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Activation of Bipolar Prototypes in Attribute Inferences

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The present study examined how prototypes, as organizational principles of knowledge about persons, affect attribute inference judgments. A distinction is drawn between bipolar and unipolar categories. Two questions are addressed: First, whether only one or both prototypes of bipolar categories like extraversion–introversion are activated in making inference judgments, and second, whether information about the applicability of a stimulus item to a target is processed differently than information about the inapplicability of the stimulus item. The results support the hypothesis that only one prototype is activated and that this is the affirmative one, irrespective of whether the stimulus information is applicable or inapplicable to the target person. The implications of these findings are discussed.

The experiment reported here is stimulated by recent concerns in social and person perception pertaining to the way that information is interpreted, stored in memory, and retrieved. Research on these problems often employs such concepts as *schema* (Markus, 1977; Stotland & Canon, 1972), *prototype* (Cantor & Mischel, 1977, 1979), and *script* (Bower, Black, & Turner, 1978; Schank & Abelson, 1977). Each of these concepts pertains to a structure for encoding and representing infor-

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mation. Earlier versions of how attribute inferences are mediated relied on the argument of semantic similarity (e.g., Ebbesen & Allen, 1979; D'Andrade, 1965, 1974; Felipe, 1970; Kuusinen, 1969; Peabody, 1967), which assumes that attribute inferences are a function of the degree of perceived semantic similarity between attributes.

The general aim of the present paper is to provide a more detailed examination of the way the prototype model accounts for attribute inference judgments. According to that model, person categories are organized around their clearest or most typical exemplars (cf. Reed, 1972; Rosch, 1977, 1978). Thus, when information is presented about a person, person prototypes may organize its perception, storage, and retrieval (cf. Cantor & Mischel, 1979; Rogers, Kuiper, & Kirker, 1977; Markus, 1977).

Two types of prototypes must be differentiated in the domain of person perception. A distinction should be made between categories that fall along a bipolar dimension (e.g. extravert–introvert) and those that represent the pole of an essentially unipolar dimension (e.g. Catholic–Non-Catholic). In the former case a clear prototype will be associated with each of the poles. The information that somebody is not an extravert may elicit not only the response, "does not have the features of a typical extravert," but it may also activate the prototype associated with the polar opposite (i.e., "does have the features of a typical introvert"). In the case of unipolar dimensions, however, telling somebody that a person is not a member of the polar category (i.e., "is not a Catholic") does not elicit any clear prototype.

The experiment reported here examined the way in which bipolar attributes mediate attribute inferences. Subjects received information that a target person had rated a particular attribute as either definitely applicable to himself/herself, or as not at all applicable. Then, they judged the applicability of each of several other attributes for describing the target. Both the stimulus attributes and the attributes rated by subjects varied systematically in the extent to which they were typical of a prototypic extravert or a prototypic introvert.

The processes underlying inferences about a target person in the situation described above and the role of prototypic representations of persons in making these inferences are not clear. This role depends on whether the information presented suggests that the target person possesses an attribute contained in one of the prototypes or suggests that he does not. To see this, suppose first that the target indicates that an attribute typical of an introvert applies to him/her. It seems reasonable to suppose that, based on this information, the subject will also judge other attributes typical of a prototypic introvert to characterize the target as well. However, this could be true for at least two reasons. A prototype explanation would argue that the subject activates the "introvert" pro-

totype as a result of the information, and infers the applicability of other attributes on the basis of the content of this prototype. A semantic similarity explanation would argue that the subject simply infers the applicability of other attributes on the basis of their semantic similarity to the given attribute, without invoking a prototype at all.

The prototype and semantic similarity possibilities are difficult to distinguish empirically. However, it seems reasonable to suppose that if subjects activate a prototype on the basis of the information presented, the content of this prototype serves as a direct source of knowledge to use in judging the target. To this extent, their judgments of the target with respect to attributes that are highly typical of the prototype may be made with greater confidence, and thus may be more extreme, than they would be if they were made on the basis of the more general semantic similarity of the attributes to the target attribute. Thus, if a stimulus attribute like "venturesome" activates the extravert prototype, it may lead an item such as "seeks others to communicate with them" to be endorsed strongly, despite the lack of any immediate semantic similarity between these two items. Furthermore, if attribute judgments are based on a prototype, then they should depend on how typical the attributes are of the prototype. In fact, a prototype model would suggest that irrespective of its degree of typicality a stimulus attribute should evoke the prototype, as long as its typicality is sufficient to activate it. In contrast, applicability judgments for the response items should be a function of their typicality. That is, response items which are highly typical of the prototype should be inferred to apply more strongly than those items which are moderately typical of the prototype. However, if judgments are based on semantic similarity *between* the items, the typicality of the attributes for the prototype should not necessarily have any effect.

This line of reasoning has also implications for the primary question of concern here, namely, whether or not the activation of the prototype associated with one of two bipolar categories also activates the converse prototype. That is, suppose the information that the target possesses an attribute contained in the "introvert" prototype activates the "extravert" prototype as well. Then, the subject should use the content of both affirmative and converse prototypes as a direct source of knowledge in judging the target, and inferences that attributes typical of an introvert are applicable to the target should be made with just as much confidence (i.e., should be just as extreme) as inferences that attributes typical of an extravert are *not* applicable. Furthermore, these inferences should once again be a function of the typicality of the response attributes for the prototype, and not a function of the typicality of the stimulus attribute for the prototype.

On the other hand, if activation of an introvert prototype does not

simultaneously activate the converse prototype, then judgments of response items incongruent with the affirmative prototype are made on the basis of the semantic similarity of the incongruent attributes to the stimulus attribute, and should therefore be made with less confidence, or be less extreme than the judgments for congruent response attributes. Furthermore, if responses for the incongruent attributes are not mediated by a prototype then they should not be a function of typicality whereas responses for congruent attributes should.

Related questions arise when the target indicates that an attribute typical of a prototype category (e.g., an introvert) does *not* apply. In this case, subjects' judgments of the target with respect to other attributes may depend upon whether the information elicits access to either an "introvert" prototype, an "extravert" prototype, both prototypes, or neither prototype. For example, suppose the subject activates only the "introvert" (i.e., the converse) prototype and uses the content of this prototype to infer what the target is *not*. Then, he will respond confidently, and therefore more extremely, when the response item being judged is congruent with the converse prototype (i.e., judgments at the "not applicable" end of the scale), but will not respond extremely when the attribute is contained in the "extravert" prototype. In this case, only the judgments on response items belonging to the converse prototype will be a function of response item prototype typicality. However, suppose that a target's statement that an introverted attribute is not applicable elicits only the affirmative prototype. In this case, the subject is more likely to be more confident of his judgments that the target possesses attributes contained in the "extravert" prototype (i.e., judgment at the "applies" end of the scale) than that the target does *not* possess attributes contained in the "introvert" prototype. The former judgments will be a function of response item prototype typicality but not the latter. Third, suppose the target information elicits simultaneously the affirmative and the converse prototype (i.e., the target is typified as both an "extravert" and "not an introvert"). In this case, both types of judgments described above will be made with confidence (i.e., extremely), and the extremity of these judgments will be again a function of the typicality of the attributes for the respective prototypes. Finally, if neither prototype is activated by the target information, and all judgments are made solely on the basis of semantic similarity of the attributes judged to the target attribute, these judgments should be similar for both types of attributes and should be made with less confidence (or extremity) than when the target information activates a category (i.e., the condition where the target person says that the stimulus attribute applies).

METHOD

Overview

Forty-eight undergraduates (32 males and 16 females) from the University of Mannheim volunteered to participate in this experiment for pay (3 Deutsche Mark). Each subject received information about a target person's self-rating with respect to 1 of 24 behaviors and traits, 12 of which conveyed extraversion and 12 of which conveyed introversion. The items contained in each of the two sets varied in typicality with respect to the category to which they pertained.

The scale position of the target person's ratings was varied to convey that the attribute presented either "applied fully," or "did not apply at all." With 24 items and two scale positions, there were a total of 48 stimulus combinations. Each subject received a unique stimulus configuration, and then, in each case predicted on the basis of this information how the target person would respond on the remaining 23 items.

Subjects' judgments were analyzed as a function of the type of stimulus attribute (introverted vs extraverted), the typicality of this attribute (high vs medium), the target's self-rating (applicable vs inapplicable), the type of attribute rated (extraverted vs introverted), and the typicality of the attribute rated (high vs medium).

Selection of Stimulus Materials

Two preliminary studies were conducted for purposes of selecting stimulus materials. In the first study, 39 subjects who did not participate in the main experiment were asked to describe the attributes of a typical *extravert*, whereas 39 additional subjects were asked to describe those of a typical *introvert*. Subjects were randomly assigned to the groups. The question was open-ended and the answers were provided in written form. The descriptions thus obtained were content analyzed and 58 individual items were identified. These referred to behaviors in isolation, behaviors in different contexts, traits, and interests. All the items were thus subject-generated for the categories.

The 58 items obtained from the first study were then given to two independent samples of 20 persons each, in a random order. One group rated these items with respect to their typicality for an extraverted person, and the other group with respect to their typicality for an introverted person. Subjects were allocated randomly to the two groups. Subjects were asked to judge each item on a 7-point scale of typicality from "atypical" to "typical," with the midpoint denoted (in German) "neither/nor" and the three points on either side of it denoted "somewhat," "quite," and "highly," respectively.[1] These points were subsequently

[1] The German labels employed here were: highly, sehr; quite, ziemlich; somewhat, etwas; and neither/nor, weder/noch.

numbered from 1 (highly atypical) to 7 (highly typical). The labels for the scale positions were taken from a study concerned with developing verbal labels for scale intervals and had shown that these particular labels were semantically equidistant from each other (Rohrmann, 1978). This meant that subjective variations in the interpretation of scale positions were minimized. Furthermore, the use of identical labels on each side of the scale midpoint (4) permitted distances in relation to this midpoint to be compared. The 24 subject-generated items used in the study are given in Table 1 along with their mean typicality ratings.

TABLE 1
THE 24-PERSON DESCRIPTIONS AND THEIR MEAN TYPICALITY RATINGS

		X_E	X_I
Items descriptive of an extravert			
High typicality			
1. Enjoys social connections		6.30	2.29
2. Has lots of friends		6.10	2.71
3. Venturesome		6.00	2.57
4. Seeks others to communicate to them		6.00	3.00
5. Likes talking		6.00	2.60
6. Open-hearted		5.90	2.90
	$\bar{x}$	6.05	2.68
Low typicality			
1. Can't stand long periods of solitude		5.20	2.95
2. Doesn't have anxieties in his/her dealings with others		5.15	3.60
3. Adapts easily		5.10	2.95
4. Easily enthused		5.08	3.03
5. Searches others to discuss his/her personal problems		5.05	2.20
6. Is not reserved in new situations		4.95	2.65
	$\bar{x}$	5.09	2.90
Items descriptive of an introvert			
High typicality			
1. Often thinks about him/herself		2.48	6.10
2. Attempts to solve his/her problems on his/her own		2.67	5.85
3. Doesn't face issues openly, chewing them inwardly		2.65	5.71
4. Does not wish to reveal him/herself		3.00	5.65
5. Is not noticed in groups		3.00	5.55
6. Inaccessible		2.57	5.45
	$\bar{x}$	2.73	5.72
Low typicality			
1. Appears distanced		2.43	5.05
2. Likes playing chess and reading books		3.53	4.85
3. Is interested in things that can be done on one's own		2.91	4.70
4. Uncertain		2.40	4.67
5. Finds it difficult to speak about him/herself		2.40	4.50
6. Isolated		2.25	4.52
	$\bar{x}$	2.65	4.71

The six most typical items for each category constituted the high typicality group. The six moderate typicality items were selected such that their mean typicality would be 1 scale point below the high typicality group. The mean ratings of items high and moderate in typicality for an extravert were 6.05 and 5.09, respectively, while the mean ratings of items high and moderate in typicality for an introvert were 5.72 and 4.71, respectively.

Procedure

Each subject was given a booklet with the following standard instruction (in German): "In this booklet you will find 24 person descriptions. The first description has been answered by an hypothetical person. He has put a cross indicating how well this description applies to him personally. Your task is the following: consider carefully how this hypothetical person would have rated himself on the remaining 23 items and then answer each description as you think it would have been answered by this person."

The target person's response to the stimulus item was conveyed along a 7-point scale identical to the one used by subjects to make their ratings. Points along the scale were assigned the same verbal labels as the scale used to collect normative data; in this case, however, the scale endpoints were labeled "inapplicable" (1) and "applicable" (7). It should be noted that degree of confidence in judgment was not independently measured since it has been repeatedly shown that there is a high positive linear relationship between degree of confidence in judgment and extremity of judgment (Cantril, 1946; Suchman, 1950; Stroebe & Fraser, 1971).

The applicability of the description to the target person was manipulated through information that the target had rated the description as either "highly inapplicable" (1) or "highly applicable" (7) along the scale provided.

Following the target's self-rating, subjects rated each of the 23 remaining descriptions in terms of how the target person would have answered them along the scale described above. (The stimulus item was always excluded from the set.) The set of response items contained extravert and introvert items of both high and moderate typicality. The subjects received the items in random order of presentation.

RESULTS

Applicability Ratings

In order to test the predictions about the use of prototypes in bipolar dimensions, it is necessary to establish that the stimulus and response items pertain to a bipolar dimension. Thus, if the stimulus information leads to a bipolar use of the response attributes, one would expect

extravert stimuli to activate an extravert prototype which in turn would lead to ratings of the extravert response items as applicable and ratings of the introvert response items as inapplicable (and vice versa for introvert stimuli). Furthermore, inapplicable extravert stimuli activate an introvert prototype which in turn would lead subjects to rate extravert response items as inapplicable and introvert response items as applicable (and vice versa for inapplicable introvert stimuli). Thus, an analysis of subjects' ratings, averaged over the scales representing each combination of trait type typicality as a function of three between-subject variables—stimulus item prototype (extraverted vs introverted), stimulus items typicality (high vs moderate), and target rating (applicable vs inapplicable)—and two within-subject variables—type of response item and response item typicality—should yield a significant three way interaction term for stimulus item prototype (extraverted vs introverted), target rating (applicable vs inapplicable), and type of response item (extraverted vs introverted). In fact, this interaction is highly significant, $F(1, 120) = 497.07$; $p < .001$. As can be seen from Table 2 these findings suggest that the extraversion–introversion dimension is used in a bipolar manner in attribute inference judgments. The only other significant term in this analysis was a main effect of response typicality, $F(1, 120) = 5.90$; $p < .05$, suggesting that overall moderate typicality items were judged somewhat less extremely ($\bar{x} = 3.94$) than the high typicality items ($\bar{x} = 4.26$).

The findings in Table 2 show that the stimulus items activate extraversion–introversion prototype, which in turn is used as the basis for judging the response items. However, they do not help us determine

TABLE 2

MEAN APPLICABILITY RATINGS FOR EXTRAVERSION-INTROVERSION

	Stimulus applicability	
	Applicable	Inapplicable
Extravert stimulus		
Extravert response items	5.89	2.62
Introvert response items	2.44	5.54
Introvert stimulus		
Extravert response items	2.95	5.54
Introvert response items	5.22	2.53

Note. A value of 7 indicates that the response items were rated "highly applicable" and a value of 1 indicates a rating of "highly inapplicable."

whether one or both of the two polar prototypes are activated, and if just one, whether it is the affirmative or converse prototype. To do this we must convert the direct applicability ratings into polarity scores.

Polarity Scores

The examination of the predictions resulting from the prototype model requires an analysis of variance in which one of the two within-subjects factors, namely, type of response item (extraverted vs introverted) is modified. Instead, a response item congruity factor is employed (congruity vs incongruity), whereby a congruent response item is one in which the item is congruent with the stimulus-activated affirmative prototype, and an incongruent response item represents the pole opposite to the stimulus-activated affirmative prototype. Furthermore, in order to obtain comparable polarity scores for both the congruent and incongruent response items the subjects' responses on the incongruent response items were reverse scored. Thus, high scores indicated high polarity throughout.

Subjects' polarity scores, averaged over the six scales within each response congruity and response item typicality condition, were analyzed as a function of the three between-subject variables—stimulus item prototype (extraverted vs introverted), stimulus item typicality (high vs moderate), and target rating (applicable vs inapplicable)—and two within-subject variables—response item congruity and response item typicality. The first question concerns whether subjects access just one pole (the stimulus-induced prototype) or both poles in making judgments based on bipolar prototypes. The prediction for the single pole prototype model is that if response items are congruent with the activated prototype, then the inferences for the congruent response items should be more polarized. However, if both ends of the rating scale are anchored by polar opposite prototypes, then the polarity scores for the congurent response items should be identical to the polarity scores of the incongruent response items. In fact, the analysis of variance yielded a significant main effect for congruity, $F(1, 120) = 4.55$; $p < .05$, supporting the single prototype model, namely, congruent items were more polarized ($\bar{x} = 5.57$) than incongruent response items ($\bar{x} = 5.37$). This finding suggests that only the affirmative prototype is activated and that it anchors the "applicable" end of the judgment scale.

The second prediction that follows from the single prototype hypothesis concerns the effect of typicality, suggesting an interaction between congruity and typicality. That is, if the affirmative prototype is accessed, then those items which are highly typical and congruent with the prototype should be more polarized than items which are moderately typical and congruent with the prototype. On the other hand, no such difference should be obtained for incongruent response items. In fact, the interaction

between response congruity and response typicality yielded a significant effect, $F(1, 120) = 11.83$; $p < .01$, lending support for the single prototype model. The mean difference between high typicality congruent response items ($\bar{x} = 5.78$) and moderate typicality congruent response items ($\bar{x} = 5.35$) was significant, $F(1, 120) = 10.20$; $p < .01$, and in the expected direction, whereas this difference for incongruent reresponse items (high typicality $\bar{x} = 5.26$; moderate typicality $\bar{x} = 5.47$) was not significant, $F(1, 120) = 1.06$.

The final question is whether the use of affirmative prototypes is restricted to the case in which people are given information about what the target person is (i.e., when the target rating is "applicable"). When people are given information about what the target person is not (i.e., when the target rating is "inapplicable") they may activate the converse prototype, or activate both. If it is the case that only the affirmative prototype is activated by "applicable" information and not by "inapplicable" information then the target rating main effect should be significant. If, however, this single prototype model applies for both information conditions, then the target rating main effect should not be significant. In the analysis of variance for polarity scores the target rating main effect is not significant, $F(1.40) = .12$, the mean for the applicable condition being 5.43 and for the inapplicable condition 5.48. Furthermore the absence of any significant interactions between target rating and response congruence, $F(1, 120) = .84$, as well as between target rating, response congruence and response typicality, $F(1, 120) = 1.19$, suggests that there is consistent support for the prediction that subjects activate only the affirmative prototype in making inferences on bipolar continua. All other terms in the analysis of variance were nonsignificant.

DISCUSSION

The present study supports the proposition that bipolar categories are employed in a dimensional manner in making attribute inference judgments about persons. Thus, when a target person is said to possess an attribute that is contained in one of two bipolar categories (e.g., an extravert), the subject infers not only that those attributes associated with this category apply, but also that those associated with the other (introvert) category do not. However, the processes that mediate these two types of inference judgments are not identical.

Two central questions were addressed in this study: (a) whether the prototype associated with only one of two bipolar categories is accessed (*vs* simultaneously accessing both) when making attribute inference judgments based on stimulus information relevant to only one of the two categories, and (b) whether information that a stimulus item is not applicable to the target person is processed differently than information that the stimulus item is applicable to the target.

With respect to the first question, the findings of the present study suggest that only one of two bipolar prototypes is accessed in making attribute inference judgments. This is suggested by the evidence that response items congruent with the category applying to the target person are judged more extremely than are incongruent response items. Thus, of the two categories, it is always the affirmative prototype, the one applicable to the target, that is activated and mediates the attribute inferences. This conclusion is strengthened by the finding that high typicality congruent items are judged as applying more extremely than moderate typicality congruent items, whereas there is not such a tendency for the incongruent response items. Finally, the absence of any effect due to stimulus item typicality suggests that irrespective of whether stimulus items are highly or moderately typical of the category they activate the prototype.

These findings suggest that the following processes may mediate attribute inference judgments. Given stimulus information that is applicable to the target person, only the affirmative prototype is activated; however, this is not a function of the stimulus typicality for the prototype. The affirmative prototype anchors the "applicable" end of the response scale. Each response attribute is then compared with those contained in the activated prototype. Those items that are highly typical of the prototype are judged to apply strongly to the target person, i.e., extremely, whereas those items which are moderately typical of the activated prototype are judged to be applicable to the target significantly less strongly than high typicality items. Since the converse category prototype is not activated, response items associated with this category are judged on the basis of their dissimilarity to the activated prototype and are thus judged less extremely overall, and the typicality of these items for their category does not influence the inference judgments.

The above results could alternatively be interpreted in terms of differences in the units comprising the response scale at different levels of applicability. For example, suppose that the response scale categories on the "inapplicable" side of the scale midpoint (i.e., the range of subjective values to which each category pertains) are larger than those on the "applicable" side. Then, inapplicable items might be assigned less extreme response categories than applicable items even though the two items were equidistant from the subjective scale midpoint (i.e., neutrality). This could also explain the differences in response item typicality for the affirmative prototype, i.e., differences in response item typicality were found to produce greater differences in subjects' responses when items were applicable than when they were not. There are two possible reasons to suspect that this may not be the case. First, the scale points were specified with labels known to reduce scale asymmetry (cf. Rohrmann, 1978). The second argument is contained in the significant interaction between response congruence and response item typicality.

This interaction shows that high typicality response congruent items are judged significantly more extremely than moderate typicality congruent response items; however, the difference between high and moderate typicality for the response incongruent items, although not significant, shows a systematic tendency in the opposite direction. This latter finding also suggests that scale asymmetry alone would not account for the present findings.

The second question addresses the processing of negative and positive information. Most studies dealing with prototypes (e.g., Cantor & Mischel, 1977) or schemata (e.g., Markus, 1977) have been concerned with positive instances of information. In the present study subjects who are given negative information (i.e., the stimulus information is inapplicable to the target) appear to activate the affirmative prototype and not the category associated with the stimulus item. Thus, the prototype activated in both positive and negative information instances is always the affirmative prototype.

The judgments of attributes associated with the converse prototype appear to be made on the basis of their semantic dissimilarity to the affirmative prototype. Thus, a mixed model appears best able to account for the mediating process in attribute inference judgments involving two bipolar categories. The affirmative prototype functions as the knowledge base as Cantor and Mischel (1977) suggest. However, Cantor and Mischel's (1977) study, which employs a recognition memory paradigm and demonstrates that subjects identify items in the recognition test that are not presented in the acquisition set but are "*conceptually related*" to those presented, can be accounted merely by semantic similarity (cf. D'Andrade, 1965, 1974; Shweder, 1975, 1977; Shweder & D'Andrade, in press). Subjects identify items in the recognition test that are semantically similar to those presented in the acquisition phase.

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