

Personality Psychology

A Roadmap for Future Interactions Between Research on Personality and Learning

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In this introduction to the special collection of papers on the relation between learning and personality research, we provide a functional-cognitive framework that can guide interactions between learning and personality researchers. It highlights that learning researchers can treat personality variables as potential (first or second order) moderators of learning effects. They can also examine whether the effects of personality on learning itself depend on other moderators. Personality researchers can benefit from looking for stable individual differences in known learning effects. Together with learning researchers, they can analyze personality as learned and thus malleable behavior. We end by summarizing the papers of the special collection and by situating them within our framework.

Between the 1940s and 1990s, psychology witnessed intense debates on the relation between personality and learning, involving influential researchers such as Spence, Eysenck, and Gray (see Zinbarg & Revelle, 1989, for a brief review). Although work on this topic continues until today (e.g., Bredemeier & Berenbaum, 2008; Carver & Scheier, 2012; Carver & White, 1994; Corr et al., 2013), it is no longer as popular as it was half a century ago. Levey and Martin (1981) listed three reasons for this decline in interest. First, some of the debates on learning and personality were at least partially resolved. Second, since the 1970s, more and more emphasis was put on cognitive factors in learning phenomena such as classical conditioning, which drew attention away from other factors such as personality. Third, overarching theories such as those of Hull (1943) were replaced by more specialized theories and empirical research that focused on one specific topic rather than on relations between different topics in psychology.

All these reasons, however, refer to temporary evolutions in psychological science. They do not provide fundamental arguments against studying the relation between personality and learning. In this paper, we provide a new framework for how personality and learning research can interact to their mutual benefit. We do so in a way that is not tied into a specific theoretical position, so as to allow for cumulative research that does not hinge on the merits of specific theories. Our framework is based on the meta-theoretical, functional-cognitive framework for research in psychology (De Houwer, 2011; Hughes et al., 2016). After

briefly introducing this meta-theoretical framework, we discuss how learning research could benefit from considering personality. Afterwards, we explore how personality research could benefit from considering learning. In a final section, we provide an overview of the papers that are part of the special collection of which this paper is the introduction. In addition to summarizing those papers, we discuss how they can be situated in the framework for research on personality and learning that we set out in this paper.

The Functional-Cognitive Framework for Research in Psychology

Psychological scientists can adopt at least two different aims (De Houwer, 2011; De Houwer & Hughes, 2020; Hughes et al., 2016). First, they can strive to predict and control behavior by studying environment-behavior interactions. For instance, if we know that fear of dogs is a function of aversive experiences with dogs (e.g., being bitten by a dog), we can predict an increase in the probability of fear responses to dogs after such an aversive event. By studying how these instances of fear conditioning can be prevented or their effects altered (e.g., via procedures that involve repeated exposure to dogs), we can also develop ways to influence fear responses to dogs. This is an example of a functional approach in psychology in that the focus is on documenting (the moderators of) behavioral phenomena, that is, the way in which behavior (e.g., fear of dogs) is a function of elements in the environment (e.g., aver-

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sive experiences with the dog). Gaining knowledge about behavioral phenomena has scientific merit as such because it reveals the environmental causes of the behavior (i.e., it helps explain behavior in terms of environment) and thereby allows for prediction and influence of behavior. Ideally, such descriptions are formulated in abstract terms (e.g., classical conditioning) that can be applied across a wide range of situations (see Hughes et al., 2016, for more details).

Second, psychological scientists can aim to uncover the mental mechanisms via which elements in the environment influence behavior. For instance, being bitten by a dog might result in the formation of an association in memory between the representation of the dog and the representation of being bitten. Once the association has been formed, encountering a dog might activate not only the representation of dogs but also, via spreading of activation, the representation of being bitten. This would then result in a fearful anticipation of being bitten and thereby fear responses to the dog (e.g., Mineka & Zinbarg, 2006). In this approach, the focus is on *mental explanations* of behavioral phenomena, that is, on how mental processes and representations mediate the impact of environment on behavior. Because of the mental nature of the explanations, this approach is often referred to as the cognitive approach in psychology.

Although functional and cognitive approaches in psychology have fundamentally different aims, they can be mutually supportive. On the one hand, knowledge of environment-behavior interactions (i.e., functional knowledge) constrains cognitive theories about those interactions. For instance, a good cognitive theory of fear conditioning should be able to explain not only that aversive experiences with dogs can lead to fear of dogs but also that fear conditioning can be reversed by repeated exposures to dogs (i.e., extinction). On the other hand, good cognitive theories can generate new predictions about environment-behavior interactions. For instance, they might predict that conditioned fear of dogs can be reduced by repeated exposure to dogs particularly when those exposures are accompanied by a strong expectation that the dogs will bite (e.g., Craske et al., 2018).

The extent to which the functional and cognitive approaches are mutually reinforcing depends, however, on the extent to which behavioral phenomena are defined independent of explanatory mental concepts. For instance, if fear conditioning as a behavioral phenomenon is defined in terms of the formation of associations in memory, researchers cannot consider other mental theories that might fit better with the available functional knowledge about fear conditioning (e.g., propositional theories of conditioning; see De Houwer & Hughes, 2020, for a discussion).

Learning Research Can Benefit From Taking Into Account Personality Research

In line with the functional-cognitive framework for research in psychology, learning can be defined as changes in behavior that are due to regularities in the environment (De Houwer et al., 2013; De Houwer & Hughes, 2023). Different types of learning can be distinguished on the basis of

the type of regularity that is responsible for the change in behavior. For instance, both sensitization and classical conditioning can refer to an increase in the intensity of a response but in the case of sensitization, this change is due to a regularity in the presence of one stimulus (i.e., the repeated presentation of a stimulus) whereas in the case of classical conditioning, it is due to a regularity in the presence of two stimuli (e.g., the pairing of a conditional and unconditional stimulus).

Starting from this definition, functional learning research documents the moderators of different learning effects, that is, the variables that moderate whether regularities lead to changes in behavior. These moderators can be divided into five groups: (1) the nature of the stimuli involved (e.g., whether fear conditioning is stronger for evolutionary relevant stimuli such as snakes), (2) the nature of the behavior that is assessed (e.g., whether stimulus pairings lead to changes in both involuntary and voluntary behavior), (3) the nature of the organism whose behavior is examined (e.g., whether fear conditioning occurs in animals with specific brain lesions), (4) the nature of the context (e.g., whether fear conditioning depends on the presence of secondary tasks), and (5) the nature of the regularity itself (e.g., whether fear conditioning depends on contiguity rather than statistical contingency; see De Houwer & Hughes, 2020, for a review of the different moderators of different learning effects).

From this perspective, personality variables can be thought of as a potential moderator of learning effects, more specifically as differences in certain aspects of the nature of the organism whose behavior is examined. In line with a functional-cognitive framework, this requires that personality is conceived of in a non-mental manner (i.e., without referring to mental mechanisms), either descriptively (as scores on personality scales) or behaviorally (as differences in how people behave in different situations; see Perugini et al., 2016, for a discussion). For instance, fear conditioning effects could be stronger in people scoring high on neuroticism scales than in people scoring low on those scales (e.g., Duits et al., 2015). In cases like this, personality (e.g., neuroticism) is a first order moderator of a learning effect (e.g., fear conditioning). In addition to being first order moderators, personality variables could also moderate the effect that other variables have on learning (see Vervliet & Boddez, 2020, for a discussion). For instance, the degree to which fear conditioning becomes stronger with increases in the aversity of events might be higher for people scoring high compared to low on neuroticism scales. This is an example of personality (i.e., neuroticism) as a second order moderator of learning (i.e., as a moderator of the moderating effect of aversity on fear conditioning). Finally, the moderating impact of personality variables on learning might also be moderated by other variables. For instance, the impact of neuroticism on fear conditioning might be stronger in threatening contexts than in safe contexts.

Thinking of personality variables as potential moderators of learning effects has merit for several reasons. First, it provides a heuristic framework for research on the rela-

tion between learning and personality. More specifically, it highlights different ways in which learning and personality can interact (i.e., personality as a first order moderator of learning, as a second order moderator of other moderators of learning, as a moderator of learning whose effect depends on other moderators; see previous paragraph). Second, studying these different interactions between learning and personality provides knowledge that can be used to better predict learning effects by measuring personality variables (e.g., identify people at risk for adverse effects of aversive events). Third, given research showing that personality can be changed (e.g., Roberts et al., 2017), functional knowledge about the relation between learning and personality offers new opportunities for influencing learning by changing personality (e.g., shield people from adverse effects of aversive events by changing aspects of their personality). Finally, like all functional knowledge, functional knowledge about the relation between learning and personality constrains cognitive theories of learning whereas cognitive theories of learning that take into account personality can be used to predict new ways in which personality and learning interact.

Personality Research Can Benefit From Taking Into Account Learning Research

A first way that learning research can contribute to personality research is by highlighting a wealth of behavioral phenomena that could reveal patterns of stable individual differences. This approach has already proven its merits in the context of research on impulsivity, more specifically individual differences in delay discounting. Delay discounting is a well-known learning effect that refers to a moderator of reinforcement, that is, of increases in the frequency of behavior (e.g., lever pressing) as the result of behavior-outcome relations (e.g., food pellets that are delivered after pressing a lever). More specifically, it refers to the fact that reinforcement becomes weaker as the delay between the behavior and the presentation of the outcome increases. It has been observed that there are stable individual differences in the extent to which the behavior-outcome delay moderates reinforcement. Most importantly, these individual differences also seem to be related to individual differences in important real-life phenomena such as eating behavior (e.g., Madden et al., 2017).

The example of delay discounting is but one example of how learning research could contribute to a fundamental aim of personality research: to identify stable individual differences that predict important real-life behaviors. In addition to delay discounting, there are many other learning effects for which stable individual differences could exist (see Bouton, 2016; Catania, 2013, and De Houwer & Hughes, 2020, for book-length reviews of learning effects). Looking for stable individual differences in learning effects could thus become a novel approach to achieving the aims of personality research, somewhat echoing the strategy of collecting T-test data proposed by Cattell (Cattell & Warburton, 1967) which until now has been mostly limited to the domain of risk-taking (Santacreu et al., 2006).

Although this learning approach can be adopted together with other, existing approaches, it has two important advantages. First, at the conceptual level, it allows for precise definitions of individual differences. As argued above, learning effects can be defined functionally, that is, strictly in terms of the interaction between environment and behavior (e.g., delay discounting as the impact of behavior-outcome delay on reinforcement). Hence, it can be specified very clearly what individuals differ in. Second, at the empirical level, it is clear what measures of individual differences in learning effects should look like: they should be based on procedures that allow one to establish the extent to which an individual shows the effect. For most learning effects, several well-established procedures have been developed (see Bouton, 2016; Catania, 2013). Although it needs to be verified that different procedures for the same learning effect converge with regard to the individual differences that they reveal, this methodological wealth offers unique opportunities for personality researchers.

A second way in which learning research can contribute to personality research is by fostering a dynamic perspective on personality, starting from personality trait structures empirically established through decades of research (Big Five, see McCrae & John, 1992; Big Six, see Ashton & Lee, 2007). These personality trait structures can be considered as a convenient way to represent the main broad dimensions of personality that can accommodate many specific traits either as facets of a broad trait (e.g., Anxiety) or as interstitial among them, that is, related to more than one trait (e.g., Intolerance of Uncertainty). From a functional perspective, personality can be thought of as a behavioral phenomenon (see Perugini et al., 2016): it refers to clusters of stable individual differences in how people interact with their environment. For example, it has been shown that a core feature of Extraversion is the tendency to behave in ways attracting social attention (Ashton et al., 2002), whereas a main aspect of Conscientiousness is the tendency to engage in behaviors improving the efficiency and accuracy in completing tasks (Ashton & Lee, 2001). Besides robust cumulated empirical evidence showing that personality traits predict consequential outcomes (Roberts et al., 2007), including mortality risk (Graham et al., 2017), there is also evidence that personality traits are themselves affected by repeated performance of behaviors. For example, recent longitudinal studies have shown that students who do more homework become more conscientious over time and not the other way around (Göllner et al., 2017) and that over time poor sleep quality leads to more Neuroticism as well as the other way around (Stephan et al., 2018).

Such a behavioral perspective implies that personality was also shaped by the learning history of the individual and that personality can be changed by new experiences (Wrzus & Roberts, 2017). It also fits well with the idea that personality, just like any other behavior, is not only the product of past experiences but also shapes the experiences that individuals have (Baumert et al., 2017). By drawing a parallel between personality and (patterns of) behavior, the vast knowledge that we have about learning and behavior

(e.g., Catania, 2013, for a review) can be put to use for the study of personality.

Special Collection

In the final part of this paper, we summarize and reflect on the papers that are part of the special collection on learning and personality. We also discuss how they can be situated in the functional-cognitive framework that we put forward in our paper.

Wong and colleagues (this issue) provide an extensive review of studies that focus on interindividual difference variables as first order moderators of avoidance learning. Avoidance learning is particularly important from a clinical point of view in that it lies at the heart of anxiety disorders. They note, however, that many studies on this topic produced mixed or null effects. Based on their review, they discuss possible reasons for the inconsistency of the existing findings and provide recommendations for future research.

The mixed picture that emerges from the Wong et al. (this issue) review paper is echoed in the four empirical papers on Intolerance of Uncertainty (IoU) that are part of the special section. On the one hand, Cobos et al. found that IoU moderates emotional experiences (i.e., feelings of relief) during avoidance learning. They also found that individual differences in trait anxiety moderate avoidance behavior during a learning (acquisition) and unlearning (extinction) phase. On the other hand, Cobos et al. did not find the expected moderation effects during a reminder (renewal) phase that was presented after the learning and unlearning phase. Moreover, neither Carpentier et al. (this issue), nor Rodriguez-Sobstel et al. (this issue) found clear evidence for IoU as a first order moderator of safety learning, that is, learning when aversive events will *not* occur. Finally, Johnson and colleagues (this issue) present an empirical study on IoU as a second order moderator of learning. More precisely, they examined whether IoU moderates the known effect of threat reinforcement rate on fear conditioning. Also in their study, results provided at best mixed evidence for the impact of IoU. Together with the review of Wong and colleagues, the novel empirical data on IoU that are reported in this special section highlight the challenges involved in identifying robust moderating effects of individual differences variables on fear-related learning.

The special section also contains two papers that looked at personality as a first order moderator of evaluative conditioning (EC), that is, the impact of stimulus pairings on liking (also see Bunghez et al., in press). EC has received considerable attention because it provides a potential pathway for shaping the preferences and attitudes that are thought to guide many aspects of behavior (see Hofmann et al., 2010; Moran et al., 2023, for reviews). As was the case with the papers on fear-related learning, the results of the two papers on EC are mixed. On the one hand, Casini et al. found that Neuroticism (more specifically the facets of anxiety and vulnerability) strengthened not only the effects of negative unconditional stimuli but also the effects of positive unconditional stimuli in EC. On the other hand, Ingendahl et al. (this issue) found little evidence for an effect of Neuroticism on EC. Extraversion, Conscientiousness, and

Openness also did not moderate EC but Agreeableness did. It is possible that first order moderation effects of personality on EC are small and dependent on context. In any case, future studies on this topic need to deploy large samples to detect what seem to be small effects.

Finally, Jusepeitis et al. (this issue) focus on self-esteem as an individual difference variable that could be changed via learning procedures. They reasoned that if participants are repeatedly prompted to say “true” after sentences indicating self-worth, their self-esteem might increase. Although this learning procedure had effects on performance in the procedure itself, these effects did not generalize to established measures of self-esteem.

When reflecting on this collection of papers, a number of methodological issues stand out. First, we are happy to see that several of the authors contributing to this special collection did not shy away from reporting null findings of pre-registered studies. Indeed, it is possible that in the past, null findings did not always find their way to publication, obscuring the interpretation and robustness of findings that were published. The value of pre-registration is particularly substantial in research on learning and personality, as multiple operationalizations of learning effects (e.g., early versus late extinction effect), multiple measures of learning (e.g., physiological versus verbal measures), and multiple facets of personality (e.g., anxiety and vulnerability as separate facets of Neuroticism) give rise to an abundance of possible combinations and hypotheses that can be tested (Lonsdorf et al., 2019; Nosek et al., 2018).

Second, we applaud that all authors who reported new studies were mindful of the issues of sample size and statistical power (Lakens, 2022). Research on learning and personality indeed requires large samples – even more so if interactions with additional variables are under investigation. Studies with low statistical power have both a reduced chance of detecting a true effect (type II error) as well as a reduced likelihood that a significant result reflects a true effect (type I error). We hope that the research community and their funders remain ready to invest in this.

Third, all authors who reported new studies shared their data and materials. This not only offers other researchers the opportunity to reproduce the reported results but also allows for novel analyses based on combinations of different data sets while achieving the sample size and statistical power that is necessary to reach firm conclusions about the interplay between learning and personality (Nosek et al., 2022).

In sum, the papers included in this special collection illustrate a variety of approaches that are possible when studying the interplay between learning and personality. Although the results reported in the papers are mixed, it is important to consider that the matrix resulting from all possible individual difference variables, all possible learning phenomena, and all possible types of interactions between research on personality and learning is so large that it is bound to include important phenomena that will shed new light on human behavior. We therefore hope that our framework will help learning and personality researchers to

navigate this vast matrix and to fill in the cells with robust results.

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Contributions

JDH, MP, YB, FS:

- Substantial contributions to conception and design
- Drafting the article or revising it critically for important intellectual content
- Final approval of the version to be published

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Competing Interests

No competing interests.

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Supplementary Materials

Peer Review History

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