**Dynamic patterns of personality states, affects and goal pursuit before and during an exercise
intervention: a series of N-of-1 trials combined with ecological momentary assessments**

Celia Kingsbury^{1,2} & Paquito Bernard^{1,2}

¹Physical activity sciences department, Université du Québec à Montréal, Montréal, QC, Canada

²Research Centre, University Institute of Mental Health in Montreal, Montreal, QC, Canada

Celia Kingsbury <https://orcid.org/0000-0002-1348-8653>

Paquito Bernard <https://orcid.org/0000-0003-2180-9135>

Paquito Bernard served as lead role for formal analysis, methodology and writing-review, editing and contributed equally to conceptualization and writing-original draft. Celia Kingsbury contributed equally to conceptualization, funding acquisition, and writing-original draft as well as served in a supporting role for writing review and editing.

Data, R code and additional online materials are openly available (<https://osf.io/umq35/>). This research received no specific grant from any funding agency. PB is supported by the Université du Québec à Montréal, Institut Universitaire de Santé Mentale de Montréal and by a salary award from the Fonds de recherche du Québec – Santé. Authors have no conflicts of interest to disclose. We gratefully thank J. Presseau who generously shared his assessment tools, and S. Eskamp and E. Fried for their tutorials and shared R codes. We also thank Guillaume Chevance for his revision and suggestions.

Correspondence concerning this article should be addressed to Paquito Bernard, Université du Québec à Montréal, Montréal, Canada, Faculté des sciences, 41 avenue du Président Kennedy, Montréal, Québec, Canada. Email : bernard.paquito@uqam.ca

Dynamic patterns of personality states, affects and goal pursuit before and during an exercise**intervention: a series of N-of-1 trials combined with ecological momentary assessments****Abstract**

Objective: Despite the established association between personality traits and physical activity, prior studies have failed to identify the dynamics between the momentary manifestation of personality traits (states) and cognitive-affective mechanisms in relation to physical activity. Based on the Whole Trait theory, the current study modeled the temporal associations between daily personality states, affects and pursuit of personal goals before and during a physical exercise intervention. **Method:** This series of N-of-1 used an A (10-day)-B (42-day) design paired with ecological momentary assessments in 10 inactive adults. Personality states, affects and pursuit of personal goals (conflict, facilitation) were self-reported three times per day. Physical exercise intervention included two weekly supervised sessions. Idiographic network analyses and generalized additive models were carried out. **Results:** Levels of association between personality states, affects and pursuit of personal goals were modified during intervention. Their respective weight in the networks during the exercise intervention followed an individual pattern. The intervention was associated with a systematic non-linear change in the level of goal facilitation and goal conflict. More individual temporal patterns were observed for personality states and affects levels. **Conclusions:** Findings partially supported the direction of associations between personality states and cognitive-affective constructs postulated in Whole Trait Theory. Our findings suggested that personality states, affects and personal goal pursuit are considered as interconnected and evolving system modifiable by an exercise intervention. They need to be replicated; however, they represent a first step in better understanding the cognitive-affective mechanisms underlying the manifestation of personality states in a behavior change context.

Keywords: Single case experimental study, physical activity, personality states, daily associations, network analysis, experience sampling method

Introduction

Accumulating studies in the health psychology field recognize the associations between personality traits and health behaviors (Ferguson, 2013). Among the existing personality models, the Five Factors Model is one that has been repeatedly associated with physical activity (PA) behaviors (Wilson & Dishman, 2015). This model is an integrative framework that describes regularities in behavior and organizes them into broad personality categories that are composed of the following five dimensions of personality traits (McCrae & Costa, 1987): *Openness*, which describes the regulation of reactions to novelty; *conscientiousness*, which describes the regulation of hardworking behaviors to obtain a long-term goal and ease with to accept the constraints associated with this goal; *extraversion*, which describes individuals' sensibility to 'rewards' regulation system and positive and pleasant emotions and cognition control; *agreeableness*, which describes the regulation of the tone in relations and dialogues with others, and *neuroticism*, which describes individuals' sensibility to perceive a real or symbolic threat, and reactivity to this threat. Each person manifests different levels of these traits, hence representing the variability in individuals' personalities through behavior. These traits influence a variety of important behaviors and life outcomes (Soto & Jackson, 2013).

In terms of PA behaviors, three meta-analyses observed positive PA associations with openness, conscientiousness and extraversion, and a negative association with neuroticism. However, conflicting findings were found for agreeableness trait (Rhodes & Smith, 2006; Sutin et al., 2016; Wilson & Dishman, 2015). PA levels were also found to be associated with longitudinal personality trait trajectories (e.g., lower PA levels are associated with a decline in conscientiousness over time (Stephan et al., 2018)). Inversely, personality traits tend to be associated with PA levels on the long term (e.g., within-person level decrease of PA is longitudinally associated with all personality traits variations (Jokela et al., 2018)). Despite the established relationship between the Five Factors Model personality traits and PA, prior studies have failed to identify the specific psychological mechanisms underlying this phenomenon. In this regard, from a situationist perspective, the Whole Trait Theory (WTT) allows

to understand the interactions between the expression of personality traits from moment to moment and their psychological and behavioral components.

Whole Trait Theory

Fleeson's WTT integrates the Five Factors Model to provide an explanatory account of the manifestation of personality traits through behavior. Specifically, the WTT poses that individuals have unique personality structures that are sensitive to daily situations they encounter. For example, during the course of very few days, people can shift from being extraverted to introverted, at a varying intensity. Shifts in their personality trait's manifestation from moment to moment results in a distribution of the intensity at which they can manifest them. The WTT proposes that cognitive-affective mechanisms (e.g., affects and personal goals) explain the dynamic that underlie the manifestation of individuals' personality variability, in other words, the explanatory part of personality (Fleeson & Jayawickreme, 2015). These mechanisms are part of a system regulated by structural and dynamic elements before producing a behavior. The structural elements are the *inputs*, the *intermediates*, and the *outputs*. *Inputs* represents internal/external events such as to perform a PA session (Matz & Harari, 2020). *Intermediates* are other internal/external events that are significantly modified by the *inputs* such as cognitive-affective processes. *Outputs* are the finality of the system resulting in an increase or decrease on the manifestation of behavior which will respond to the *inputs*. Specifically, the structural elements are activated through dynamic elements which trigger a dynamic flow, hence resulting in the occurrence of a change in the manifestation of personality traits.

The WTT hypothesizes that the change in the manifestation of each personality traits are causing the manifestation of *personality states*. They are defined as "having the same affective, behavioural, and cognitive content as a corresponding trait" (Pytlik Zillig et al., 2002). However, contrary to personality traits, which apply on a monthly or yearly scale, personality states last for few minutes or hours. Sharing many proprieties and consequences with traits is known as isomorphism.

That is, personality states are similar to traits in affective and behavioral content but are manifested in momentary experience (Fleeson & Jayawickreme, 2015).

Personality states' association with affects and personal goals pursuit

Among the different cognitive-affective mechanisms, respective associations between affects, personal goal pursuit and personality states have been previously examined in studies based on the WTT (Heller et al., 2007; Kritzler et al., 2020; Wilt et al., 2017). When trait-state isomorphism (e.g., shared properties between corresponding traits and states) are assessed, it needs to be completed in the participants' natural environment, and measured with ecological momentary assessment (EMA). This assessment method involves repeated sampling of subjects' current behaviors and experiences in real time. The following section reviews the existing evidence on the association between personality states, affects and personal goals.

Affects are defined as any mental state of pleasure or displeasure with some degree of arousal (Russell, 2003). Previous research posits that extraversion and neuroticism are fundamentally affective in nature (McNiel & Fleeson, 2006) and other analyses point to the affective nature of the other traits of the Five Factors Model as well (Kritzler et al., 2020; Wilt et al., 2017). Studies using an experimental method where state extraversion and state neuroticism were manipulated reported that extraversion states were associated with self-reported positive affects, and neuroticism states were associated with self-reported negative affects (McNiel et al., 2010; McNiel & Fleeson, 2006). Furthermore, EMA studies showed that within-person variability in extraversion, agreeableness and openness states was associated with variability in positive affects, whereas within-person variability in neuroticism were strongly associated with variability in both positive and negative affects (Bleidorn & Denissen, 2015; Fleeson et al., 2002; Wilt et al., 2017). In essence, literature supports the shared isomorphism between personality states and positive and negative affects.

Personal goals are represented as future-oriented representations of what individuals strive for in various life domains (Austin & Vancouver, 1996). Specifically, pursuing personal goals implies

affective, cognitive, and behavioral response patterns (Elliot & Friedman, 2007). Studies investigating the relationships between personality states and goals revealed that state extraversion, state conscientiousness and state neuroticism are associated with pursuing specific personal goal (Heller et al., 2007; McCabe & Fleeson, 2016). For example, Heller (2007) showed that participants feeling more extraverted per moment were pursuing a higher number of approach goals, and participants feeling more neurotic per moment were pursuing a higher number of avoidance goals. Similarly, the pursuit of personal goals can predict personality states manifestation. In other words, the manifestation of state extraversion and state conscientiousness serve different purposes (McCabe & Fleeson, 2016).

Regarding state extraversion, another EMA study showed that the relationship between personal goals and positive affects was partially mediated by state extraversion (McCabe & Fleeson, 2012). In sum, scientific evidence reveals that affects and the pursuit of personal goals are psychological constructs that play an important role in the dynamic of personality states.

Personality states and PA

To our knowledge, associations between personality states and PA have been examined in two studies. The first study measured neuroticism, extraversion and conscientiousness states in two independent samples for 24 and 10 consecutive days, respectively. Results showed that intraindividual levels of conscientiousness, extraversion and neuroticism states were associated with PA (Möttus et al., 2017). A second study investigated the effect of spending time in gym on personality states in a large sample. Results demonstrated that going to the gym was associated with all five personality states. Participants had lower level of openness and neuroticism, and higher level of agreeableness, conscientiousness, and extraversion during and after spending time in the gym. Except for Openness, these associations were not modified when the personality states ‘history’ (four hours before) were added in analyses (Matz & Harari, 2020). Despite these findings, research still lacks in taking into account of the temporal dimension and the dynamics patterns of personality states on PA behavior, as well as the potential effect of PA on personality states variability.

Personality states, affects and goals: an interconnected system

As described in the studies previously presented, personality states' association with cognitive-affective mechanisms and PA tends to be studied in silos. However, evidence suggests potential bidirectional associations between personality states, pursuit of personal goals and PA, and that PA is prospectively associated with personality states and affects change at short term. Previous investigations identified a bidirectional association between daily levels of affects and PA behaviors (Kanning & Schoebi, 2016). Repeated PA sessions were also associated with negative affects reduction (Reed & Ones, 2006). Additionally, personal goals pursuit has been associated with PA levels. Penseau's prospective studies showed that the level of daily intergoal conflict and facilitation were negatively and positively associated with self-reported and objectively measured PA, respectively (Penseau et al., 2010, 2013). In sum, personality states, affects and goal pursuit can be considered as interconnected and evolving system modifiable by PA (Heino et al., 2021).

Limits

In light of the existing literature, four limits have been identified: 1) When personality states are studied in regards to affects, pursuit of personal goals or PA, the five states are not systematically included; 2) The potential cognitive-affective mechanisms associated within WTT were systematically studied in silo in relation to the WTT, instead of being integrated together; 3) No previous studies examined the effects of an intervention (*intermediates*) on cognitive-affective outcomes (*input*) and personality states (*output*); 4) All previous associations have been tested at nomothetic level (i.e., within-group, not individuals, see e.g. Chevance et al., 2021).

The current study aimed to examine the temporal dynamic patterns of associations between personality states, affects and pursuit of personal goals before and during an exercise intervention using N-of-1 trials. We adopted an idiographic approach because it helps to understand the heterogeneity of responses to a behavior change intervention (Chevance et al., 2021) and to model individual trajectories of the psychological constructs (Heino et al., 2021; Kwasnicka & Naughton, 2020). The following five

hypotheses were formulated: 1) The five personality states, before and after the intervention, will be significantly associated with affects and goal pursuits before the intervention; 2) The respective within-day associations between personality states, affects and pursuit of personal goals identified during the baseline will be modified by the intervention without common pattern between the participants; 3) The centrality of affects or goals pursuits, considered as ‘input’ in WTT will be more important during the intervention; 4) The valence of affects should be significantly increased by the intervention; 5) Explore the effects of the intervention on personality states and the pursuit of personal goals temporal patterns (exploratory hypothesis).

Method

Participants

The data collection occurred between September and November 2020 in Montreal. Participants were recruited from an add on Facebook. Inclusion criteria were: 1) adults aged from 20 to 65 years old; 2) physically inactive; 3) at ease with reading and understanding French language; 4) living in a 20 km radius of the Université du Quebec à Montréal. The physical inactive status was operationalized as a self-reported weekly PA assessed during a screening interview using the Global PA questionnaire. Inactivity status was determinate with a validated cut-offs of > 600 MET-min/week. Exclusion criteria were: 1) a self-reported diagnosis of severe mental illness or substance use disorder; 2) a sensory disorder; 3) pregnant women; 4) a physical disability; 5) a positive answer to the PA Readiness Questionnaire, which tells if it is necessary to the participant to seek further advice from their doctor or a qualified exercise professional before becoming more physically active (Canadian Society for Exercise Physiology, 2017). This study was approved by the Ethics Committee of Université du Québec à Montréal (certificate number: 4080).

Study design and procedures

A series of N-of-1 trials with A-B design was combined with daily EMA measures and accelerometry to collect data (Bentley et al., 2019). The baseline consisted of a 10-day baseline period.

The intervention period lasted for 42 days and participants were asked to attend to two weekly individual supervised exercise sessions. For the 52 consecutive days, participants were prompted by the app EthicaData three times a day with semi-random time points.

To objectively verify PA levels, the participants wore a wrist-worn accelerometer (GENEActiv), during the 52-day study (Hees et al., 2013). To control the possible intervention effect on level of personal goal conflict and facilitation and personality traits, two questionnaires from initial assessments were repeated at the end of the intervention (i.e. personality traits and pursuit of personal conflicting and facilitating goals). The study design is represented with Table S1, available in supplementary files.

Measures

Baseline evaluations

Assessments were completed with the research assistant through videoconference. Participants complete a sociodemographic, general health, tobacco consumption, alcohol and cannabis consumption (see Additional information on baseline questionnaires section in supplementary files). Such data were collected to characterize the study sample.

Personality traits. Based on the Five Factors Model, the validated 30-item French version of Big-Five Inventory was used to measure personality traits (Plaisant et al., 2010). Participants had to report the degree of approval on 30 auto-descriptive items designed to assess each of the five factors with a Likert scale from 1 “strongly disapprove” to 5 “strongly approve”. The 30-item BFI has been shown to have good psychometric properties with good reliability, retest reliability, and factor structure.

Level of conflict and facilitation between personal goals. An adapted personal project assessment has been used to measure the level of conflict and facilitation between personal goals (Presseau et al., 2010, 2013). Following Presseau’s (2013) method for assessing personal goals, participants were informed about the definition of a personal goal and listed 3 to 8 personal projects they were regularly engaged in. Each participant would evaluate their level of conflict and facilitation

between all personal goals with a scale from 1 “No conflict/facilitation between goals” to 10 “Strong level of conflict/facilitation”. The mean scores indicate a representation of the conflict and facilitation level for each goal. Participants’ personal goals were used for the daily goal pursuit evaluation.

EMA questionnaires

EMA outcomes of interest were: personality states (10 items), affects (3 items), and investment in personal goal pursuit (3 to 8 items). EMA items are presented Table 2 in supplementary files.

Personality states. Different approaches exist to measure personality states, and no consensus exists (Horstmann & Ziegler, 2020). The brief validated scales are the most frequently used method (Kritzler et al., 2020). Personality states were assessed with the validated French version of Ten Item Personality Inventory (Courtois et al., 2020). Participants used a bipolar (“Not at all” – “Strongly”) visual-analog scale starting with “Right now, I feel...” to indicate the extent to which of the 10 statements described their personality during that moment of the day.

Affects. Affects were measured with the three items of the Swedish Core affects Scale using a bipolar visual-analog scale (Västfjäll & Gärling, 2007). They measure valence of affects.

Pursuit of personal goals. Pursuit of personal goals were assessed through an idiographic measure. The listed personal goals during the initial evaluation were included in EMA application. Participants assessed how much time and/or energy they put in pursuing their goals since the last notification using a bipolar visual-analog scale (0 “Not at all” – 100 “Strongly”) (Presseau et al., 2010, 2013). To characterize their daily level of goal conflict and goal facilitation, item scores were weighted based on the baseline mean of conflict/facilitation levels associated with personal goals.

Intervention

The physical exercise intervention was initially planned in the laboratory gym at university, however it was closed due to the COVID-19 pandemic. Thus, individual supervised exercise sessions could be completed either in a park close to the participant’s location or online during rainy days (more details are available in the Sanitary measures section in supplementary files). Participants attended one-

hour individual exercise sessions two times per week for six weeks (a training session is available in Table S3 in supplementary files).

Statistical analyses

Idiographic networks

To examine the idiographic dynamic associations among personality states, affects and pursuit of personal goals, graphical vector autoregressive models were carried out together with network visualization (Epskamp et al., 2018). These idiographic networks allowed to identify the most critical psychological factor(s) and association(s) variations within individuals and phases A/B.

Contemporaneous and temporal networks were obtained for each participant. In the idiographic contemporaneous network, the edges represent associations between the factors, after controlling for all the other symptoms in the previous- and same time point (Borsboom, 2017). The nodes and edges represent the variables and the associations between variables, respectively. In the idiographic temporal network, the edges indicate which factor predicts other factors in the next time point.

Centrality

The network was further analyzed by calculating two types of centrality indices: outstrength, instrength. Outstrength estimates how much information a factor sends directly to other factors (i.e., number of edges departing from the node). Instrength estimates how much information a psychological factor receives directly from other factors (i.e., number of edges arriving at the node) (Epskamp et al., 2018). We conducted a visual analysis of the centrality indices plots to identify the highest centrality indices in the networks during the baseline and during the intervention.

Temporal patterns

Temporal patterns of personality states, affects, and pursuit of personal goal were modelled using generalized additive models (GAMs). The data were aggregated by day and construct. This nonparametric model allows non-linear relationships to be flexibly modelled without specifying the

functional form, with non-normal distribution of variable and with missing data (Chevance et al., 2021).

Sensitivity analyses

In order to control a potential personality trait levels modification, a second measure was performed after the intervention. Pre- and post-intervention BFI scores were presented with radar charts and visually analyzed. Plasticity of personal goals pursuits was also controlled with visual analyses. Furthermore, we conducted a visual analyses and randomization tests with available accelerometer data to verify if participants increased their device-measured PA level (Bulté & Onghena, 2012). The R code and data for this study are available here: <https://osf.io/umq35>.

Results

Participant characteristics

Nine females and one male were recruited. All socio-demographic characteristics from initial assessments are presented in Table 1. They were aged between 24 and 63 years old ($M = 40.8$, $SD = 16.9$). The EMA missing values ranged from 3.2% (participant 480) to 33.1% (participant 481) (see Table S2 in supplementary files for more details). All participants attended all physical exercise sessions, except for participant 329 who missed only one session. Unfortunately, we encountered a battery dysfunction with the GENEActiv accelerometers during the intervention, hence the number of consecutive days measuring exercise data were ranged from 30 (participant 448) to 49 (participant 302). Due to a technical problem, accelerometry data were available for only 9/10 participants. Daily total time spent exercising was ranged between 128 (participant 329) to 245 (participant 378) minutes. All participants' daily physical activity time (min/day) during baseline and the intervention period are available in the Accelerometry data (participant #) section in supplementary files.

The following section presents contemporaneous and temporal networks findings, and centrality indexes results. Shared patterns of associations found in the idiographic contemporaneous networks during the baseline and the intervention are presented below in the following order: personality states'

association with affects, and personality states' association with personal goals. Then, temporal networks and centrality strongest indexes among participants are presented both during the baseline and the intervention, however temporal network analysis could not be conducted for three participants. Furthermore, exhaustive results from one participant are presented. Findings for other participants are available in Additional results (participant #) section in supplementary files.

Contemporaneous associations during the baseline

Personality states and affects

During the baseline, contemporaneous networks showed no associations between state openness and affects, except for three participants where they were positively correlated (participant 302, 477 and 481). No associations were found between state conscientiousness and affects. State extraversion was positively associated with affects in five participants (participant 329, 378, 448, 480 and 481). State agreeableness was positively associated with affects in six participants (participant 302, 329, 378, 448, 480 and 481). Lastly, state neuroticism was negatively associated with affects in six participants (participant 302, 329, 448, 477, 480 and 481).

Personality states and personal goals

During the baseline, contemporaneous networks showed associations between personal goal pursuit and state openness in two participants (participant 329 and 480). State conscientiousness and personal goal pursuit presented various associations among participants: with goal conflict, four showed a negative association (participant 329, 333, 477 and 480), and one a positive association (participant 302). With goal facilitation, one showed a positive association (participant 480) and another one revealed a negative association (participant 333). State extraversion was variously associated with personality goal pursuit: with goal conflict, two demonstrated a positive association (participant 346 and 481) and one a negative association (participant 477). With goal facilitation, two showed a positive association (participant 329 and 480) and another one a negative association (participant 477). State agreeableness was positively associated with goal conflict in one participant

(participant 378), negatively associated with goal conflict in one participant (participant 477), and negatively associated with goal facilitation in one participant (participant 302 and 378). Three participants showed a negative association between state neuroticism and goal facilitation (participant 387, 480 and 481) and three revealed a positive association with goal conflict (participant 378, 477 and 481).

To resume, during the baseline period, personality states extraversion, agreeableness and neuroticism were the most repeatedly associated states with affects during the baseline among the participants. Openness and conscientiousness states were also associated with affects, however in a less important amount among participants. Pursuit of personal goals presented varying associations with personality states, yet recurrent associations were observed among participants: state conscientiousness was negatively associated with goal conflict, and state neuroticism was negatively associated with goal facilitation and positively associated with goal conflict.

Contemporaneous associations during the intervention

Our results showed that the associations between personality states, affects and pursuit of personal goals at the individual level identified in the baseline phase were modified by the intervention, except for participant 448 (e.g., see Network analysis (participant 448) section in supplementary files). All ten participants showed new associations in the network during the intervention, and in eight participants, the associations observed during the baseline were no more significant during the intervention. All personality states showed different associations with personal goals during the intervention among participants. Globally, state conscientiousness and state extraversion's positive association with affects, and state neuroticism's negative association with affects were observed in a greater number of participants during the intervention.

Temporal associations and strong centrality indices

Based on a visual analysis of centrality indices plots, we identified the highest centrality indices during both the baseline and the intervention for each participant and compared them to find common

patterns. First, we identified the variables with the highest outstrength level, which estimates how much information a variable at $t - 1$ sends directly to other variables at time t . Among the seven participants with available data, five participants on seven presented at least one variable that remained strong in the network during the intervention. The other two participants showed completely different temporal networks during the intervention. For example, in participant #329, openness and extraversion states presented the highest outstrength levels during the baseline, whereas during the intervention, it was agreeableness and neuroticism states.

As for the instrength levels, which estimates how much information a variable receives directly from other variables, three participants on seven presented at least one variable that remained strong in the network during the intervention. The four others showed completely different temporal networks during the intervention. For example, in participant #346, agreeableness state and affects presented the highest instrength levels during the baseline, whereas during the intervention, it was neuroticism and openness states.

Based on our visual analysis of temporal networks, cognitive-affective variables at $t-1$ were temporally associated with personality states in only three participants during the intervention : goal conflict was positively associated with agreeableness in participant #302; goal facilitation was positively associated with neuroticism, agreeableness and consciousness, and was negatively associated with extraversion; goal conflict was positively associated with openness, and was negatively associated with neuroticism in participant 346.

Different personality states temporal patterns emerged from participants during the intervention. For four participants (participants 302, 329, 333, 346), extraversion state outstrength levels remained stable in both phases. In other words, the intervention did not vary the degree to which state extraversion tends to funnel the flow of activation across other variables. Also found in four participants (participant 302, 329, 333, 477), agreeableness state instrength levels increased during the intervention, that is agreeableness state increased in the quantity of information it receives directly

from other variables. The instrength levels of neuroticism states also increased in four participants (participant 329, 333, 346, 378) during the intervention. However, the main result observed from our data is that all participants presented different patterns.

Our results show that the intervention ‘triggers’ a modification of the outstrength and the instrength levels of the variables of interest in almost half of the participants. All participant’s analyses and networks are available in the Network analysis (participant #) section in the supplementary file. Below are complete descriptions of a network analysis (participant #333).

Participant 333

Contemporaneous network. During the baseline (see figure 1-A, top left), we found no associations between personality states and affects. Goal facilitation and goal conflict were negatively associated with conscientiousness ($r = -0.23$ and $r = -0.23$, respectively), and goal facilitation was negatively associated with agreeableness ($r = -0.11$). During the intervention (see figure 1-A, top right), three personality states became positively associated with affects: conscientiousness ($r = 0.32$), extraversion ($r = 0.23$) and agreeableness ($r = 0.12$), whereas neuroticism was negatively associated ($r = -0.29$) with affects. The baseline associations between personality states and goals conflict and facilitation were no longer significant.

Instrength (temporal network). Instrength estimates how much information a variable receives directly from other variables. For participant 333 temporal network, at baseline (see figure 2-B), affects was most frequently involved in the shortest lagged indirect connections between other constructs. During the intervention (see figure 2-B), Goal facilitation became the most important variable in the network. Personality states extraversion, conscientiousness and Agreeableness did not vary significantly, however they kept a high level in both phases

Outstrength (temporal network). Outstrength estimates how much information a variable at $t - 1$ sends directly to other variables at time t . For participant 333, at baseline (see figure 2-B), personality state openness and goal facilitation were the strongest variables in the network. During the

intervention (see figure 2-B), the activation properties of goal facilitation decreased and became the less important, contrary to openness which kept the same strength. Goal conflict's level increased and became the second most important variable of the network.

Temporal patterns of affects, personal goal facilitation and goal conflict, and personality states

Detailed results of the GAMs performed for the five personality states, affects and personal goal conflict and goal facilitation for each participant are available in Table 2. There is a significant effect of the exercise intervention on the temporal patterns of personality states. State neuroticism was significantly modified by the intervention in nine participants, with 6 showing a non-linear association. State conscientiousness was significantly modified by the intervention in 8 participants, five showing a non-linear association, two showing a negative association and one showing a positive association. State extraversion and agreeableness were significantly modified by the intervention in both seven participants, with four showing a non-linear association, two showing a negative association and one showing a positive association. Finally, the intervention significantly modified state openness in only five participants, three showing a non-linear association, one showing a negative association and one showing a positive association. Based on our analyses, goal conflict and goal facilitation were the only two variables that have been significantly modified by the intervention in all participants, presenting mostly non-linear associations.

Sensitivity analyses

Based on visual analysis, BFI, goal conflict and goal facilitation pre- and post-intervention scores were relatively similar among participants, except for participant 333. All figures are available in supplementary files (see Figure S1 and Figure S2). A visual analyses of figures suggested that among 7/9 of participants with available accelerometer data, they increased their device-measured PA level. However, randomization tests suggested that a significant increase of physical activity level was only observed for participant 333 ($p = 0.04$).

Discussion

Main findings

The aim of the present study was to examine the temporal dynamic patterns of associations between personality states, affects and pursuit of personal goals before and during an exercise intervention using N-of-1 trials. Whereas previous studies examined our outcomes of interest in silo, this study expands upon the current literature by using a network analysis approach to merge the dynamic relations between the variables of interest, within single individuals. Our data support that personality states, affects and personal goal pursuit are considered as interconnected and evolving system modifiable by an exercise intervention. Our level of analysis helps to better understand how personality states in relation to cognitive-affective variables are linked with PA change.

Shared isomorphism between personality states, affects and personal goals

We partially validated our first hypothesis, which was that the five personality states would be significantly associated with affects and personal goal pursuits during the baseline period. First, our findings showed that the five personality states were associated with affects and personal goal pursuits before the intervention, however important variations (i.e., level and directions of associations) between participants were observed. Our results are not as similar with previous EMA studies, where all five personality states showed a within-person association with affects (Kritzler et al., 2020; Wilson et al., 2017). In our case, the most noteworthy result was the consistent strong positive association between both state extraversion and agreeableness and affects, and the negative association between state neuroticism and affects in both five and seven participants, respectively, which have been reflected in previous researches (McNiel et al., 2010; McNiel & Fleeson, 2006; Wilt et al., 2017).

It reveals the affective nature of personality states, that is when participants were feeling more extraverted and agreeable, their affects were more positive, and inversely, when they were feeling more neurotic, they reported their affects to be more negative. Interestingly, three participants showed no associations between personality states and affects during the baseline period, however it changed

during the intervention. This may be due to differential affective response to PA partially explained by initial physical fitness level (Ekkekakis et al., 2011).

Regarding personal goals, our results revealed recurrent associations with two personality states among participants: state conscientiousness was negatively associated with goal conflict, and state neuroticism was negatively associated with goal facilitation and positively associated with goal conflict. In other words, when participants reported a higher level of goal conflict, they reported lower level of state conscientious. Inversely, when they were feeling more neurotic, they reported lower levels of goal facilitation and higher levels of goal conflict. This is coherent with the proprieties associated with state conscientious and neuroticism reported in previous EMA investigations (Heller et al., 2007; McCabe & Fleeson, 2016). Indeed, conscientious state is associated with goal achievement and neuroticism is associated with individuals' sensibility to perceive a real or symbolic threat, and reactivity to this threat that could be translated with perception of threat in achieving personal goals.

However, these studies also found associations between personal goals and extraversion states (Heller et al., 2007; McCabe & Fleeson, 2016). The discrepancy between their results and ours could be explained by the longer period of data collection and the nature of the idiographic analyses used in the present study, which allowed the detection of person-specific associations that might not appear at the group level. One participant showed no associations between personality states and the pursuit of personal goals, which remained the same during the intervention. This may also be due to the level of difficulty of choosing personal goals by participants.

Changes in personality states, affects and pursuit of personal goals associations

Our second hypothesis postulated that the respective associations between personality states, affects and pursuit of personal goals identified during the baseline would be modified by the intervention, without common pattern between the participants. We partially validated our hypothesis. Indeed, contemporaneous networks were modified during the intervention phase for all participants except one (participant 448). In our case, state conscientiousness and state extraversion's positive

association with affects, and state neuroticism's negative association with affects were observed in a greater number of participants during the intervention. The networks change may be partially explained the effects of physical exercise on personality stated. Indeed, a previous investigation showing that time spent in a gym was associated with a modification of personality states at short term (Matz & Harari, 2020). This result could be the first demonstration of an exercise intervention effects on the dynamic of modeled associations.

Our third hypothesis postulated that the exposition to the same input (i.e., exercise intervention) among participants would increase the centrality of affects or personal goals pursuits in temporal networks. As described in the WTT, external events activate affects and personal goals pursue which would in turn generate a change in the manifestation of the personality states, in other words, a change in the personality states in response to the initial external event. However, our results showed that none of these two constructs had a dominant centrality index in the networks during the intervention. In other words, the weight (instrength and outstrength) of each variable in the networks have increased or decreased differently among participants during the intervention. Our results partially support the WTT because personality states could drive affects and personal goals in some participants, instead of both affects and personal goals driving personality states. In a more practical purpose, the elements that gained centrality during the intervention should be considered as 'drivers' of individual networks. Hence, knowing the strongest 'drivers' in a network could help to develop future personalized behavior change intervention.

Affects during the intervention

Our forth hypothesis proposed that the valence of affects would significantly increase due to the intervention. Our results showed the intervention did not increase positive affects. In fact, the exercise intervention modified affects in six participants: four presented a negative linear association, and two showed a non-linear association, which reflects incoherence with previous literature (Williams & Evans, 2014). A strong body of research supports the improvement of affective valence during and

after an exercise intervention (Kanning & Schoebi, 2016; Powell et al., 2009; Schwerdtfeger A et al., 2010). More specifically, in both Powell (2009) and Schwerdtfeger (2010)'s studies, higher exercise levels predicted high positive affective states. Our results did not corroborate these findings and go beyond by supporting the opposite idea. Indeed, our GAMs showed a no significant effect in four participants, and a non-linear association for two.

Effects of the intervention on personality states and pursuit of personal goals temporal patterns

Regarding our fifth hypothesis, our data enable us to explore the effects of the intervention on personality states, affects and pursuit of personal goals temporal patterns. Goal conflict and goal facilitation were the most frequent modified variables by the intervention: seven participants showed a non-linear association, two showed a negative linear association and one a positive linear association. Kwasnicka et al. (2020) suggested that when non-active adults follow an exercise intervention, the amount of time they invest in both facilitating goals and conflicting goals may occur with individual patterns. Our results also suggested that the intervention was associated with a change in state neuroticism, state conscientiousness, state extraversion and state agreeableness level. However, the linearity of the association varied among participants. The effects of our intervention on personality states with no-linear patterns may also be considered as potential mechanism explaining the previous longitudinal association found between high level of PA on personality traits trajectories at long term (Stephan et al., 2014).

More generally, exercise seems to give rise to individual variations of specific cognitive-affective variables among participants. Nonetheless, the recurrence of the non-linear patterns is a major finding in the comprehension of the temporal interaction between personality states, affects and personal goals during an exercise intervention.

These findings contribute to a granular understanding of the mechanisms underlying the effect of an exercise intervention. Traditional approaches often imply that the change and the reactions to change are linear, hence omitting to look at the complexity of change mechanisms (Heino et al., 2021).

To our knowledge, this is the first attempt to test the WTT hypotheses using an integrative and dynamic approach (Ruissen et al., 2021). Specifically, this study is the first to examine the temporal dynamic patterns of personality states, affects and pursuit of personal goals before and during an exercise intervention using N-of-1 design. We combined EMA with an idiographic approach which allowed us to measure personal goal pursuit's variations, as recommended in previous literature (Ruissen et al., 2021). It leads to novel insights about the dynamics between cognitive-affective variables and personality states before and during an exercise intervention.

This study has several strengths. First, all participants had a notable adherence rate to the intervention and EMA. Our methodology also contributed to modelize the connectedness between variables before and during an intervention and helps to comprehend how much of the network differ from one person to another. Additionally, the combination of our network analyses and GAMs provides a complete portrait of the evolution of associations, weights and temporal dynamics. Indeed, network alone cannot take account of temporal variation, therefore it gives the opportunity to grasp the complexity of these intraindividual networks. Finally, levels of goal conflict and goal facilitation were relatively similar pre- and post-intervention, thus our idiographic measures were reliable during the study.

Limitations

Our study presents some limitations. First, temporal models for three participants could not be generated with our statistical approach. Second, we did not measure the level of arousal to characterize affects (Russell, 2003). Third, a battery dysfunction occurred with the GENEActiv accelerometers during the intervention, hence the number of consecutive days of collected exercise level data varies among participants. Fourth, participants' PA levels were relatively high during the baseline phase. This may be explained as a reaction effect to physical activity assessments (Wilding et al., 2016). Finally, we performed separate GAMs for each variable because, as expected, the distribution of our dependent

variables (i.e., personality state) were not normal. Thus, it exhibits a high risk for type 1-error for these results.

Conclusion

Taken together, these findings suggest consistent evidence for the dynamics between personality states, affects and pursuit of personal goals to be varying differently in nodes and in strength among individuals during a physical exercise intervention. Although our results did not support that affects and personal goals systematically drive personality states, they indicate the physical exercise could modify the intraindividual levels of goal conflict and goal facilitation in non-linear manner. These results need to be replicated and confirmed, however they represent a first step in better understanding the cognitive-affective mechanisms underlying the manifestation of personality states in a behavior change context. Future studies could use a protocol similar to ours in order to test the dynamics between cognitive-affective mechanisms in relation to health behaviors other than PA such as diets and tobacco smoking. The specificity for each health behavior could be explored and would contribute to develop targeted interventions.

Bibliography

- Austin, J. T., & Vancouver, J. B. (1996). Goal constructs in psychology : Structure, process, and content. *Psychological Bulletin*, 120(3), 338-375. <https://doi.org/10.1037/0033-2909.120.3.338>
- Bentley, K. H., Kleiman, E. M., Elliott, G., Huffman, J. C., & Nock, M. K. (2019). Real-time monitoring technology in single-case experimental design research : Opportunities and challenges. *Behaviour Research and Therapy*, 117, 87-96.
<https://doi.org/10.1016/j.brat.2018.11.017>
- Bleidorn, W., & Denissen, J. J. A. (2015). Virtues in action – the new look of character traits. *British Journal of Psychology*, 106(4), 700-723. <https://doi.org/10.1111/bjop.12117>
- Borsboom, D. (2017). A network theory of mental disorders. *World Psychiatry*, 16(1), 5-13.
<https://doi.org/10.1002/wps.20375>
- Bulté, I., & Onghena, P. (2012). When the Truth Hits You Between the Eyes. *Methodology*, 8(3), 104-114. <https://doi.org/10.1027/1614-2241/a000042>
- Canadian Society for Exercise Physiology. (2017). *Directives en matière de mouvement sur 24 heures*. scpe.ca/directives
- Chevance, G., Perski, O., & Hekler, E. B. (2021). Innovative methods for observing and changing complex health behaviors : Four propositions. *Translational Behavioral Medicine*, 11(2), 676-685. <https://doi.org/10.1093/tbm/ibaa026>
- Courtois, R., Petot, J.-M., Plaisant, O., Allibe, B., Lignier, B., Réveillère, C., Lecocq, G., & John, O. (2020). [Validation of the French version of the 10-item Big Five Inventory]. *L'Encephale*, 46(6), 455-462. <https://doi.org/10.1016/j.encep.2020.02.006>
- Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities : Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine (Auckland, N.Z.)*, 41(8), 641-671.
<https://doi.org/10.2165/11590680-000000000-00000>
- Elliot, A. J., & Friedman, R. (2007). Approach-avoidance : A central characteristic of personal goals. In *Personal project pursuit : Goals, action, and human flourishing* (p. 97-118). Lawrence Erlbaum Associates Publishers.

- Epskamp, S., Borsboom, D., & Fried, E. I. (2018). Estimating psychological networks and their accuracy : A tutorial paper. *Behavior Research Methods*, 50(1), 195-212.
<https://doi.org/10.3758/s13428-017-0862-1>
- Ferguson, E. (2013). Personality is of central concern to understand health : Towards a theoretical model for health psychology. *Health Psychology Review*, 7(sup1), S32-S70.
<https://doi.org/10.1080/17437199.2010.547985>
- Fleeson, W., & Jayawickreme, E. (2015). Whole Trait Theory. *Journal of Research in Personality*, 56, 82-92. <https://doi.org/10.1016/j.jrp.2014.10.009>
- Fleeson, W., Malanos, A. B., & Achille, N. M. (2002). An intraindividual process approach to the relationship between extraversion and positive affect : Is acting extraverted as. *Journal of Personality and Social Psychology*, 83(6), 1409. <https://doi.org/10.1037/0022-3514.83.6.1409>
- Hees, V. T. van, Gorzelniak, L., León, E. C. D., Eder, M., Pias, M., Taherian, S., Ekelund, U., Renström, F., Franks, P. W., Horsch, A., & Brage, S. (2013). Separating Movement and Gravity Components in an Acceleration Signal and Implications for the Assessment of Human Daily Physical Activity. *PLOS ONE*, 8(4), e61691. <https://doi.org/10.1371/journal.pone.0061691>
- Heino, M. T. J., Knittle, K., Noone, C., Hasselman, F., & Hankonen, N. (2021). Studying Behaviour Change Mechanisms under Complexity. *Behavioral Sciences*, 11(5), 77.
<https://doi.org/10.3390/bs11050077>
- Heller, D., Komar, J., & Lee, W. B. (2007). The Dynamics of Personality States, Goals, and Well-Being. *Personality and Social Psychology Bulletin*, 33(6), 898-910.
<https://doi.org/10.1177/0146167207301010>
- Horstmann, K. T., & Ziegler, M. (2020). Assessing Personality States : What to Consider when Constructing Personality State Measures. *European Journal of Personality*, 34(6), 1037-1059.
<https://doi.org/10.1002/per.2266>
- Jokela, M., Airaksinen, J., Kivimäki, M., & Hakulinen, C. (2018). Is Within-Individual Variation in Personality Traits Associated with Changes in Health Behaviours? Analysis of Seven Longitudinal Cohort Studies. *European Journal of Personality*, 32(6), 642-652.
<https://doi.org/10.1002/per.2173>

- Kanning, M. K., & Schoebi, D. (2016). Momentary Affective States Are Associated with Momentary Volume, Prospective Trends, and Fluctuation of Daily Physical Activity. *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.00744>
- Kritzler, S., Krasko, J., & Luhmann, M. (2020). Inside the happy personality : Personality states, situation experience, and state affect mediate the relation between personality and affect. *Journal of Research in Personality*, 85, 103929. <https://doi.org/10.1016/j.jrp.2020.103929>
- Kwasnicka, D., & Naughton, F. (2020). N-of-1 methods : A practical guide to exploring trajectories of behaviour change and designing precision behaviour change interventions. *Psychology of Sport and Exercise*, 47, 101570. <https://doi.org/10.1016/j.psychsport.2019.101570>
- Matz, S. C., & Harari, G. M. (2020). Personality–place transactions : Mapping the relationships between Big Five personality traits, states, and daily places. *Journal of Personality and Social Psychology*. <https://doi.org/10.1037/pspp0000297>
- McCabe, K. O., & Fleeson, W. (2012). What Is Extraversion For? Integrating Trait and Motivational Perspectives and Identifying the Purpose of Extraversion. *Psychological Science*, 23(12), 1498-1505. <https://doi.org/10.1177/0956797612444904>
- McCabe, K. O., & Fleeson, W. (2016). Are traits useful? Explaining trait manifestations as tools in the pursuit of goals. *Journal of Personality and Social Psychology*, 110(2), 287. <https://doi.org/10.1037/a0039490>
- McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, 52(1), 81-90. <https://doi.org/10.1037/0022-3514.52.1.81>
- McNiel, J. M., & Fleeson, W. (2006). The causal effects of extraversion on positive affect and neuroticism on negative affect : Manipulating state extraversion and state neuroticism in an experimental approach. *Journal of Research in Personality*, 40(5), 529-550. <https://doi.org/10.1016/j.jrp.2005.05.003>
- McNiel, J. M., Lowman, J. C., & Fleeson, W. (2010). The effect of state extraversion on four types of affect. *European Journal of Personality*, 24(1), 18-35. <https://doi.org/10.1002/per.738>

- Möttus, R., Epskamp, S., & Francis, A. (2017). Within- and between individual variability of personality characteristics and physical exercise. *Journal of Research in Personality*, 69, 139-148. <https://doi.org/10.1016/j.jrp.2016.06.017>
- Plaisant, O., Courtois, R., Réveillère, C., Mendelsohn, G. A., & John, O. P. (2010). Validation par analyse factorielle du Big Five Inventory français (BFI-Fr). Analyse convergente avec le NEO-PI-R. *Annales Médico-psychologiques, revue psychiatrique*, 168(2), 97-106. <https://doi.org/10.1016/j.amp.2009.09.003>
- Powell, R., Allan, J. L., Johnston, D. W., Gao, C., Johnston, M., Kenardy, J., Pollard, B., & Rowley, D. I. (2009). Activity and affect : Repeated within-participant assessment in people after joint replacement surgery. *Rehabilitation Psychology*, 54(1), 83-90. <https://doi.org/10.1037/a0014864>
- Presseau, J., Sniehotta, F. F., Francis, J. J., & Gebhardt, W. A. (2010). With a little help from my goals : Integrating intergoal facilitation with the theory of planned behaviour to predict physical activity. *British Journal of Health Psychology*, 15(4), 905-919. <https://doi.org/10.1348/135910710X494105>
- Presseau, J., Tait, R. I., Johnston, D. W., Francis, J. J., & Sniehotta, F. F. (2013). Goal conflict and goal facilitation as predictors of daily accelerometer-assessed physical activity. *Health Psychology*, 32(12), 1179-1187. <https://doi.org/10.1037/a0029430>
- Pytlík Zillig, L. M., Hemenover, S. H., & Dienstbier, R. A. (2002). What do we assess when we assess a Big 5 trait? A content analysis of the affective, behavioral and cognitive processes represented in the Big 5 personality inventories. *Personality and Social Psychology Bulletin*, 28(6), 847-858. <https://doi.org/10.1177/0146167202289013>
- Reed, J., & Ones, D. S. (2006). The effect of acute aerobic exercise on positive activated affect : A meta-analysis. *Psychology of Sport and Exercise*, 7(5), 477-514. <https://doi.org/10.1016/j.psychsport.2005.11.003>
- Rhodes, R. E., & Smith, N. E. I. (2006). Personality correlates of physical activity : A review and meta-analysis. *British Journal of Sports Medicine*, 40(12), 958-965. <https://doi.org/10.1136/bjism.2006.028860>
- Ruissen, G. R., Zumbo, B., Rhodes, R. E., Puterman, E., & Beauchamp, M. (2021). Analysis of dynamic psychological processes to understand and promote physical activity behaviour using

intensive longitudinal methods : A primer. *Health Psychology Review*, 68.

<https://doi.org/10.1080/17437199.2021.1987953>

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, 110(1), 145-172. <https://doi.org/10.1037/0033-295X.110.1.145>

Schwerdtfeger A, Eberhardt R, Chmitorz A, & Schaller E. (2010). Momentary affect predicts bodily movement in daily life : An ambulatory monitoring study. *Journal of Sport & Exercise Psychology*, 32(5), 674-693. rzh.

Schwerdtfeger, A., Eberhardt, R., Chmitorz, A., & Schaller, E. (2010). Momentary affect predicts bodily movement in daily life : An ambulatory monitoring study. *Journal of Sport & Exercise Psychology*, 32(5), 674-693. <https://doi.org/10.1123/jsep.32.5.674>

Soto, C. J., & Jackson, J. J. (2013). Five-Factor Model of Personality. In C. J. Soto & J. J. Jackson, *Psychology*. Oxford University Press. <https://doi.org/10.1093/obo/9780199828340-0120>

Stephan, Y., Sutin, A. R., Luchetti, M., Bosselut, G., & Terracciano, A. (2018). Physical Activity and Personality Development over Twenty Years : Evidence from Three Longitudinal Samples. *Journal of research in personality*, 73, 173-179. <https://doi.org/10.1016/j.jrp.2018.02.005>

Stephan, Y., Sutin, A. R., & Terracciano, A. (2014). Physical activity and personality development across adulthood and old age : Evidence from two longitudinal studies. *Journal of Research in Personality*, 49, 1-7. <https://doi.org/10.1016/j.jrp.2013.12.003>

Sutin, A. R., Stephan, Y., Luchetti, M., Artese, A., Oshio, A., & Terracciano, A. (2016). The five-factor model of personality and physical inactivity : A meta-analysis of 16 samples. *Journal of Research in Personality*, 63, 22-28. <https://doi.org/10.1016/j.jrp.2016.05.001>

Västfjäll, D., & Gärling, T. (2007). Validation of a Swedish short self-report measure of core affect. *Scandinavian Journal of Psychology*, 48(3), 233-238. <https://doi.org/10.1111/j.1467-9450.2007.00595.x>

Wilding, S., Conner, M., Sandberg, T., Prestwich, A., Lawton, R., Wood, C., Miles, E., Godin, G., & Sheeran, P. (2016). The question-behaviour effect : A theoretical and methodological review and meta-analysis. *European Review of Social Psychology*, 27(1), 196-230. <https://doi.org/10.1080/10463283.2016.1245940>

Williams, D. M., & Evans, D. R. (2014). Current Emotion Research in Health Behavior Science.

Emotion Review, 6(3), 277-287. <https://doi.org/10.1177/1754073914523052>

Wilson, & Dishman, R. K. (2015). Personality and physical activity : A systematic review and meta-analysis. *Personality and Individual Differences*, 72, 230-242.

<https://doi.org/10.1016/j.paid.2014.08.023>

Wilson, Thompson, R. J., & Vazire, S. (2017). Are fluctuations in personality states more than fluctuations in affect? *Journal of Research in Personality*, 69, 110-123.

<https://doi.org/10.1016/j.jrp.2016.06.006>

Wilt, Bleidorn, W., & Revelle, W. (2017). Velocity explains the links between personality states and affect. *Journal of Research in Personality*, 69, 86-95. <https://doi.org/10.1016/j.jrp.2016.06.008>

Table 1

Participants' characteristics at baseline

ID	Age	Sex	Education	Income	Couple	Children	BMI	Health disease	Alcohol use	Cannabis use	SSS
302	26	F	Bachelor's	< 20k\$	No	-	40	-	No	No	5
329	24	F	Bachelor's	40k\$-60k\$	Yes	-	42	Asthma	No	No	7
333	47	F	Bachelor's	60k\$-90k\$	Yes	2	25	Celiac disease	No	No	9
346	54	F	College	40k\$-60k\$	Yes	2	23	-	No	No	7
378	28	F	Bachelor's	< 20k\$	No	-	22	-	Low risk	No	5
477	58	M	College	60k\$-90k\$	Yes	2	46	-	Low risk	No	6
479	63	F	College	60k\$-90k\$	Yes	2	28	-	Low risk	No	6
481	24	F	Bachelor's	< 20k\$	No	-	20	Ecxema, asthma	No	No	6
480	24	F	College	< 20k\$	No	-	19	-	No	Low risk	5
448	60	F	Master	60k\$-90k\$	Yes	2	25	-	No	No	6

Note. ID = Identification, BMI = Body Mass Index, SSS = Subjective social status, F = Female, M = Male

Figure 1*Participant 333 contemporaneous and temporal networks (A) and centrality plots (B)***A**

Phase A-contemporaneous, id333

Phase B-contemporaneous, id333

Phase A-temporal, id333

Phase B-temporal, id333

B

Table 2

Generalized Additive Models for five personality states, affects, and goal conflict and facilitation

ID ¹		O ²	C ³	E ⁴	A ⁵	N ⁶	Aff ⁷	Conf ⁸	Facil ⁹
302	sig ¹⁰	○ ¹¹	○	● ¹²	●	●	●	●	●
	shape	-	-	↘ ¹³	↘	↗ ¹⁴	↘	↗ ¹⁵	↗
329	sig	●	●	●	●	●	●	●	●
	shape	↗	↗	↗	↗	↗	↘	↗	↘
333	sig	●	●	●	●	●	●	●	●
	shape	↗	↗	↗	↗	↘	↘	↗	↗
346	sig	○	○	○	●	●	●	●	●
	shape	-	-	-	↗	↗	↗	↘	↗
378	sig	●	●	●	●	●	●	●	●
	shape	↘	↗	↗	↗	↗	↘	↗	↘
448	sig	●	●	●	●	○	●	●	●
	shape	↗	↗	↗	↘	-	↗	↗	↗
477	sig	○	●	○	○	●	○	●	●
	shape	-	↗	-	-	↘	-	↗	↗
479	sig	○	●	●	○	●	○	●	●
	shape	-	↘	↗	-	↗	-	↘	↗
480	sig	○	●	○	○	●	○	●	●
	shape	-	↗	-	-	↗	-	↗	↗
481	sig	●	●	●	●	●	○	●	●
	shape	↗	↘	↘	↗	↗	-	↗	↗

Note. ¹ID = Identification, ²O = Openness, ³C = Conscientiousness, ⁴E = Extraversion, ⁵A =

Agreeableness, ⁶N = Neuroticism, ⁷Aff = affects, ⁸Conf = Conflicting goals, ⁹Facil = Facilitating goals,

¹⁰sig = significance (p = .05), ¹¹○ = no significant association, ¹²● = significant association, ¹³↘ =

negatively linear, ¹⁴↗ = non-linear, ¹⁵↗ = positively linear.