

# Categorical Cognition: A Psychological Model of Categories and Identification in Decision Making: Extended Abstract

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This paper introduces a notion of categorization into economics and derives its implication for economic decision making. In particular, based on a wealth of research from psychology, we build a model of social cognition centered on the basic principle that humans process information with the aid of categories. We derive some basic results regarding what our model of categorization implies about biases in decision making, and then apply this model to understand some simple forms of discrimination in economic contexts, including labor and lending markets, and identity choice; though we envision even broader implications.

Our contribution may be described as follows: (1) we develop a formal model of social cognition based on categorization of experiences, (2) we show that such categorization results in particular biases based on the frequency with which an observer encounters similar situations, (3) we provide a theoretical basis for the experimental evidence in social psychology attesting that people tend to characterize others by race (Brewer, 1988; Bruner, 1957; Fiske and Neuberg, 1990); (4) we show that discrimination can exist in environments where there is no taste for discrimination and personal attributes (such as employment qualifications) are fully observable; (5) we show that this discrimination is unique to minority groups and not the consequence of some “coordination failure”; and (6) we discuss implications of the model regarding social identity, which we view as self-categorization.

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### *A Description of Our Model of Categorization*

In understanding how a human groups memories and stores them in the brain, psychologists have developed ideas of how categories are important. There is substantial experimental evidence that when faced with an object or person, a given individual's brain "automatically" activates a category that, according to some metric, best matches the given object (and at times context) in question.<sup>1</sup> There is also new evidence in social psychology and cognitive neuroscience that the brain pays particular attention to racial identity<sup>2</sup>. While the reasons behind the use of categories are not yet completely understood, there are theories based on the efficiency of storage and retrieval of information (much like the organizing of a file system on a computer) as well as speed in being able to react.<sup>3</sup> Effectively, this is a bounded rationality story in which there are both costs to storing details of every past interaction separately, and costs to and delays in activating stored information based on how finely it is stored. So, the first piece of the puzzle from our perspective is that a given decision maker will store information from their past experiences in a finite set of bins to be called "categories." We sidestep the interesting question of how the number of such categories might be selected, and for now simply take it to be some given number  $n$ .

The second question regards both how new information is stored in categories as well as how it is called up.<sup>4</sup> The activation of a category when faced with a new object is accomplished through a matching of the "attributes" of the object with the attributes associated with the category. In particular, an "attribute" is one of the observable characteristics of the object. Associated with each category is an idea of which attributes something in that category should have. For instance if we think of a category of "bird", then it would have "beak", "feathers", "wings", etc., as attributes associated with it. We call the list of attributes associated with a category a "prototype."

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<sup>1</sup>For example, see Allport (1954), Bargh (1994, 1997, 1999) for views on the automaticity of categorical thinking, and Dovidio et. al. (1986) for some of the experimental evidence. Note that under automaticity subjects are often not even aware of the process, much less the biases that are inherent in it.

<sup>2</sup>For instance, see Hart et. al. (2000) and Phelps et. al (2000).

<sup>3</sup>Rosch (1978) is perhaps the most precise. She argues that humans are searching for "cognitive efficiency" by minimizing the variation in attributes within each category for a fixed set of categories.

<sup>4</sup>There is evidence that the storage of information and the categorization structure is quite different in young children during their "developmental stages" than when they are adults (see Hayne, 1996, and Quinn and Eimas, 1996). While understanding the development of categories is an important question, we will focus on the behavior of adult decision makers, whose categorical structure is largely in place.

The given object's attributes are then compared to the prototypes of different categories until a best match is found. The precise process by which such matching is made is not completely understood at present based on what we have seen in the psychology literature.<sup>5</sup> We assume that decision makers act in rough congruence with a sort of "cognitive efficiency," which we take as the minimization of a distance metric between the given object and the matching prototype. This matching process is what is often called "identification."<sup>6</sup>

The third piece of the puzzle is what is then to be done with the categorical information once it is activated. For instance, once a decision maker has activated a category for a new object, say "bird", what happens next? This is where the theory of "stereotypes" comes into play. The idea of a stereotype is that it is an association of a given category with a series of different possible behaviors or other characteristics<sup>7</sup>. The priming of the category leads to an activation of the stereotype, which is the basis for the prediction of future behavior. The formation of stereotypes is another place where the understanding in the psychology literature is still a bit nebulous.<sup>8</sup> Here we model the stereotype as built on past interactions with objects in a given category. This black-boxes the issue of whether this is entirely built on a person's own interactions or also through what they might have heard or vicariously experienced, as we can treat such vicarious information as being stored in the same way. We shall, however, refer to a representative type for a category as a "prototype" rather than a "stereotype," for reasons that we come back to discuss later.<sup>9</sup>

On top of this automatic process of identification with a category and calling of a prototype, there is evidence that people then go through a thinking process where the conscious mind reasons through the information it has

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<sup>5</sup>For example, see Sternberg and Ben-Zeev (2001), Chapter 3.

<sup>6</sup>See Rosch (1978).

<sup>7</sup>In the psychology literature these are also often referred to as attributes (Hamilton and Sherman, 1994; Hamilton, Sherman, and Ruvolo, 1990; Stangor and Ford, 1992; and Stangor and Lange, 1994). Here we separate readily identifiable attributes used in first activating a category, like "beak", "wings", etc., with those things such as characteristics or behaviors that we might try to predict, like, "is difficult to catch", "is frightened of cats", etc. This distinction is somewhat artificial, but will be very useful from our perspective.

<sup>8</sup>See Hilton and Von Hippell (1996). For instance, part will be based on personal experience, but part can also be based on public information. There is evidence that people can accurately describe the "stereotype" associated with a given group or category that they believe others to have, even if it is not exactly what comes up in their own minds.

<sup>9</sup>For a discussion of some of the standard uses of these terms, see Hilton and von Hippel (1996).

at hand.<sup>10</sup> In situations where an individual has time to think (which are often more relevant in economic applications) the reaction may move beyond reacting to the prototype. Here individuals more carefully review the past situations that they can recall based on the category that has been activated and bring in other considerations. This part of the puzzle is probably the most complicated and the least well understood from the psychological perspective. This is, therefore, the part of the model where our treatment is the most ad hoc.

Based on these different pieces of the puzzle, the crux of this paper is to put together a formal model of a decision maker which is consistent with what psychologists know about how the human mind stores and retrieves information and uses it to form predictions about behavior that are relevant to economists.

## References

- [1] Allport, G.W. 1954. *The Nature of Prejudice*. Reading MA: Addison Wesley.
- [2] Bargh, J.A. 1999. "The Cognitive Monster: The Case Against the Controllability of Automatic Stereotype Effects" in *Dual Process Theories in Social Psychology*. New York: Guilford
- [3] Bargh, J.A. 1997. "The Automaticity of Everyday Life." in R.S. Wyer, Jr. (Ed.), *The Automaticity of Everyday Life: Advances in Social Cognition*. Vol 10, 1-61. Mahwah, NJ: Erlbaum.
- [4] Bargh, J.A. 1994. "The Four Horsemen of Automaticity: Awareness, Intention, Efficiency, and Control in Social Cognition." in T.K. Srull and R.S. Wyer, Jr. (Eds.), *Handbook of Social Cognition*. Vol 1, 1-40. Hillsdale, NJ: Erlbaum.
- [5] Bargh, J.A. 1984. Automatic and Conscious Processing of Social Information, in T.K. Srull and R.S. Wyer, Jr. (Eds.), *Handbook of Social Cognition*. Vol 3, 1-43. Hillsdale, NJ: Erlbaum.
- [6] Brewer, M.B. 1988. "A Dual Process Model of Impression Formation." in T.K. Srull and R.S. Wyer, Jr. (Eds.), *Advances in Social Cognition*. Vol 1, 1-36. Hillsdale, NJ: Erlbaum.

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<sup>10</sup>See Bargh (1984), Devine (1989), and Leeper and Brown (1997).

- [7] Bruner, J.S. 1957. "On Perceptual Readiness." *Psychological Review*, 64, 123-152.
- [8] Devin, P.G. 1989. "Stereotypes and Prejudice: Their Automatic and Controlled Responses." *Journal of Personality and Social Psychology*. 56:5-18.
- [9] Dovidio, J.F., Evans, N., and Tyler, R.B. 1986. "Racial Stereotypes: The Contents of Their Cognitive Representations." *Journal of Experimental Social Psychology*, 22, 22-37.
- [10] Fiske, S.T., and Neuberg, S.L. 1990. "A Continuum of Impression Formation, from category based to individuating processes: Influences of Information and Motivation no Attention and Interpretation." *Advances in Experimental Social Psychology*, 23, 1-74.
- [11] Hamilton, D.L., and Sherman, J.W. 1994. "Stereotypes", in T.K. Srull and R.S. Wyer, Jr. (Eds.), *Handbook of Social Cognition*. Vol 2, 1-68. Hillsdale, NJ: Erlbaum.
- [12] Hamilton, D.L., Sherman, S.J., and Ruvolo, C.M. 1990. "Stereotype-Based Expectancies: Effects on Information Processing and Social Behavior." *Journal of Social Issues*, 46, 35-60.
- [13] Hart, A., Whalen, P., Shin, L., McInerney S., Fischer, H., and Rausch, S. 2000. "Differential Response in the Human Amygdala to Racial Outgroup vs Ingroup Face Stimuli." *Neuroreport*, 11, 2351-2355.
- [14] Hayne, H. 1996. "Categorization in Infancy," in Rovee-Collier, C., and Lipsitt, L (Eds.), *Advances in Infancy Research*, 10.
- [15] Hilton, J.L., and von Hippel, W. 1996. "Stereotypes." *Annual Review of Psychology*, 47, 237-271.
- [16] Lepore, L., and Brown, R. 1997. "Category and Stereotype Activation: Is Prejudice Inevitable?" *Journal of Personality and Social Psychology*. 72: 275-87
- [17] Phelps, E., O'Connor, K., Cunningham, W., Funayama, E., Gatenby, J., Gore, John., and Banaji, M. 2000. "Performance on Indirect Measures of Race Evaluation Predicts Amygdala Activation." *Journal of Cognitive Neuroscience*, 12:5, 729-738.

- [18] Quinn, P.C., and Eimas, P.D. 1996. Perceptual Organization and Categorization in Young Infants, in Rovee-Collier, C., and Lipsitt, L (Eds.), *Advances in Infancy Research*, 10, 1-36.
- [19] Rosch, E. 1978. "Principles of Categorization", in E. Rosch and B.B. Lloyd (Eds.), *Cognition and Categorization*, 27-48. Hillsdale, NJ: Erlbaum.
- [20] Stangor, C., and Ford, T.E. 1992. "Accuracy and Expectancy-Confirming Orientations and the Development of Stereotypes and Prejudice." *European Review of Social Psychology*, 3, 5-89.
- [21] Stangor, C., and Lange, J.E. 1994. "Mental Representations of Social Groups: Advances in Understanding Stereotypes and Stereotyping." *Advances in Experimental Social Psychology*, 26, 357-416.
- [22] Sternberg, R., and Ben-Zeev, T. 2001. *Complex Cognition: The Psychology of Human Thought*. NY: Oxford University Press.