CHAPTER 16

The Dynamic Interactive Model of Person Construal

Coordinating Sensory and Social Processes

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As you walk down a busy street, you happily glance around, momentarily glimpsing dozens if not hundreds of other people. As decades of research have shown, a mere glimpse of these individuals allows you to to place each of them quickly and efficiently into a number of relevant social categories. Most important, it seems, are sex, race, age, and emotion (Calder, Young, Perrett, Etcoff, & Rowland, 1996; Macrae & Bodenhausen, 2000), although it is becoming increasingly clear that other, more ambiguous categories may be automatically extracted as well, such as sexual orientation (Rule, Macrae, & Ambady, 2009). All this information may be availed to perceivers in just a fraction of a second. In the laboratory, for example, if a participant is asked explicitly to categorize a face by sex, response latencies generally hover around a half a second (e.g., Quinn & Macrae, 2005). Of course, reaction time tasks are accompanied by a large motor component (all the time required to convert cognitive representations into a hand movement), and event-related potential (ERP) findings suggest that such categorizations may be cognitively furnished within even shorter time periods (e.g., Freeman, Ambady, & Holcomb, 2010; Ito & Urland, 2003). Regardless, perceivers are able to extract categorical information rapidly from other people with impressive ease, so much so that the process appears to be mandatory.

It is only recently that social psychologists have become concerned with the perceptual processes culminating in social categorization. Traditionally, the focus has been on the consequences of categorization and the host of cognitive, affective, and behavioral effects that ensue. Consider, for example, two influential models of impression formation, Fiske and Neuberg's (1990) continuum model and Brewer's (1988) dual-process model. According to these models, from some array of available cues arises a dominant categorization (e.g., black), which then exerts a host of influences on impressions, memory, and behavior. It automatically activates related stereotypes (Devine, 1989), albeit conditionally (Gilbert & Hixon, 1991; Macrae & Bodenhausen, 2000), which then bias impressions in ways that are often stereotypically consistent. This category-based responding, however, may be tempered by a number of factors, such as attention or motivation. With the help of such intervening factors, these models posit that perceivers may move beyond categories and begin to rely more on individuating information, such as the observation that the target person pushed her friend.

In general, these models argue that perceivers by default resort to category-based responding, presumably because it maximizes cognitive efficiency and streamlines the demands of social interaction (also see

Allport, 1954). However, motivational states, such as the desire to be accurate, can move perceivers from category-based to more individuated impressions, involving a piecemeal integration of unique aspects of a target's behavior (Fiske & Neuberg, 1990). Inconsistencies between stereotypes and a target's behavior, or bad category fit, can also lead to more individuated impressions (Brewer, 1988). Moreover, attentional resources may limit perceivers' ability to move toward more individuated responding. As such, these person perception models aim to parse out the relative contributions of stereotypical and individuated information in forming impressions of others.

Although sharing a similar aim, Kunda and Thagard's (1996) parallel constraint satisfaction model takes a different approach, arguing that stereotypical and individuated information are given equal priority in person perception, and that both kinds of information are simultaneously integrated into a coherent impression through constraint satisfaction. This stands in contrast to Fiske and Neuberg's (1990) and Brewer's (1988) models, in that stereotypical information does not inherently receive more weight than individuating information. Instead, the Kunda and Thagard (1996) model assumes there are no fundamental differences in the representation of stereotypical and individuating information; all that matters is the strength of the information.

One important aspect common to all these models is that initial categorization provides the starting point, after which subsequent impressions, memory, or other social phenomena are predicted and explained. With a given categorization having taken place (e.g., black), the aim of these models is to understand the variety of factors that guide subsequent impressions and contribute to more category-based versus individuated responding. But what of initial categorization itself? Although these models have long acknowledged that perceivers tend to categorize spontaneously along a dominant dimension from brief exposure to another's face, the process underlying this remained relatively obscure.

Outside the social psychological literature, on the other hand, there has been an expansive body of work examining the mechanisms underlying face perception (e.g., Bruce & Young, 1986; Farah, Wilson, Drain, & Tanaka, 1998; Haxby, Hoffman, & Gobbini, 2000). By connecting insights from the social literature on social categorization to the cognitive and vision literatures on face perception, an emerging area of work has begun to forge the relationships between lower-level sensory processing and higher-order social cognition. This has often been referred to as *person construal* research. Traditional social psychological research focused on the aftermath of social categorization and its influences on downstream phenomena. Person construal research, on the other hand, aims to understand how perceptual cues and their bottom-up operations ultimately lead to particular social categorizations.

Thus, seminal models of person perception (Brewer, 1988; Fiske & Neuberg, 1990; Kunda & Thagard, 1996) have been enormously valuable for explaining high-level impressions and perceivers' differential reliance on categorical versus individuating information in judging others. However, they have not aimed to explain the initial categorization process itself. Instead, extant models have treated categorization as a rapid, straightforward process that triggers a number of consequential effects. This is consistent with a long tradition in social psychology, dating back to the seminal work of Allport (1954), who argued that categorizing others is a highly efficient and spontaneous, perhaps inevitable, phenomenon that the cognitive system uses to economize on mental resources. This quickly became a guiding principle in the field of person perception. Categorization, accordingly, allows us to avoid dealing with the complexities and inconsistencies inherent to other people, and instead to provide a convenient shortcut for social interaction.

Although this characterization is highly valuable and probably correct, one problem is that despite categorizations being highly rapid and efficient, each is also highly complex. And each is complex in ways that are not likely to be captured adequately by this "feed forward" approach, in which bottom-up cues feed activation forward onto a dominant category, which feeds activation forward onto related stereotypes, which then feed into a number of downstream effects (also see Johnson & Freeman, 2010). The main trouble is that there is potentially a great deal of feedback as well, in which stereotypes and higher-order social cognitive phenomena constrain lower levels of processing (e.g., category activation), thereby fundamentally altering basic perceptions. On encountering a middle-aged black man, for example, one dominant categorization has been argued often to arise (e.g., black), with the dominant category determined by a number of factors (Bodenhausen & Macrae, 1998). The stereotypes associated with this dominant category then figure into perceivers' impressions with some degree of priority (Brewer, 1988; Fiske & Neuberg, 1990; Kunda & Thagard, 1996) and become subject to a variety of downstream interpretative processes and, in some cases, inhibitory control (Bodenhausen & Macrae, 1998). What has not readily been considered, however, is that initial categorization—as automatic as it may be—could potentially be affected by the very stereotype activations and downstream processing that it triggers.

Recently, we proposed a dynamic interactive model of person construal, which provides a computational account of the real-time social categorization process and emphasizes its cyclical, ongoing, and interactive nature (Freeman & Ambady, 2011). The model posits an intimate interplay between bottom-up sensory cues and top-down social factors in driving the process of categorizing others. In this process, particular categorizations emerge from the ongoing interaction between lower-level sensory processing and higher-order social cognition. As such, ultimate categorizations (e.g., "He's a man!") are the stable end result of a dynamic process in which both bottom-up and top-down factors gradually constrain one another over time.

BOTTOM-UP, MEET TOP-DOWN

One of the most important considerations motivating the dynamic interactive model of person construal is how social category representations would be implemented in a human brain, and the dynamics involved in activating those representations. At the neural level, the representation of a social category would be reflected by a pattern of activity distributed across a large population of neurons. Thus, activating a social category representation would involve continuous changes in a pattern of neuronal activity (Smith & Ratcliff, 2004; Spivey & Dale, 2006; Usher & McClelland, 2001). Neuronal recordings in nonhuman primates have shown that, very soon after a face is presented, about half of a face's visual information rapidly accumulates in temporal cortex neurons, while the remaining half gradually accumulates over the following hundreds of milliseconds (Rolls & Tovee, 1995). This gradual evolution of a face's representation tends to involve a transition between initial coarse analysis of the face to a more fine-grained representation (Sugase, Yamane, Ueno, & Kawano, 1999). As such, during early moments of the categorization process, the transient interpretation of a face is partially consistent with multiple categories (e.g., both male or female), because the coarse "gist" available is partially suggestive of both categories. As more information accumulates and representations become more fine-grained, the pattern of neuronal activity dynamically sharpens into an increasingly confident representation (e.g., male), while other, competing representations (e.g., female) are naturally pushed out (Freeman, Ambady, Rule, & Johnson, 2008; Spivey & Dale, 2006; Usher & McClelland, 2001). One important function of this dynamic competition is the ability of the perceptual system to take the natural diversity that is inherent in others' sensory cues (e.g., slightly masculine features on a woman's face) and slot it into the rigid categories that are needed to so readily perceive other people.

Importantly, during those fuzzy hundreds of milliseconds it takes for the neuronal activity to achieve a stable pattern (~100% male or ~100% female), top-down factors—such as context, stereotypes, motivation, or attention—could also potentially exert an influence beyond bottom-up processing of facial cues, thereby partly determining the pattern toward which the system will gravitate (e.g., Bar, 2004; Grossberg, 1980; Spivey, 2007), thereby partly influencing social categorization. Accordingly, social categorization would incorporate not just another's facial cues (and vocal and bodily cues), but also top-down sources, rendering categorization always a compromise between the perceptual cues "actually" there and the baggage perceivers bring to the categorization process. Why would this be the case? Intuitively, we might expect that our basic perception of a visual stimulus, such as a face, would be immune to top-down factors and instead entail a veridical representation of the perceptual information before our eyes (see Marr, 1982). This was long presumed to be the case (e.g., Fodor, 1983; Pylyshyn, 1984; but see Bruner & Goodman, 1947). However, most researchers would now agree that human perception is a highly active and constructive process. To the extent that perception is for action and for guiding functionally adaptive interactions with the environment (Gibson, 1979), one might expect it to be able to be adjusted by top-down factors—such as expectations, motivations, or attention—so long as these factors may facilitate adaptive behavior.

The visual world, of course, is rife with ambiguous and conflicting information—ever more so in perceiving social targets—and it is the job of the perceptual system to construct coherent, meaningful percepts that the cognitive system can use to effect behavior. Consider, for example, the words in Figure 16.1A. A visual pass across the top of the figure and one effortlessly sees "CAT," and a visual pass across the bottom and one just as effortlessly sees "THE." If one were to cover up the first and last letters of each word, however, one would be quick to note that the middle letter "A" in CAT and middle letter "H" in THE are entirely identical. Yet when placed in the different contexts of surrounding letters, the identical letter stimulus is perceived one way ("A") or the other ("H") based on whichever helps the perceptual system construct the most coherent interpretation. More specifically, perceivers' expectations—in this case, based on stored lexical representations of "cat" and "the"—constrained the perceptual processing of the middle letler, biasing it in a way that agreed best with prior conceptual knowledge.

FIGURE 16.1. (A) The ambiguous middle letter is readily disambiguated by the surrounding letters based on prior conceptual knowledge. (B) A face's race may be similarly disambiguated by the surrounding context cues based on prior stereotype knowledge. From Freeman, Penner, Saperstein, Scheutz, and Ambady (2011). Copyright by the authors. Reprinted by permission.

Such influences of context are hardly limited to ambiguous stimuli. You may not have realized, for example, that the word *letter* in the last sentence of the previous paragraph in fact did not read *letter.* A *t* was switched for an *l,* but the processing of the other letters likely constrained processing of the *t,* biasing it toward an *l* to create a more coherent perception (i.e., forming *letter* rather than *letler*). The word recognition system was attracted to perceive *letter* as it had a preexisting conceptual representation for it, and the surrounding letters gave the system enough evidence to run with that interpretation. Reminiscent perhaps of the tendency for person perceivers to economize considerably on mental resources (Allport, 1954; Macrae & Bodenhausen, 2000), readers tend not to process every single letter of every word; in fact, they may skip whole words altogether (Sereno & Rayner, 2003). For a streamlined perceptual–cognitive pipeline, prior expectations and conceptual knowledge—and in some cases motivations as well (Balcetis & Dunning, 2006; Pauker et al., 2009)—are rapidly brought to bear on the basic processing of visual information, allowing context and expectations to fill in the patterns for which we are too lazy to seek fine-grained evidence.

What permits these influences of expectation on perception is the intimate exchange between bottom-up and top-down forces. Three decades ago, the pioneering work of McClelland and Rumelhart (1981) elegantly showed that such context effects naturally arise out of the dynamics of a simple network of interconnected artificial neurons—a connectionist network—in which representations of features, letters, and words recurrently feed activation back and forth with one another until settling on a best-fitting state. Returning to the CAT/THE example, bottom-up processing of the written text's features activates letter representations, which in turn activate conceptual representations of the words *cat* and *the,* which in turn exert top-down pressure back on the letter processing. Ultimately, this top-down feedback is able to bias the ambiguous middle letter toward an "A" interpretation in the context of CAT and toward an "H" interpretation in the context of THE. As such, it is the dynamic interaction between bottom-up and top-down information sources that yields such flexible and context-sensitive perception.

Our dynamic interactive model applies these seminal insights from the word recognition literature to person construal. A general diagram of the model appears in Figure 16.2. Technically, it is a recurrent connectionist network with stochastic interactive activation (McClelland, 1991). A number of pools are depicted; in specific instantiations of the model, each pool will contain a variety of nodes (e.g., *female, Asian, caring, male cues*). Specific details may be found in Freeman and Ambady (2011). The network provides an approximation of the kind of processing that might take place in a human brain (Rogers & McClelland, 2004; Rumel-

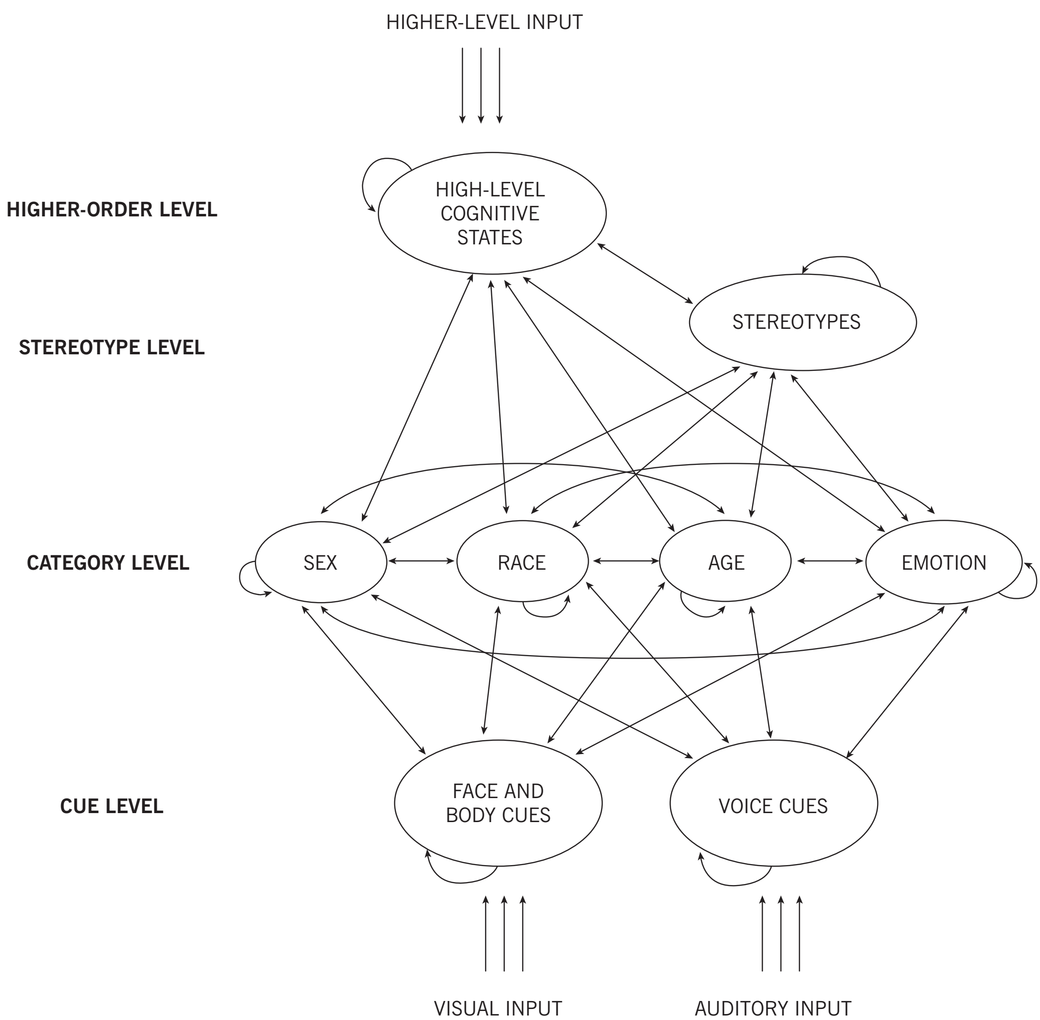

FIGURE 16.2. A general diagram of the dynamic interactive model of person construal. From Freeman and Ambady (2011). Copyright by the American Psychological Association. Reprinted by permission.

hart, Hinton, & McClelland, 1986; Smolensky, 1989; Spivey, 2007), particularly in the context of perceiving other people.

Initially, both bottom-up and top-down inputs stimulate the system (see Figure 16.2). This may include many forms of input, including bottom-up input of another's face, voice, or body, and top-down input from higher-order systems involved in motivations or top-down attention, for example. Every version of the model contains a number of nodes that are typically organized into four levels of processing (corresponding to cues, categories, stereotypes, and high-level cognitive states). At every moment in time, a node has a transient activation level, which can be interpreted as the strength of a tentative hypothesis that the node is represented in the input. After the system is initially stimulated by bottom-up and top-down inputs, activation flows among all nodes at the same time (as a function of their particular connection weights). Note that many connections between the nodes are bidirectional. This results in a dynamic back-and-forth flow of activation among many nodes in the system, leading them gradually to readjust each other's activation more and more as they mutually constrain one another over time. This leads the system to stabilize gradually over time onto an overall pattern of activation that best fits the inputs and maximally satisfies the system's constraints (the inputs and the relationships among nodes). Presumably, we argue, this stable state would correspond to an ultimate perception of another person.

In short, the model assumes that perceptions of other people dynamically evolve over fractions of a second, emerging from the interaction between bottom-up sensory cues and top-down social factors. This renders social categorization to be, in a sense, a gradual process of negotiation between the variety of sensory cues "actually" inherent to a person, and the baggage an individual perceiver brings to the perceptual process.

PUTTING THE "SOCIAL" BACK IN SOCIAL CATEGORIZATION

To illustrate better the dynamics of the model, let us consider an example. It has long been known that race has important relationships with social status. White individuals tend to be stereotyped as having high status, whereas black individuals tend to be stereotyped as having low status. Occupation categories, however, also are associated with status stereotypes: Businesspeople are stereotyped as having high status, whereas janitors are stereotyped as having low status. As such, cues related to occupation might come to activate status stereotypes that then constrain the perception of race, similar to how the surrounding letters in "CAT" and "THE" activated word representations that constrained the perception of the middle letter.

In a previous set of studies, we presented participants with faces generated to have varying level of race content, from white to black, and surrounded those faces by either business or janitor attire (Freeman, Penner, Saperstein, Scheutz, & Ambady, 2011). In Figure 16.1B, for example, we see the same racially ambiguous face surrounded by either business or janitor attire. When participants were asked to categorize the race of these faces, business attire increased the likelihood of a white categorization, whereas janitor attire increased the likelihood of a black categorization. Furthermore, these influences of context were exacerbated as a face's race became more ambiguous. One likely explanation for these effects is that while facial race was being processed, contextual attire cues activated occupation categories in parallel, which in turn began activating status stereotypes. Once active, the stereotypes then constrained categorization by exerting top-down feedback on the race categories with which they happen to be associated. When we implemented this process in a version of our dynamic interactive model, the model's dynamics strongly corroborated these experimental effects.

Figure 16.3 illustrates this specific version of the general model (see Figure 16.2). To illustrate its operations, let us consider the case of the system being presented with a somewhat ambiguous white face with janitor attire. Presenting the system with this stimulus and the task demand of race categorization sets a process into motion in which visual input of the face activates cue nodes and higher-level input of the task demand activates higher-order nodes. The *race task demand* node places excitatory pressure on the *white* and *black* categories, and inhibi-

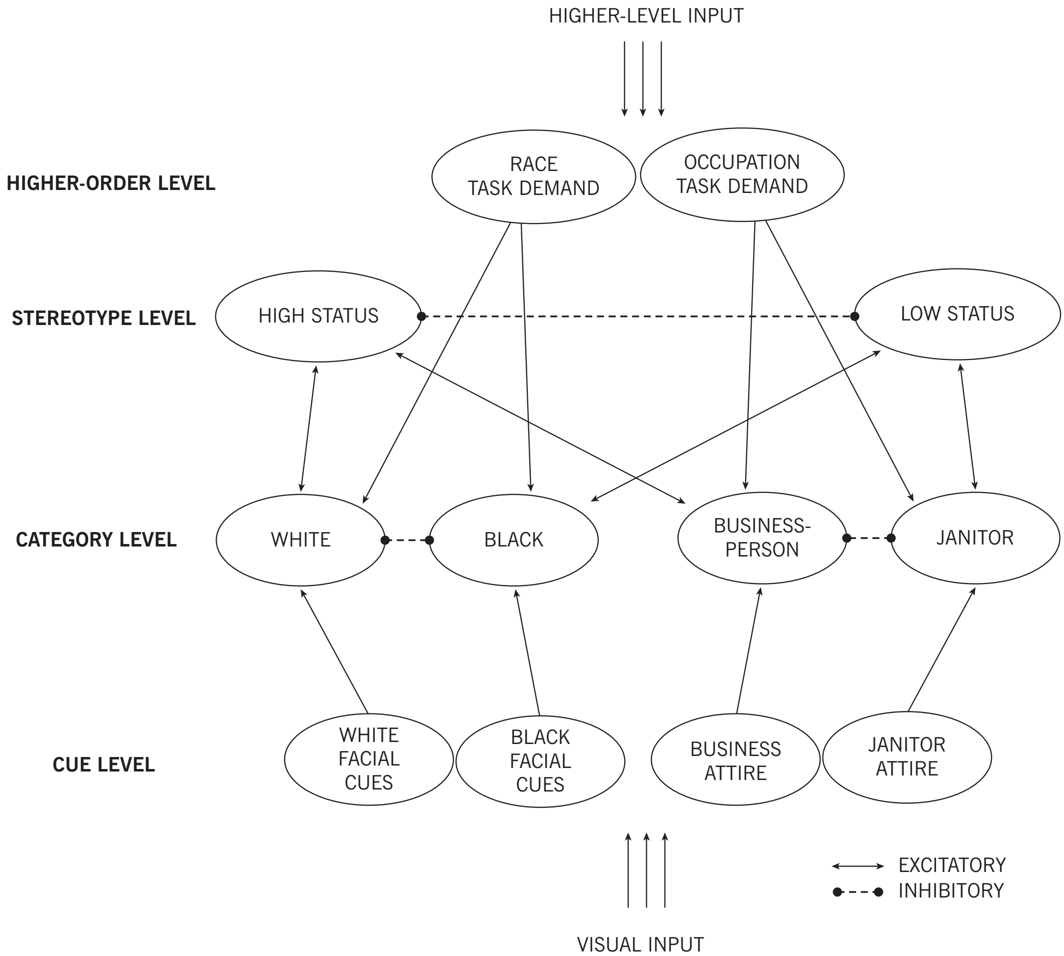

FIGURE 16.3. A specific instantiation of the dynamic interactive model of person construal from Freeman, Penner, Saperstein, Scheutz, and Ambady (2011). Copyright by the Authors. Reprinted by permission.

tory pressure on the *businessperson* and *janitor* categories. This results in the *white* and *black* categories becoming partially active for the particular task. The strongly activated *white facial cues* category excites the *white* category. Now that the *white* and *black* categories are active in parallel, they begin to compete with one another through ongoing, mutual inhibition, and eventually stabilize onto one category (see Freeman et al., 2008; Freeman, Pauker, Apfelbaum, & Ambady, 2010). While this process unfolds, the *white* category puts excitatory pressure on the *high status* stereotype and the *black* category puts excitatory pressure on the *low status* stereotype. Now that the conflicting status stereotypes are also active in parallel, they also begin competing with one another (see Freeman & Ambady, 2009). At the same time, activation of the *janitor attire* node excites the *janitor* category and inhibits the *businessperson* category. Note that the *janitor* category is also inhibited by the *race task demand* node (as this is a race categorization task), so it only gains a small amount of activation. However, that meager amount of activation is sufficient to start putting excitatory pressure on the *low status* stereotype. At this point, the stereotype nodes are being fed activation by both race and occupation categories in an ongoing fashion. Here comes the critical part. Because this is an interactive, recurrent system, while the competition between stereotypes is still resolving, the stereotype nodes also place their own activation pressures back on the category nodes, thereby providing top-down feedback. The result is that the *janitor* category's excitation of the *low status* stereotype winds up exerting excitatory pressure on the *black* category, helping it win against the *white* category.

In some instances, especially when the bottom-up information (i.e., face) is particularly ambiguous, such top-down pressures wouldhave enough strength to make the *black* category more likely to win the race–category competition, thereby driving the system's ultimate categorization responses. In other instances, especially when the bottom-up information is clear-cut, such pressures would not have enough strength to alter responses wholesale. Instead, what occurs is a stronger partial parallel activation of the *black* category (until it gradually decays, succumbing to the *white* category). As a result of stereotypes feeding back into the category competition—even slightly—the activation dynamics of the *black* and *white* categories are altered nevertheless, even though the competition's outcome is not ultimately affected. Computationally, what is happening here is that perceivers' stereotypical expectations are combining with incoming visual information to shape initial categorizations of other people, sometimes wholesale and at other times only temporarily.

Indeed, in a previous set of studies we found that participants' race categorization responses were biased by contextual attire cues, likely due to stereotypes (Freeman et al., 2011). But what about cases where the ultimate response is not biased? In a number of studies, we have used a mouse-tracking technique to open up the categorization process and gain insight into its real-time processing dynamics. This technique allows us to probe further such cases in which the ultimate response does not seem to be particularly biased. In the context of this study, we found that even when participants ultimately categorized a face with janitor attire as white, the process leading up to their response was nevertheless partially biased toward the *black* category (presumably due to the dynamic modulation of stereotypes, triggered by contextual cues). The converse effect held as well. Even when participants ultimately categorized a face with business attire as black, the categorization process was partially biased toward the *white* category. The main mouse-tracking result from this work appears in Figure 16.4.

Participants were presented with a face stimulus and asked to indicate whether the target was black or white by moving the mouse from the bottom-center of the screen to either top corner of the screen (see Figure 16.4). As seen in the figure, before ultimately categorizing a face with janitor attire as white, the mean mouse trajectory was simultaneously and partially attracted to select the black response, continuously across construal. In other words, participants' movements were neither in a discrete pursuit straight to the response associated with bottom-up facial cues (i.e., white) nor in a discrete pursuit straight to the response associated with top-down stereotypes (e.g., black). Instead, the evolving categorization process was always in a weighted combination of both response alternatives, because both bottom-up sensory and top-down social forces were driving the social category dynamics in real time, until partici-

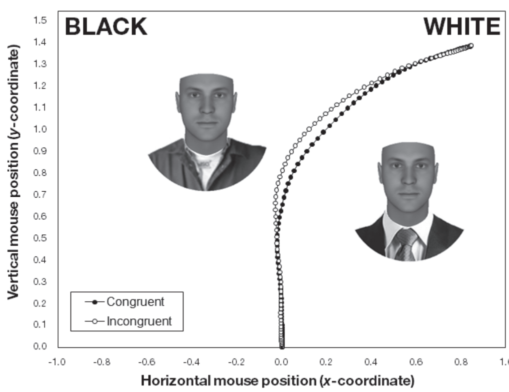

FIGURE 16.4. Main mouse-tracking results. Before ultimately categorizing a face with janitor attire as white, mouse movements exhibited a continuous, partial attraction toward the black category response. A similar attraction effect toward the white category response was observed for cases where faces with business attire were categorized as black. From Freeman, Penner, Saperstein, Scheutz, and Ambady (2011). Copyright by the authors. Reprinted by permission.

pants gradually stabilized onto, in this case, a single, white categorization response.

It is worth noting that because categorizations are compromises between bottom-up and top-down information, the importance of one information source is dependent on the other. Thus, as alluded to in the previous simulation, when perceptual cues are ambiguous and provide only weak information, the bottom-up ambiguity invites strong influences from top-down constraints. Indeed, results from the previous study were consistent with this perspective. We found that as a face's race became increasingly ambiguous, the effects of context and stereotypes became increasingly pronounced; when more ambiguous, perceptions were especially biased by top-down stereotypes and pulled toward the category stereotypically associated with the status cue (Freeman et al., 2011). Thus, there is a tradeoff between bottom-up and top-down influences that is driven by their respective strengths.

Similar principles hold when top-down constraints are weak, thereby inviting strong influences from bottom-up cues. Take, for example, the influences of race categories on sex categorization via stereotypes. A black target will activate stereotypes such as aggressive and athletic, which, due to incidental overlap with the male category, in turn put excitatory pressure on the male category; similarly, an Asian target will activate stereotypes such as docile and communal, which in turn put excitatory pressure on the female category. These top-down pressures from race-triggered stereotype activation could readily bias the sex categorization process, especially when a target's sex is ambiguous (Johnson, Freeman, & Pauker, 2012). However, there are many cases in which such top-down stereotype pressures are weaker. For instance, the *white* category does not have strong associations with sex-related stereotypes; thus, a white target would not induce strong top-down, race-triggered stereotype pressure on sex categorization. In these cases, the top-down constraints on sex categorization would be quite weak, thereby allowing bottom-up cues to be a strong determinant of perceptions (Freeman & Ambady, 2011; Johnson et al., 2012).[1]

Together, what the previous examples illustrate is that initial categorizations of others are, in fact, hardly "initial" at all. They emerge out of feedback loops across a dynamic and interactive person construal system. As automatic and spontaneous as they may be, they are not mere "readouts" of facial features. Instead, they arise out of a complex process shaped by not only bottom-up cues but also the prior knowledge, expectations, and higher-order social cognitive baggage that individual perceivers bring to the table. Specifically, the model assumes that basic social category activation is readily influenced by the very stereotypes and downstream processing it triggers. Not only does activation of the *black* category trigger stereotypes of low-status, for example, but activation of low-status stereotypes influences activation of the *black* category. "Initial" categorizations emerge out of a gradual, dynamic coordination of both sensory factors (e.g., facial cues) and social factors (e.g., stereotypical expectations), ultimately yielding flexible and integrated perceptions of other people.

As described earlier, person perception models in the social literature have tended to focus on high-level impressions and on knowledge about individuals and groups. Models in the cognitive and vision literatures, on the other hand, have described the perceptual mechanisms that permit facial perceptions. A dynamic interactive model might help unify these literatures by describing how the lower-level processing modeled in the cognitive and vision literatures works together with the higher-order processing modeled in the social literature to give rise to person construal. It argues for an intimate and inextricable connection between both the "sensory" and the "social," in which both lower-level sensory and higher-order social factors collaborate in complex ways to give rise to initial categorizations. In such a way, social psychological processes are theoretically permitted to play a larger role in visual construals of other people than has previously been considered.

RELATIONSHIP TO DUAL-PROCESS FRAMEWORKS

In spite of their differences, prior models of person perception, including Fiske and Neuberg's (1990) continuum model, Brewer's (1988) dual-process model, and Kunda and Thagard's (1996) parallel constraint satisfaction model, have all stressed the tension between categorical and individuated styles of processing. The models agree in that both styles of processing are involved in impression formation, but they differ in what priority each contributes to impressions and when various factors may drive their respective contributions. Our model, instead, homes in on perceivers' categorical processing, and aims to understand how particular categories and the stereotypes they trigger become activated in the first place. For example, all three models, as well as Bodenhausen and Macrae's (1998) related model, start with initial categorization. Our model opens up that initial categorization process, well before subsequent person processing and impression formation have had a chance even to begin.

Whereas the previously mentioned models deal with the interplay of individuating information (e.g., he smiled at his friend) and category information (e.g., stereotypes) on forming impressions, our model currently does not aim to account for the accrual of individuating information. Moreover, our model aims to explain basic category and stereotype activation rather than high-level impressions. In the future, however, it would be interesting and valuable to incorporate individuating information into the model, because it could have numerous influences on category and stereotype activation. For now, we can say that once implemented, it would likely function more similarly to Kunda and Thagard's (1996) model than to Fiske and Neuberg's (1990) or Brewer's (1988) model. Hypothetically, individuating information would be processed the moment it is observed and thereafter provide an immediate and parallel constraint on all person construal system processing.

Rather than center on a duality between categorical and individuating information, however, our model centers on a different duality most relevant to person construal: bottom-up sensory versus top-down social cognitive sources of information. Prior person perception models have certainly made the bottom-up versus top-down distinction as well. In such models, however, category knowledge was treated as a top-down biasing structure, whereas individuating/person-based attributes were treated as the bottom-up information sources that build into perceptions (e.g., Brewer, 1988). Instead, our model instead treats category knowledge itself as the perceptual phenomenon of interest; and it views stereotypes and higher-order social cognition as top-down information sources that constrain it, whereas perceptual cues are the bottom-up determinants driving it. Thus, our model deals with the interplay of bottom-up and top-down influences on basic "initial" category and stereotype activations, which in prior models were treated as the top-down influence itself on other phenomena (e.g., impressions).

Such influences in our model are argued to run in parallel with one another, richly interacting via feedback loops produced across a dynamic person construal system. However, it is important to note that there is nothing that distinguishes the inherent nature of bottom-up and top-down information in the model. Rather, it is more appropriate to talk about bottom-up and top-down *effects* on certain representations or levels of processing in the system, rather than the existence of separate bottom-up and top-down *processes*. This is because many excitatory and inhibitory pressures influence (and are influenced by) social category activation, and these arise from complex interactions between lower levels (the cue level) and higher levels (stereotype and higher-order levels) of processing to such an extent that they are difficult to separate as being solely "bottom-up" or "top-down." It is true that the system is initially stimulated by external input that is clearly and unambiguously bottom-up or top-down, with bottom-up input originating from the visual and auditory systems, and top-down input originating from a top-down attentional system or motivational system. However, once the system is initially stimulated by these external bottom-up and top-down inputs, bottom-up and top-down processing become inextricably intertwined.

Take, for example, the effects of status stereotypes on race categorization described earlier. The most proximal mechanism underlying these effects was the accumulated top-down pressures from status stereotypes, which exerted a continuous influence on race categories. But such a top-down effect was set into motion only by the bottom-up processing of contextual attire cues, which activated status stereotypes, which eventually exerted top-down influence on race categories. Thus, while effects in the system can perhaps be described as primarily bottom-up or top-down for descriptive purposes, ultimately bottom-up and top-down processes are in such interaction that it is difficult definitively to tease them apart. The “top-down” influence of status stereotypes only came into being from the “bottom-up” processing of contextual attire cues. Thus, there is an intimate and complicated exchange between the bottom-up and the top-down, between the “sensory” and the “social,” that yields ultimate construals. Indeed, we feel that this is not so much a problem as it is a central argument of our framework. A deep coextension exists, we argue, between bottom-up sensory–perceptual and top-down social cognitive processes, in which stable person construals rapidly emerge out of the ongoing interactions between them. And arguably, they are so confounded with one another that attempting to separate them out may not be the most meaningful distinction that research could make (however, see discussion in Freeman & Ambady, 2011, pp. 270–271).

A separate distinction between processes that has given rise to enormous theoretical strides in social psychology has been that of automatic and implicit versus controlled and explicit processes. For example, a variety of social psychological models, including the associative–propositional evaluation (APE) model (Gawronski & Bodenhausen, 2006), the dual-attitude model (Wilson et al., 2000), the systems of evaluation model (SEM; Rydell & McConnell, 2006), and the reflective–impulsive model (RIM; Strack & Deutsch, 2004), posit two at least partially independent processes or systems: one that is associative, implicit, automatic, and/or impulsive, and another that is propositional, explicit, controlled, and/or reflective. In general, the former involves simple associative links that are activated in patterns based on principles of similarity and congruity in a relatively automatic and resource-independent fashion (e.g., similar to a connectionist model). The latter involves higher-order reasoning and controlled, resource-dependent processing, and can often either affirm or deny the former’s representations. For example, a spontaneous, implicit negative evaluation of a black target (driven by the former) may be affirmed or denied by one’s explicit racial attitudes (driven by the latter). There is considerably more complexity and nuance to each of these models, but common to them all is this general kind of processing division.

Prior models in the person perception literature have dealt with these two processing styles differently. In Fiske and Neuberg’s (1990) continuum model, default category- and stereotype-based responding corresponds to more automatic processing, whereas individuated responding (dependent on a perceiver’s motivation) corresponds to more controlled processing. In Brewer’s (1988) dual-process model, both category- and person-based responding may involve automatic or controlled processing, depending on one’s motivation and involvement. In Kunda and Thagard’s (1996) model, categorical–stereotypical and individuating information are simultaneously integrated by a single process assumed to be relatively automatic. However, Kunda and Thagard cautioned that impression formation may in many cases involve causal reasoning that recruits additional controlled processing beyond the scope of their model.

Our model is more similar to that of Kunda and Thagard (1996), in that it presumably deals with relatively automatic processing only. This is even more the case with our model than with theirs, however, as the process we model is initial categorization itself, which is widely agreed to be highly automatic (Macrae & Bodenhausen, 2000). Once an initial categorization occurs, however, how the stereotypes it activates then figures into perceivers’ impressions and behavior, or is inhibited or controlled, is a separate question receiving considerable debate (Bargh, 1999; Macrae & Bodenhausen, 2000). Despite initial categorization being highly automatic, for example, a number of studies has shown that perceivers’ goal states and other preconditions can modulate whether it in fact occurs, rendering it conditionally automatic (Macrae & Bodenhausen, 2000). However, although goals may modulate whether categorizations do or do not occur, it is unclear what their role would be in tampering with the dynamics and outcomes of those categorizations. For example, although perceivers’ goals can change whether categorization may occur, if it in fact does occur, can they control whether stereotypes are free to alter basic face processing, biasing it toward a white or black categorization based on contextual cues? Similar to how automatically the word "CAT" is lifted off CAT and "THE" lifted off THE due to readers' stored conceptual knowledge (see Figure 16.1A), it is unclear whether person perceivers would have control over stereotypes' alteration of lower-level perceptual processing. Individual differences in implicit racial prejudice (which presumably influence how strongly racial stereotypes are active; Lepore & Brown, 1997) do appear to influence lower-level perceptual processing (Hugenberg & Bodenhausen, 2004), and this is accounted for in our model (Freeman & Ambady, 2011). Moreover, goals such as task demands certainly play a role in amplifying or attenuating the activation of certain category activations, which is a basic tenet of our model. Future research will need to examine whether more complex goals beyond simple task demands, and other controlled processes, can interact with the relatively automatic person construal system we have modeled to shape basic perceptions. For the time being, we speculate that the answer is "yes," and this may be a very fruitful line for investigation in the future.

CONCLUSION

In summary, the dynamic interactive model of person construal aims to explain the initial category and stereotype activation process—a process that, in extant models in person perception, has formed the starting point for understanding subsequent phenomena. In this process, basic construals of other people rapidly but gradually emerge from an ongoing interaction between bottom-up sensory–perceptual and top-down social cognitive processes. Arguably, they interact to such an extent that it may not be helpful to attempt to tease apart processes as definitively "bottom-up" or "top-down"; instead, it would be more helpful to assess their relative contributions in driving particular effects. That is, we argue that there are not two distinct processes, but only one highly integrative and dynamic process.

The proposed framework should not be seen as competitive with extant models in person perception. Instead, it builds on them with a different level of analysis, zooming in on the initial categorization process itself. In doing so, it connects the higher-order social phenomena more traditionally studied in the person perception and social cognition literatures to basic sensory processes, and argues for their rich coextension in driving the process of construing others. However, many questions remain. How the relatively automatic process of person construal figures in with more controlled processes, and the phenomena richly explored in dual-process frameworks in social psychology, will be extremely important to address in the future. For now, however, by linking the "social" to the "sensory" in such inextricable ways, person construal has arguably been rendered a problem that is not just the province of social psychology to solve, but an exciting collaboration among the cognitive, vision, and neural sciences as well (see Adams, Ambady, Nakayama, & Shimojo, 2011; Balcetis & Lassiter, 2010).

NOTE

1. In virtually all cases, category nodes in instantiations of our model would settle into an attractor state involving only one predominantly active node (e.g., male) within a given dimension (e.g., sex). Because activation is stochastic, even if bottom-up cues are inherently equibiased (e.g., 50% masculine, 50% feminine) and top-down constraints exert equal pressures on both male and female categories, random noise would eventually lead either the male or female category to win the competition. However, the model cannot currently explain more stable categorization responses that are more graded in nature (e.g., biracial/multiracial). Such stable graded category states are being investigated for future instantiations of the model.

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