

Models of Duality

ANAND KRISHNA, ROLAND DEUTSCH, and FRITZ STRACK

Abstract

Duality models generally assume that human psychology is based on two separate systems of information processing. These systems have specific characteristics that differentiate them from one another. Such models are increasingly common in social psychology today. A selection of duality models is discussed and categorized according to three factors: the type of mental representation used in the specified processes (experiential vs. nonexperiential), the methods of processing (associative vs. propositional), and the differing degree of automaticity (based on the aspects of efficiency, awareness, intentionality, and controllability) of the processes. In addition, models' statements about the superiority of one process over the other are enumerated. Foundational models of attribution, stereotyping, persuasion, and more general models are explained in an overview. Central aspects of these foundational models are extracted and applied in a discussion of current duality models in general social psychology, as well as newer dual-process models of attitudes, moral judgments, and self-regulation. Models positing a process superior in information processing are contrasted with models positing two processes with different specializations in information processing, and the implications of improved integration and specialization are discussed.

INTRODUCTION

A BRIEF INTRODUCTION TO DUALITY

The discipline of psychology aims to explain human feeling, thinking, and behavior using a variety of theories. Many prominent psychological theories stem from the information-processing paradigm, which concerns itself with the investigation of psychological processes involved in the encoding and retrieval of information as well as in inference generation. This paradigm has led to a great proliferation of theories in psychology. *Dual-process theories* based on the information-processing paradigm have been formulated with regard to many different types of behavior and judgment. Their most important and fundamental similarity is the assumption that human feeling, thinking, and behavior can best be explained by two different psychological processes that jointly determine judgments and behavior. These mechanisms

may work in tandem or may come into conflict when they specify incompatible behaviors or judgments.

Social psychology has produced so many duality models since the 1980s that it has become necessary to categorize them to prevent theoretical confusion and aid integration. According to Payne and Gawronski (2010), social psychological duality models are typically influenced by either or both of two dualities: the duality of implicit and explicit memory and the duality of automatic and controlled processes. The distinction between implicit and explicit processes corresponds to the difference between conscious and unconscious processes, whereas the distinction between automatic and controlled processes is more concerned with the differing roles of effort, intentionality, and controllability in different processes. Many social psychological models show structural similarities because they are based on these similar conceptualizations of duality. For example, all models agree that the different processes they specify may require different amounts of cognitive capacity or effort, and therefore all models predict that one psychological process will be favored over another under circumstances where capacity or effort is limited. Typically, models will also specify a process that leads to better or worse results than the other under specific circumstances. However, there are often differences in the more detailed specifications of these models, such that they are not exchangeable. In order to present social psychological models of duality in an integrative manner, it is therefore necessary to apply a systemization that reflects both conceptual similarities and critical differences between them.

The system used to organize models in this essay is based on an earlier review of duality models in social psychology by Strack and Deutsch (2015). The system incorporates three factors that serve as a framework to showcase both similarities and differences of psychological duality models. The first factor is the *representation type* dealt with by the model. This refers to whether processes work with or from subjective experiences, such as affective feelings (e.g., emotions, moods), nonaffective feelings (e.g., hunger, other bodily experiences), and perceptions, or whether they work with or from nonexperiential information-bearing structures (e.g., episodic, procedural, semantic representations). The second factor is the *type of information processing* postulated in the model, referring to whether information is processed in an associative or propositional (rule-based) manner. Associative processing is based on factors such as frequency and recency of prior use, which determine the accessibility of a concept and therefore influence how likely it is that the same concept or a similar one is activated. Propositional processing can apply relationships with truth-values between objects and categories, allowing syllogistic reasoning about objects that do not necessarily depend on experience. Both methods of information processing may

be applied to either type of representation, such that both experiential and nonexperiential representations may be processed associatively or propositionally. This implies that experiential feelings may associatively activate other feelings or related nonexperiential representations (e.g., seeing a snake activates a feeling of fear and the semantic category “snake”) and vice versa (e.g., thinking of the word “snake” may activate a feeling of fear). It further implies that propositional reasoning may categorize and use nonexperiential representations (e.g., applying the category “snake” to an animal seen in the environment—“that is a snake”) as well as experiential feelings (e.g., attributing a feeling of fear to a snake—“I am afraid of that snake”). The specification of how different representation types are processed is a useful standard of comparison for duality models. In particular, the questions of how the postulated processes interact and under what circumstances either is dominant can be more easily addressed in this way.

The third factor used to compare models in this essay is the *automaticity of processes*. Although automaticity is a heterogeneous term, containing (among others) the facets of efficiency, intentionality, controllability, and awareness, many models assume a connection between various conceptualizations of automaticity and types of information processing. For example, associative processes may be seen as more automatic than rule-based processes in a given model. The facets of automaticity can be considered independent (albeit often correlated) dichotomous (intentionality) or continuous (efficiency, controllability, and awareness) dimensions which are addressed to various degrees by duality models. The efficiency of a process is the degree to which it requires central resources (and therefore its susceptibility to constraints on those resources). Intentionality is the degree to which a process was started by an intention. Controllability is the degree to which a process can be stopped or changed when a corresponding decision to do so is formed. Awareness, broadly, is the degree to which a person is capable of reporting a process that has taken place. Although not a duality in their own right, these automaticity facets play an important role in many duality theories. Therefore, they are included as a third factor in the system of organization utilized in this essay.

Duality models often carry an implicit assumption that one of the two processes they postulate is more accurate than the other. Such assumptions may also be informative in integrating these models—if a process that is conceived to be more accurate is also typically assigned similar characteristics with regard to the factors of representation type, processing style, and automaticity, it makes sense to construct an integration with this in mind. In addition, models that contradict each other with regard to the accuracy of their respective processes may be tested against one another using this attribute, thereby giving future research an avenue to compare models.

SOCIAL PSYCHOLOGICAL MODELS OF DUALITY

FOUNDATIONAL MODELS

Many social psychological theories formulated before Steven A. Sloman's conceptually pioneering paper in 1996, as mentioned in the following sections, already showed some attributes of duality. What follows is a short overview of foundational models from varying areas of social psychology and a discussion of their duality in terms of the three factors discussed earlier (representation type, method of processing, and automaticity).

Models of Person Perception. When perceiving another person, people make judgments about the determinants of that person's behavior, so-called attributions. Gilbert and his colleagues have postulated a *three-stage model* of attribution that explains attributions in terms of three mental operations: identifying what actions a target person is performing (*categorization*), inferring dispositional attributes of the target (*characterization*), and modifying these attributes by factoring in situational constraints (*correction*). The duality in this theory is between a highly automatic, noninferential categorization process and the two other, more effortful inferential processes. The contents dealt with in processing are uniformly abstract representations, so the duality here is based primarily on automaticity and effort of use. However, the two sides of this duality interact to a degree; characterization is facilitated by the outcome of the categorization process and therefore less effortful than correction. This model thereby assumes that the automatic categorization process cannot lead to any conclusions about a perceived actor without more effortful, inferential processes—therefore, Gilbert's model conceptualizes the latter process as more important for correct information processing. Indeed, even within the inferential processes, the more effortful one may correct the correspondence bias of the less effortful one—effort leads to better conclusions. As an example, a shouting manager might easily be characterized as aggressive, but correcting this impression for the stress he might be under due to an approaching project milestone is more difficult.

Another dualistic model of person perceptions is that of Brewer. More generally than Gilbert's model, Brewer assumes that impressions of other people are formed based on a categorization into a group and an individuation of distinct attributes. In this case, both processes deal with abstract representations and may vary in the automaticity and method of processing. However, this model proposes that the process of categorization and the process of individuation each lead to a separate representation of a given person. Depending on the social requirements of dealing with this person (such as whether one is dependent on the person), different processes and representations will be accessed. Unlike Gilbert's model, Brewer does not assume that

either process has the advantage in reaching correct conclusions. Instead, contextual factors determine which process is adequate. Thus, an employee might compare their manager to other managers using a group-based categorization, but might later individuate their manager when interacting informally at an office party, using different views according to the context.

Devine has proposed an influential model of stereotyping that has a dualistic core. Her *dissociation model* states that culturally prevalent stereotypes and personal beliefs about their validity can exist in memory at the same time and may contradict each other. The activation of stereotypes is held to be highly automatic owing to long experience and learning for such stereotypes, whereas the activation of personal beliefs requires cognitive effort. Both of these representations are semantic rather than experiential, but stereotypes are processed associatively while personal beliefs propositionally apply truth-values to them. As such, the duality in this model is between an automatic, associative process and an effortful, propositional process. This duality carries the implicit assumption that the automatic process must be corrected by the effortful process to counter stereotype processing, which is typically conceptualized as inaccurate. The dissociation model therefore tends toward judging the effortful, propositional process as leading to better conclusions. Therefore, a tired employee might automatically stereotype a manager as authoritarian, only allowing for other possibilities when rested and capable of effort.

Models of Persuasion. Several influential models of persuasion and attitude change also showed a dualistic structure. Two models in particular stand out: the *elaboration likelihood model* (ELM) and the *heuristic systematic model* (HSM). Petty and Cacioppo's ELM describes attitude change through persuasion as mediated by two different processes, namely *central elaboration* and *heuristic shortcuts*. Central elaboration refers to an effortful processing of information that is relevant to the topic. This information is extracted from the persuasive message and other relevant input variables (e.g., features of the communicator), such as whether an argument holds up to logical analysis. Heuristic shortcuts are the topic-independent aspects of input variables that may serve as bases for evaluation of the argument based on simple rules. For example, a long and involved argument may be more convincing irrespective of its content if one applies the rule "long and involved arguments are usually correct." Both of these processes require the application of rules and both are effortful (heuristic shortcuts less so than central elaboration), but the ELM specifies different types of representations that might be utilized by either process. Beyond nonexperiential representations such as arguments, experiential representations such as affect may be used as information by either

process. As such, the major duality in the ELM is between an effortful and a less effortful process.

Chaiken and Trope's (1999) HSM, on the other hand, assumes a similar dichotomy of processes (*heuristic vs. systematic processing*), but conceptualizes their duality slightly differently. Heuristic processing also draws on topic-irrelevant heuristic cues, but is conceptualized as less effortful and less aware than systematic processing, which concentrates on the judgment-relevant content of the persuasive message. These two processes may interact in different ways, such that heuristic processing may introduce biases into systematic processing, systematic processing may override heuristic processing and both processes may work additively when in agreement. Similarly to the ELM, affective and other experiential cues as well as nonexperiential cues may be used by both processes in the HSM, although both remain rule-based. With regard to the categorization applied in this essay, the HSM differs from the ELM primarily in the inclusion of a greater role of automaticity in the duality of its systems.

Both of these models of persuasion assume a highly effortful process that evaluates persuasive information according to its own logical merits. If attitude change is assumed to be most accurate when new, attitude-relevant information is systematically compared to existing attitudinal information for consistency, then the more effortful process certainly has an advantage over the less effortful process described in either theory. Therefore, it can be said that models of persuasion assume that the accuracy advantage lies with more elaborative, systematic processing.

General Models. Epstein's *cognitive experiential self-theory* is a theory of personality that is based on a duality between an experiential system and a rational system. The experiential system is associative in structure and comprises emotions and basic needs. The rational system, on the other hand, is governed by logical rules and concerns itself with assessments and appraisals of current events. The experiential system is conceptualized as highly automatic, whereas the rational system is not. The two systems operate in parallel and interact, allowing each system to process the judgmental conclusions of the other. Therefore, Epstein's model contains a duality of an automatic, associative system which is primarily concerned with experiential representations, but may be influenced by abstract representations, and a nonautomatic, rule-based system which is conversely concerned with abstract representations and influenced by experiential ones. It is important to note that although Epstein discusses his theory in psychodynamic terms, he distances himself from the negative view of the unconscious espoused by many psychodynamic theories and instead posits that the experiential system may be

more efficient and accurate than the rational system under certain circumstances, thereby judging neither system superior.

The *motivation and opportunity as determinants* (MODE) model proposed by Fazio and colleagues introduces important moderators of when different processes are dominant. In Fazio's conception, attitudes may influence behavior and judgments in different ways. The first possibility lies in providing a standard for deciding which outcomes of a given behavior might be positive or negative. The second is seen as more automatic; in this case, attitudes directly influence the construal of a situation and its components. Similarly, certain attitudes themselves may be activated associatively and automatically on perception of a relevant stimulus, whereas in other cases, attitudes may be constructed by the integration of features of the attitude object, a process that is less automatic and is seen as rule-based. In both processes, attitudes are conceptualized as nonexperiential, abstract representations of an association between an object and an evaluation. Neither process is seen as more accurate than the other. Moderators of process use are specified in the model: As situation construal and attitude activation are highly automatic, they are presumed to require little motivation and capacity to work—for example, when making a low-investment choice of sweets in a shop, many people will construct the set of possible choices completely without sweets they dislike without explicitly comparatively evaluating them. They will also often rely on their spontaneous feelings to select a sweet from the options they do consider. For less automatic rule-based application of attitudes, motivation and capacity are seen as broadly multiplicative determinants. So when selecting a new car, where the motivation to avoid error is high, people instead construct the choice set and their attitudes toward the options effortfully. Importantly, the MODE model introduces clear predictions of when which process will be dominant into the emerging trend of delineation between generally automatic, associative processing and generally effortful, rule-based processing in the foundational models listed.

This delineation is the subject of Sloman's (1996) *systems of reasoning* theory. As mentioned earlier, Sloman's model has acted as a conceptual basis for many dual-process theories since its publication in 1996. The systems of reasoning theory is based on one of the dualities used in this essay to describe dual-process models: the duality between associative and rule-based reasoning. In detail, the model proposes two autonomous, noninteractive systems that operate in parallel. The associative system computes based on the principles of similarity and temporal contiguity. The rule-based system applies descriptive or normative rules to variables. Both systems may process the same contents with their respective computation methods, thereby generating possibly contradictory results, so that eating sweets may be associated with good taste and pleasure, but violate the rule of "do not eat

unhealthy foods.” This may lead to judgmental errors or biases; however, neither system is superior, as both are specialized in solving different types of problems. Sloman’s model makes no statements about automaticity and restricts itself mostly to nonexperiential representations (an exception would be its inclusion of perceptual modalities in the associative system), but it does conceptually summarize many aspects of the models listed up to now. The somewhat different assumptions made in the theories of persuasion, however (i.e., more automatic rule-based processing as opposed to associative processing, the use of experiential representations), open up several questions that have been addressed in more current research.

CURRENT MODELS

General Models of Duality. A model of memory that covers both experiential and nonexperiential representations as well as associative and rule-based processing is the *memory systems theory* of Smith and DeCoster. This integrative model posits the existence of two systems of long-term memory—one that is responsible for picking up general regularities in the environment (a slow process) and one that stores episodic records quickly, including details and the context. This duality is connected with a difference in method of processing—the slow memory system is associative in nature, so that representations that are already associated with a given content are activated when that content is activated, whereas the fast memory system operates based on linguistic principles and rules. In addition, the slow memory system is assumed to be automatic, while the fast memory system depends on motivation and effort and is controllable. The systems operate in parallel and may also interact in various ways, with each system being specialized for different tasks and neither being superior. This model provides more concrete specifications of how two systems of processing might be embedded in memory, parsimoniously explaining many social phenomena (e.g., in persuasion, person perception) and nonsocial phenomena (e.g., in judgment and decision-making).

A model that applies a similar integrative logic to reasoning is that of Kahneman and Frederick (2004). On the basis of classical research showing the existence of cognitive heuristics that are applied to simplify judgments under uncertainty, this model aims to integrate these diverse effects into a general dual-process theory. Kahneman and Frederick assume that judgments are generated based on intuitive (System 1) or reflective (System 2) processes. System 1 is assumed to be highly automatic and associative, often dealing with emotionally charged contents, whereas System 2 is effortful, slow, and serial. This division reflects previous models in distinguishing between an automatic, associative system and a nonautomatic, rule-based

system. However, the systems can interact. For example, well-practiced, complex cognitive operations may eventually become automated and move from System 2 to System 1. In addition, System 2 may monitor System 1, stepping in to “override” automatic responses if they are of insufficient quality. The operation of cognitive heuristics is explained in the model via the mechanism of *attribute substitution*—when performing a complex judgment, heuristic processing involves substituting an attribute possessed by the judgment object with an attribute that is easier to generate from System 1. For example, when deciding which new car to buy, the complex integration of attributes such as fuel efficiency and acceleration into a general judgment of the value of each car in System 2 might be substituted by the affective reaction to the cars elicited in System 1, so that the judgment basis of “gut feeling” is suggested. System 2 may in turn correct this judgment via monitoring. This model covers both types of representations as well as both methods of processing. Attribute substitution offers an explanation of many heuristics, but it remains open whether all types of judgmental simplifications can be explained by purely associative processes or whether they constitute a less effortful form of rule-based processing. The idea that System 2 monitors System 1 and corrects judgments implies that System 1 is generally less accurate. System 2 may therefore be seen as the superior system in this model.

A further attempt to integrate findings pointing at a general duality of processing is the *reflective–impulsive model* (RIM) of Strack and Deutsch (2004). The RIM seeks to combine motivational, cognitive, emotional, and behavioral elements into one theory specifying their interaction in information processing. Drawing on similar distinctions as mentioned earlier, between an automatic, associative system and an effortful, rule-based system, the RIM assumes that behavior is governed by an *impulsive* and a *reflective* system. The impulsive system is always active, whereas the reflective system requires capacity and motivation. When the reflective system is activated, both systems operate in parallel. The associative nature of the impulsive system extends to experiential representations as well as nonexperiential ones, including behavioral schemata. This implies that the impulsive system can directly activate behavior associatively if the activation and connection to the behavioral schema are strong enough. The reflective system, on the other hand, may propositionally generate judgments and behavioral intentions, which then activate behavioral schemata. Importantly, the two systems interact continually, as the impulsive system is assumed to be the long-term memory “store” from which the reflective system draws concepts which it then links propositionally. Therefore, information preactivated in the impulsive system is more likely to be used in propositions in the reflective system and therefore to become a part of the reasoning process. On

the other hand, as the reflective system activates contents simultaneously in the impulsive system, these contents may become linked to one another, creating a degree of automaticity in often-repeated judgments or behaviors. When, however, the two systems are in conflict (i.e., the impulsive system automatically activates behaviors or thoughts that are antagonistic to the reflective system's propositional judgment), the capacity of the reflective system to change the current activation pattern is dependent on cognitive resources and motivation. Thus, the RIM captures everyday behavioral impulses that we fall victim to when distracted or apathetic, such as breaking our diets by grabbing a sweet. In this model, both experiential and nonexperiential cues can be processed in both associative and rule-based ways and behavior is included directly in the theory. An important advantage of the RIM is an explanation of the effects of behavior on cognition, motivation, and affect—as behavioral schemata are associatively linked to cognitive, motivational, and affective structures via the impulsive system, behavioral activation may spread to these areas as well. In general, the RIM makes no statement on the relative accuracy of the two systems.

Duality Models in Specific Psychological Applications. Applications of newer duality models to various areas of social psychology have increased in recent years. In the following, examples of newer duality models in the areas of attitude research, moral judgments, and self-regulation will be discussed.

Gawronski and Bodenhausen (2011) have applied the RIM, as mentioned earlier, to attitude research in their *associative and propositional processes in evaluation* (APE) model. Therein, explicit attitudes are evaluative propositional beliefs with subjective truth-values, whereas implicit attitudes are associative clusters of concepts related to the attitude object with varying valence and levels of accessibility, depending on the context of activation. Behavioral consequences may result from both types of attitude. Responses may be facilitated when implicit and explicit attitudes are in harmony or inhibited when the two types of attitudes disagree. A drive for cognitive consistency is assumed to be a motivational force in the model, so that affective responses caused by the activation of implicit attitudes may be integrated into the propositional judgment only if they are consistent with other information currently active in propositional processing. In turn, propositional processing can selectively activate specific associative clusters, thereby influencing implicit attitudes. One of the implications of this model is that a negation of a statement with a truth-value may have different results depending on whether cognitive capacity is available in processing it. As associative clusters can only represent an existing or nonexisting link, not a negated link, negated statements (e.g., sweets are not healthy) should

strengthen associative links (between “sweets” and “healthy”). Only via propositional processing can the negative truth-value be applied to the statement, implying that negated statements may have paradoxical effects on attitudes under conditions suboptimal for propositional processing. In addition, inconsistencies in cognitions or between cognition and behavior should only lead to changes in explicit attitudes (processed propositionally), as truth-values are required for a meaningful identification of inconsistency between statements. Implicit attitudes should change only over the long term as the modified explicit attitude influences associative activation patterns. For example, the proposition that wasteful sports cars are bad for the environment is simply derived, but spontaneous positive associations with such cars may not change without cognitively reaffirming this proposition often over time. Similarly to the MODE model of attitudes, the APE model makes no statement about whether either implicit or explicit attitudes are more accurate or correct.

In the field of moral judgments, Haidt’s (2001) *social intuitionist* model has helped understanding phenomena and inspired a new wave of research. This model assumes that moral judgments are, on one hand, based on automatic, affective moral intuitions and, on the other hand, effortful, aware, intentional moral reasoning. Moral intuitions are seen as spontaneous judgments that operate outside awareness but sometimes result in affective reactions, such as a disgust response to consensual, safe incest between adults. These intuitions function according to pattern matching and parallel distributed processing principles, which are similar to associative processing as conceptualized earlier. In the model specifications, emotion and affect play no direct role (being activated by moral intuitions but not necessarily being further processed). However, much research supporting the model has focused on moral emotions, conflating them with moral intuitions. With this in mind, the model covers experiential as well as nonexperiential processing in both associative and rule-based ways. A link to nonaffective experiential cues drawn in the social intuitionist model is the assumption that the associations used in moral intuition are based on learned moral concepts and may contain representations of bodily experiences. Haidt mentions that moral judgments based on intuition may often lead to suboptimal conclusions and describes moral reasoning as a highly biased process, leading to the tentative conclusion that intuition in the social intuitionist model is conceptualized as generally inferior to reasoning.

Duality models have also contributed to research in the field of self-regulation. Many behaviors in daily life are habitual; that is, they occur with little effort or intentionality under appropriate circumstances. Such habits may sometimes be inappropriate or unwanted responses to a given situation. For example, not eating a habitual donut on coffee

break can cost us effort. A dual-process model that reflects this conflict is Metcalfe and Mischel's (1999) *hot/cool system*. In this model, hot processing is emotional, associative, and does not require much thought. Cool processing, on the other hand, deals mainly with nonexperiential contents and is required for volitional and goal-directed behavior. The duality of this model again contrasts an automatic, associative system against an effortful, rule-based system, but in this case, the hot system deals primarily in experiential (emotional) contents, whereas the cool system processes more abstract, nonexperiential contents. Many moderating variables determine whether the hot or cool system prevails in a conflict, among them internal strategies (such as directing attention away from "hot" stimuli) and external strategies (such as blocking visual access to "hot" stimuli). This duality model therefore serves to integrate many aspects of self-regulation and provide a framework to test them. Coming from the field of self-regulation, the hot/cool system model necessarily assumes the cool, regulatory system is more relevant to the individual's goals than the hot, emotional system, leading to the conclusion that the cool system is superior.

THE SEARCH FOR THE SUPERIOR PROCESS

Many of the models presented have made statements about whether one of their two processes is more accurate than the other. Although several models make no explicit statement on this point, two basic positions can be extracted: The idea that the more effortful, systematic process is generally superior (further referred to as *effortful superiority*) and the idea that either system can outperform the other given the correct situational factors (further referred to as *specific adaptation*). The idea of effortful superiority comes from a research perspective that investigates the functioning of the less effortful system by measuring errors in tasks with "correct" rational answers. This "heuristics and biases" approach tends toward the general assumption that less effortful processing cannot outperform more effortful, systematic processing. This view is criticized by proponents of specific adaptation, who argue that complex systematic processing may be inferior to the application of simple rules under specific circumstances, such as when large amounts of information must be processed to reach an optimal decision. Making clear statements as to which position is correct is difficult, as often, different duality theories do not agree on the exact architecture of the processes described. For example, the debate whether the application of heuristics can be superior to more effortful processing deals with two rule-based processes of varying levels of automaticity, whereas many studies of the performance of intuitive judgments versus systematic judgments examine

the relative merits of associative and rule-based processing. Clearly, these two questions are fundamentally different and may benefit from different approaches.

To address the question of the “superior process,” it is therefore necessary to clearly define the parameters of the processes involved. Specifically, a deeper understanding of the architecture of the processes being examined would allow the derivation of situational factors that favor one process over the other.

REFERENCES

- Chaiken, S., & Trope, Y. (Eds.) (1999). *Dual-process theories in social psychology*. New York, NY: Guilford Press.
- Gawronski, B., & Bodenhausen, G. (2011). The associative–propositional evaluation model: Theory, evidence, and open questions. *Advances in Experimental Social Psychology, 44*, 59–127.
- Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgement. *Psychological Review, 108*, 814–834.
- Kahneman, D., & Frederick, S. (2004). Attribute substitution in intuitive judgment. In M. Augier & J. G. March (Eds.), *Models of a man: Essays in memory of Herbert A. Simon* (pp. 411–432). Cambridge, MA: MIT Press.
- Metcalfe, J., & Mischel, W. (1999). A hot/cool system analysis of delay of gratification: Dynamics of willpower. *Psychological Review, 106*, 3–19.
- Payne, B. K., & Gawronski, B. (2010). A history of implicit social cognition: Where is it coming from? Where is it now? Where is it going?. In B. Gawronski & B. K. Payne (Eds.), *Handbook of implicit social cognition: Measurement, theory, and applications* (pp. 1–15). New York, NY: Guilford Press.
- Slooman, S. A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin, 119*, 3–22.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*, 220–247.
- Strack, F., & Deutsch, R. (2015). The duality of everyday life: Dual-process and dual-system models in social psychology. In P. Shaver & M. Mikulincer (Eds.), *APA handbook of personality and social psychology*. Washington, DC: American Psychological Association.

ANAND KRISHNA SHORT BIOGRAPHY

Anand Krishna is a graduate student in social psychology at the University of Würzburg. His research interests include the duality of implicit and explicit processes as well as more economically focused topics, such as the endowment effect and purchase behavior as symbolic self-completion.

ROLAND DEUTSCH SHORT BIOGRAPHY

Roland Deutsch is an associate professor of social psychology at the Technical University of Dresden (Germany) and a member of the Collaborative Research Center on Volition and Cognitive Control. His research focuses on attitude change, indirect measures of social cognition, and approach/avoidance behavior. Jointly, Fritz Strack and Roland Deutsch have been working on a dual-system model of social cognition and behavior, which has been applied to various fields of psychological science.

FRITZ STRACK SHORT BIOGRAPHY

Fritz Strack is a professor of social psychology at the University of Würzburg (Germany). His research interest lies in the domain of social cognition and includes memory, judgment, emotion, and behavior. A list of his publications can be obtained from Google Scholar.

RELATED ESSAYS

Models of Revealed Preference (*Economics*), Abi Adams and Ian Crawford
Mental Models (*Psychology*), Ruth M. J. Byrne
Emerging Trends: Asset Pricing (*Economics*), John Y. Campbell
Heuristic Decision Making (*Political Science*), Edward G. Carmines and Nicholas J. D'Amico
Misinformation and How to Correct It (*Psychology*), John Cook *et al.*
Four Psychological Perspectives on Creativity (*Psychology*), Rodica Ioana Damian and Dean Keith Simonton
Behavioral Economics (*Sociology*), Guy Hochman and Dan Ariely
Emotion and Decision Making (*Psychology*), Jeff R. Huntsinger and Cara Ray
Resource Limitations in Visual Cognition (*Psychology*), Brandon M. Liverence and Steven L. Franconeri
Against Game Theory (*Political Science*), Gale M. Lucas *et al.*
Heuristics: Tools for an Uncertain World (*Psychology*), Hansjörg Neth and Gerd Gigerenzer
Creativity in Teams (*Psychology*), Leigh L. Thompson and Elizabeth Ruth Wilson