

Preregistration

# Migration Experience Trajectories: A Three Mode Principle Component Analysis

Jannis Kreienkamp<sup>1</sup>, Kai Epstude<sup>1</sup>, Rei Tendeiro-Monden<sup>2</sup>, Maximilian Agostini<sup>1</sup>, Peter de Jonge<sup>1</sup>, Laura F. Bringmann<sup>1</sup>

<sup>1</sup> University of Groningen, Department of Psychology

<sup>2</sup> Hiroshima University, Graduate School of Advanced Science and Engineering

*12. May 2022*

## Study Information

---

<b>Title</b>	Migration Experience Trajectories: A Three Mode Principle Component Analysis
--------------	--

---

<b>Description</b>	<p>Recent calls for:</p> <ul style="list-style-type: none"><li>- ABCD model (esp., affect and desire)</li><li>- longitudinal data (for both acculturation and intergroup literature)</li><li>- real-life data (for both acculturation and intergroup literature)</li></ul> <p>Recent developments:</p> <p>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., <a href="#">Keil et al., 2020</a>) or using web-based applications (e.g., <a href="#">?</a>)</p>
--------------------	---

- data collection possible (e.g., ContactLogger ([Keil et al., 2020](#)), FormR (?))
- analyses become more accessible ([O'Donnell et al., 2021](#))

Problem: HOWEVER, ...

- unclear how do deal with this more complex data (many variables, persons, and time points)
- many different variables could be important
- how to consider them jointly (e.g., VAR, DSEM, ARIMA, cross-lagged panel analysis for testing model predictions, limited to specified lag and mean stationarity; Trajectory focused: mixed effects model, spline regressions, latent growth curve modeling, limited: often univariate outcome)
- heterogeneity between people, over time, and across variables
- **unclear how to identify core/important developments.** Especially across multiple variables at the same time (i.e., multiple aspects).
- unclear which variables, time scales, and methods are useful in practice

Solution:

- 3MPCA uses the data cube

not merely important for hypothesis generation, but also for identifying and understanding adaptive and maladaptive patterns. Allows us to identify clusters of similar individuals and developments, and whether these clusters differ in key adaptation markers (including, well-being, intergroup anxiety, outgroup trust, or societal participation).

We recently proposed that migration experiences and the resulting psychological changes (i.e., acculturation) can be structured in terms of affect, behavior, cognition, and desire developments (ABCD of acculturation). However, while there have been several calls for intensive longitudinal and real-life data on acculturation, little data has thus far investigated the development of migration experiences and no research has assessed the co-development of all four experience aspects. Yet, understanding how people differ in their migration trajectories, can be crucial in understanding adaptive and maladaptive patterns. Simultaneously clustering the person-, experience aspect-, and time level of migration experiences, using a three mode PCA, may allow to identify clusters of similar developments and whether these clusters differ in key adaptation markers (including, well-being, anxiety, trust, or societal inclusion).

In its most essential interpretation, the intergroup contact hypothesis postulates that frequent and positive contact with an out-group reduces prejudice and increases favorable attitudes towards the other group (??). A key condition for these contact benefits has been that the interaction is perceived as positive — making the interaction quality a crucial mechanism of inter-group contact (e.g., ?). It is widely accepted that equal status, common goals, collaboration, and structural support during the interaction form the optimal conditions for a positive contact (Allport’s Optimal Contact conditions, ?). And indeed a major meta-analytic review showed, that intergroup contact benefits were larger when Allport’s conditions were met. However, the meta-analysis also showed that contact resulted in more positive intergroup relations even when Allport’s conditions were not met (?). It, thus, remains unclear why and how exactly Allport’s conditions work.

We propose that Allport’s optimal contact conditions are effective in creating positive contact because they constitute common psychological needs of the interacting individuals. If this is indeed the case, the impact of fulfilling other fundamental needs should produce similar beneficial contact results. And more importantly, the satisfaction of key situation needs during the interaction should predict the positive contact effects most strongly.

---

## Hypotheses

1. Based on the most general understanding of the contact hypothesis, an increase in frequency and quality of contact should jointly account for changes in more favorable outgroup attitudes.
  - a. Participants with more intergroup interactions should have more favorable outgroup attitudes.
  - b. Outgroup attitudes should be more positive after an intergroup interaction compared to a non-outgroup interaction.
  - c. Participants with more intergroup interactions should have more favorable outgroup attitudes depending on the average interaction quality.
2. 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.

- a. Based on Allport’s optimal contact conditions, outgroup attitudes should be more favorable after intergroup interactions with equal status, common goals, collaboration, and structural support.
  - b. Based on past research on the role of interaction quality, interaction quality should be perceived as more positive after intergroup interactions with equal status, common goals, collaboration, and structural support.
  - c. Taken together, the variance explained in outgroup attitudes by Allport’s optimal contact should to a large extent be explained by interaction quality.
3. Based on our proposal, intergroup interactions with higher situational core need fulfillment should predict more favorable outgroup attitudes due to more positive interaction quality perceptions.
    - a. Outgroup attitudes should be more favorable after intergroup interactions with high key need fulfillment.
    - b. Interaction Quality should be perceived as more positive after intergroup interactions with higher key need fulfillment.
    - c. The variance explained in outgroup attitudes by key need fulfillment should to a large extent be explained by interaction quality.
    - d. The effect of key need fulfillment on outgroup attitudes should be specific to intergroup interactions and not be due to need fulfillment in general. Thus, the effect of key need fulfillment on outgroup attitudes should be stronger for intergroup interact than for non-outgroup interactions (or need fulfillment during a time of no interaction).
    - e. The effect of key need fulfillment on outgroup attitudes should persist even when taking other fundamental psychological needs into account. Thus, the effect of key need fulfillment on outgroup attitudes should remain strong even after controlling for autonomy, competence, and relatedness fulfillment during the interaction (cf., self-determination theory).
  4. Based on our proposal, intergroup interactions with higher situational core need fulfillment should predict outgroup attitudes at least as well as Allport’s conditions.
    - a. The need model (H3a) should predict more variance in outgroup attitudes than the model based on Allport’s conditions (H2a).

- b. The effect of key need fulfillment on outgroup attitudes should persist even when taking Allport's conditions into account. Thus, the effect of key need fulfillment on outgroup attitudes should remain strong even after controlling for equal status, common goals, collaboration, and structural support.

## Design Plan

<b>Study type</b>	<b>Observational Study.</b> Data is collected from study subjects that are not randomly assigned to a treatment. This includes surveys, natural experiments, and regression discontinuity designs.
<b>Blinding</b>	No participant blinding is involved in this study.
<b>Study design</b>	This study used an extensive longitudinal design. Using a daily diary format, for at least 30 days participants received a short survey twice per day (at around 12pm and 7pm). We additionally included a longer pre- and post measurement survey the days before and after the extensive longitudinal data collection.
<b>Randomization</b>	No randomization is involved in this study.

## Sampling Plan

<b>Existing data</b>	<b>Registration following analysis of the data:</b> As of the date of submission, you have accessed and analyzed some of the data relevant to the research plan. This includes preliminary analysis of variables, calculation of descriptive statistics, and observation of data distributions. Please see <a href="https://cos.io/prereg">cos.io/prereg</a> for more information.
<b>Explanation of existing data</b>	The data was collected as part of a larger collaboration on daily intergroup relations. The researchers have had no direct access to the data, as the data was collected using an automated system using the FormR framework (?). The data were then downloaded and stored securely on an encrypted device until the eventual data analysis. None of the researchers have accessed the data thus far.

<b>Data collection procedures</b>	<p>The data was collected in a three step procedure:</p> <ol style="list-style-type: none"> <li>1. Entry Survey: A pre-measurement questionnaire (appr. 25 minutes) including demographic information, and relations to the Dutch majority (payment: 2 Euros).</li> <li>2. Experience Recaps: At least 30 days of short reflection surveys (appr. 3—5 minutes) on intergroup interactions twice a day (payment: 1 Euro per Recap; up to 2 Euros per day).</li> <li>3. Conclusion Survey: On the last day, we conclude with a post-measurement questionnaire (appr. 25 minutes) with some questions on habits and reflections on the study (payment: 2 Euros).</li> </ol> <p>After the initial 30 day duration, participants are offered the possibility to continue participating in the study either with payment if daily diary measures were missed during the initial study phase or without payment after a total of 60 daily diary measurements were completed. After the initial 30-day period, participants receive automated feedback visualizing the development of their own well-being, attitudes, and motive responses as an additional initiative and to give participants access to their own data and to compensate study participation.</p>
<b>Sample size</b>	<p>Our target sample size is a sum of 4,000 daily diary measurements. With 100% completion rate that would be archived with 67 participants (60 daily diary responses each). Given that we expect some incomplete daily diary measurements, we aimed to recruit 80 participants.</p>
<b>Sample size rationale</b>	<p>The targeted sample size depended on a combination of different factors. Different analyses were planned as part of the collaboration and budgeting was a practical constraint. Some analyses were planned based on (1) the pre- to post measurements, (2) the dynamic developments over the daily diary measurements, or (3) the contemporary effects within the daily diary measurements.</p> <p>Power considerations of mixed effects model such as with extensive longitudinal data are difficult to estimate because of the complex covariance structures. Simulation studies based on the first two samples within this project indicated that with well-distributed scales, and small to medium effect sizes, 70-80 participants with at</p>

least seven daily diary measurements and a simple pre–post survey were sufficiently powerful (power = .8, alpha = .05) to answer most of the key research questions of the collaboration.

The ultimate sampling procedure decision was made as a practical balancing of the number of participants and the number of measurements provided by each participants. Given that this study primarily focuses on the contemporaneous effects within the daily diary measurements, power should be high enough.

---

<b>Stopping rule</b>	Participants will be recruited until 80 participants finish the pre-measurement. Invitations to complete additional daily diary measurements will be extended until participants chose to leave the study or at the most until two months (i.e., 64 days) after the initial entry survey (i.e., from the pre measurement survey).
----------------------	---

## Variables

---

<b>Manipulated variables</b>	Not applicable given that the study design is observational.
------------------------------	--

---

<b>Measured variables</b>	<p><b>Key variables:</b></p> <ol style="list-style-type: none"> <li>1. Whether an interaction happened during the past daytime period             <ol style="list-style-type: none"> <li>a. Did you meet a Dutch person this [morning/afternoon]?</li> <li>b. Did you meet a Non-Dutch person [morning/afternoon]?</li> </ol> </li> <li>2. Number of interactions during the past daytime period             <ol style="list-style-type: none"> <li>a. How many interactions with Dutch people did you have this [morning/afternoon]?</li> <li>b. How many interactions with Non-Dutch people did you have this [morning/afternoon]?</li> </ol> </li> <li>3. Key need assessment             <ol style="list-style-type: none"> <li>a. What was your main goal during the interaction with [name interaction partner]?</li> <li>b. During the interaction with [name interaction partner] your goal [free-text entry interaction key need] was fulfilled.</li> </ol> </li> </ol>
---------------------------	--

## PREREGISTRATION: MIGRATION EXPERIENCE TRAJECTORIES

4. Allport's Conditions (equal status, common goal, collaboration, and structural support)
  - a. The interaction with [name interaction partner] was on equal footing (same status)
  - b. [name interaction partner] shared your goal ([free-text entry interaction key need])
  - c. The interaction with [name interaction partner] was cooperative
  - d. The interaction with [name interaction partner] was voluntary
5. Interaction Quality
  - a. Overall, the interaction with [name interaction partner] was: Unpleasant to Pleasant
6. Outgroup Attitudes
  - a. After the interaction, how favorably do you feel towards the Dutch.

### Control variables:

1. Self Determination Theory needs ("During the interaction with [name interaction partner]")
  - a. I was myself.
  - b. I felt competent.
  - c. I shared information about myself.
  - d. [name interaction partner] shared information about themselves.
2. General key need during daytime
  - a. What was your main goal during this [morning/afternoon]?
  - b. During this [morning/afternoon] your goal ([free-text entry daytime key need]) was fulfilled
  - c. How important was your goal ([free-text entry daytime key need]) to you:
3. Student Goals ("Please rate the importance of each goal during the interaction with [name interaction partner]"):
  - a. Social support / social connection goals
  - b. Romantic or sexual relationship goals



- c. Academic goals
- d. Career goals
- e. Financial goals
- f. Health / fitness goals
- g. Leisure / fun goals
- h. Personal improvement / growth goals
- i. Service / helping goals
- j. Spiritual / religious goals

**Additional Analyses:**

1. Generalization from interaction partner to outgroup
  - a. After the interaction, how favorably do you feel towards [name interaction partner].
  - b. The interaction with [name interaction partner] was representative of the Dutch.
2. Alternative interaction quality definition (“Overall, the interaction with [name interaction partner] was . . . ”)
  - a. Unpleasant to Pleasant
  - b. Superficial to Meaningful
  - c. Ineffective to Effective
  - d. Unimportant to Important
3. Potential moderation by the relationship with interaction partner
  - a. How close do you feel to [name interaction partner]?
  - b. How much do you trust [name interaction partner]?
  - c. What is your relationship with [name interaction partner]?
4. Potential moderation by key need characteristics
  - a. [name interaction partner] helped fulfill your goal [free-text entry interaction key need].
  - b. How important was your goal ([free-text interaction key need]) to you?
5. Potential moderation by the interaction characteristics
  - a. How long was the interaction? (in minutes)

- b. What was the main language during the interaction?
- c. The interaction was: With a single other / In a group

*Full variable information is available in the codebook ('Codebook\_AOT-M\_ItemsPerSection.xlsx')*

---

## Indices

1. Mean Allport's conditions. 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 independent factors (?, p. 766). Similar to past studies we thus hope to build a global indicator (e.g., see ?). As with other indices we will ensure that the individual items indeed relate to a common latent construct and are meaningfully combine in an index. If this is not possible we will create sub-indices and/or assess the impact of the conditions separately.
  - a. The interaction with [name interaction partner] was on equal footing (same status)
  - b. [name interaction partner] shared your goal ([free-text entry interaction key need])
  - c. The interaction with [name interaction partner] was cooperative
  - d. The interaction with [name interaction partner] was voluntary
2. Mean belongingness during intergroup contact
  - a. I shared information about myself.
  - b. [name interaction partner] shared information about themselves.
3. Mean alternative interaction quality definition ("Overall, the interaction with [name interaction partner] was ...")
  - a. Unpleasant to Pleasant
  - b. Superficial to Meaningful
  - c. Ineffective to Effective
  - d. Unimportant to Important

## Analysis Plan

---

### Statistical models

We will use a sequential analysis strategy in line with our proposed hypotheses. 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  $t$  ( $t = 1, \dots, T_i$ ; level 1) for individual  $i$  ( $i = 1, \dots, n$ ; level 2). It should be noted that we will follow a hierarchical modeling approach. We follow the common four-step procedure (e.g., ?): (1) Test whether enough variation exists within and between participants to justify a multilevel structure, (2) (sequentially) add key predictors, (3) check whether a random slope explains an adequate amount of variance, and (4) check for autocorrelations and heteroscedasticity. For brevity we will only present the full multilevel regression formulas below.

1. Contact Hypothesis (partially using between participant aggregates to meaningfully include interaction frequency)

- a. Correlation:

$$r_{ContactFreq, Attitude} \neq 0 \quad (1)$$

- b. Regression:

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

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

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

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

- c. Regression:

$$Attitude = ContactFreq \times AverageQual \quad (3)$$

2. Allport's Conditions

- a. Regression:

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

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (4)$$

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

- b. Regression:

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

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (5)$$

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

c. Regression:

$$\text{Level 1: } Attitude_{ti} = \beta_{0i} + \beta_{1i}AllportConditions_{ti} + \beta_{2i}InteractionQuality_{ti} + e_{ti}$$

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (6)$$

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

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

### 3. Key Need fulfillment

a. Regression:

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

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (7)$$

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

b. Regression:

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

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (8)$$

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

c. Regression:

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

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

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (9)$$

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

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

d. Regression:

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

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

$$\beta_{3i}KeyNeedFulfill * InteractionQuality_{ti} + e_{ti}$$

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

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

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

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

(10)

e. Regression:

$$\text{Level 1: } Attitude_{ti} = \beta_{0i} + \beta_{1i}KeyNeedFulfill_{ti} + \beta_{2i}Autonomy_{ti} + \beta_{3i}Competence_{ti} + \beta_{4i}Relatedness_{ti} + e_{ti}$$

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

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

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

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

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

(11)

#### 4. Comparison with Allport's Conditions

a. Model Comparison:

$$AIC_{KeyNeedModel} < AIC_{AllportModel} \quad (12)$$

b. Regression:

$$\text{Level 1: } Attitude_{ti} = \beta_{0i} + \beta_{1i}KeyNeedFulfill_{ti} + \beta_{2i}AllportConditions_{ti} + e_{ti}$$

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i} \quad (13)$$

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

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

All multilevel assumptions are tested as usual including (e.g., for random slopes model with  $j$  within person predictors):

$$\text{Level 1 Variance: } e_{ti} \sim \mathcal{N}(0, \sigma^2) \quad (14)$$

$$\text{Level 2 Variance: } \begin{bmatrix} u_{0i} \\ \vdots \\ u_{ji} \end{bmatrix} \sim \mathcal{N} \left( \begin{bmatrix} 0 \\ \vdots \\ 0 \end{bmatrix}, \begin{bmatrix} \tau_{00}^2 & & \\ \vdots & \ddots & \\ \tau_{j0} & \dots & \tau_{jj}^2 \end{bmatrix} \right) \quad (15)$$

---

#### Transformations

We will mean-center all level-one predictors within participants (i.e., cluster mean centering). This is relevant for any predictor variable during the interaction (e.g., key need fulfillment, interaction quality, ...). We mean-center within-person predictors, to meaningfully distinguish within and between person variances and because we obtain a meaningful intercept when having a random slope model (e.g., ?).

<b>Inference criteria</b>	We will use the standard $p < .05$ criteria for determining whether the correlation and regression coefficients are statistically significant. However, given the large sample size we will place a particular emphasis on effect sizes in our interpretations of the results.
<b>Data exclusion</b>	No checks will be performed to determine eligibility for inclusion besides verification that each subject answered each of the variables of interest for a given analysis. Outliers will generally be included in analyses, however we will use sensitivity analyses to assess the robustness of the results to outliers.
<b>Missing data</b>	Given the (expectedly) large sample size of contemporaneous measurements, we will remove all instances during which a participant did not respond to any of the relevant variables. Given that we are not necessarily interested in individual trajectories in our analyses, we will use all available data (i.e., will not remove entire participants but rather individual incomplete daily diary measurements).
<b>Exploratory analyses (optional)</b>	<p>? proposed in their integrative theory of intergroup contact that “group salience” should moderate the positive effect of intergroup contact on outgroup attitudes. They argue that especially when the outgroup membership is salient, the positive attitudes should generalize from the outgroup individual to the general outgroup. We have data to test this hypothesis within a large intensive longitudinal dataset of daily intergroup interactions. We do this by separately assessing attitudes towards the outgroup interaction partner and the outgroup generally. And by assessing whether perceiving the interaction as representative of the outgroup moderates the positive contact effects.</p> <p>To build confidence in our conclusions about the role of contact quality we calculate an alternative measure of interaction quality that includes perceived pleasantness, meaning, effectiveness, and importance of the interaction.</p> <p>We expect that certain contextual characteristics may be related to the positive effects of high quality outgroup interactions. Therefore, we will look for the effect of key need fulfillment on outgroup attitudes while also including information about the interaction partner (perceived closeness, trust, relationship), the interaction</p>

characteristics (duration, interaction language, group vs. dyadic), as well as characteristics of the key need (importance of the need, fulfillment due to the interaction partner).

## Other

---

<b>Other (Optional)</b>	Not applicable.
-------------------------	-----------------

---

## References

- Keil, T. F., Koschate, M., and Levine, M. (2020). Contact Logger: Measuring everyday intergroup contact experiences in near-time. *Behavior Research Methods*, 52(4):1568–1586.
- O'Donnell, A. W., Friehs, M. T., Bracegirdle, C., Zúñiga, C., Watt, S. E., and Barlow, F. K. (2021). Technological and analytical advancements in intergroup contact research. *Journal of Social Issues*, 77(1):171–196.