Personality Dynamics: An Integrated Process-Trait Perspective

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Abstract

Personality dynamics emphasizes intraindividual personality processes and their relationship with traits, representing a research perspective that integrates processes and traits. With advances in research methods, relevant theoretical and empirical research has developed rapidly over the past two decades. Personality dynamics research typically builds upon theories such as Whole Trait Theory and Cognitive-Affective Personality System theory, employing intensive longitudinal data and dynamic modeling methods to investigate intraindividual interactive processes among cognitive, emotional, motivational, and physiological domains, person-situation interaction processes, or the relationship between personality processes and traits. Future researchers can expand existing research in the following aspects: theoretically, by attending to distinguishing between intraindividual and interindividual personality structures, integrating normal and abnormal personality theories, and further discussing temporal effects; in empirical research, by combining multiple measurement methods to enhance measurement validity and intraindividual measurement reliability.

Full Text

Preamble

Personality Dynamics: An Integration of Process and Trait Perspectives

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1. Conceptual Development and Research Significance of Personality Dynamics

Personality dynamics (Kuper et al., 2021) focuses on the short-term fluctuation processes and underlying mechanisms of personality within specific cultural or situational contexts, as well as the integration of intraindividual personality processes and interindividual personality structures (Kuper et al., 2021). In the early 20th century, Allport defined personality as "the dynamic organization within the individual of those psychophysical systems that determine his unique adjustments to his environment" (1937, p. 48). Mischel (1968) further discovered that self-reported personality traits showed low correlations with actual behaviors in daily life, and that individual behavior was highly situation-specific. During the same period, Lewin (1951) demonstrated that understanding behavior required studying its dynamic nature, defining behavior as changes in states over time. Methodologically, to integrate cross-sectional data with temporal information, Cattell and Luborsky (1950) proposed a three-dimensional data cube (comprising subjects, variables, and time) based on traditional factor analysis, thereby incorporating dynamic information about how variables change within individuals over time into their model.

These early ideas about personality dynamics shared a common emphasis on personality changes across different situations and temporal dimensions, focusing on the continuity and variability of states. However, prior to the 21st century, personality psychology research primarily focused on universal structures of interindividual differences, adopting a trait-based perspective (Five-Factor Model; McCrae & Costa, 1997). The intraindividual personality dynamics proposed by Allport and others were not widely empirically validated at the time, mainly because research methods for implementing and analyzing intraindividual repeated measurement data were considered "time-consuming, labor-intensive, and of low practical value" (Baldwin, 1946, pp. 164–165). Nevertheless, these theoretical ideas provided a rich foundation for personality dynamics research.

In the past two decades, with advances in data collection and statistical modeling methods, an increasing number of researchers have emphasized the perspective of personality dynamics, leading to a substantial rise in related studies. Researchers argue that personality dynamics research can effectively supplement trait theory and represents an important direction for advancing contemporary personality research (e.g., Mõttus et al., 2020; Revelle & Wilt, 2020; Rauthmann et al., 2019; Jayawickreme et al., 2021; Rauthmann, 2021a). First, personality dynamics research combines an intraindividual perspective with the traditional interindividual perspective. Trait research typically analyzes cross-sectional data from multiple individuals at a single time point rather than measuring longitudinal personality manifestations across multiple time points (Mõttus et al., 2017). However, interindividual personality structures derived from cross-sectional data cannot be directly used to describe intraindividual personality structures (Molenaar, 2004). For instance, analyses of intraindividual repeated measurement data have revealed substantial heterogeneity in intraindividual

personality structures across individuals, which do not all conform to the interindividual Big Five structure (Hamaker et al., 2005). Moreover, personality dynamics research moves beyond describing interindividual personality traits to focus on theoretical explanations. While personality traits are useful for describing structure, they struggle to explain the formation and functioning mechanisms of personality (John et al., 1988). For example, individuals high in extraversion tend to exhibit social activity, assertiveness, and sensation-seeking in daily life. However, "extraversion" itself represents the covarying component of these related behaviors, motivations, and emotional expressions and is not independent of these manifestations; therefore, it cannot serve as a cause of behavior. If researchers wish to explain personality structure, they must investigate the processes underlying trait formation and functioning (such as the physiological and social-cognitive processes underlying extraversion).

2. Theoretical Framework of Personality Dynamics

Personality dynamics theories focus on theoretical explanations for both interindividual personality variation and intraindividual personality processes (Kuper et al., 2021). Several recurring themes emerge: distinguishing between stable and variable aspects of personality (e.g., Mischel & Shoda, 1995; Fleeson & Jayawickreme, 2015; Rauthmann, 2021b); emphasizing personality as a self-regulating system (e.g., Mischel & Shoda, 1995; Corr, 2008; DeYoung, 2015; Wood et al., 2017); focusing on personality manifestations in specific situations or emphasizing environmental influences (e.g., Rauthmann, 2021b; Fleeson & Jayawickreme, 2015; DeYoung, 2015); and highlighting personality as an organization composed of multiple processes (e.g., Mischel & Shoda, 1995; Fleeson & Jayawickreme, 2015; Sherman et al., 2012).

Based on specific research emphases, personality dynamics theories can be divided into two categories: personality process models and personality integration models. Personality process models focus on the specific processes through which individual personality systems generate behavior across different situations, concentrating on explaining the influencing factors and generation mechanisms of behavior. Representative approaches include explaining behavior through neurophysiological foundations and social-cognitive processes, as well as theoretical perspectives emphasizing person-environment interactions. Process models share a common focus on elaborating the processes of behavior generation and therefore typically do not emphasize the composition or origins of personality traits, nor the relationship between traits and processes. In contrast, personality integration models focus on explaining the origins of personality traits and their functioning mechanisms. These models typically integrate personality process models with personality trait models, examining the relationship between processes and traits, and emphasizing the nature and relationship between stable and unstable components within the personality system. Research questions include: Why do group-level personality traits form? Why do individual-level personality traits form? What personality processes constitute personality traits?

The following sections introduce these two perspectives and their representative theoretical models.

2.1 Personality Process Models

A core issue in personality research is how to explain fluctuations in individual personality across situations. Personality process models elucidate the generation processes of personality manifestations, providing theoretical hypotheses for the mechanisms underlying behavioral fluctuations within individuals across different situations (Baumert et al., 2017). Representative approaches primarily include social-cognitive personality models that explain personality manifestations from perspectives of information processing, goal orientation, self-regulation, and self-organizing systems (Cervone et al., 2001), as well as neurophysiological personality models that emphasize reward-punishment systems, behavioral approach and avoidance, and conditioning (DeYoung & Gray, 2009). Additionally, since personality processes necessarily occur within situations, some researchers have examined how situations and personality systems mutually influence each other to generate behavior. The following sections introduce these representative theories.

(1) Social-Cognitive Personality Models

Social-cognitive personality models have three key features: First, individuals and environments engage in "reciprocal determinism" (Bandura, 1978), jointly constituting a complex system rather than treating environment and individual as two independent variables. Second, they use cognitive and emotional processes in situations as the basic unit of analysis for personality, thus not supporting trait theories that decontextualize personality. Finally, they view personality as a self-organizing system formed by the interaction of multiple fundamental cognitive-emotional processes (Cervone et al., 2001).

Cognitive-Affective Personality System (CAPS) theory (Mischel & Shoda, 1995) represents a prominent social-cognitive personality theory. As shown in Figure 1 [Figure 1: see original paper], CAPS theory posits that personality is a system composed of different cognitive-affective units, including: encoding and construal of situations, expectancies and beliefs, goals and values, affects, and self-regulatory competencies. These units continuously interact as situations change, thereby generating specific behaviors (Mischel & Shoda, 1995). Although specific behaviors show considerable variability, an individual' s behavior in particular situations demonstrates certain stability, manifesting as "if-then" situation-behavior contingencies (Shoda et al., 1994). CAPS theory helps explain why behavior is simultaneously variable and stable, receiving support from several studies. For example, research shows that situational similarity predicts behavioral similarity at both interindividual and intraindividual levels (Sherman et al., 2010), and that individuals' state conscientiousness significantly correlates with task urgency and complexity in current situations, with stable individual differences existing in the degree of correlation between intraindividual

situations and personality states (Minbashian et al., 2010).

[Figure 1: see original paper] CAPS Theoretical Model Diagram (Mischel & Shoda, 1995)

(2) Neurophysiological Personality Models

Compared to social-cognitive models, neurophysiological personality models explore the origins of personality manifestations from more fundamental cognitive-neural processes. These models share the view that two basic neurocognitive processes exist: approach and avoidance. Approach and avoidance processes are reinforced by environmental punishment and reward stimuli, while the personality system reflects individuals' response patterns to stimuli. Among neurophysiological personality models, Reinforcement Sensitivity Theory (RST) has been particularly influential (Corr, 2008; Smillie, 2008). This model proposes that stimuli produce behavior through the mediation of different physiological-behavioral systems, dividing them into three subsystems with distinct neurophysiological bases: the Fight-Flight-Freeze System (FFFS), which responds to negative stimuli and generates avoidance and freezing defensive behaviors when individuals feel fear, and whose activation inhibits the behavioral approach system; the Behavioral Approach System (BAS), which processes positive stimuli and promotes positive emotions when reward stimuli appear or punishment stimuli are removed, correlating with optimism and impulsivity, and whose activation inhibits the FFFS; and the Behavioral Inhibition System (BIS), which conducts risk assessment, enabling individuals to respond more cautiously to goal-conflict situations. This system activates when both FFFS and BAS are simultaneously active and correlates with anxiety and rumination (Corr, 2008). RST posits that these three systems cause behavior, with individual differences in personality arising from different sensitivities of the nervous system to punishment and reward stimuli.

(3) Person-Environment Relations Personality Model

The Person-Environment Relations Model (PERM; Rauthmann, 2021b) treats individuals and environments as two independent variables, focusing on examining different types of interactive relationships between them. The model is shown in Figure 2 [Figure 2: see original paper]. Lewin (1935) proposed early last century that individual behavior is determined by both internal individual factors and external environments. Building on Lewin' s theoretical ideas, Rauthmann and colleagues proposed PERM, which further distinguishes individual and environmental factors into stable traits and fluctuating states, and incorporates a temporal dimension to summarize the types of relationships and interaction mechanisms between individuals and environments. PERM posits that the dependent variable of interest (i.e., behavior) is jointly determined by stable environmental characteristics e (such as social norms), unstable environmental characteristics E (such as situational features), stable intraindivual trait factors p (such as physical appearance), and unstable intraindividual factors P (such as emotional states). Person-environment relationships are represented by

the connections in the model, formed through navigation mechanisms.

Specifically, person-environment relationships can be divided into four categories (Rauthmann, 2021b, pp. 442–484): (1) **Interaction relationships** (such as paths *c*' and *c' '), *representing the interaction between individual and environmental variables. For example, Trait Activation Theory (Tett et al., 2013) proposes that traits are only activated when relevant situational cues appear. (2)* ***Correlational relationships*** *(such as path* d*), representing simultaneous correlations between person and environment variables. For instance, behavioral genetics has found significant correlations between individuals' specific genetic sequences and their environments (Dick et al., 2015). (3)* ***Fit relationships*** *(a special case of interaction and correlational relationships), reflecting the degree of compatibility between individuals and environments. For example, the Person-Environment Fit Model (Vianen, 2018) suggests that optimal behavioral outcomes occur only when individual variables match environmental variables, regardless of each system' s absolute level. (4)* ***Lagged relationships*** *(such as paths* n* and *o*), referring to cross-lagged relationships between individual and environmental factors at different time points, which can be understood as environmental shaping of personality or individuals' ability to shape their environments.

[Figure 2: see original paper] Person-Environment Relations Model Diagram (Rauthmann, 2021b, p. 438)

2.2 Personality Integration Models

Some researchers propose that a complete personality model should include both interindividual personality structure and intraindividual personality processes.

(1) Whole Trait Theory

Whole Trait Theory (WTT; Fleeson & Jayawickreme, 2015) posits that descriptive traits manifest as frequency distributions of personality states. WTT argues that while traditional Big Five personality traits can describe individuals'general personality levels, they fail to capture daily personality manifestations. Therefore, WTT proposes using frequency distributions of repeatedly measured personality states to describe personality. All distribution parameters can describe individual personality (e.g., the peak represents typical personality states, standard deviation represents personality variability, etc.). Compared to traditional trait theory, descriptive traits provide richer information—even when different individuals share the same Big Five trait level, their distributions of personality states in daily life may show different patterns. Explanatory traits specifically refer to the collection of internal cognitive, emotional, physiological, and motivational processes that generate personality manifestations at a given moment. The connotation of explanatory traits directly draws on social-cognitive personality theory (Fleeson, 2017), positing that personality manifestations result from interactions among different social-cognitive processes.

WTT' s innovation lies in integrating descriptive and explanatory traits. The process by which explanatory traits form descriptive traits is called accretion (Fleeson & Jayawickreme, 2015). Accretion emphasizes that personality manifestations are not formed by a single process but by the interactive influence of different cognitive, emotional, physiological, and motivational processes, and that personality manifestations represent not general personality tendencies but personality at a specific moment. Some empirical studies support the theoretical hypothesis that explanatory traits form descriptive traits. For instance, research shows that individuals' current motivational processes can explain 50% of the variance in corresponding personality states (McCabe & Fleeson, 2016), and that individuals' current subjective situational characteristics can systematically and significantly predict current personality states (Zachry et al., 2018).

WTT' s descriptive traits broaden the concept of traditional personality traits, providing a theoretical framework that connects personality processes with personality manifestations. Moreover, the frequency distribution concept is easily understood and operationalized, making it the most widely applied personality dynamics framework to date. One researcher reviewed English empirical studies on intraindividual personality processes from 1994 to 2021 using Academic Search Complete, Business Search Complete, PsychINFO, and PsychARTICLES databases, finding 82 empirical studies on intraindividual personality processes. Among these, most adopted WTT (56.68%) and CAPS (19.23%) as theoretical frameworks (Ness et al., 2021, p. 325). In contrast, empirical research based on other theories remains relatively rare.

[Figure 3: see original paper] Whole Trait Theory Model Diagram (Fleeson & Jayawickreme, 2015)

(2) Knowledge-Appraisal Personality Architecture

Similar to WTT, the Knowledge-Appraisal Personality Architecture (KAPA; Cervone, 2004; Cervone & Little, 2019) also extends social-cognitive personality theory. KAPA argues that traditional social-cognitive personality theories, such as CAPS, suffer from not clearly distinguishing processes from structures. For example, goals and values units in CAPS theory can represent either long-term stable goals or dynamically changing goal appraisal processes (Bandura & Cervone, 1986), making it difficult for applied researchers to operationalize social-cognitive personality variables and leading to criticisms that social-cognitive personality theory neglects stable personality structures (Cervone, 2004).

KAPA' s innovation lies in redividing the personality system, distinguishing stable and unstable variable systems by definition: The stable component of the personality system consists of individuals' mental representations and beliefs about self, others, and the environment, termed knowledge structures—comprising self-schemas and situational beliefs. The dynamic component consists of individuals' appraisals of relationships between themselves and specific situations. The functioning process of the personality system is shown in Figure 4 [Figure 4: see original paper]: The current situation activates knowledge struc-

tures and directly influences situational interpretation; the current situation can also directly activate certain appraisal processes (e.g., social norms in specific situations prompt individuals to act accordingly). Additionally, priming from recent situations on individuals' current cognitive and emotional states affects the retrieval of knowledge structures and appraisal processes.

[Figure 4: see original paper] KAPA Theoretical Model Diagram (Cervone, 2004)

KAPA theory has received some empirical support. For example, Di Blas et al. (2017) measured individual-specific self-knowledge structures and individuals' appraisal processes across different situations based on KAPA theory, finding that individuals' appraisals of self-efficacy were situation-specific and dependent on their knowledge structures. Moreover, not all interindividual personality trait structures (such as the Big Five) influence appraisals in situations; only individual-specific knowledge structures significantly affect individuals'appraisal processes in corresponding situations.

(3) Cybernetic Big Five Theory

Another highly influential meta-theoretical perspective in personality dynamics is cybernetics, which aims to improve and develop system functioning through information transmission and feedback (Wiener, 2019). From this perspective, DeYoung proposed Cybernetic Big Five Theory (CB5T; 2015). CB5T posits that personality reflects universal behavioral regulation and control systems formed through genetic and environmental influences during human evolution. It is an adaptive system with self-regulating functions, designed to help individuals better survive and adapt in threatening and challenging environments while achieving their needs (DeYoung, 2010), with certain neurophysiological foundations (the limbic system and basal ganglia).

To ensure system operation, humans have developed two mechanisms: personality traits and characteristic adaptations. As shown in Figure 5 [Figure 5: see original paper], personality traits represent probabilistic descriptions of stable patterns of emotion, motivation, cognition, and behavior. To cope with different types of stimuli that repeatedly emerged during evolution, humans formed universal response patterns corresponding to different stimuli. CB5T' s personality traits differ in meaning from traditional Big Five traits: whereas Big Five traits represent general behavioral tendencies that are decontextualized, CB5T' s personality traits are situation-specific. Different personality traits respond to different types of stimuli and have corresponding physiological bases—for example, neuroticism represents a defense system responding to threatening stimuli, while openness represents exploration and use of information. Characteristic adaptations are a series of situation-specific goals, interpretations, and strategies stored in individuals' memory, reflecting individual-specific response processes formed due to different specific situations. Personality traits and characteristic adaptations are two independent systems that mutually influence each other. Individuals may exhibit adaptive behaviors that differ from their traits

depending on the situation—for example, introverted individuals may display extraverted states in social situations (Safron & DeYoung, 2021).

[Figure 5: see original paper] Cybernetic Big Five Theory Model Diagram (DeYoung, 2015)

2.3 Other Theoretical Perspectives

In addition to the theoretical perspectives described above, some personality dynamics theories target specific domains (Kuper et al., 2021), such as the PERSonality and SOCial Relationships framework (PERSOC; Back et al., 2011), which emphasizes the bidirectional relationship between personality and social relationships, and Personality Affect Construal Theory (Thapa et al., 2020), which examines how personality generates emotions across different situations. Furthermore, since this article focuses on short-term personality fluctuation processes, it lacks discussion of models related to long-term personality development. This does not imply that personality development is unimportant or unrelated to personality dynamics or trait research. Some researchers argue that only by studying short-term personality dynamics, personality traits, and long-term personality development as an integrated whole can we truly explain fluctuations, structure, and development (Baumert et al., 2017). To date, no theory has comprehensively addressed how to integrate these three types of personality research, though some theories focus on integrating short-term dynamics with long-term development, such as the Life Story Model from a narrative perspective (McAdams & McLean, 2013) and the TESSERA model (Triggering situations, Expectancy, States/State Expressions, and ReActions; Wrzus & Roberts, 2017; Wrzus, 2020). For more introductions to personality dynamics theories, refer to *Handbook of Personality Dynamics and Processes* (Rauthmann, 2021a) and *Measuring and Modeling Persons and Situations* (Wood et al., 2021).

3. Research Methods for Personality Dynamics

As evident from the theoretical perspectives above, personality dynamics research focuses on personality processes and mechanisms. Clearly, single-measurement cross-sectional data cannot meet these requirements; researchers need to repeatedly measure individuals' personality states and situations. Repeated-measurement longitudinal data can be divided into panel data with longer measurement intervals and intensive longitudinal data (Hamaker & Wichers, 2017). Panel data are suitable for studying personality development trends but cannot capture short-term fluctuations in personality variables and interaction processes among variables. In contrast, intensive longitudinal data are characterized by high measurement frequency (ranging from once to multiple times per day) (Walls & Schafer, 2006) and are suitable for exploring intraindividual variable processes. Recent advances in intensive longitudinal data analysis methods have directly contributed to the renaissance of personality dynamics research, enabling researchers to consider personality

processes, personality systems, and situation interactions from an intraindividual perspective. The following sections discuss personality dynamics research methods from three aspects: data collection methods, measurement tools, and data analysis.

3.1 Data Collection Methods

The Experience Sampling Method (ESM), a systematic approach to collecting life experiences (Csikszentmihalyi & Larson, 2014), has been widely applied in personality dynamics research in recent years (Conner et al., 2009; Horstmann & Ziegler, 2020). Data obtained through ESM can model fluctuations in each individual' s states and aggregate individual-level data for interindividual comparisons, making it the most common data collection method in existing personality dynamics research.

Specific sampling methods in ESM can be divided into two categories: interval-contingent sampling and event-contingent sampling (Horstmann, 2021). Interval-contingent sampling involves measuring participants' states at fixed or random time intervals, ranging from once to multiple times per day. Since measurement points are only time-related, the situations participants report from are random, allowing collection of large amounts of personality state data from diverse situations in a short time. However, because measured situations reflect participants' real lives, certain situations may recur frequently with little variation—for example, student participants may report mostly from study-related situations during the study period. This method may therefore fail to capture situations of interest to researchers and is unsuitable for studying personality changes in specific situations. Event-contingent sampling, in contrast, requires participants to report when specific events occur, making it suitable for research targeting particular situations or events, such as asking participants to report their states when social behaviors occur (Geukes et al., 2017).

3.2 Measurement Tools

Short-term personality fluctuations are inseparable from individuals' situations. Based on different measurement targets, relevant measurement tools can be divided into two categories: personality process measurement tools and situation measurement tools.

To study processes, researchers typically measure personality states. Personality states are quantitative indicators describing individuals' external behaviors and internal psychological processes such as cognition, emotion, and motivation at specific time points (Horstmann & Ziegler, 2020). Some studies investigate fluctuations in general personality tendencies in daily life, such as measuring fluctuations in the Big Five (e.g., Fleeson & Law, 2015) or Big Six (e.g., Horstmann et al., 2021) in daily life. Commonly used scales include the Ten-Item Personality Inventory (Gosling et al., 2003) and the Mini International Personality

Item Pool (Donnellan et al., 2006). Researchers typically modify instructions to transform trait measures into state measures (e.g., changing "Please respond based on your general condition" to "Please respond based on the past three hours"), while some studies select items from standardized personality trait scales (e.g., choosing items with high factor loadings; Fleeson, 2001). Additionally, some studies use single psychological processes related to specific personality traits as measurement units, such as self-control processes (Hofmann et al., 2012), negative emotions (Pihet et al., 2017), and motivational processes (Hart & Albarracín, 2009).

Some studies also measure the situations in which states occur. Situations—defined as the environments individuals currently inhabit—play a non-negligible role in explaining and predicting individual states (Fleeson, 2004; Furr & Funder, 2004). Situational information can be divided into three categories (Rauthmann et al., 2015): situational cues (physical features of the environment, such as a chair), situational characteristics (psychological meaning of cues, such as a chair meaning work), and situational categories (types of situations with similar characteristics, such as work-related situations). Among these, situational characteristics—individuals' psychological perceptions of situations—have the strongest predictive power for individual behavior. Measurement tools for situational characteristics have only recently gained attention. Commonly used scales include the DIAMONDS situational characteristics scale (Rauthmann & Sherman, 2016b), which divides situational characteristics into eight dimensions: Duty, Intellect, Adversity, Mating, pOsitivity, Negativity, Deception, and Sociality. Its ultra-brief version contains only one item per dimension (Rauthmann & Sherman, 2016a), making it most commonly used in intensive longitudinal research. Other situational characteristics measures include the Situational Five scale, compiled from German dictionary adjectives (Ziegler et al., 2019); the Situational Six scale, compiled from Hebrew daily language corpora (Oreg et al., 2020); and the CAPTION scale, developed through integrated lexical research methods (Parrigon et al., 2017). Updated measurement methods for situational characteristics enable systematic research on relationships between situational characteristics and personality states in daily life. For example, research shows that situational characteristics significantly correlate with personality states without clear directional influence (Rauthmann et al., 2016); when participants perceive higher "friendliness" characteristics in situations, they exhibit higher extraversion levels (Fleeson, 2007); and personality traits and situational characteristics can independently predict corresponding personality states (Sherman et al., 2015).

3.3 Data Analysis Methods

Intensive longitudinal data on personality processes require different analytical approaches than cross-sectional research, with basic requirements being the ability to model nested data structures and temporal effects. First, intensive longitudinal data contain multiple state measurements from multiple individuals,

forming a two-level structure of intraindividual (state level) and interindividual (trait level). Ignoring this nested structure in analysis may cause severe result bias. Second, due to short measurement intervals, temporal effects between states (such as autoregressive and cross-lagged effects) cannot be ignored and are often the focus of research.

Accordingly, analytical methods suitable for personality process data can be roughly categorized into: (1) Models addressing multilevel data structure: Multilevel Models (MLM; Nezlek, 2008) and Multilevel Structural Equation Models (MSEM; Sadikaj et al., 2021); (2) Models suitable for analyzing variable interactions: Dynamic Structural Equation Models (DSEM; Asparouhov et al., 2018) and Group Iterative Multiple Model Estimation (GIMME; Beltz & Gates, 2017); (3) Methods suitable for multivariate modeling and visualization: Network Analysis (Borgatti et al., 2009); and (4) Models suitable for extracting dynamic features: Dynamic System Models (DSM; Sosnowska et al., 2019, 2020). Note that these categories are not mutually exclusive but rather inclusive and complementary. For example, DSEM and multilevel network models can both handle nested data; besides DSM, network models can also extract dynamic features at both variable and system levels; and network models can be combined with DSEM to examine multivariate interaction relationships. The following sections introduce these four modeling approaches and their extended applications in personality dynamics research.

(1) Multilevel Models (MLM) and Multilevel Structural Equation Models (MSEM)

MLM is the most commonly used analytical method in empirical research, capable of separating interindividual and intraindividual variation and providing more accurate parameter estimates for multilevel data where measurement points are nested within individuals (Nezlek, 2008). A review of 82 English empirical studies on intraindividual personality variation from 1994 to 2021 using Academic Search Complete, Business Search Complete, PsychINFO, and PsychARTICLES databases found that most studies used MLM for analysis (50%) (Ness et al., 2021, p. 340).

A minority of studies have applied MSEM, which combines the advantages of multilevel models and structural equation models. Compared to MLM, MSEM is more flexible, allowing inclusion of measurement models, multiple dependent variables, mediators, or moderators (Hox, 2013). In personality dynamics research, MSEM enables researchers to simultaneously examine correlations among cognition, emotion, behavior, and situations at the intraindividual level, as well as moderating effects of interindividual personality variables (Sadikaj et al., 2021). For example, one study used MSEM to find that individuals' positive and negative emotions moderated the relationship between current task demands and state conscientiousness, and that emotional intelligence predicted this moderating effect (Minbashian et al., 2018). Additionally, MSEM can explore relationships between intraindividual state change processes and interindividual trait differences, such as investigating how the interaction between par-

ents' daily autonomy-supportive parenting and their own daily need satisfaction significantly affects parents' subjective well-being (Neubauer et al., 2022).

(2) Dynamic Structural Equation Models (DSEM) and Group Iterative Multiple Model Estimation (GIMME)

Relatively new methods for modeling interactions among intensive longitudinal variables (such as autoregressive and cross-lagged effects) include DSEM, which models at the group level, and GIMME, which models at the individual level. Compared to traditional multilevel models, these approaches are more flexible and provide more accurate parameter estimates (Zheng et al., 2021).

DSEM is an integrated model combining multilevel models, time series models, structural equation models, and time-varying effect models (Asparouhov et al., 2018). It can model individual-specific variation, intraindividual time series, multivariate relationships, and time-point-specific variation. The full DSEM is expressed as: *Y* {it} = Y*{1,it}* + *Y_{2,i}* + *Y_{3,t}*, with its core being the decomposition of variation in individuals' current states (*Y* {it}*) into three components: individual traits (*Y*{2,i}*), characteristics of the current time point (*Y_{3,t}*), and individual state fluctuations at the current time point (*Y_{1,it}*). When time-point characteristics are absent or not of interest (e.g., the effect of Monday on individuals' stress levels), researchers can omit the *Y _{3,t}* component and use a two-level DSEM model (Zheng et al., 2021), suitable for examining carryover effects of previous states on current states and cross-lagged effects among different states. Empirical studies include Pavani et al. (2017), who used two-level DSEM to explore bidirectional influences between emotions and emotion regulation within individuals. Since the model decomposes variation into interindividual and intraindividual components, it can also examine relationships between intraindividual processes and interindividual traits. For example, research found that variability in the lagged effect of interpersonal stress on emotional reactions significantly correlated with borderline personality disorder (Dixon-Gordon & Laws, 2021).

While DSEM separates intraindividual and interindividual variation and models both levels simultaneously, GIMME adopts a fully idiographic perspective, estimating time series for each individual and then including paths significant in most individual models into a group model. Thus, GIMME is more suitable for research aiming to model individuals specifically. In empirical research, one study using GIMME found that the relationship between intraindividual personality state structure and depression traits was significant in some participants but not in others (Jackson & Beck, 2021).

Since some personality processes in theories involve multivariate interactions —for example, WTT posits that cognitive, emotional, physiological, and motivational processes interactively influence personality trait manifestations—most research requires simultaneous modeling of more than two variables, generating numerous simultaneous and lagged effect coefficients between variable pairs. A common practice is to combine DSEM or GIMME with network analysis, using

visual network models to more clearly observe mutual influence relationships among variables while also enabling network-level feature extraction.

(3) Network Analysis

Networks consist of nodes and edges between them. Nodes can represent personality process variables such as cognition, emotion, and behavior, while edges can represent simultaneous correlations, autoregressive relationships, or cross-lagged relationships among states. Network analysis can reveal system-level features of multivariate networks (such as network density and centrality) and node-level features (such as each node' s relative contribution to the system) (Newman, 2018).

The Graphical Vector Autoregressive Model (GVAR; Epskamp, 2017; Epskamp et al., 2018) combines vector autoregressive models with network models. Multilevel GVAR can simultaneously estimate interactions among multiple variables and separate intraindividual lagged effects (lagged networks), intraindividual simultaneous effects (contemporaneous networks), and interindividual effects (between-person networks). A conceptual diagram of the model is shown in Figure 6 [Figure 6: see original paper]. In empirical research, individualized vector autoregressive graphical models can be constructed for each individual to obtain unique network structures and parameters. For example, Beck and Jackson (2020) used multilevel GVAR to explore the relationship between participants' idiographic personality networks and their stability, finding substantial individual differences in personality systems, manifested as different strengths of contemporaneous and lagged relationships and different core nodes across individuals' networks.

[Figure 6: see original paper] Schematic Diagram of Fixed Effects in Graphical Vector Autoregressive Model

Note: Circles represent network nodes (variables), with P1 to P5 representing different personality process variables of interest. Edges represent relationships between nodes, such as partial correlation coefficients. Edge thickness generally represents connection strength, and color represents positive or negative relationships. Multilevel GVAR can provide individualized lagged and contemporaneous networks for each participant, as well as group-level lagged, contemporaneous, and between-person networks as shown in the figure. Based on this, researchers can further examine node characteristics and network-level features.

Using networks to model personality processes represents not only methodological progress but also theoretical innovation, shifting research focus from variable covariation to relationships between variables. In traditional factor analysis models, personality traits are defined as the covarying component of different cognitive, emotional, and behavioral indicators—that is, latent variables. For example, extraversion is considered the cause of covariation among measured variables like "I like going to parties" and "I like interacting with people." However, this assumption may not be accurate; covariation among measurement indicators may result from direct interactions between variables (Costantini et

al., 2015). That is, personality is a network formed by mutual influences among different cognitive, emotional, and behavioral variables. From this perspective, the correlation between "I like interacting with people" and "I like going to parties"arises from a direct causal relationship: "I like going to parties because I like interacting with people" (Cramer, 2012). Based on this, some researchers argue that network analysis can integrate personality processes and structures, viewing personality as a weakly emergent system formed by multivariate networks, representing new system properties arising from interactions among underlying elements (Baumert et al., 2017).

(4) Dynamic System Models

Dynamic System Modeling (DSM; Fishwick, 2007) views personality as a complex system with self-regulating functions, positing that individuals have a stable equilibrium level. When individuals deviate from this equilibrium due to environmental or internal influences, the personality system self-regulates until equilibrium is restored. Specific applications include the Personality Dynamics Model (PersDyn; Sosnowska et al., 2019, 2020) and the Change as Outcome Model (Danvers et al., 2020).

PersDyn uses differential equation modeling to extract system-level personality parameters. In the model, changes in personality states are predicted by the difference between current personality states and baseline levels, parameters representing individuals' self-regulation capacity, and random components (Sosnowska et al., 2020). Researchers can use PersDyn to extract new dynamic features to describe individuals' personality state systems, such as: baseline personality (the average level of individuals' personality states), personality variability (variation of personality states around the baseline across time and situations), and personality attractor level (the speed at which individuals return to baseline after deviation, representing the self-regulation capacity of the personality system). Similarly, the Change as Outcome Model (Danvers et al., 2020) also centers on self-regulation and equilibrium in personality states. Unlike PersDyn, this model uses a linear regression framework, treating current state levels as independent variables and the difference between next-timepoint and current state levels as dependent variables, making it more easily understood. Empirical research by Danvers et al. (2020) using this model on Big Five state data found substantial heterogeneity in individuals' personality systems, with a small number of individuals having two or three equilibrium levels, manifesting in daily life as consistently showing different personality states across different situations. Thus, compared to traditional personality trait theory, constructing personality as a complex system can reveal more novel information.

However, constructing personality systems through complex systems theory also has clear limitations. Since it is still in early development, the theoretical meaning of new parameters such as attractors and equilibrium levels remains unclear and requires further empirical validation. Moreover, modeling approaches are relatively complex and cannot yet construct multidimensional models for multiple variables simultaneously. Existing research has only implemented separate

models for each personality trait, failing to reflect interactions among different personality dimensions within individuals, and resulting findings often lack generalizability.

(5) Summary of Data Analysis Methods

The multilevel models, dynamic structural equation models, network analysis, and dynamic system models introduced above can all be used to study personality dynamics. Since most of these models are cutting-edge methods, researchers can refer to Zheng et al. (2021) for a review of intensive longitudinal data models and the book *Intensive Longitudinal Methods* (Bolger & Laurenceau, 2013) for further learning. Additionally, since selecting appropriate models can be challenging for many researchers, we propose a basic selection flowchart (Figure 7 [Figure 7: see original paper]). Researchers can make decisions based on specific research questions. For example, since WTT posits that various personality processes interactively influence personality manifestations, researchers can construct network models of psychological processes such as cognition, emotion, and motivation, and extract dynamic system features of networks to explore their relationships with descriptive personality traits. Alternatively, researchers can use DSEM to construct dynamic models of individual and environmental variables based on PERM' s hypotheses about person-environment relationship mechanisms. It is important to note that previous empirical research has mostly used MLM and MSEM to model personality process variables. Although these can separate intraindividual and interindividual effects, they are essentially static models that do not consider temporal dependencies (i.e., that past states influence future states) and cannot model the mechanistic explanations and dynamic relationships posited by personality dynamics theories. Therefore, future research should adopt dynamic models whenever possible.

[Figure 7: see original paper] Model Selection Flowchart

4. Current Status of Applied Research Abroad

Applied research on personality dynamics primarily concentrates in industrial/organizational psychology and clinical psychology (Kuper et al., 2021; Sosnowska et al., 2021), covering topics such as whether personality exhibits variability, whether personality variability has predictive validity, factors influencing personality variability, and personality interventions.

In industrial/organizational psychology, numerous studies examine personality factors that predict job performance. Research shows that personality states, variability in personality states, and interindividual differences in personality state variability can all influence various work behaviors and performance. For example, conscientiousness states significantly positively predict individuals' job performance and organizational citizenship behavior (Debusscher et al., 2016, 2017), while conscientiousness variability significantly positively predicts counterproductive work behavior (Vossen & Hofmans, 2021). Additionally, research based on CAPS theory found that interindividual differences in personality state-

situation relationships significantly predict task performance beyond traditional personality traits (Minbashian et al., 2010). Researchers have also explored factors influencing personality fluctuations in work contexts, including situational and interpersonal factors. For instance, work stress (Hofmans et al., 2015) and interpersonal conflict (Judge et al., 2014) can significantly affect personality state variability. Dóci et al. (2021) constructed intraindividual dyadic models and found that fluctuations in leaders' core self-evaluations synchronized with fluctuations in employees' core self-evaluations.

In clinical psychology, personality dynamics thinking is mainly applied in personality disorder and intervention research. Intraindividual variability patterns are crucial in describing personality disorders—for example, emotional, cognitive, and behavioral instability is a core feature of borderline personality disorder, while narcissistic personality disorder manifests as a dynamic process where external evaluations influence self-esteem management and behavior (Hopwood, 2018). Empirical studies include Wright et al. (2017), who found that the relationship between intraindividual perceived others' dominance and individuals' own antagonism was stronger in patients with narcissistic personality disorder. Bringmann et al. (2016) constructed network models of negative emotional processes and found that individuals with denser negative emotion networks had higher neuroticism levels. Furthermore, personality dynamics thinking provides support for personality intervention research (Rebele et al., 2021), with some empirical studies supporting intervention effectiveness, such as interventions for adolescent problematic drinking behavior (Conrod et al., 2008; Conrod et al., 2013; O' Leary-Barrett et al., 2016). O' Leary-Barrett et al. (2016) conducted a two-year intervention targeting risk personality factors for adolescent problematic drinking (e.g., impulsivity, anxiety sensitivity), significantly improving adolescents' problematic drinking behavior.

5. Indigenous Personality Dynamics Research in China

The theoretical developments and applied research described above have primarily occurred abroad. The following section reviews personality dynamics research in China. An advanced search was conducted on CNKI (https://www.cnki.net/) with the following parameters: literature categories included Clinical Medicine, Neurology, and Psychiatry under Medical and Health Sciences; Psychology under Philosophy and Humanities; Social Science Theory and Methods, Sociology and Statistics, and Educational Theory and Management under Social Sciences II; and Management under Economics and Management Sciences. Publication dates ranged from January 1, 2000, to June 17, 2022. The keyword "personality" was fixed in the title, while topic keywords were searched separately according to the following categories: (1) Research adopting an individual perspective: keywords "individual perspective, intraindividual," yielding 7 articles; (2) Research on personality state fluctuation processes: keywords "personality state, personality fluctuation, personality dynamics," yielding 101 articles; (3) Research adopting personality

dynamics theoretical perspectives: keywords "Whole Trait Theory, WTT, Cognitive-Affective Personality System, CAPS," yielding 5 articles; (4) Research discussing both personality traits and situations: keywords "trait*situation," yielding 47 articles; (5) Research using intensive longitudinal data methods: keywords "experience sampling method, intensive longitudinal, diary method," yielding 1 article. A total of 161 articles were identified. After reading abstracts for further screening—requiring empirical studies to have repeated measurement intervals of personality process variables within one day, and theoretical reviews to focus on short-term dynamic change processes, mechanisms, related theories, or the association and integration between personality states and traits—only 9 articles met the criteria (see Table 1).

Current Status of Indigenous Personality Dynamics Research

Year	Author	Type	Source	Title
2019	Wei Jia	Review	*Journal of Jining Normal University*	Personality Variability: The Debate, Integration, and Application of Traits and Situations in Personality Psychology
2018	Yu Miao, Xu Yan	Abstract	*Abstracts of the 21st National Psychology Academic Conference*	The Influence of Implicit Personality Theory and Emotion on Personality State Changes
2015	Guo Yongyu, Hu Xiaoyong	Review	*Psychological Science*	Traits, Motivations, and Narratives: Three Paradigms and Their Integration in Personality Research

Year	Author	Type	Source	Title
2006	Xiao Chonghao	Review	*Journal of Hanshan Normal University*	New Trends in Personality Research: The Cognitive-Affective Personality System
2005	Xiu Qiaoyan, Gao Fengqiang	Review	*Journal of Nanjing Normal University (Social Sciences Edition)*	Integrating CAPS Theory with Personality Psychology
2004	Yang Ziyun, Guo Yongyu	Review	*Journal of Huazhong Normal University (Humanities and Social Sciences Edition)*	Units of Personality Analysis: Traits, Motivations, and Their Integration
2006	Zhang Kaijing	Review	*Journal of Liaoning Educational Administration Institute*	A Review of the Trait-Situation Debate in Personality Psychology

As evident, personality dynamics theoretical thinking has not been fully discussed or applied in China. Only a very small number of researchers have systematically discussed personality variability and the integration of personality processes and traits. For example, Yu Miao et al. (2020) introduced some personality dynamics theories and the use of experience sampling methods in their review; Guo Yongyu and Hu Xiaoyong (2015) discussed the integration of personality narratives, motivational processes, and personality traits; and Yu Miao and Xu Yan (2018) indicated in their research abstract that personality states show significant variability and can transform with personality traits. Internationally, the personality dynamics field has developed for nearly fifteen years, with an increasing number of personality psychologists recently emphasizing the need to move beyond the Big Five framework, integrate personality trait and state theories, and shift from personality description to explanation

(e.g., Blum et al., 2021; Quirin et al., 2020; Cervone & Little, 2019; Rauthmann et al., 2019; Jeronimus & Reitsema, 2018). Methodologically, existing empirical research mostly uses intensive longitudinal data and multilevel models, while dynamic modeling methods (e.g., DSEM, GIMME, DSM) have developed more recently and have not yet been widely applied internationally. This article briefly introduces the concept and historical development of personality dynamics, explanatory and integrative models, and intensive longitudinal data collection and research methods. Future researchers can explore relationships among personality traits, processes, and development based on Chinese samples using dynamic modeling methods, expand personality dynamics research by integrating traditional Chinese personality thinking, or include cross-cultural comparisons to test the universality of existing theories. In summary, the personality dynamics research field has considerable room for expansion in both depth and breadth, with future research promising to deconstruct/reconstruct personality concepts and integrate/build new theoretical systems.

6. Future Directions

6.1 Theoretical Development

Personality dynamics theories focus on personality processes and formation mechanisms, advancing personality research from description to explanation, representing an important direction for personality research development. Future researchers can continue to integrate and develop existing personality dynamics theories in the following aspects.

Researchers should distinguish between intraindividual and interindividual personality structures in their theories. WTT, CAPS theory, and KAPA theory all explain personality functioning mechanisms through social-cognitive processes but do not address the evolutionary and genetic origins of group-level personality structures or how human neurobiology and hormones shape personality formation and manifestation. In contrast, CB5T views personality as control systems formed through genetic and environmental influences during human evolution, explaining the origins and functions of group-level personality traits (i.e., interindividual personality structures) from an evolutionary perspective, while noting that individuals' characteristic adaptations vary. However, CB5T less frequently addresses specific cognitive, emotional, and motivational processes in daily life. In other words, social-cognitive personality integration models (like WTT) are more suitable for explaining the formation and functioning mechanisms of intraindividual personality structures, while cybernetic personality integration models (like CB5T) are suitable for explaining the origins and functions of interindividual personality structures.

Future theories can achieve further integration. Personality dynamics theories can be further integrated with psychopathology theories. Personality theories are mostly based on normal personality, with traditional theories tending to focus on stable traits, while psychopathology research and clinical practice always

occur within specific situations and dynamic processes (Ringwald et al., 2021), typically belonging to separate research systems. However, researchers have indicated that a key to case conceptualization for individuals with personality disorders lies in effectively linking static trait assessment results with individuals' fluctuating manifestations in daily life (Hopwood et al., 2015). Thus, personality dynamics theory presents an opportunity to integrate abnormal psychology and personality research. For example, CB5T treats variation in basic control mechanisms as a continuous spectrum, viewing personality disorders as extreme manifestations of personality functioning. Future researchers can expand personality dynamics theoretical frameworks by combining clinical practice and psychopathology theories.

Furthermore, future researchers can further explore temporal effects in theories. Existing personality dynamics theories have not systematically discussed the influence of temporal factors, failing to fully embody the meaning of "dynamics." For example, WTT defines descriptive personality traits as probability density distributions of personality states, using distribution parameters like mean, peak, and standard deviation to characterize individuals' personality systems. However, this definition does not consider temporal sequence relationships among states. In response, some researchers propose treating periodicity of personality manifestations or speed of behavioral responses as personality traits (Beck & Jackson, 2021), while others construct dynamic system models with personality state changes as dependent variables (Sosnowska et al., 2020). However, these attempts involve more frontier modeling methods for personality states and lack theoretical foundations. Future theories can further enrich the connotation of "dynamics" by combining empirical research and methodological developments.

6.2 Measurement Improvements

Future research can combine data collection from multiple channels, including self-reports, other-reports, physiological indicators, and digital footprints. Current personality dynamics measurement mostly uses self-report forms. However, traditional self-report forms are not well-suited for intensive longitudinal research. Intensive self-reporting undoubtedly imposes a significant burden on participants, forcing researchers to compromise between minimizing intrusion into participants' lives and optimal sampling intervals. Moreover, self-report data only reflect participants' subjective judgments, cannot escape retrospective bias, cannot measure objective environmental variables, and reliance on a single measurement method may cause common method bias (Mõttus, 2016).

Researchers can supplement self-reports with other-reports, which can separate individuals' subjective interpretations of situational characteristics from socially constructed facts shared by multiple people. Very few studies have used other-report measurement methods. For example, Abrahams et al. (2021) collected both young teachers' self-reported situational characteristics and supervisors' other-reported situational characteristics as bystanders, separating situational

characteristic variation into relatively subjective individual interpretations and relatively objective group consensus.

Another emerging measurement method is sensor-based personality assessment. Personality Computing (Phan & Rauthmann, 2021) is an interdisciplinary field combining personality psychology and computer science. Researchers often use portable electronic device sensors (e.g., smartphones, wristbands) to passively collect participants' life data, such as using sensors (accelerometers, Bluetooth, GPS) and metadata (call logs, text messages, app usage) to gather objective information about individuals (activity trajectories, social behaviors, sleep) and environments (locations, sounds, humidity) (Vaid et al., 2021). Compared to experience sampling methods, passive data collection provides continuous, objective data throughout the study period, does not depend on participant compliance, and minimizes participant burden. For example, Kalimeri et al. (2019) combined smartphone and computer data with self-report data, finding that individuals' website visit records and app usage information could predict moral stances, values, and personality tendencies with low to moderate accuracy.

6.3 Methodological Considerations

In future research, investigators must first consider whether their personality state measures are appropriate for their research questions. Although some empirical studies currently focus on personality states, operational definitions of personality states are inconsistent and unclear across studies, with few questionnaires specifically developed for personality state measurement, resulting in varying specific items used across studies.

When constructing measurement methods, the nature of the construct and research purpose must be considered first. The meaning of personality states differs across theoretical perspectives. For example, WTT views personality states as manifestations of corresponding personality traits, with common measurement methods adapting personality trait items for state measurement. However, personality states obtained through this method cannot be directly interpreted as manifestations of corresponding personality traits for several reasons. First, causes of individuals' current states usually involve not just a single personality trait but multiple traits. For instance, an individual' s current extraverted behavior may result from high extraversion trait levels or high conscientiousness trait levels, leading to higher extraverted state levels in social situations requiring extraversion (Fleeson, 2017). Additionally, individuals' personality states are influenced by current situational factors (Sherman et al., 2015).

Thus, personality state variation derived from Big Five or other personality trait questionnaires reflects the interactive result of multiple psychological processes (e.g., cognition, emotion, or motivation). If researchers wish to study a specific trait' s functioning process, they can consider measuring more fundamental cognitive, emotional, or motivational processes; refine measurement to specific subdimensions of traits to ensure measured variation represents the target trait; or

ask participants about their understanding of each trait dimension before formal testing and use participant-specific items to measure states. For example, some researchers ask participants to self-report personality traits most salient to them and assess specific personality manifestations in preset situations (Di Blas et al., 2017). Alternatively, researchers can develop questionnaires suitable for measuring personality states based on individual measurement data. For instance, Zimmermann et al. (2019) used diary methods to collect intensive longitudinal data, constructed a short personality dynamics diary questionnaire through multilevel confirmatory factor analysis, and validated the scale' s interindividual and intraindividual reliability and validity in an independent sample.

Furthermore, if researchers wish to examine personality system functioning mechanisms, they can simultaneously measure multiple psychological processes. The theoretical idea of personality as a multivariate system is reflected in several personality models—for example, CB5T views personality as a self-organizing system, and CAPS theory posits that different cognitive-affective units interactively shape individual personality manifestations. However, related empirical research often focuses on single-variable processes (e.g., Mogg & Bradley, 2016; Wendt et al., 2020). Only by simultaneously examining all processes can researchers test interactive relationships among processes and their unique effects. For example, using WTT as a theoretical framework, researchers can compare cognitive, emotional, and motivational processes behind similar behaviors in different situations or different behaviors in the same situation to explore whether accretion process sets underlying different personality manifestations are situation- or behavior-specific (Baumert et al., 2017).

Finally, researchers must attend to reliability and validity issues at the state level. A common method for establishing reliability is averaging intraindividual measurement points and calculating internal consistency coefficients as reliability indicators. However, this approach yields reliability for average states—that is, interindividual-level reliability—while neglecting reliability of states themselves. Moreover, most studies do not test the reliability and validity of used items in independent samples (Horstmann & Ziegler, 2020). Future research should verify reliability at the intraindividual measurement level (Nezlek, 2017) and can report results using multilevel confirmatory factor analysis (Bolger & Laurenceau, 2013, p. 138; Bolger et al., 2012).

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Wu Fan: Conceptualization, writing, and revision
Hu Yueqin: Supervision and revision

Note: Figure translations are in progress. See original paper for figures.