

Investigators inspired by Baumert and colleagues' compelling call to travel up to personality structure may benefit from clearer sense of where they are going.

COGNITIVE STRUCTURES COUNT

Consider three features in Baumert and colleagues' article:

By MS Word count, "cognitive structures" appears zero times. (Google Scholar counts 150,000+ appearances in the literature.)

Baumert and colleagues (p. 504) articulate two questions about causal systems and personality functioning—why "individuals with different trait levels behave differently in the same situation" and "an individual with some trait level behaves differently in different situations"—but not a third: why an individual [with any trait level] behaves *similarly* in different situations. The third question references Allport's (1937, p. 330) evidentiary criterion for traits.

Psychological mechanisms explain behavioral "patterns of variation across situations" (p. 503). What, then, explains *consistency* across situations? It can't be broad traits; we've abandoned that traits-as-explanations ship.

The features are related. Baumert and colleagues discuss cognitive structures ("mental representations, schemas and scripts," p. 510) but do not fully exploit their potential for identifying "social cognitive operations" (p. 507) that explain traits.

Potential operations:

- (1) Some enduring cognitive structures (e.g., schemas; Beck, 1991; Markus, 1977) are so accessible that they become activated in multiple situations.
- (2) In any given situation, cognitive structures influence dynamic processing (Higgins, 1996, 1999). Highly

accessible structures therefore foster similar processing across different situations.

- (3) Because the processing dynamics are "driving forces that influence ... behaviors" (p. 505), the cognitive structures-to-processes link fosters behavioral consistency.

This three-step path is the integration of social-cognitive structures, processes, and behavioral coherence—patterns of consistency and meaningful variability—advanced in the KAPA model of personality architecture (Cervone, 2004). Its assessment principles (Cervone, Shadel, & Jencius, 2001) facilitate identification of these patterns and their underlying causes (reviewed in Cervone, 2008; Cervone & Quirin, 2017). Researchers have employed KAPA-model theoretical principles and assessment methods to advance three other goals discussed by Baumert and colleagues: testing causal processes experimentally (Artistico & Rothenberg, 2013; Cervone et al., 2008), intervening for behavioral change (Scott & Cervone, 2016), and accounting for within-person variability while empirically integrating between-person and within-person methods (Di Blas, Grassi, Carnaghi, Ferrante, & Calarco, 2017).

KAPA-model efforts may not achieve the "complete integration" (p. 504) Baumert and colleagues desire. But the big picture is this: Their call for explaining individual differences through bottom-up explanatory strategies that reference causal systems that are conceptually distinct from qualities to be explained is a breath of fresh air—or one might say, a much-appreciated second wind (cf. Cervone, 1997, 1999). If this perspective is now consensus, we finally have one less discipline of personality psychology than we used to (cf. Cervone, 1991). That's good news. Everyone else is living in a world of "bottom-up innovation" where "everything connects" (Hoque & Baer, 2014, pp. 21 and 1). Why not us?

Integration in Personality Research: Evolution is the Missing Catalyst

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Abstract: Baumert and colleagues make a compelling case for integration in personality research, but fall short of presenting a convincing program for achieving it. I argue that evolution is the "missing catalyst" of integration and that the field is destined to remain fragmented until it fully embraces the evolutionary paradigm. I illustrate the heuristic and integrative power of an evolutionary approach by focusing on the central issue of motivation; recasting motivational processes in a modern biological perspective affords a wealth of integrative insights that cut across process, development, and structure. Copyright © 2017 European Association of Personality Psychology

In the article, Baumert and colleagues review three domains of personality research—structure, process, and development—and make a compelling case that the discipline needs to make a major step toward integration. Despite the authors' remarkable effort, the research program that emerges from the paper is unconvincing; the

proposed directions are largely methodological, and it is hard to see how they would lead to an integrated understanding of personality rather than just more of the same. Reading the paper felt like watching a chemical experiment where something critical is missing. The authors do a great job of laying down the components

and mixing them together; but as much as they keep stirring and shaking, the elements fail to react and combine as expected.

I surmise that evolution is the missing catalyst of integration. While Baumert and colleagues do not dismiss the biological aspects of personality as unimportant, in practice they treat them as optional—something that can be added at a later time to complete the picture. But what if evolutionary concepts are foundational rather than peripheral? The structure of personality traits, their development, and the underlying cognitive/motivational processes are all products of our species' history and have been shaped and refined by millions of years of selection across countless generations. If this is the case, successful integration may only be achieved within a broader evolutionary framework—a metatheory that enables a truly functional understanding of personality and behavior (Durrant & Ellis, 2003; Tooby & Cosmides, 2015). In a recent chapter, I showed how such an integrative approach can be applied to personality development (Del Giudice, in press). For broader surveys, see the volumes by Buss and Hawley (2011) and Carere and Maestripieri (2013). To readers unfamiliar with evolutionary psychology, I recommend the introduction by Tooby and Cosmides (2015), which also touches on issues of motivation, emotion, and individual differences.

In the remainder, I illustrate the potential of this approach by focusing on motivation, one of the key topics of Baumert and colleagues' article. The authors define motivation generically as selective approach/avoidance and distinguish between “biological drives” such as hunger and “socialized motivations” such as status seeking. Recasting motivational processes in a modern evolutionary perspective affords a wealth of integrative insights that cut across process, development, and structure. The mechanisms that underlie motivation are best understood as specialized goal-directed systems with access to both innate and learned knowledge (Cosmides & Tooby, 2013; Del Giudice, in press; Tooby & Cosmides, 2015). While approach and avoidance are important, motivational regulation involves much more—from context-sensitive switching between alternative goals and strategies, to coordination of multiple cognitive and physiological processes through emotions (e.g., Al-Shawaf, Conroy-Beam, Asao, & Buss, 2016).

Crucially, evolutionary theory illuminates the deep hierarchical structure of motivational goals. Genetic replication (achieved either by reproducing directly or by favoring related individuals) is the ultimate, overarching function of all living organisms. Life history theory shows how this meta-goal can be decomposed into a number of broad tasks—including survival, growth, learning and body maintenance, mating, and parenting—and how the balance between competing tasks is adjusted depending on the characteristics of the individual and its environment (see Del Giudice, Kaplan, & Gangestad, 2015). On a finer scale, life history tasks are accomplished by a large number of overlapping but functionally specialized mechanisms

that deal with specific problems, from choosing food and avoiding pathogens to finding and attracting mates, maintaining beneficial cooperative relationships, increasing one's status and social influence, acquiring and transmitting knowledge, and so forth. All these motivations are equally “biological” and linked to reproductive fitness within the ecological niche of our species. The resulting model of motivation is remarkably rich, and—in contrast with abstract functionalist models that do not consider the fitness costs and benefits of behavior—implies a complex but non-arbitrary structure of partially conflicting goals (e.g., Aunger & Curtis, 2013; Del Giudice, in press; Kenrick, Griskevicius, Neuberg, & Schaller, 2010).

This approach helps with the daunting task of identifying which of the potentially infinite dimensions of the environment are most likely to be relevant to a given individual and gives deeper meaning to the phrase “the mind has the structure it has because the world has the structure it has” (Anderson, 1991). While Baumert and colleagues limit their analysis to the regularities of the present environment as experienced by a single individual, an evolutionary perspective suggests that the present structure of the mind also embodies the regularities of the *ancestral* environment and its statistical structure across multiple generations (Tooby & Cosmides, 2015). If so, understanding the nature of our ancestral environment is a precondition for understanding the structure of personality. Of course, evolved developmental programs interact with present ecological conditions; for example, there is fascinating evidence that recent increases in the complexity of human societies may have lessened the strength of trait covariation, leading to greater differentiation of individual personalities (Lukaszewski, Gurven, von Rueden, & Schmitt, 2017).

The preceding paragraphs barely scratch the surface. While there is no room to present them even cursorily, other exciting contributions include the concept of *internal regulatory variables* as sources of behavioral covariation and coherence across multiple systems (Cosmides & Tooby, 2013); life history models that track the emergence and change of motivational priorities across the life span (e.g., Del Giudice, in press; Kenrick et al., 2010); and novel insights into the nature of developmental plasticity, sensitive periods, and transitions between the major life stages (e.g., Del Giudice, 2014a, 2014b; Frankenhuis & Fraley, in press; Frankenhuis, Panchanathan, & Nettle, 2016). Besides reframing and integrating existing knowledge, evolutionary models can reveal phenomena that are invisible from other perspectives. For example, *parent-offspring conflict theory* (Trivers, 1974; see Schlomer, Del Giudice, & Ellis, 2011) shows that parental influences are only partially in the biological interest of children and may explain why family experiences have surprisingly little systematic effects on adult personality (Del Giudice, 2009, in press). Keeping personality research insulated from the broader evolutionary paradigm can only delay integration further and prevent the discipline from achieving its full potential.

based view of extraversion suggests that extraverts seek out conversation even if there is little to gain or with unpleasant partners. On the other hand, a reward sensitivity explanation explains why an extravert might instead choose to stay home and play online poker (Lucas & Diener, 2001).

Second, even if broad traits are mainly theoretical fictions (i.e., more emergent via many narrower processes), they are still useful fictions (Revelle & Elleman, 2016). Emergent explanations seem necessarily limited by their complexity. Even if they are more correct, the focus on narrow processes or knotty arrays of nodes and connections seems unlikely to produce a useful or satisfying explanation for why extraverts behave as they do over time. For example, if we want to know whether Sam will attend Joe's party, knowing Sam's level of extraversion (or BAS) is probably less informative than knowing how Sam feels about Joe or how Sam feels about parties in general. However, knowing about Sam's extraversion is more informative in predicting myriad other behaviors, such as starting conversations in elevators or driving fast. It is not clear how many micro-processes might be needed to fully describe behavior in the Big Five/Six domains, but it would certainly be unmanageable to consider all simultaneously. As such, broad trait-level explanations are at the 'right' level for understanding some phenomena. Somewhere between 2 super-traits and 30 facets is a level of resolution that captures important differences between people. It is possible and desirable that we include *explanations*, rather than merely descriptions, at this level of analysis (e.g., DeYoung, 2015).

Of course broad correspondence explanations still benefit from studying momentary processes. Experience sampling studies of 'state extraversion' highlight both the stability of aggregated states as well as the substantial intra-personal variation across time and situations. This underscores the need for dynamic explanations, but it does little to provide them. Indeed, the correlates of extraverted states tend to be similar for dispositional introverts and extraverts (e.g., increased positive affect for all; Fleeson, Malanos, & Achille, 2002).

Why, then, do extraverts act extraverted more often? Experiments have also manipulated state extraversion. This approach speaks to the causal consequences of trait-related behaviors, for example, extraverted behavior makes people feel like they are making social contributions (Sun, Stevenson, Kabbani, Richardson, & Smillie, 2017) and evokes pleasant responses from others (Davydenko, Zelenski, Gonzalez, & Whelan, 2017). While such findings help us understand how extraversion plays out in-the-moment, they are silent about what internal factors cause those states. Other manipulations, such as positive emotions, can produce state extraversion (Whelan & Zelenski, 2012). Here, causality is pointing towards the personality domain, but we urge extreme caution in extending causal effects from the state to the trait level. Indeed, the covariance structures differ at trait and state levels (Hamaker, Nesselroade, & Molenaar, 2007), and processes likely do too.

As a complementary, and perhaps more powerful approach, experimental manipulations can speak to (trait-level) causal processes when the manipulation targets the causal explanation (Zelenski, 2007). For example, if trait extraversion is about reward sensitivity, we expect to see momentary personality differences only when rewards are present (Smillie, Cooper, Wilt, & Revelle, 2012). Although broad traits are not ideally suited to predicting momentary behaviors, lab contexts can control (hold constant) extraneous factors such that reliable trait by manipulation interactions emerge. Moreover, holding the situation constant allows us to confidently attribute variation to internal personality factors, an advantage compared to most naturalistic experience sampling (Fleeson & Law, 2015). That is, when people report on situations, these reports are already filtered through an interpretive lens, which may be an important source of trait-level explanations (e.g., sensitivity to noticing reward cues).

In sum, broad trait correspondent processes can explain both momentary and long-term behavior trends, something that emergent approaches have yet to do satisfactorily.

AUTHORS' RESPONSE

Working Towards Integration of Personality Structure, Process, and Development

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Abstract: Based on the thoughtful and thought-provoking comments, we strengthened some of the main proposals of our framework to integrate research on personality structure, process, and development. Integration is an important, yet challenging goal for personality science, and we see considerable potential for it, theoretically and in empirical research. We clarified our use of critical concepts, such as behaviour, trait, and personality structure. We suggest that avoiding use of broadly construed traits will be helpful in preventing circularity in explanations. Strictly speaking, we see no causal role for broadly construed traits. We discuss how observed structural differences between measures taken over different time scales or within and between individuals, can inform hypotheses about shared and unique causal mechanisms, and argue for the unique relevance of psychological processes in personality science. Copyright © 2017 European Association of Personality Psychology

We greatly appreciate the thoughtful and thought-provoking comments that we have received in reaction to our article “Integrating Personality Process, Personality Structure, and Personality Development.” We are very pleased that several commenters saw merit in our integrative framework. Crucial issues were also raised.

The very goal of developing a framework for the integration of the key questions and tasks of personality psychology has stimulated controversy. Some authors argued that (complete) integration may not be desirable because it could restrict possible approaches and thus hamper creativity (Allik & Realo; Noordhof, Kamphuis, Eigenhuis, Boyette, & Conradi; Mund, Hagemeyer & Neyer). Others argued that integration is not (yet) possible (Bleidorn & Hopwood; Nofhle), and still others emphasized that integration had been established as a goal already (Cervone; Jeronimus, Ormel, & Riese; Fajkowska & Domaradzka) and accomplished to a considerable degree (Cervone; Fajkowska & Domaradzka; Mayer & Allen). In line with our proposal, however, a substantial number of comments acknowledged integration as an important, yet challenging goal for personality psychology (Beck & Jackson; Eaton; Finnigan & Vazire; Geukes & Back; Hicks & Durbin; Kubiak & Ebener-Priemer; Markon; Mayer & Allen; Nofhle; Shiner; Zelenski & Blouin-Hudon).

Despite potential agreement on the importance of integration, our proposed framework did not fully satisfy commenters for different reasons. Some highlighted that the framework has revealed urgent needs for clarification of central concepts, such as our working definitions of behaviour and personality, and specifically a looming circularity in explanations (Greve & Kappes; Markon; Noordhof et al.; Uher). Also, some commenters found our framework too vague regarding the appropriate unit of analysis for personality research (Fajkowska & Domaradzka; Little) and missed a more substantial theoretical development of the fundamental organization of mechanisms to be addressed (Del Giudice; Fajkowska & Domaradzka). Besides these requests for theoretical specificity, some commenters were not convinced that psychological processes could offer sufficiently informative explanations for personality psychology. They argued that suggesting that inter-individual differences in intra-individual processes can cause variation in other processes

or overt behaviour begs the question of why people come to differ in those processes in the first place (Jeronimus et al.) and why and how differences among persons become relatively stable and consistent (Bleidorn & Hopwood; Cervone; Greve & Kappes).

Yet many commenters saw potential in our framework for further theoretical specifications and extensions. They made suggestions for how to refine our proposal to conceptualize psychological processes as explanatory factors of behaviour, structure, and development. Specifically, commenters suggested as refinements identifying generic sequences of processes (Geukes & Back) and distinct functional areas (Mayer & Allen), detailing person-situation transactions (Bell & Saltz; Rauthmann; Tucker-Drob), and acknowledging implicit (Hicks & Durbin) in addition to explicit (Nofhle) agentic processes. Several commenters proposed that system-theoretical, cybernetic approaches to integration could embrace self-regulatory, self-reflective, and learning processes, as we discussed, and allow detailed predictions regarding structure and development (DeYoung; Fajkowska & Domaradzka; Jeronimus et al.; Mayer & Allen; Sih et al.). Some commenters argued that other levels of explanations, apart from psychological processes, should be added, such as biological processes (DeYoung; Hicks & Durbin) and genetic determinants (Tucker-Drob).

Importantly, several comments highlighted the synergy most likely to result from drawing connections to related disciplines. From evolutionary theory and animal approaches to personality, a number of exciting new directions for research and for integrating structural and process-oriented approaches to personality were identified (Bell & Saltz; Del Giudice; Sih et al.). Regarding clinical research and application, commenters brought to our attention progress toward integration of process, structure, and development in psychopathology (Research Domain Criteria RDoC; see Sher). Researchers attempting to integrate normal personality structure, process, and development can learn from psychopathology research by including more detailed process analyses than the ones we reviewed, and by looking at interventions used in clinical applications that aim to change personality and foster its development (Roberts, Luo, Briley, Chow, Su, & Hill, 2017). Given the strong interest in intervention in psychopathology, integrating process, structure,

and development as we propose will help bridge the gap between “normal” personality theory and research on one hand and personality disorder theory and research on the other (Eaton; Jeronimus et al.; Sher; Widiger; Wright et al.).

Besides theoretical refinements, several authors elaborated on methodological approaches to advance research within our proposed framework. They underscored our call for investigation of inter-individual differences in intra-individual psychological processes to explain behaviour, its covariation, and its development (e.g. Lönnqvist). But as Beck and Jackson noted, it is crucial to determine “... how to select *what* is measured, how often (*when*) to measure it, *where* to measure it, and how to model it once data are collected ...” (p. 530). Finnigan and Vazire, Kubiak and Ebener-Priemer, and Back and Geukes stressed the relevance of repeated assessments on short time scales to depict processes as within-person variation and their inter-individual differences. These intensive assessments (“measurement bursts” Finnigan & Vazire, p. 542) should be coupled with longitudinal designs on longer time scales to reveal enduring changes in those processes and their inter-individual differences (Kandler). These authors, together with Hicks and Durbin, also highlighted the necessity of multi-method approaches beyond self-report to convey insight into relevant processes. Moving research outside the lab and exploiting the potential of new technologies could reveal how persons select into different environments, shape their environments in active and reactive ways, and, in turn, are influenced in relatively enduring ways (Kubiak & Ebener-Priemer; Rauthmann). At the same time, personality needs rigorous experimental research in the lab to understand and isolate the underlying basic processes, as we and some commenters (e.g. Lönnqvist; Zelenski & Blouin-Hudon) have stressed.

Shiner argued that childhood and adolescence should be particularly revealing for the integration of process, structure, and development, because these are phases in life during which substantial change occurs at all levels. Others might add that this also applies to old age. Beck and Jackson extended our short section on network analyses by outlining the added value of idiographic network analyses in exploring inter-individual differences in idiosyncratic organizations of intra-individual processes (also see Little for emphasis on idiographic analyses). Since designs and analyses need considerable complexity to reveal how processes, structure, and development come together on empirical grounds (Finnigan & Vazire; Nofhle; Revelle & Condon), comments rightfully cautioned to insure the replicability of empirical results (Allik & Realo; Lönnqvist; Markon).

On the basis of these stimulating comments, we would like to clarify and strengthen our main proposals.

1. What does integration mean and why is it useful?

What was the goal of our article? We wanted to provide a theoretical framework (not a full-blown specific theory) guiding personality research toward the integration of its key tasks. Should we aim at complete integration? We believe we should, simply because simultaneously considering all three key questions and tasks of personality science will help any specific theoretical approach reach its full potential.

Even if one key question is the main concern of a researcher or a line of research, the other questions should not be ignored because joint consideration might help avoid limited or incorrect conclusions. Some research focuses on developmental trajectories and long-term processes (Jeronimus et al.; Nofhle), while other research focuses on short-term processes underlying particular patterns of behaviour (Cervone). The goals should be cross-talk between these lines of research and ultimately merging of efforts (see Finnigan & Vazire).

We have acknowledged and hasten to repeat that we were not the first to call for integration and that previous attempts at integration have had impact on personality theory and research. We recognize that steps toward integration taken in the past have yielded important insights. For example, process-oriented research has articulated associations among inter-individual differences in process variables and linked them with inter-individual differences in overt behaviour (Cervone; Zelenski & Blouin-Hudon). Interactionist approaches have flourished after Cronbach’s (1957, 1975) calls for integration of experimental and correlational research (e.g., Poropat & Corr, 2015), and Whole Trait Theory (Fleeson & Jayawickreme, 2015) has provided integration of within and between person variation. More attempts at integration exist than the ones cited in our selective review (e.g. Fajkowska & DeYoung, 2015a, b; Maruszewski, Fajkowska, & Eysenck, 2010). Some of the comments brought integration efforts in adjacent fields of research, such as psychopathology (Sher) and animal personality (Bell & Saltz; Sih et al.), to our attention. Personality psychology will certainly gain substantially from this cross-disciplinary talk (Eaton; Widiger; Wright et al.; see also the literature from other disciplines cited by Jeronimus et al.).

Why do we call for integration? Depending on the main research focus (structure, process, or development) from which integrating steps were initiated previously, our framework highlights how complete integration can be approached. While process-oriented research has progressed in linking inter-individual differences in processes and behavioural patterns, and even established causal connections among specific processes or between processes and overt behaviour (e.g. selective attention to threat contributing to anxious reactions to stress), generalizability of these mechanisms to other behavioural and process domains remains underexplored. Accordingly, we do not know how specific the identified processes are in shaping particular kinds of behaviours and not others (e.g. does attention to threat not only shape anxious reactions, but also feelings of sadness, avoiding social interactions, feeling uncertain of one’s own opinions, complying with rules, striving for order, etc?). Responses to these kinds of questions will reveal the degree to which factors in hierarchical trait models correspond to the organization of causal processes or emerge from complex transactions among those processes (Wood, Gardner, & Harms, 2015).

Correspondence and emergence. To reiterate, inter-individual differences in a particular set of processes could be causally related to inter-individual differences in other processes and behaviours that are correlated among each other, but causally unrelated to processes and behaviours that are uncorrelated with this set. In these cases, we would

characterize the clustered relations as correspondent to traits derived from factor analyses. Such patterns could be common, as pointed out in the comments of DeYoung and Zelenski and Blouin-Hudon. However, in our article we put particular emphasis on the possibility of emergence, which means that processes could transact with each other in complex ways giving rise to the observed patterns of correlations of inter-individual differences (see also Beck & Jackson). In our opinion, this possibility has not been considered sufficiently in structurally informed research. As DeYoung pointed out, the question of correspondence or emergence is not a strict dichotomy. Rather, factor-analytically derived traits may involve some correspondent processes, coupled with processes that they share with uncorrelated traits (reflective of emergence; for an empirical example, see Wood et al., 2015). Yet let us restate (along with Lönnqvist), this is an empirical question!

Process and development. Development-focused research has not yet fully embraced potential ways in which insight into psychological processes can illuminate why people change in enduring ways and differ in how they change (Greve & Kappes). In particular, understanding processes that explain behavioural variability at short time scales could illuminate change occurring at longer time scales (development), as sequences of these processes accumulate (Geukes & Back).

Does integration restrict research or does it help to identify communalities among theories and research programmes? Some commenters raised concern that integration might restrict research, thus hampering progress in specific lines of research (Allik & Realo, Noordhof et al., Mund et al.). So how much diversity should be allowed within our integrative framework? We claim that the framework can incorporate diverse theoretical approaches (such as many of those exemplified in the comments), diverse methodological solutions (e.g. network analysis, experiments, and factor analyses), and diverse starting points or main research foci (i.e. the main interest of a researcher may lie in one of the key tasks). However, we argue that personality research should be working towards integration. According to Buss (2008), “personality psychology aspires to be the broadest, most integrative, branch of the psychological sciences. Its content is not restricted to particular subsets of psychological phenomena, such as information processing, social interaction, or deviations from normality. Personality psychologists historically have attempted to synthesize and integrate these diverse phenomena into a larger unifying theory that includes the whole person in all myriad modes of functioning” (p. 29).

We see substantial potential for integration of theoretical approaches. For instance, a common principle which can be identified within evolutionary, interpersonal, psychodynamic, and various other frameworks which were nominated as ‘potentially incompatible’ (cf. Bleidorn & Hopwood) is *utility maximization*—where different parties, and within psychodynamics and ‘modular’ theories of mind, sometimes different ‘agencies’ within the person (e.g. Buss, 2008; Kurzban & Aktipis, 2007) are each attempting to maximize the attainment of their specific goals or the satiation of their specific motives. Consistent with Beck and Jackson, we

agree that instantiating the process ideas discussed here will be aided by more rigorously formalized models. Part of the advantage of formalized models is in helping to clarify where different frameworks may offer overlapping or even fully redundant processes or units of analysis, such as the *needs* or *drives* within motivational theories, *preferences* within economic theories, and *values* within decision-making theories. We reviewed how some of these models might look (e.g. game theoretical and expectancy-value models, network models), and other ideas were presented in the comments (e.g. Geukes & Back). We suspect that the power of these theoretical models to be widely integrative will become more apparent as the measurement and modeling implications of such models become more explicitly and formally represented.

Methodological requirements of integration. Regarding methodological solutions, we greatly appreciate Finnigan and Vazire’s comment that, along with other comments (Beck & Jackson; Kubiak & Ebner-Priemer; Nofle; Wright et al.; Zelenski & Blouin-Hudon), called for increasing design sophistication. Sophistication includes multi-method assessment, intensively repeated measurement to depict intra-individual processes and their inter-individual differences, longitudinal designs that allow studying their more enduring changes, as well as sampling situations and measuring them with as much care as we measure personality (Kubiak & Ebner-Priemer; Nofle; Rauthmann).

2. Conceptual clarity remains an ongoing challenge (not only) in personality science

To write our article truly collaboratively, we started out with a set of working definitions of the key concepts. Despite the extensive discussions and iterations among ourselves needed to reach acceptance of the working definitions we presented, they elicited much criticism from some commenters. As a crucial lesson, therefore, we suggest that all personality psychology discussions rest on explicit definitions of key concepts. We continue by describing alterations to some of our proposed definitions (e.g. ‘behaviour’), prompted by reviewer comments, which we think improve upon those offered by us initially, as well as defend some (e.g. ‘trait’, ‘structure’) which we believe should attain greater usage in personality psychology.

Definition of ‘behaviour’. We appreciate the conceptual criticism that our use of the term ‘behaviour’ was very broad (Mund et al.; Uher). Though perhaps overt behaviours, certainly spinal reflexes should be excluded as not particularly relevant to personality psychology (see Allik & Realo; though potential modulation of centrally mediated reflexes through affective or motivational processes, and inter-individual differences in these modulations could be of interest; e.g. Lawson, MacLeod, & Hammond, 2002). More important, we agree that distinguishing among observable behaviours and internal cognitive, affective, and motivational processes on conceptual and operational levels is necessary to avoid circularity in explanations. As noted correctly by some commenters (Greve & Kappes; Lönnqvist; Markon; Noordhof et al.), trying to explain broad summaries of

processes and behaviours with processes that those summaries include can be as circular as taking the summary labels as causal for their constituent parts. However, specific processes might be causally responsible for covariation observed among other processes and overt behaviours that cluster under broad trait labels.

Definition of ‘trait’. A general problem is that broad trait labels mean clusters of rather different processes and behaviours and are therefore not helpful in explaining manifest behaviour. In other words, focusing on the aggregate obscures the potential causal relations among its constituent parts and, thereby, conceals explanations of why these parts (internal processes and observable behaviours) come to correlate. When explaining manifest behaviours through psychological processes, or when explaining a particular process by other psychological processes, the explanandum or dependent variable has to be conceptually distinguishable from the explanans or independent variable. Even if the definition of the manifest behaviour involves reference to intentions, as Greve and Kappes highlighted (e.g. aggressive behaviour is defined as behaviour intended to damage someone), there are further internal processes that are not identical with these intentions and that are therefore candidates for non-circular explanations (e.g. expecting rewards such as financial benefit or social approval, by hurting others can motivate aggressing against someone). Reference to intentions might be involved in some definitions of manifest behaviours but not in others (e.g. helping can occur incidentally). As Markon cautioned, in empirical research, internal processes are regularly inferred from observable behaviours, making circularity plausible (especially if the existence of different levels of analyses, with their respective explanatory frameworks and focuses of interest, is not acknowledged; Hughes, De Houwer, Perugini, 2016). However, indicators of the hypothesized causal processes can be chosen so that they do not overlap with the observable behaviours to be explained, or with indicators of other psychological processes that might be shaped by the causal processes. Put differently, Markon rightly cautioned against operationalization overlap, which continues to be a prevalent and underappreciated problem across common methods for measuring personality (e.g., Möttus, 2016). An important function of process approaches to personality may be to help form better guidelines of when we should *not* lump indicators into a single scale of a “broader trait” despite evidence that these indicators may show substantial correlations with one another.

Formal vs substantive definitions of traits (and states). We would like to emphasize that we did not reserve the use of the term ‘trait’ to particular dimensions of inter-individual differences, nor to any level of aggregation. So yes, “individual differences in the degree to which certain affects, cognitions, or self-regulatory plans are set into motion when the person is teased by peers” (Lönqvist, p. 553) and “degree of liking for Starbucks coffee” (DeYoung, p. 538) should be both considered traits, as they conform to our working definition of psychological traits as “relatively stable inter-individual differences in the degree/extent/level of coherent behaviours, thoughts, feelings.” As Kandler pointed out,

our definition of ‘trait’ is consistent with latent-state-trait theory (Steyer, Schmitt, & Eid, 1999) which is a psychometric generalization of classical test theory, and as such a formal (not substantive) theory that can be applied to any inter-individual variable. Kandler also clarified that any variable, independently of how it is measured, can involve state and trait variance, distinguished by a relative level of stability over relevant time. (We discuss appropriate time scaling later on.) We are not convinced by definitions of traits proposed in the literature that are based on content or aggregation level. DeYoung proposed differentiating between traits and characteristic adaptations based on evolutionary principles. However, this appears to boil down to a distinction based on aggregation level, since concrete manifestations of tendencies that are described independent of historical or cultural context (e.g. avoidance of threat) depend on those contexts, at least in large parts (e.g. threat can exist in vans, flying spears or Frisbees, hot Starbucks coffee, or sabre-toothed tigers).

We appreciate that making ‘trait’ a cross-cutting concept that applies to ALL process and behavioural variables represents a shift in use of the term, and potentially in thinking, for some personality psychologists. However, we suspect that efforts to distinguish traits from other substantively defined units, such as abilities, motives, or self-esteem, has brought little progress, and instead, might hamper progress in the better specification of the causal dynamics linking process variables to one another and to behaviour.

3. What theoretical status should be assigned to factor-analytically derived traits?

Traits as ambiguous abstract labels are not useful. So what is the status of factor-analytically derived traits within our framework (Lönqvist)? This is indeed an important question. We think that use of broad trait labels, such as Extraversion or Agency and Communion, in causal analyses continues to be a major source of confusion and imprecision in personality research and theory. These labels are ambiguous and used in several distinct senses. Sometimes, they are used operationally for the aggregates of correlated overt behaviours and internal processes (see e.g. Zelenski & Blouin-Hudon). Other times, these labels are used as placeholders for assumed (or less often, hypothesized) correspondent processes. For example, Noordhof et al. suggested that “traits may be causal to inter-individual differences in [parameters of] process” (p. 560) and continued to exemplify that properties of the nervous system give rise to inter-individual differences in psychological processes underlying overt behaviour. Although there seems to be a common belief that factor-analytically derived dimensions show strong correspondence to specific processes, there is often insufficient work to translate abstract factor labels (e.g. Extraversion) into the suspected processes that might truly produce much of the covariation between constituent elements (e.g. reward sensitivity). To avoid this kind of confusion in future discussions, it seems desirable to proceed more immediately to identify the processes that are hypothesized to be indicated by these structural factors and talk about these specific

processes rather than the abstract trait labels as causes. For instance, Widiger's description that "Psychopathy, for example, is a syndrome consisting of traits of antagonism, low conscientiousness, extraversion, high neuroticism, and low openness" (p. 574) could be reinterpreted as "Psychopathy is a syndrome influenced by dislike of other people, overvaluation of effort conservation over commitment completion, lack of usual reactivity to social rewards, over-concern with punishment, and lack of interest in novel experiences." The view of structural factors as having some close associations with major psychological processes is compatible with many trait theories (e.g. DeYoung; Fajkowska & Domaradzka; Zelenski & Blouin-Hudon), but getting rid of the abstract labels in discussions of causality, and instead specifying the processes or behaviours that we think are doing the causal work, will clarify how such statements actually can be tested and evaluated.

Can factorially derived traits be considered causes of life outcomes? As noted before, factorially derived traits, as summaries of processes and open behaviours, cannot serve to explain their constituent parts. In other words, factorially derived traits can play *no* causal role with regard to the processes and behaviours they entail. But what about their causal roles in so-called life-outcomes? Research has established that factorially derived traits are powerful *predictors* of outcomes, such as health, wealth, or marital status (Allik & Realo; Zelenski & Blouin-Hudon). Such outcomes are best conceived as results of many distinct behaviours, accumulated across time (Mõttus, 2016). These behaviours may belong to a broad factorially derived trait such as conscientiousness. Despite being caused (in emergent or correspondent ways) by underlying processes, the constituents of these clusters of behaviours may collectively be causal in generating outcomes. Drinking and smoking can impair one's health. Skipping preventive medical check-ups or not complying with therapeutic instructions can, too. Moreover, these behaviours may compensate or amplify each other's effects on someone's health status to some extent. Thus, behaviours clustering under the trait label 'Conscientiousness' may be (proximate) causes of outcomes, even if they are themselves caused by underlying processes. So does a person's level of Conscientiousness cause his or her health status? No, but the behaviours clustering under this abstract label may be doing the causal work. Some behaviours might be causal but some might counteract them (Baumert, Schmitt, & Blum, 2016), while other behaviours clustering under this label might be inconsequential for the outcome at hand (e.g. being on time and studying hard). Consequently, broad trait labels may serve as guidelines for intervention programs, but which behaviours actually matter needs to be established separately of the broad trait labels (Mõttus, 2016).

4. How should we conceptualize personality structure?

What do we mean by personality structure and how many structures are there? Cervone raised the question of how many personality structures there are. Given our working definition of structure, as "manner in which traits or states are organized with respect to each other among

individuals, or states organized within individuals" (see our article), it should not be surprising that we would say there is no single personality structure. The structures that can be extracted from the data box depend on if and how we aggregate cells, and which vectors are correlated. Variation in correlational patterns—across contexts, across cultures, across individuals, across measures, but also across informants (Hicks & Durbin), and across different time scales (Revelle & Condon)—is not a problem per se. To the contrary, such variation can help to illuminate the factors that generate variability in the data box. For example, different correlational patterns obtained by using different measures or combinations of measures can help to identify method specificity/shared method variance. This in turn may help to increase the validity of measures. Structural variation across individuals can reveal how individuals construe situations (see the example in our article on individual differences in the rejection schema, p. 511). Structural variation across cultures can reveal differences in culturally shared interpretations of situations and others' behavior. Structural variation across contexts may result from social norms (such as dress codes of one kind at work and another in leisure contexts) that differentially constrain individual differences in behavior.

Inter- and intra-individual structure. In the past and in some comments, personality psychologists have emphasized in particular that structures observed at the between-person level and at the within-person level may differ (Jeronimus et al.; Kubiak & Ebener-Priemer; Mund et al.; Zelenski & Blouin-Hudon). This has sometimes been taken to imply that different causal mechanisms are responsible for between-person and within-person variation. We argued in our article that this is not necessarily true. We greatly appreciate Revelle and Condon's comment that clarifies this discussion. They proposed the illuminating metaphor of traits:states being somewhat analogous to climate:weather. Weather, climate, and climate change are inherently related, yet each phenomenon operates at a different time scale. While they share fundamental causes (i.e. "the difference between energy from the sun minus that re-radiated by the earth" Revelle & Condon, p. 564), at each time scale different specific causes come into play. Revelle and Condon suggested that we think analogously about states, traits, and development. While they are inherently connected, each phenomenon is observable at a different time scale, and both shared and unique causal forces could potentially be involved at each time scale.

5. Time Scale Matters.

Revelle and Condon explained that "seemingly non-ergodic phenomena" (p. 564) at the between- and within-person levels potentially confound differences in time scale. As two examples of such "seemingly non-ergodic phenomena," Mund et al. mentioned inter- and intra-individual correlations among positive and negative affect, and Kubiak and Ebener-Priemer mentioned inter- and intra-individual correlations between blood pressure and physical activity. In both examples, between- and within-person correlations differ. But Revelle and Condon's note about time

scales can illuminate why. Within a time scale of minutes, people tend to experience either positive or negative affect so that within-person correlations tend to be negative, and physical activity causes increases in blood pressure. However, within longer time scales (e.g. across weeks), frequencies of positive and negative affective episodes are unrelated, and repeated physical activity can reduce resting blood pressure and its response to any instance of physical activity.

Consider the example of affect structure closely: Assume we measure positive and negative affect in a sample of individuals repeatedly at several randomly chosen times during a day and repeat this procedure over a period of many days. If we correlate positive and negative affect intra-individually over all time points, we will find a negative correlation between positive and negative affect because most people do not experience positive and negative emotions simultaneously, except for a small number of rather unusual situations. If we correlate negative and positive affect *at any single occasion* inter-individually across all members of the sample, we will also find a negative correlation for the same reason. At a randomly selected occasion, most individuals will report positive but not negative or negative but not positive affect to a certain degree.

Now what happens if we change the time scale and aggregate affect over all measurement occasions? The individual average of positive affect across occasions can serve as a trait measure of positive affectivity and the individual average of negative affect across occasions as a trait measure of negative affectivity (Hudson, Lucas, & Donnellan, 2017). When correlating these individual aggregate affectivity scores inter-individually, we know from many studies that the correlation will be closer to zero (Watson, Wiese, Vaidya, & Tellegen, 1999). We could also look at what happens if we partially aggregate affect over time by forming parcels and correlate these parcels of positive and negative affect intra-individually. Most likely, the result will depend on how many time points we aggregate. Given, however, that affective states typically change quickly, the aggregation over a few days will result in intra-individual correlation between parcels that is similar to the inter-individual correlation, i.e., close to zero. So at each time scale, separately, we can hypothesize that the same mechanisms might be responsible for within- and between-person variation. But of course, this needs to be tested (Jeronimus et al.).

Importantly, observing different correlational patterns at different time scales does not imply necessarily that different processes are at work. The processes that generate positive and negative affect in any concrete situation are also relevant for understanding frequencies of positive and negative affect over time. Some people might selectively expose themselves to negative or positive situations, might selectively attend to negative or positive cues, might selectively interpret cues more negatively or more positively, might be affected more strongly by negative or positive information, etc. These processes may explain, in combination with features of the situations encountered, the affective reaction of a person in

any concrete situation and, by implication (due to the aggregation of these specific instances), the person's average affectivity over the interval, and how their affectivity changes over time.

Now consider Kubiak and Ebener-Priemer's example of differences in intra-individual vs inter-individual patterns of physical activity and blood pressure. In this example, again, inter- and intra-individual comparisons confound different time scales. But this example differs in interesting ways from the first example. Due to biological processes that we do not address here, in any moment, physical activity leads to an increase in blood pressure. Assume that we measure, similar to the affectivity example, momentary physical activity and blood pressure in a sample of individuals repeatedly at several randomly chosen times during a day and repeat this procedure over a period of a year. If we correlate physical activity and blood pressure intra-individually across the time points, we will find a positive correlation. If we correlate both variables at a specific time point inter-individually, we will also find a positive correlation because people who are more physically active than other people at that particular moment will show a higher blood pressure than other people at this same moment.

Now, assume that we aggregate physical activity and blood pressure, separately, intra-individually across all time points. We obtain the average physical activity and the average blood pressure of each member of the sample. If we correlate these two averages inter-individually, we will find a negative correlation. Why? Because, given a certain intensity of physical activity (e.g. running 100 meters in 20 seconds) and all other factors being equal, blood pressure increases less (slope) and peaks (maximum) earlier in people who exercise a lot as compared with people who exercise less. Thus, unlike in the affectivity example, there are more complex processes going on here as the average across time of one variable (physical activity) operates as a moderator of the effect of itself on another variable (blood pressure). In other words, in this case there are different mechanisms involved, at different time scales.

In the present examples, when un-confounding comparisons from differences in time scales, intra- and inter-individual comparisons might or might not yield identical results. The two examples differ with regard to the question whether different time scales require different explanations. In the affect example, the same processes that explain frequencies of affect across time, whereas in the second example, additional processes come into play when patterns across longer time scales compared with shorter time scales are to be explained.

These considerations, together with empirical results, indicate the fundamental relations among states and traits and development. Traits can be viewed as inter-individual differences in recurring characteristics of short-term processes (such as intra-individual mean levels of states or mean change in states in response to particular stimuli; Fleeson, 2001). As several commenters stressed, the question of time scale is critical, but cannot be answered categorically (Jeronimus et al.; Kandler; Kubiak & Ebener-Priemer; Mund

et al.; Revelle & Condon). Rather, depending on the phenomenon of interest and the research focus, different time scales will be appropriate (see again the climate–weather analogy by Revelle & Condon). Also, choosing informative time scales depends on detailed explorations and correct descriptions of the phenomena of interest, so empirical data are required (Kandler; Revelle & Condon).

6. The psychological process level is useful for working toward integration

Last but not least, we would like to promote once more the psychological process level of analysis. Several comments suggested that our perspective would benefit from incorporating other levels of explanation, including biological features and evolutionary pressures. Doing so would be compatible with our framework. As Del Giudice correctly assessed, we see these other levels of explanation as principally compatible, and additionally informative, but we perceive unique value in focusing on psychological process variables. In particular, psychological processes represent proximal causes of overt behaviour. For explanation of concrete observable behaviour in concrete situations, this is likely the most powerful level. Relatedly, psychological processes offer opportunity for psychological intervention to change consequent processes and overt behaviour.

Given the importance of psychological process variables, adding other levels of explanation, in our view, has the status of detailing the causes of the causes. This would have been beyond the scope of one article. Compatible with the understanding that the psychological situation is the proximal cause of behaviour (e.g. Lewin, 1943; Reis, 2008; Rauthmann et al. 2015), we are content to assert that features of the objective environment mentioned by other commenters (e.g. biological factors) can be modeled as having their effects on behaviour *through* the psychological processes we discuss. For instance, we placed a strong emphasis on motivational dimensions (desires, preferences, etc.). A person's momentary or characteristic level of these motivational dimensions has to come from somewhere. Consistent with Hicks and Durbin, part of this will be basic biological factors, like dopamine genes, amygdala function, and so on. However, again, we can understand the role of these biological factors on a person's behaviour as being mediated through their effects on motives and other process variables that together construct the psychological situation and more proximally shape behaviour.

Article, Comments, and Rejoinder are a Valuable Package

To conclude, we greatly appreciate the criticism, discussion, and elaboration that our call for integration of personality structure, process, and development and our framework for integration received in the 33 comments. Taken together, 78 colleagues (19 authors of the article and this rejoinder and 59 authors of comments) have reflected, contributed, discussed, criticized, and provided constructive suggestions for the field in this sequence of article, comments, and response. We believe therefore that this collective effort forms a 'package' that can enrich the field in years to come.

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