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REFLECTION AND IMPULSE

A Framework for Basic Research and Applied Science

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Behaving in ways that optimize the satisfaction of an organism's needs is a challenging task. Not only do organisms face a tremendous degree of uncertainty about what kinds of behaviors will be successful in a given environment; they are also faced with numerous decision dilemmas (Goschke, 2013), one of the most important being the dilemma caused by conflicts between short-term pay-offs and long-term goals. The distinction between impulsive (i.e., short sighted, fast) decisions and behaviors on the one hand and reflected (i.e., far sighted, slow) decisions and behaviors on the other hand is at the core of many everyday problems and captured by multiple psychological theories. Impulsive decisions and behaviors are typically defined as occurring quickly, with little care for accuracy, and without consideration of future outcomes. Reflective decisions and behaviors, on the other hand, are typically defined in terms of the opposite characteristics, involving slower responses that are based on careful consideration of multiple outcomes, including abstract and future consequences (Evenden, 1999; Kagan, 1966).

Is it better to quickly act on the spur of the moment? Or is it better to reflect on things and act in accordance with what the future might bring? There is no universal answer to this question. Being overly future-oriented might come at great risk, because events become more uncertain with increasing temporal distance. Yet, being overly oriented towards short-term outcomes can undermine successful need fulfillment if long-term consequences are ignored (Goschke, 2013; Green & Myerson, 2004). A smart organism must be able to engage in both impulsive and reflective behavior, and to flexibly switch between decision strategies depending on the circumstances. Although there is ample evidence for stable personality differences in terms of impulsivity, it is also evident that people's readiness to act reflectively or impulsively varies depending on external and internal conditions. Many behavioral problems in normal and clinical settings involve

intense, enduring, and often inadequate calibrations regarding impulsivity and reflectivity. Aggression without considering consequences, overeating, infidelity in committed relationships, drug abuse, and overspending all involve a miscalibrated tendency for impulsive responding. In contrast, rumination, indecision, suppression of emotion expression, and compulsion might be interpreted as involving an overly dominant tendency to engage in reflection. Understanding the psychological underpinnings of impulsive versus reflective responding is therefore of great significance for both basic research and applied research.

In what follows, we will briefly illustrate how the distinction between reflection and impulse, broadly defined, is at the core of many areas in psychology. We will then turn towards describing attempts to integrate and unify the many different findings and theories. As an example of such generalized duality models, we will briefly describe the central assumptions of the Reflective–Impulsive Model (Strack & Deutsch, 2004). We will then review the impact that duality models had on the field and discuss two reasons that we deem at least partially responsible for this impact. We close by discussing potential future directions for research in the realm of generalized duality models.

The Ubiquity of the Duality

The duality of reflection versus impulse has entered human thinking long before the advent of scientific psychology. It has been evident in philosophy, religion, and art since ancient times (for reviews, see Hofmann, Friese, Müller, & Strack, 2011; Strack & Deutsch, 2015; see also Hofmann & Friese, Chapter 8, this volume). For example, both Plato and Aristotle developed ideas of how passion and reason might be in conflict, and why passion might sometimes overrule reason, resulting in short-sighted behavior. Within psychology, theorizing about impulsive versus reflected behavior occurred relatively early, one example being Le Bon's (1895) crowd-psychology, where crowds were described as being driven by rudimentary emotional impulses. In psychiatry, psychodynamic theory essentially rests on the opposition of a relatively autonomous, impulsively acting psychological system that is determined by primary needs and emotions, and potentially opposing forces that are primarily determined by rational assessments of the world as well as social-normative information (Freud, 1949).

In modern academic psychology, theories and research relating to impulse versus reflection are ubiquitous and prevalent in nearly every sub-discipline. In research on personality, impulsivity was long recognized as important, either as a particular trait (Kagan, 1966) or as part of more complex theories of personality (Eysenck & Eysenck, 1969; Gray, 1981). In developmental psychology, the ontogenetic trajectory of acquiring the ability to forego a small, immediate reward in favor of a larger, delayed reward has received a tremendous amount of attention (e.g., Mischel, 1974; Mischel, Ebbesen, & Zeiss, 1972). Social psychologists have studied impulsive behavior in various domains, such as impulsive aggression

(Berkowitz, 1974), emotional (Mackie & Smith, 2004) and automatic (Devine, 1989) determinants of discrimination, submission to authorities (Milgram, 1975), or spontaneous and reflected paths from attitudes to behavior (Fazio, 1990). In cognitive psychology, multiple lines of research include components of the reflective–impulsive duality (cf. Payne & Gawronski, 2010), the most important being the distinction between automatic and controlled cognitive processes (Schneider & Schiffrin, 1977). Likewise, theories of executive function (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Norman & Shallice, 1986) and self-control (Baumeister, Heatherton, & Tice, 1994) address the goal-dependent adjustment of automatic or habitual responses. Expanding on these ideas, some cognitive neuroscientists assume that the forces underlying automatic and controlled responses can be linked to distinct neuroanatomical systems (Lieberman, 2007). In clinical psychology, conflicts between rational insights and emotional responses are a common topic. For example, anxiety disorders are characterized by intense emotional responding that may overpower pre-existing beliefs about the harmlessness of the situation (Ouimet, Gawronski, & Dozois, 2009). Addiction and compulsion are phenomena where people engage in self-harming behaviors against their better knowledge. Research on the psychological underpinnings of economic behavior has devoted much attention to the phenomenon of impulsive buying (Vohs & Faber, 2007). This brief, and certainly incomplete, review suggests that the reflection-impulse duality is central for theory and research within and outside of academic psychology. It also demonstrates that it is prevalent in a very broad range of research areas, with each area having an idiosyncratic interpretation and application of the duality.

Duality Models: The Quest for Commonalities

A central goal of science is to identify laws or regularities at the most general level possible. Duality models in psychology (for reviews, see Gawronski & Creighton, 2013; Sherman, Gawronski, & Trope, 2014; Strack & Deutsch, 2015) have been designed to serve this goal. Content-specific variants of these models aim to integrate existing theory and research within one particular field (Gawronski & Creighton, 2013; Strack & Deutsch, 2015). For example, Metcalfe and Mischel (1999) proposed their Hot/Cool Model to integrate and explain empirical patterns of impulsivity in the realm of delayed gratification. Fazio's (Fazio, 1990) MODE model was designed to integrate findings on the relation between attitudes and behavior. As another prominent example, Haidt's (2001) Social Intuitionist Model seeks to explain observations in the realm of emotional and cognitive influences on moral judgments.

Going beyond content-specific applications, generalized duality models seek to integrate theory and research across various domains of psychological functioning. Striving for higher levels of generality, such models aim to explain phenomena in multiple content-domains by postulating the operation of a limited

set of general psychological processes. According to these theories, the multiple dualities proposed by domain-specific theories (e.g., heuristic vs. systematic, automatic vs. controlled, affective vs. cognitive) can be linked to clusters of more basic processes that serve as the foundation of these dualities. For example, Sloman's (1996) systems of reasoning theory proposes a parallel, interactive operation of associative and rule-based processes. Based on the specifications of these processes, the theory assumes that the associative system is more heavily engaged in intuition and creativity, whereas the rule-based system is assumed to be more heavily engaged during deliberation. That is, instead of postulating a duality of intuition versus deliberation, the systems of reasoning theory specifies a duality of processes from which intuition and deliberation emerge.

Another feature of generalized duality-models is that they often import concepts from other well-established psychological theories, which further bolsters their generality. For example, Smith and DeCoster's (2000) integrative theory of dual-process models incorporates the idea of two complementary memory systems that was established in cognitive psychology (McClelland, McNaughton, & O'Reilly, 1995). As another example, Strack and Deutsch's (2004) Reflective–Impulsive Model, incorporates the concept of a supervisory system (Norman & Shallice, 1986) that modulates the activation of behavioral schemata. As a final example, Lieberman's (2007) neurocognitive reflexive–reflective model incorporates the idea of a conflict-detector module that mobilizes cognitive control (Botvinick et al., 2001).

The Reflective–Impulsive Model

As a prominent example of dual-system models that inspired the chapters in this volume, we will briefly describe the core assumptions of the Reflective–Impulsive Model (RIM) (Strack & Deutsch, 2004). At its core, the RIM contains a number of hypotheses about how the human mind can be divided into two clusters of psychological processes and mental structures that form two distinct, yet mutually interacting, processing systems.

The Impulsive System (IS) is assumed to contain a universal associative memory store that is connected to perceptual units as well as a motoric pathway to behavior. The core contents of the associative memory store are clusters of associated representations. Representations can refer to concrete states of the world, cognitive abstractions, inner psychological responses, such as affect, as well as motor responses. For example, an associative cluster related to broccoli might contain representations of how it looks, smells, and tastes, verbal labels (e.g., *broccoli*), fragments of the feelings associated with eating it, as well as eating-related motor codes. The RIM also postulates a special form of associative clusters: behavioral schemata. These schemata contain motor representations (e.g., chewing) along with typical triggers (e.g., sensation of food in the mouth) and consequences (e.g., softening of food; swallowing). Motor schemata are the structures that directly control behavior, and they do so if they are activated above an execution threshold.

The IS is also characterized by a set of processes: activation processes, learning processes, and motivational processes. Representations in the IS can be in different states of activation. They receive activation from external input (e.g., perception, reflection), but also from associatively connected representations. More specifically, elements are assumed to be connected via associative links of varying strength, and if one representation gets activated, the activation will spread to associated representations proportional to the strength of their association. Learning processes modulate or create associative links according to the principle of contiguity: the more often representations are activated simultaneously, the stronger will be the association. Motivational processes are assumed to change the readiness of certain classes of behaviors depending on inner and outer conditions. Valenced stimuli, affective states, and compatible behavioral schemata are thought to mutually activate each other, thereby creating states of motivational orientations towards approach and avoidance. Deprivation of needs is predicted to pre-activate behavioral schemata that contain need satisfaction as a typical outcome. The IS is also assumed to generate states of core affect, which vary in valence and arousal. Given that the processes in the IS mainly depend on a simple spread of activation or modulations of activation potentials as a function of motivational factors, the IS is claimed to operate under a higher degree of automaticity than its counterpart, the Reflective System (RS).

Like the IS, the RS is characterized by structural- and process-assumptions. Structurally, the RS is conceptualized as a short-term memory store in which information can be represented for a brief time. Rehearsal processes are necessary to maintain the information in the RS for longer periods. According to the RIM, the RS transforms activated representations in the IS into a propositional format. Propositional representations in the RS capture more complex relations between elements than the simple mutual activation in the IS, and they come with a subjective representation of the truth of the represented relation. Core processes in the RS are the construction of propositional representations, the generation of inferences based on syllogistic reasoning, the generation of decisions based on anticipated consequences and their evaluation, as well as intending. The process of intending translates behavioral decisions into behavioral readiness. More specifically, intending in the RS is assumed to activate behavioral schema in the IS that are relevant to the decision, and the activation is hypothesized to last until the behavior was executed. Based on attributions or categorizations performed in the RS, core-affective states generated in the IS can be transformed into specific emotions. Another way to describe the RS is to characterize it as a meta-representational system that operates on the basis of the IS. Because of its more complex mental operations (e.g., construction of propositions, maintenance through rehearsal, reasoning based on multiple elements), the RS is hypothesized to operate less automatically than the IS. The RS is also endowed with a core

motivational principle, which is epistemic in nature: it strives for consistency among propositions.

Although the IS and the RS are characterized by distinct functional properties, the RIM suggests a mutually interactive relation between two systems, in that the components of propositional representations in the RS are assumed to be based on contents of the IS. Hence, the likelihood that elements of the IS become part of representations in the RS should depend on their activation level. Conversely, mental operations in the RS should change the activation level of contents in the IS. By virtue of these (and other, less central) assumptions, the RIM explains a large number of phenomena in various realms of psychological functioning. At the same time, the RIM's assumptions about processing features and operating conditions of the two systems lead to testable predictions regarding how a given behavioral phenomenon may be brought about.

Impact on Theory and Research

Generalized duality models have had, and still have, a considerable impact on various fields of psychology. We argue that generalized duality models owe their impact to at least two factors. First, the generalized, integrative nature of these models facilitates their application to multiple sub-disciplines. Second, the bold claims that are typical for these models fuel theoretical debates, and thereby scientific progress through the generation of empirical research aimed to resolve these debates.

Integrative Nature

Parsimony and generality are important goals in theory construction (Gawronski & Bodenhausen, 2015). Generalized duality models aim at maximizing both criteria. First, they do so by integrating components of multiple, domain-specific theories, such as persuasion theories (Petty & Cacioppo, 1986), stereotyping theories (Devine & Monteith, 1999), and self-control theories (Metcalfe & Mischel, 1999). Second, they do so by importing well-established, highly general concepts, such as knowledge activation (Higgins, 1996), implementation intentions (Gollwitzer, 1999), and core affect (Russell, 2003). We argue that both aspects also help to reduce the fragmentation of psychology, which has been identified as one of the main adversaries of cumulative science (Kruglanski, 2001).

Duality models have been criticized for being overly detailed and less parsimonious than competing theories. However, when evaluating the parsimony of a theory, it is important to look at the total number of theoretical assumptions that is needed to explain a given finding, not the number of processes proposed by the theory. Thus, a theory that postulates two processes can be more parsimonious than a theory that postulates one process and a multitude of parameters and parameter interactions (cf. Gawronski & Bodenhausen, 2015).

The total number of assumptions should also be compared to the number of phenomena that can be explained with a theory. Based on these criteria, generalized duality models fare extremely well compared to competing theories that postulate either a single unitary process or more than two processes.

Maximizing parsimony and generality is desirable not only for abstract epistemological reasons; the two criteria also facilitate research in a very concrete manner. One facilitating factor is that hypotheses about general processes and principles are applicable to a much greater number of concrete research problems compared to hypotheses that are domain-specific. This difference can be expected to be potentiated in cases where generalized duality models are based on the ubiquitous duality of impulse versus reflection, such as the RIM (Strack & Deutsch, 2004). The chapters of the present volume showcase many examples of a cross-fertilizing influence of the RIM.

One example is research on personality. From a general perspective, generalized duality models such as the RIM might be seen as a potential framework for understanding the underpinnings of trait impulsivity (Evenden, 1999; Kagan, 1966). However, the theoretical impact of the RIM goes far beyond trait impulsivity, as documented by Back and Nestler (Chapter 9, this volume). By drawing conceptual links to the earlier distinction between implicit and explicit facets of personality, the authors provide a differentiated process framework that can be adapted to better understand various kinds of personality processes, their measurement, and their relation to behavior. As another example, Topolinski (Chapter 6, this volume) shows how research on intuition has been plagued with ambiguities regarding the characterization of the concept. Applying a theoretical framework based on the distinction between associative activation and propositional representation proved helpful in shaping a conceptually coherent definition, suggesting that judgments of any kind, including intuitive and heuristic judgments, are generated in the reflective system (cf. Deutsch & Strack, 2008; Topolinski & Strack, 2009). In their take on aggression, Banse, Schmidt, and Imhoff (Chapter 15, this volume) conclude that the RIM captures the explanatory power of a more focused aggression model. At the same time, their review suggests that the adoption of core concepts of generalized duality models (associative vs. propositional representations; associative vs. decision-based paths to behavior) enriches research on the psychological underpinnings of aggression. In a similar vein, Hagger (Chapter 10, this volume) argued that research on health behavior has greatly benefited from including non-decisional factors that influence behavior without abandoning the concepts of expected utility and self-efficacy, which have long played a dominant role in health psychology.

The surge in duality models in social psychology came hand-in-hand with the development of new measurement techniques that were hoped to provide a more direct access to some of the constructs specified in duality models (Gawronski & Payne, 2010; Petty, Fazio, & Briñol, 2009). The widespread use of these procedures in various areas of psychology further contributed to the

popularity of generalized duality models. Most prominently, performance-based indirect measures such as evaluative priming (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) and the implicit association test (Greenwald, McGhee, & Schwartz, 1998) were originally thought to provide more direct access to associative representations. Later theory and research led to a more differentiated view on these original aspirations (e.g., de Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009) as well as meticulous attempts to establish and improve their validity (e.g., Greenwald, Nosek, & Banaji, 2003; Rothermund, Teige-Mocigemba, Gast, & Wentura, 2009). At the same time, various fields within and outside psychology adopted these methods, thereby extending the impact of generalized duality models as a theoretical framework.

This development is also mirrored in many chapters of the present volume, which document the successful import of such measures into research on addiction (Wiers & Gladwin, Chapter 11, this volume), anxiety (Ouimet, Chapter 12, this volume), economic cognition (Alós-Ferrer, Chapter 13, this volume), aggression (Banse et al., Chapter 15, this volume), personality (Back & Nestler, Chapter 9, this volume), and sexual behavior (Häfner & Epstude, Chapter 14, this volume). To be sure, we do not claim that the advent of duality models was a necessary condition for the emergence of the new measurement techniques. However, looking at the history of duality models and indirect measures leads us to suggest that a co-evolution took place, with the two strains of theory and methods fertilizing each other.

Bold Claims

A second reason for why generalized duality models have been quite impactful is that they tend to make bold theoretical claims on multiple levels. As Banse and colleagues (Chapter 15, this volume) have put it regarding the RIM, aiming to "integrate more than a hundred years of theory and empirical research into a unified model of social behavior is ambitious, if not daring" (p. 240). Yet, some scholars suggest that our field is suffering from theory shyness, which may be fueled by a lack in "boldness, audacity, and the readiness to take risks" (Kruglanski, 2001, p. 872). Bold claims, however risky they may be for those making them, have the potential to promote science. Bold claims may elicit enthusiasm in some scientists and rejection by others, thereby igniting fierce debates and provoking quests for decisive evidence. Of course, bold claims promote science only when they are coupled with empirically sound predictions and a willingness to revise or abandon these claims if they continuously fail (Gawronski, 2015). Although there is a risk that duality models may be formulated in a way that undermines falsifiability, there are clear ways to prevent such undesirable characteristics (Gawronski, Sherman, & Trope, 2014; Moors, 2014).

One example concerns the assumption of covariations between process dualities. Most duality models include hypotheses about systematic covariations between processes, stimulus types, processing conditions, and processing features (Gawronski et al., 2014). For example, the RIM (Strack & Deutsch, 2004) suggests that the duality of reflection versus impulse covaries with automaticity features, suggesting that impulsive processes are more automatic relative to reflective processes. As another example, Smith and DeCoster's (2000) model suggests that the duality of associative versus rule-based processing covaries with the speed of learning, with associative representations being assumed to change more slowly than rule-based representations. Such covariation claims make duality models highly falsifiable to the extent that there is an independent way of diagnosing whether a process belongs to one or the other manifestation of the duality (Gawronski et al., 2014; Moors, 2014).

Clearly, the claims of generalized duality models instigated numerous debates, many of which came along with empirical or theoretical progress (or both). Some of these debates are still ongoing. One of the earlier debates centered on the conceptual definitions of the proposed dualities, such as the distinction between rule-based and associative processing (Gigerenzer & Regier, 1996; Sloman, 1996), associative and propositional processes (Gawronski & Bodenhausen, 2006; Kruglanski & Dechesne, 2006), and implicit and explicit measures (de Houwer et al., 2009; Gawronski, LeBel, Peters, & Banse, 2009). These debates have led to more refined and precise conceptualizations of core constructs (e.g., Moors, 2010), which is also apparent in several chapters of this volume (e.g., Deutsch, Chapter 4, this volume; Gawronski et al., Chapter 7, this volume; Hofmann et al., Chapter 8, this volume).

Closely related are debates focusing on the question whether duality notions are necessary to explain phenomena in the realm of persuasion (Kruglanski & Thompson, 1999), learning (Baeyens, Vansteenwegen, & Hermans, 2009; McLaren et al., 2014; Mitchell, de Houwer, & Lovibond, 2009), evaluation (Albarracín, Hart, & McCulloch, 2006; Gawronski & Bodenhausen, 2006), self-regulation (Friese, Hofmann, & Wiers, 2011; Stroebe, van Koningsbruggen, Papies, & Aarts, 2013), or in general (Deutsch & Strack, 2006; Keren & Schul, 2009; Kruglanski, Erb, Pierro, Mannetti, & Chun, 2006). These and other debates have led to a refinement of theoretical concepts and research methods. For example, some duality models, such as the RIM (Strack & Deutsch, 2004) have taken Kruglanski and Thompson's (1999) stance that all judgments, whether heuristic, intuitive, or systematic, are formed by the same process of syllogistic reasoning. As another example, the dispute over the necessity of distinguishing between associative and propositional learning (see Gawronski et al., Chapter 7, this volume) has led to greater conceptual and methodological rigor, and stimulated a wealth of fascinating results (e.g., Moran & Bar-Anan, 2013). Critical reflections on the concept of impulsive motivational orientations (e.g., Eder & Rothermund, 2008) had similar effects (see Neumann & Kozlik, Chapter 3, this volume). Finally, the thorough analysis of issues related to a priori claims about covariations between dualities (Moors, 2014) has resulted in highly differentiated reformulations of

previously oversimplified mappings (Gawronski & Bodenhausen, 2014). Science does flourish in a mix of collaborative harmony and competitive disputes. In our view, duality models have been stimulating both facets to an impressive degree.

Future Directions

The development of duality models has certainly not reached an asymptotic state. We expect them to be further refined and improved, and to further stimulate scientific progress, not the least through their power to integrate and to provoke. As the chapters of this book illustrate, there are inspiring and thought-provoking applications of duality models in various areas of psychology. These applications generated a wide range of interesting results that will likely feed back into the continuous development of generalized duality models. Despite the diversity of these areas, there seem to be a few emerging and persisting trends that, in our view, have the potential to shape future research and theorizing.

First, we believe that the debate between duality versus single-process models is far from being over. For example, within the realm of self-control, research and theorizing in cognitive neuroscience suggests that the recruitment of cognitive control can be understood as an instance of "reward-based decision making within which operations are selected based on decision mechanisms related to those involved in other forms of reward-based choice" (Botvinick & Braver, 2015, p. 103). Although neuroscientific data by and large support a multiple-systems view on cognitive control, the motivational perspective quoted above highlights the importance of decision-making processes for the occurrence or non-occurrence of cognitive control. This view has a strong resemblance to models of self-control that describe goal-conflicts without invoking two fundamentally different systems or processes (Stroebe et al., 2013).

A second topic that we deem important for future research in the realm of generalized duality models concerns the potential limits of reflective top-down regulation. Many modern duality models emphasize the possibility for mutual influences between the two systems or processes (e.g., Gawronski & Bodenhausen, 2006; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004), which is also apparent in many chapters of this volume (see Deutsch, Chapter 4, this volume; Gawronski et al., Chapter 7, this volume; Mussweiler, Michels, & Weiss, Chapter 2, this volume; Topolinski, Chapter 6, this volume). The scientific literature as well as everyday experience provides examples for both (a) the impressive power of abstract thoughts and insights on emotions and associations (e.g., Peters & Gawronski, 2011; van Dessel, de Houwer, Gast, Smith, & de Schryver, in press) and (b) the seeming independence of the two (e.g., Gawronski, Gast, & de Houwer, 2015; Moran & Bar-Anan, 2013). Although researchers have begun to improve theorizing about the conditions of such effects (e.g., Gawronski et al., Chapter 7, this volume), there is definitely a need for further research.

A third topic that we deem important for future research is a better understanding of the inner mechanics of rule-based or propositional processes and their underlying representations. Perhaps not the least because of their simple structure, associative processes have been described in a rather precise and mechanistic way. In the realm of generalized duality models, the description of rule-based, propositional processes seems less precise and more metaphorical. Cognitive models of relational reasoning (Hummel & Holyoak, 2003, 2005) might be candidates for more detailed process descriptions that could be incorporated into existing duality models.

Conclusion

The distinction between reflection and impulse is ubiquitous in the reasoning about human behavior, both within and outside of scientific psychology. Duality models, such as the RIM, provide a broad framework in which reflective and impulsive responses can be understood as the outcomes of two operating systems with distinct features. Duality models have had a strong impact on numerous basic and applied areas, and the present volume is an impressive testament of this influence. The strong impact may in large parts be due to the integrative nature of duality models. At the same time, duality models have been the target of criticism, which stimulated fierce scientific debates. We believe that this is a strength of duality models rather than a weakness. Scientific progress builds on debates and attempts to settle disagreements based on arguments and empirical evidence. Looking at the history of duality models, we are confident that they will continue to have a strong impact in the future.

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