether the authors considered one or multiple time-points in the migration process. And if multiple are assessed, please specify which time-points were included.

- potential .... [1]
- pre .... [2]
- post .... [3]
- pre & post .... [4]
- N/A .... [5]

Code: *IncludesMajority* [Sample]

Whether members of the dominant group in the host society were considered.

Please specify whether members of the dominant group in the host society were included for the study. If they were included please note in the 'comment' code whether acculturation was measured for the dominant group.

- no .... [0]
- yes .... [1]

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Code: *HostCountry* [Sample]

Country or countries of settlement considered for study.

Please specify the host country or countries that were included in the study. This country is usually the country of settlement for the migrant group. If no country is focused on in particular, please use the code 'any' to indicate that any host country was allowed as part of the sampling strategy.

_____ , _____ , _____
character string   character string   character string

Code: *OriginCountry* [Sample]

Country or countries of origin considered for study.

Please specify the origin country or countries that were included in the study. These countries are usually the country of origin for the migrant group. If no country is focused on in particular, please use the code 'any' to indicate that migrants from any country were included as part of the sampling strategy.

_____ , _____ , _____
character string   character string   character string

7 Analysis

Code: *MainAnalysis* [Analysis]

Type of data analysis conducted by the authors.

Please specify the type of analysis conducted by the authors. If multiple analyses were conducted please report the 'main' analysis. The main analysis offers the most direct test of the hypotheses and lends the most weight during the interpretation and summary of the results. (The main analysis is often the last and most complex analysis.)

_____
character string

Code: *VariableType* [Analysis]

The place in the model that acculturation takes [if quantitative analysis]

If a quantitative analysis was conducted please specify the variable type of acculturation (during the main analysis, identified during 'MainAnalysis').

- Control . . . . [1]
- Correlation . . . . [2]
- Dependent . . . . [3]
- Mediator . . . . [4]
- Moderator . . . . [5]
- N/A . . . . [6]
- Predictor . . . . [7]
- Predictor & Dependent . . . . . . [8]
- selection criterion . . . . [9]

Analysis Type Examples:
- cluster analysis
- correlation analysis
- lagged regression
- cross-lagged panel analysis
- longitudinal analysis
- mean differences
- participant selection
- path analysis
- prevalence rates
- regression (incl. PROCESS macro)
- structural equation modeling
- social network analysis
- validation analyses
- content analysis
- open coding
- axial coding
- phenomenological praxis
- constant comparative coding

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LINKS

Kreienkamp, J., Bringmann, L. F., Engler, R. F., de Jonge, P., & Epstude, K. (2021). acculturation-review [Github repository: data, software].
https://github.com/JannisCodes/acculturation-review
Kreienkamp, J., Bringmann, L. F., Engler, R. F., de Jonge, P., & Epstude, K. (2022). The Migration Experience: A Conceptual Framework and Systematic Scoping Review of Psychological Acculturation [OSF repository: Protocol, materials, data, software].
https://osf.io/n587w/?view_only=
3e8aed00f2d34942bd5d2f3a710e0de4

CHECKLIST

☐ Theoretical literature

☐ Methodological literature

☐ Empirical literature

NOTES

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QUESTIONS?

Contact Jannis Kreienkamp at:
j.kreienkamp@rug.nl.

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Supplemental Material B

Ch3 – Annotated analyses

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This supplementary information documents the methodology and results of our systematic scoping review. As part of our open supplemental materials, we share the full RMarkdown file, which offers an annotated version of all analysis steps. This file offers a transparent and reproducible analysis code, which includes full author commentary. We rendered the RMarkdown as an interactive HTML file, which we host as part of our open GitHub repository. We recommend the rendered version for almost all readers (full R code is also available via the rendered version).

> https://janniscodes.github.io/acculturation-review/Supplemental-Material-B-Annotated-Analysis

For readers interested in the raw files, the raw RMarkdown file is available in our OSF repository (see Kreienkamp et al., 2022d) and can also be accessed as part of the full GitHub repository (Kreienkamp et al., 2022c).

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Supplemental Material C

Ch3 – Acculturation directory

This supplementary information introduces the acculturation directory. As part of the systematic scoping review, we collected and coded a wide range of theoretical and methodological manuscripts on psychological acculturation. From the literature, we were able to collect and code 233 acculturation scales as well as 93 acculturation theories. Given that this undertaking, to the best of our knowledge, brought together the largest collection of acculturation scales and theories to date, we decided to make the scales and theories as well as their attributes accessible to the readership. To this aim, we created an interactive acculturaction directory, which is available here:

https://acculturation-review.shinyapps.io/acculturation-directory/

C.1 Features

This directory has three main functions, as it aims to (1) aid selection, (2) accessibility, and (3) exploration of the review results.

The most practical function of this application is to aid researchers and practitioners in the selection of acculturation measurements and theories. The study of acculturation has produced an immense number of acculturation scales and theories. As a result, making a choice between these different approaches can be difficult. Not only is it difficult to gain an overview of the number of approaches used within the literature, but also the diversity in style and content can be overwhelming. We hope that the filter options we provide in our application can offer a first structured and intuitive entry into the plethora of acculturation scales and theories. It should be noted that this directory is not meant to replace a full literature review and only present a small amount of information on the scales and theories.

We also hope to make the scales and theories more easily accessible to the users of the application. We do so by showcasing all (publicly) available scale items by clicking the eye icon in the 'View' column. We, additionally, list the full references to all works in the References tab (linked via a 'Reference' column in the scale and theory directories).

And finally, as part of the framework development and systematic review, we have arrived at a number of conclusions about the theoretical and methodological literature on acculturation. We hope that readers can use this directory in conjunction with the main article and explore the results themselves. The data table and the appended filter allow readers interactive access to the data, and users might gain an intuitive understanding of the current state of the literature.

C.2   Interface

Users of the application arrive at the scale database, where they have interactive access to the scales themselves. There are three additional windows (i.e., tabs) available linking to the directory of the broader theoretical works (i.e., theories tab), a tab listing bibliographic information of the included works (i.e., references tab), as well as an introduction to the application and the broader review (i.e., about tab). Yet, the core element of the application remains the scale and theory directories themselves, which each consist of three main interface elements, (1) an interactive data table of the selected works, (2) a filter section, and (3) a short information box.

The visually largest space is taken up by the data table, which allows direct access to the directory. The table shows all results that fit the current filters and lists a number of key information about the included works. Next to the name of the scale or theory and the APA reference, the overview also indicates whether the scale included any of the affect, behavior, cognition, and/or desire aspects. Each of the directories also includes a number of idiosyncratic data columns, such as the number of items, or the number of life domains included in the work. Users can interact with this data table by sorting the columns based on their values and some columns are clickable areas, which

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provides access to additional information about the work. For the scales, we, for example, included (publicly) available scale items, response options, life domains considered, as well as some information on the validation sample.

The filter section contains the main mechanisms for interacting with the directory. We currently offer three main filters to identify scales that fit the users' needs and more generally allow for exploration of the theoretical and methodological literature.

- The 'Term Search Filter' allows users to search for any keyword(s) within the title of the theory or scale.

- The 'Experience Aspect Filter' allows filtering the inclusion of the affect, behavior, cognition, and/or desire aspects. If this filter is disabled, any combination of experience aspects will be displayed. Once enabled, the data table will display all works that fit the user's experience aspect focus.

- The 'Number of Items Filter' and 'Number of Domains Filter' are additional filters within the scale directory, which allow users to filter the acculturation scales by the number of items within the scale as well as the number of life domains (i.e., contact contexts) assessed within the scale. Users can use horizontal sliders to select the minimum and maximum number of items or domains that should be assessed within the scales.

The final, information section offers a top-level overview of the current scale selection. The current version shows the number of scales that fit the current filter choices, the average number of items of the selected scales, the total number of items of all selected scales, as well as a short general introduction to the directory.

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Supplemental Material D

Ch3 – Context analysis

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This supplementary information elaborates on the background literature of the contextual aspects of our conceptual framework presented in the main text. We would like to address each of the four contextual factors in more detail: (1) Cultures, (2) individuals, and (3) situations.
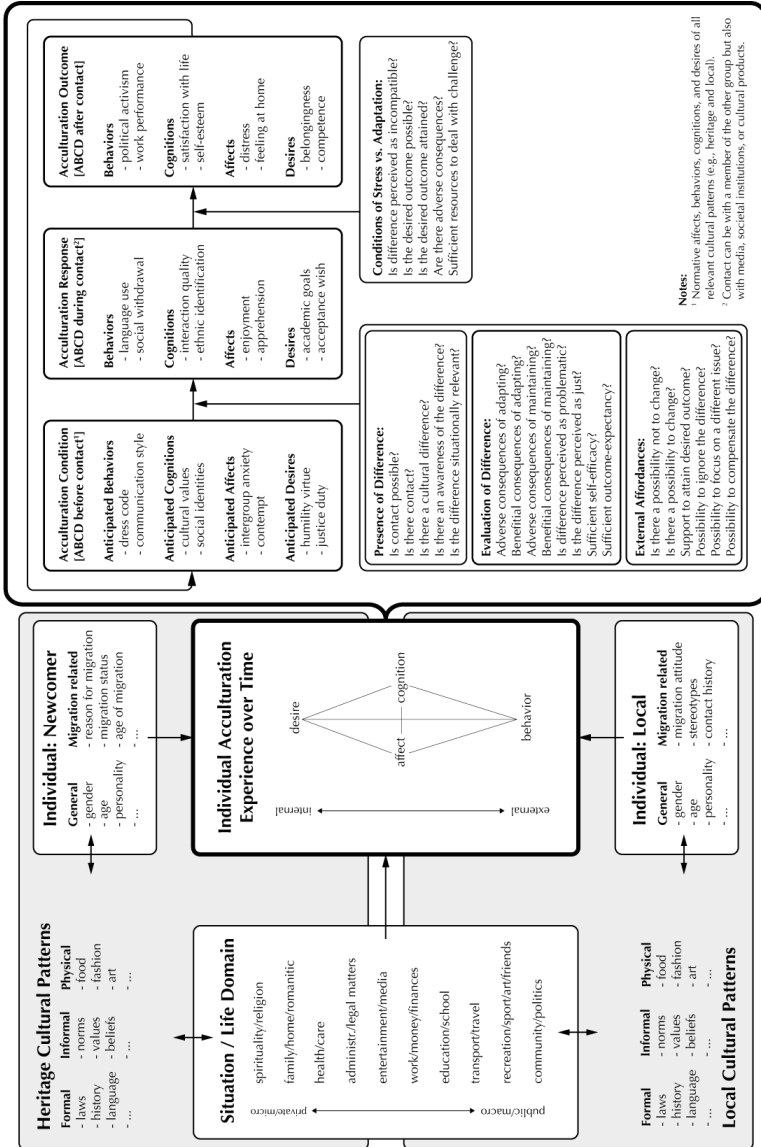
D.1   Culture

The most prominent contextual factor of psychological acculturation is probably the concept of culture. In the main text, we already discuss our conceptual approach to cultural patterns. As part of the analyses presented in this paper, we will offer such a review reflection by extracting the countries of origin and settlement for which acculturation measures were validated and investigated in empirical papers. While this does not reflect the full complexity of cultural patterns, it is a commonly used proxy available for most empirical works. This allows us to examine how much the cultural contexts are reflected within structural differences of measures and definitions (that is if we can consolidate a meaningful number of studies per cultural context).

D.2   Situation

Beyond the cultural patterns, the interactions of cultural adaptation are further dependent on the situational context. As part of the main manuscript, we already introduce a conceptual discussion of the contact context. What structurally unites the different conceptualizations of life domains is the dimension of closeness to the individual. That is, most areas of life found in the literature can be arranged from the most immediate (i.e., micro or private, such as family) to the broadest levels (i.e., macro or public, including government or media). So, based on sociological theories of social institutions (Durkheim, 1982), literature on life domains in acculturation (Arends-Tóth & van de Vijver, 2006b, 2007; Zane & Mak, 2004), a categorization of psychological influences by the British Psychological Society (Michie et al., 2005), and Bronfenbrenner's Ecological systems theory (Bronfenbrenner, 1992), we conceptualized a range of life domains relevant to the migration process (also see Figure 1). As part of this

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Figure 1: Conceptual model with context and experience process.

Heritage Cultural Patterns

Formal	Informal	Physical
- laws	- norms	- food
- history	- values	- fashion
- language	- beliefs	- art
- ...	- ...	- ...

Individual: Newcomer

General	Migration related
- gender	- reason for migration
- age	- migration status
- personality	- age of migration
- ...	- ...

Acculturation Condition
[ABCD before contact[1]]

Anticipated Behaviors
- dress code
- communication style

Anticipated Cognitions
- cultural values
- social identities

Anticipated Affects
- intergroup anxiety
- contempt

Anticipated Desires
- humility virtue
- justice duty

Acculturation Response
[ABCD during contact[2]]

Behaviors
- language use
- social withdrawal

Cognitions
- interaction quality
- ethnic identification

Affects
- enjoyment
- apprehension

Desires
- academic goals
- acceptance wish

Acculturation Outcome
[ABCD after contact]

Behaviors
- political activism
- work performance

Cognitions
- satisfaction with life
- self-esteem

Affects
- distress
- feeling at home

Desires
- belongingness
- competence

Conditions of Stress vs. Adaptation:
Is difference perceived as incompatible?
Is the desired outcome possible?
Is the desired outcome attained?
Are there adverse consequences?
Sufficient resources to deal with challenge?

Presence of Difference:
Is contact possible?
Is there contact?
Is there a cultural difference?
Is there an awareness of the difference?
Is the difference situationally relevant?

Evaluation of Difference:
Adverse consequences of adapting?
Beneficial consequences of adapting?
Adverse consequences of maintaining?
Beneficial consequences of maintaining?
Is difference perceived as problematic?
Is the difference perceived as just?
Sufficient self-efficacy?
Sufficient outcome-expectancy?

External Affordances:
Is there a possibility not to change?
Is there a possibility to change?
Support to attain desired outcome?
Possibility to ignore the difference?
Possibility to focus on a different issue?
Possibility to compensate the difference?

Notes:
[1] Normative affects, behaviors, cognitions, and desires of all relevant cultural patterns (e.g., heritage and local).
[2] Contact can be with a member of the other group but also with media, societal institutions, or cultural products.

Individual Acculturation Experience over Time

desire — cognition
affect — behavior
internal — external

Situation / Life Domain

private/micro — public/macro

spirituality/religion
family/home/romantic
health/care
administr./legal matters
entertainment/media
work/money/finances
education/school
transport/travel
recreation/sport/art/friends
community/politics

Individual: Local

General	Migration related
- gender	- migration attitude
- age	- stereotypes
- personality	- contact history
- ...	- ...

Local Cultural Patterns

Formal	Informal	Physical
- laws	- norms	- food
- history	- values	- fashion
- language	- beliefs	- art
- ...	- ...	- ...

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study, we extracted information on which of these domains was assessed in the methodological and empirical literature. We then assess whether different foci on life domains also show differences in their understanding and measurement of affective, behavioral, cognitive, and motivational acculturation.

D.3 Individual

A final contextual factor we consider during the cultural adaptation process are the involved individuals themselves. Although it can, at times, be difficult to disentangle cultural from individual influences, there is a range of personal features that likely influence the cultural adaptation process. These personal differences might relate to relatively stable individual differences, such as gender or personality, but also migration-related differences, such as the reason for migration (e.g., voluntary vs. forced migration), cultural distance, or migration status. Within the migration-related factors, we would also include aspects that might change over the course of the adaptation process but give migrants different starting positions, such as language skills and education level. Similar to the influences of cultural patterns, the individual differences of the interaction partners (if there are multiple people) will likely impact the psychological acculturation process. And similar to cultural patterns, individual differences likely play a role in multiple aspects of the cultural adaptation process (also see Figure 1). As part of this study, we will mainly analyze the migration-relevant differences. Considering individual differences on a larger, cross-study level, we will mainly extract data on the types of samples collected within the validation and the empirical papers (e.g., forced vs. voluntary, youth, or clinical samples). If we find reasonable numbers of studies with specific types of samples, we will assess whether these individual differences are related to structural differences in measures or definitions used by the authors.

D.4 Measurement

As part of our efforts to capture the migration context, we were interested in cultural, individual, situational, as well as process-related contexts. Assessing these

contexts in a manner that is relevant across a wide range of studies is challenging and likely superficial at best. Yet, gaining a more general understanding of the contexts frequently considered in the literature could prove useful in evaluating and comparing conceptions of cultural adaptation. We, thus, extracted a range of general context variables from the empirical literature.

D.4.1 Cultural context

To capture the cultural contexts researched, we coded both the heritage country of the migrants as well as the country of the receiving host society. Coding the two societal contexts allows us to extract information on the specificity of the studies (e.g., Mexican migrants in the United States, vs any migrant in Scandinavia). Migrant and host country coding could also reveal patterns of interest within the literature (e.g., common migrant groups, common host societies, or common combinations investigated). And finally, if common clusters emerge, we could compare the types of experience elements assessed within each cluster (e.g., focus on behavioral adaptation in one and cognitive focus in another cluster). Note that we do not seek to equate nationalities, nations, or regions with culture. Instead, country of origin and country of settlement are the only consistently reported markers of cultural contexts, and we thus only treat them as a surface-level proxy to assess the common patterns within the literature.

D.4.2 Sample

To capture the individual background on a cross-paper level, we extract the types of samples recruited by the authors. Some studies might focus on young or elderly samples, men or women only, clinical samples, or authors might simply recruit any migrant from a certain country or region. Clusters and differences in the experience foci within these clusters might offer insights into the understanding of cultural adaptation for different individual contexts.

D.4.3 Life domains

To capture the situational contact focus of the authors, we coded which life domains the scales referred to. There is a range of ways in which we could identify the domains the authors wished to cover. Often times, authors will explicitly mention which life domains their measure aims to capture. Others will mention clear domain focus as part of sub-scale or factor labels. If there is no explicit mention by the authors, questions are likely worded to refer to a specific life domain (e.g., behaviors at school, or values in the family context). If there is no clear reference to a life domain or the questions are about life in general, we code this as meaningful information as well. We can then process the situational foci as a list of domains, which offers information on the diversity of domains (e.g., number, or similarity of domains) but also the focus in the literature in general (e.g., frequency of domain across all articles). If clusters of similar focus domains emerge, we could, additionally, assess differences in the assessment of cultural adaptation for these clusters.

D.5 Results

D.5.1 Methodological literature

To gain a general understanding of contextual factors within the validated studies, we also assessed cross-study patterns of cultural, individual, situational, and process-related focus points.

Country   To assess the cultural contexts for which scales were validated, we assessed the migrants' countries of settlement as well as the countries of origin. We found that most scales investigated a single host country ($N = 204$) and most investigated one country of origin ($N = 140$). There were only 29 scales that were validated for more than one receiving country. Looking at the country patterns, we found that an overwhelming number of scales were validated within a U.S. American settlement context ($N = 126$). But also the remaining receiving societies were mostly 'western' countries (e.g., Canada, The Netherlands, The United Kingdom, Israel, Australia) with non-western

settlement contexts, such as Taiwan, Nepal, or Russia, not being investigated across more than two study. For the migrant origin societies, there was slightly more variation. There were a few migrant groups that were investigated specifically (e.g., Mexico: 25, China:13, South Korea: 12), however most validation studies targeted broader categories of migrants (any migrants: 53, Asian: 10, Hispanic: 10, LatinX: 12). This also made it difficult to identify patterns of cultural combinations investigated (apart from Mexican and LatinX migrants in the United States).

Sample   To assess the role of different groups of individuals targeted in the scale validations, we coded the types of samples recruited for the validation studies. A majority of studies sampled any consenting adult from the migrant group of interest ($N = 126$). As seems common in academic research, a larger portion of the validated scales relied on young migrants or students ($N = 66$). Interestingly, only a small minority of validated scales targeted more vulnerable groups, such as clinical samples ($N = 3$) or refugees ($N = 6$) – despite a considerable focus on these groups within the broader literature. Given the small cell counts, we did not investigate differences in the experience measures across the different samples.

Domains   To assess the situational focus within the validated scales, we assessed the number of domains within each scale as well as more common domains across the scales. The scales included an average of 4.23 life domains ($SD = 2.71$). The most common domains to be included were 'friends/acquaintances' ($N = 155$, 66.52%), 'home/family' ($N = 145$, 62.23%), and 'entertainment/media/news' ($N = 105$, 45.06%). Looking at combinations of domains that were commonly assessed together, a number of patterns emerged within the bi-variate relationships. One cluster was, for example, around the common domain 'friends/acquaintances', which had a high proportion of co-occurences with 'entertainment/media/news' ($r = 0.46$, $p < .001$) and with 'recreation/sport/art' ($r = 0.39$, $p < .001$). However, when look at unique combinations of domains, we observed an essentially scattered field. Within the 233 scales we coded, we found a total of 138 different domain combinations.

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A considerable proportion of scales focused on a unique combination of life domains (44.21%) and a large majority of domain combinations were used by less than five percent of the scales (85.41%; also see Supplemental Material B). Thus, while there was large variation between the scales in the number, and diversity of domains, the most frequently mentioned domains were in line with the life domains proposed in the literature (e.g., Arends-Tóth & van de Vijver, 2007). Yet again, given the large variability between studies, we did not investigate differences in experience elements across the different situational domains.

D.5.2 Empirical literature

To gain a general understanding of contextual factors within the broader empirical studies, we again assessed cross-study patterns of cultural, individual, situational, and process-related focus points.

Country   To assess the cultural contexts on which the authors focused, we again assessed the migrants' countries of settlement as well as the countries of origin. Similar to the validations, an overwhelming number of scales were validated within a North American settlement context (United States: $N = 280$, Canada: $N = 44$). But also the remaining receiving societies were mostly 'western' – Western Europe (e.g., The Netherlands, United Kingdom, Germany, Italy, Spain), Australasia (Australia, New Zealand), Russia, and Israel. And only 25 studies focused on data from multiple receiving societies.

When it came to the migrants' country of origin, a majority of studies were indifferent to migrants' background and simply recruited any consenting migrant ($N = 108$), or recruited a category of migrants (e.g., LatinX or Hispanic: $N = 67$, Asian: $N = 26$ African: $N = 14$). Among the individual countries target, there was a particular focus on the east and south-east Asian region (e.g., China: $N = 48$, South Korea: $N = 37$, Vietnam: $N = 22$). Yet, different from the scale validations, there was a large variety of different origin countries that were included in less than five studies ($N = 103$ regions were targeted less than five times). Thus, the receiving countries mainly mirrored those for which scales were validated, yet there was an extensive number of origin countries

which were investigated individually or migrants were considered irrespective of their cultural origin. Moreover, it was again not possible to identify distinct cultural clusters within the literature that would be large enough to compare measures of cultural adaptation.

Sample   To assess the role of different groups of individuals targeted in the empirical work, we again coded the types of samples recruited for the studies. A majority of studies sampled any consenting adult from the migrant group of interest (N = 282, 53.61%). Of the targeted sampling strategies, most recruited young migrants (N = 97, 18.44%) women (N = 50, 9.51%), or refugees (N = 35, 6.65%). The remaining fifth of the studies recruited other more specific samples (e.g., nurses, athletes, Muslims). Interestingly, even though a large portion of papers focused on mental health outcomes, only 7 studies (1.33%) recruited clinical migrant samples. These results speak to the case that either the sub-populations are too small to be sampled properly, or relatively few empirical studies actually take individual differences into account in their sample selection. Studies may still address individual differences within the data description and within the modeling approaches (e.g., controlling for gender), yet it seems that intersectional idiosyncrasies did not seem to play a major role in the targeting of samples. Moreover, cell counts were again unbalanced, and we did not assess experience differences between the samples.

Domains   To capture the situational focus of the authors, we coded which life domains the utilized measures referred to. We coded which life domains the authors referred to, either as part of subscale labels, factor labels, explicit commentary of the authors, or clear question wordings to gain an understanding of the situational focus the authors chose. However, we did not code the theoretical situational life domains because such an undertaking would be beyond the scope of this paper. And the conceptual utility of such a coding was already explored in the methodological literature.

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D.6   Discussion

Within this supplemental material, we assessed contextual differences that were captured within the methodological and empirical literature on psychological acculturation. We focused particularly on the regional and national groups recruited to assess cultural foci, the samples recruited to capture individual differences that were sampled, as well as the life domains considered in the acculturation measures to investigate situational focus points. Across all three contextual factors, we find an enormous heterogeneity. Few studies seem to cluster around the same contexts. And while we see that there is less diversity within the methodological literature, neither the methodological nor empirical literature allowed us to identify meaningful clusters to compare experience assessments across contexts.

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Supplemental Material E

Ch4 – Annotated analysis

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This supplementary information documents the methodology and results of all three studies. As part of our open supplemental materials, we share the full RMarkdown file, which offers an annotated version of our all analysis steps. This file offers a transparent and reproducible analysis code, which includes full author commentary. We rendered the RMarkdown as an interactive HTML file, which we host as part of our open GitHub repository. We recommend the rendered version for almost all readers (full R code is also available via the rendered version).

> https://janniscodes.github.io/intergroup-contact-needs/Supplemental-Material-A-Annotated-Analysis

For readers interested in the raw files, the raw RMarkdown file is available in our OSF repository (see Kreienkamp et al., 2022b) and can also be accessed as part of the full GitHub repository (Kreienkamp et al., 2022a).

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Supplemental Material F

Ch4 – Power simulation

This supplementary information documents the power simulations we conducted after Study 1. As part of our open supplemental materials, we share the full RMarkdown file, which includes transparent and reproducible analysis code. We rendered the RMarkdown as an interactive HTML report, which we host as part of our open GitHub repository. We recommend the rendered version for almost all readers (full R code is also available via the rendered version).

https://janniscodes.github.io/intergroup-contact-needs/Supplemental-Material-B-Power-Simulation

For readers interested in the raw files, the raw RMarkdown file is available in our OSF repository (see Kreienkamp et al., 2022b) and can also be accessed as part of the full GitHub repository (Kreienkamp et al., 2022a).

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Supplemental Material G

Ch4 – Motives topic modeling

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This supplementary information documents the methodology and results of the BERT topic model we conducted as part of embeddedness analyses. To make all supplemental materials as open as possible, we share the full Python Jupyter Notebook file which offers an annotated version of our all analysis steps. This file offers a transparent and reproducible analysis code, which includes full author commentary. An interactive HTML render of the notebook is part of our open GitHub repository. We recommend the rendered version for almost all readers (full Python code is also available via the rendered version).

> https://janniscodes.github.io/bert-migrant-need-
> content/Supplemental-Material-C-BERT-topic-model-outgroup

For readers interested in the raw files, the raw Jupyter notebook is available in our OSF repository (see Kreienkamp et al., 2022b) and can also be accessed as part of the full GitHub repository (Kreienkamp et al., 2022a). Please note that this analysis used free text responses from our participants. To protect the privacy and confidentiality of our participants, we do not make the raw data openly accessible. If you would like to request access to the raw data, please reach out to the corresponding author.

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Supplemental Material H

Ch4 – Motives coding protocol

As part of our robustness analyses, we developed a coding protocol to assess the goal-directedness of participants' free-text responses regarding their main goal during interactions with outgroup members. The coding captures two dimensions: practical needs and underlying psychological needs. Two independent coders coded each response, and the dimensions were assessed separately to ensure the validity and reliability of the coding process. The full coding protocol of available as part of our OSF repository (Kreienkamp et al., 2022b):

https://osf.io/tye9s?view_only=c2d3bbf861ac485f95d218 45d6e6df27

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Supplemental Material I

Ch5 – R Tutorial

This supplementary information documents our tutorial-style illustration website. As part of our open supplemental materials, we share the full illustration as an interactive tutorial-style website. This file offers transparent and reproducible analysis code, which includes full author commentary. We rendered the Quarto project as an interactive HTML website, which we host as part of our open GitHub repository (Kreienkamp et al., 2023d). We recommend the rendered version for almost all readers (full R code is also available via the rendered version).

https://janniscodes.github.io/ts-feature-clustering-illustration/

For readers interested in the raw files, the raw Quarto files are available in our OSF repository (see Kreienkamp et al., 2023c) and can also be accessed as part of the project GitHub repository (Kreienkamp et al., 2023e).

Summary

In our globalizing world, international human migration has become a prevalent feature of many societies (McAuliffe & Khadria, 2020). How this intercultural exchange impacts society and individuals has equally become a core theme of societal and academic debate (de Graaf et al., 2017). One key issue in these debates is that of how individuals change and adapt when they get into continuous first-hand contact with other cultures — the phenomenon of 'psychological acculturation' (Rudmin, 2003). This phenomenon becomes especially crucial when we consider the adaptation experiences of migrants, who often hold the biggest potential for the receiving society but also occupy some of its most vulnerable positions (Portes & Rumbaut, 2014; Silove et al., 2017). Importantly, despite extensive research, there is still a notable lack of understanding regarding the psychological mechanisms and developmental paths involved in the psychological acculturation of migrants.

In this dissertation, I address this gap by focusing on three key research questions: Firstly, what do we conceptually mean by psychological acculturation? I seek to clarify the concept of psychological acculturation, aiming to develop a comprehensive framework for understanding it. Secondly, what are the psychological mechanisms underlying intercultural contact and acculturation? Based on the conceptual framework, I propose situational need fulfillment as a new theoretical mechanism at play during real-world intercultural interactions. And thirdly, how do these psychological mechanisms of acculturation and intergroup contact unfold over time and vary among different individuals? To capture key developments in real-world psychological data, I introduce a new method for capturing shared differences in how complex psychological mechanisms unfold over time.

To build a bottom-up and embedded understanding of what we conceptually mean with psychological acculturation, **Chapter 2** sets out to explore refugees' and migrants' experiences from a bottom-up perspective. A qualitative focus group discussion forms the basis of this exploration, delving into the multifaceted aspects of adapting to a new cultural context. This approach facilitates an immersion into the diverse stories and narratives of the participants, uncovering common psychological experiences. A key outcome of this analysis is the identification of a psychological structure characterized by affect, behavior, cognition, and desire — the ABCD of acculturation. Psychological acculturation might, for example, be understood in terms of behavioral acculturation, such as language use, or voting; cognitive acculturation, such as ethnic identification, or cultural values endorsement; affective acculturation, such as feeling at home, or loneliness; motivational acculturation, such as the satisfaction of competence or independence needs; or as a combination of any or all of these aspects. This structure not only encapsulates the different facets of migration experiences but also aligns with the varying challenges migrants face, ranging from external societal expectations to internal cultural conflicts.

Building on this foundational understanding, I then aim to develop a formal conceptual framework in **Chapter 3**. This endeavor involves integrating the ABCD structure within the existing body of literature and crafting a process model that situates psychological acculturation within a broader cultural contact context. In particular, I relate the ABCD structure in acculturation to culture, cultural contacts, and psychological adaptation — which are essential to the idea and definition of psychological acculturation. I then apply the broader framework in a systematic review of theoretical, psychometric, and applied empirical literature on psychological acculturation to test the applicability of the framework. The findings resonate with the initial focus group discussions, highlighting a discrepancy between rich, multidimensional theoretical conceptualizations and less complex empirical practices that often overlook internal aspects like affect and desire. The ABCD framework proves effective in structuring and comparing diverse conceptualizations, identifying gaps, and offering a refined perspective on psychological acculturation.

With a clearer conceptual framework at hand, in **Chapter 4** I then move on to the call for theoretical advancement in migration research. I particularly, propose that situational need fulfillment during intergroup contact offers a flexible psychological explanation for when and why intergroup contacts become positive and lead to better intergroup relations. Through three experience sampling studies, this chapter examines how the fulfillment of situational needs during intergroup interactions influences perceptions, attitudes, and well-being. The findings show that need fulfillment offers a stable and impactful mechanism for understanding intergroup contact. These findings challenge the more rigid existing paradigms of optimal contact conditions and demonstrate the importance of dynamic psychological mechanisms in shaping positive migration experiences. This chapter is instrumental in illustrating the dynamic nature of these interactions and the importance of considering situational factors in understanding migrant experiences.

With the conceptual and theoretical frameworks established, I then examine the temporal development of migration experiences in **Chapter 5**. This final empirical chapter seeks to embrace the full complexity of the intensive longitudinal data I collected following the daily experiences of migrants. In particular, I seek to address the question of how we can easily and flexibly identify developmental trajectories in such psychological time series. To deal with the complexity of many participants, variables, time points, I introduce feature-based time series clustering as a novel approach in psychological ESM data. I show that the approach allows users to flexibly pick and choose dynamic markers based on their research questions. By applying the method to the ESM studies of migrant experiences, I show that the method is particularly effective in revealing meaningful patterns in the psychological time series. Two distinct developmental groups of migrants emerge from this analysis — one group with more positive and stable experiences and one group with more challenging migration experiences. The results thus offer significant insights into the varying trajectories of migrant experiences and highlight the fluid nature of migration experiences.

In conclusion, this dissertation offers a comprehensive exploration of the migration experience. It begins with a qualitative understanding of the multi-faceted nature of acculturation, progresses to a formal conceptual framework, investigates the role of motivational needs in intergroup contact, and culminates in a novel methodological approach to understanding the temporal dynamics of migrants' experiences. This journey illuminates the importance of a multidimensional approach to acculturation. Across the chapters, it becomes clear that acculturation encompasses a range of conceptually distinct variables, organized effectively under the ABCD (affect, behavior, cognition, desire) framework. These variables are not only theoretically interlinked, but also exhibit distinct temporal patterns, underscoring the dynamic nature of the acculturation process. This synthesis reveals that acculturation is far from a singular, linear trajectory; it is a multidimensional interplay of psychological and cultural elements that evolve over time. The research highlights the interconnectedness of these dimensions and the importance of considering individual experiences, intergroup interactions, and temporal developments in understanding the migration journey. Jointly, the chapters offer a nuanced understanding of acculturation as a dynamic and complex phenomenon.

The dissertation enhances understanding of migrant acculturation, intergroup contact, motivation theory, and experience sampling method (ESM) data analysis. It emphasizes the role of dynamic motivation in migration and intergroup contact and refines ESM to capture real-time migrant experiences. Practically, it guides organizations in holistic support using the ABCD framework and advises policymakers on nuanced acculturation policies. For migrants, the ABCD framework provides a comprehensive view of acculturation, aiding in articulating their experiences.

Samenvatting

In onze globaliserende wereld is internationale mensenmigratie een belangrijk kenmerk geworden van vele samenlevingen (McAuliffe & Khadria, 2020). Hoe deze interculturele uitwisseling de samenleving en individuen beïnvloedt, is evenzeer een kernthema geworden van maatschappelijke en academische debatten (de Graaf et al., 2017). Een belangrijk vraagstuk in deze debatten is hoe individuen veranderen en zich aanpassen wanneer zij continu direct contact hebben met andere culturen — het fenomeen van 'psychologische acculturatie' (Rudmin, 2003). Dit fenomeen wordt vooral cruciaal als we kijken naar de aanpassingservaringen van migranten, die vaak het grootste potentieel hebben voor de ontvangende samenleving, maar ook enkele van de meest kwetsbare posities innemen (Portes & Rumbaut, 2014; Silove et al., 2017). Belangrijk is dat, ondanks uitgebreid onderzoek, er nog steeds een opmerkelijk gebrek aan begrip is met betrekking tot de psychologische mechanismen en ontwikkelingspaden die betrokken zijn bij de psychologische acculturatie van migranten.

In deze dissertatie richt ik me op dit gat door te focussen op drie kernonderzoeksvragen: Ten eerste, wat bedoelen we conceptueel met psychologische acculturatie? Ik streef ernaar het concept van psychologische acculturatie te verduidelijken, met als doel een uitgebreid kader te ontwikkelen voor het begrijpen ervan. Ten tweede, wat zijn de psychologische mechanismen die ten grondslag liggen aan intercultureel contact en acculturatie? Op basis van het conceptuele kader stel ik situationele behoeftebevrediging voor als een nieuw theoretisch mechanisme dat speelt tijdens interculturele interacties in de echte wereld. En ten derde, hoe ontvouwen deze psychologische mechanismen van acculturatie en intergroepscontact zich in de loop van de tijd en variëren ze tussen verschillende individuen? Om de belangrijkste ontwikkelingen in reële

psychologische gegevens vast te leggen, introduceer ik een nieuwe methode voor het vastleggen van gedeelde verschillen in hoe complexe psychologische mechanismen zich in de loop van de tijd ontvouwen.

Om een bottom-up en ingebed begrip te bouwen van wat we conceptueel bedoelen met psychologische acculturatie, zet **Hoofdstuk 2** in op het verkennen van de ervaringen van vluchtelingen en migranten vanuit een bottom-up perspectief. Een kwalitatieve focusgroepdiscussie vormt de basis van deze verkenning, die zich verdiept in de veelzijdige aspecten van aanpassing aan een nieuwe culturele context. Deze aanpak faciliteert een onderdompeling in de diverse verhalen en narratieven van de deelnemers, waarbij gemeenschappelijke psychologische ervaringen aan het licht komen. Een belangrijke uitkomst van deze analyse is de identificatie van een psychologische structuur gekenmerkt door affect, gedrag, cognitie en verlangen — de ABCD van acculturatie. Psychologische acculturatie met dit onderscheid kan bijvoorbeeld worden begrepen in termen van gedragsacculturatie, zoals taalgebruik of stemmen; cognitieve acculturatie, zoals etnische identificatie of het onderschrijven van culturele waarden; affectieve acculturatie, zoals zich thuis voelen of eenzaamheid; motivationele acculturatie, zoals de bevrediging van competentie- of onafhankelijkheidsbehoeften; of als een combinatie van een of meer van deze aspecten. Deze structuur omvat niet alleen de verschillende facetten van migratie-ervaringen, maar sluit ook aan bij de uiteenlopende uitdagingen waarmee migranten worden geconfronteerd, variërend van externe maatschappelijke verwachtingen tot interne culturele conflicten.

Voortbouwend op dit fundamentele begrip, streef ik vervolgens naar het ontwikkelen van een formeel conceptueel kader in **Hoofdstuk 3**. Deze inspanning omvat het integreren van de ABCD-structuur binnen de bestaande literatuur en het creëren van een procesmodel dat psychologische acculturatie situeert binnen een bredere culturele contactcontext. In het bijzonder, relateer ik de ABCD-structuur in acculturatie aan cultuur, culturele contacten en psychologische aanpassing — die essentieel zijn voor het idee en de definitie van psychologische acculturatie. Vervolgens pas ik het bredere kader toe in een systematische review van theoretische, psychometrische en toegepaste empirische literatuur over psychologische acculturatie om de toepasbaarheid

van het kader te testen. De bevindingen resoneren met de initiële focusgroepdiscussies, waarbij een discrepantie wordt benadrukt tussen rijke, multidimensionale theoretische conceptualisaties en minder complexe empirische praktijken die vaak interne aspecten zoals affect en verlangen over het hoofd zien. Het ABCD-kader blijkt effectief in het structureren en vergelijken van diverse conceptualisaties, het identificeren van lacunes en het bieden van een verfijnd perspectief op psychologische acculturatie.

Met een duidelijker conceptueel kader voorhanden, ga ik in **Hoofdstuk 4** verder met de oproep tot theoretische vooruitgang in migratieonderzoek. Ik stel met name voor dat situationele behoeftebevrediging tijdens intergroepscontact een flexibele psychologische verklaring biedt voor wanneer en waarom intergroepscontacten positief worden en leiden tot betere intergroepsrelaties. Door middel van drie experience sampling studies onderzoekt dit hoofdstuk hoe de vervulling van situationele behoeften tijdens intergroepsinteracties de percepties, attitudes en het welzijn beïnvloedt. De bevindingen tonen aan dat behoeftebevrediging een stabiel en impactvol mechanisme biedt voor het begrijpen van intergroepscontact. Deze bevindingen dagen de meer rigide bestaande paradigma's van optimale contactvoorwaarden uit en demonstreren het belang van dynamische psychologische mechanismen bij het vormgeven van positieve migratie-ervaringen. Dit hoofdstuk is cruciaal in het illustreren van de dynamische aard van deze interacties en het belang van het overwegen van situationele factoren bij het begrijpen van migrantenervaringen.

Met de conceptuele en theoretische kaders vastgesteld, onderzoek ik vervolgens de temporele ontwikkeling van migratie-ervaringen in **Hoofdstuk 5**. Dit laatste empirische hoofdstuk streeft ernaar de volledige complexiteit van de intensieve longitudinale gegevens die ik heb verzameld over de dagelijkse ervaringen van migranten, te omarmen. In het bijzonder, tracht ik de vraag te beantwoorden hoe we op een gemakkelijke en flexibele manier ontwikkelingstrajecten in dergelijke psychologische tijdreeksen kunnen identificeren. Om om te gaan met de complexiteit van veel deelnemers, variabelen, tijdspunten, introduceer ik tijdsreeksclustering op basis van kenmerken als een nieuwe benadering in psychologische ESM-gegevens. Ik laat zien dat de aanpak gebruikers in staat stelt om dynamische markers flexibel te kiezen op basis van

hun onderzoeksvragen. Door de methode toe te passen op de ESM-studies van migratie-ervaringen, toon ik aan dat de methode bijzonder effectief is in het onthullen van betekenisvolle patronen in de psychologische tijdreeksen. Uit deze analyse komen twee duidelijke ontwikkelingsgroepen van migranten naar voren — een groep met meer positieve en stabiele ervaringen en een groep met meer uitdagende migratie-ervaringen. De resultaten bieden dus aanzienlijke inzichten in de uiteenlopende trajecten van migratie-ervaringen en benadrukken de vloeiende aard van migratie-ervaringen.

Samenvattend biedt dit proefschrift een uitgebreide verkenning van de migratie-ervaring. Het begint met een kwalitatief begrip van de veelzijdige aard van acculturatie, gaat verder met een formeel conceptueel kader, onderzoekt de rol van motivationele behoeften in intergroepcontact en mondt uit in een nieuwe methodologische benadering om de tijdelijke dynamiek van de ervaringen van migranten te begrijpen. Deze reis belicht het belang van een multidimensionale benadering van acculturatie. In de hoofdstukken wordt duidelijk dat acculturatie een reeks conceptueel verschillende variabelen omvat, die effectief zijn georganiseerd onder het ABCD (affect, gedrag, cognitie, verlangen) kader. Deze variabelen zijn niet alleen theoretisch onderling verbonden, maar vertonen ook duidelijke tijdelijke patronen, wat de dynamische aard van het acculturatieproces benadrukt. Deze synthese onthult dat acculturatie verre van een enkelvoudig, lineair traject is; het is een multidimensionale interactie van psychologische en culturele elementen die in de loop van de tijd evolueren. Het onderzoek benadrukt de onderlinge verbondenheid van deze dimensies en het belang van het overwegen van individuele ervaringen, intergroepsinteracties en tijdelijke ontwikkelingen bij het begrijpen van de migratiereis. Gezamenlijk bieden de hoofdstukken een genuanceerd begrip van acculturatie als een dynamisch en complex fenomeen.

Samengevat draagt het proefschrift bij aan het theoretische en praktische begrip van migrantenacculturatie, maar ook aan de theoretische domeinen van intergroepcontact en motivatie, evenals aan onze methodologische gereedschapskist voor ESM-data. Het onderzoek benadrukt het belang van motivatie in migratie, waarbij de nadruk ligt op dynamische, situationele behoeften boven statische concepten, en verbetert de methode van ESM om de ervaringen

van migranten in de dagelijkse praktijk beter vast te leggen. Praktisch gezien leiden de bevindingen organisaties in het aannemen van een holistische onder- steuningsbenadering gebaseerd op het ABCD-raamwerk en adviseren ze belei- dsmakers om genuanceerd beleid te ontwikkelen dat rekening houdt met de complexe acculturatieprocessen. Voor migranten biedt het ABCD-kader een breed perspectief op hun acculturatietraject, hetgeen helpt om hun ervaringen beter te verwoorden.

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I have rewritten this section several times, and to the surprise of probably no one, each revision was an exercise of shortening and removing detail. This shortening has affected each and every group of people who have been a part of this journey. It might be amusing to some and horrifying to my supervisors to learn that I had even considered having an (online) supplemental material for this acknowledgment section. In the end, I hope I can convey my general gratitude here and can communicate to each one of you personally how much I appreciate your support and companionship.

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