Combining Social Concepts:  
The Role of Causal Reasoning

ZIVA KUNDA, DALE T. MILLER, AND THERESA CLAIRE  
Princeton University

Four studies examined how people combine social concepts that have conflicting implications (e.g., Harvard-educated and carpenter). Several kinds of evidence indicated that such combinations are guided by causal reasoning that draws upon both causal relations contained within the constituent concepts and on broader world knowledge. Open-ended descriptions of members of combinations contained explicit causal descriptors, as well as emergent attributes not used to describe members of constituents. Ratings of the likelihood that combination members possessed various attributes were not fully predicted by comparable ratings of constituents. Causal reasoning appeared to be most pervasive for combinations viewed as more surprising, suggesting that surprise may have triggered the generation of causal accounts.

Upon hearing that a person belongs to a social category for which there is a well-developed representation, or stereotype, it is typical to form a set of expectations about that person. It may be assumed, for example, that a Harvard-educated person will be intelligent and affluent, that a carpenter will be rugged and handy, and so on. But every person belongs to more than one social category, and these different categories will evoke different, sometimes even conflicting, expectations. Consider a person who is both Harvard-educated and a carpenter. Forming a unified impression of such a person requires the combination of not only two concepts, but ones that, for most people, have conflicting implications. The present research seeks to determine whether unified impressions are formed in such cases and, if so, how this is accomplished. Rephrased in terms more familiar to cognitive scientists, our research focuses on conceptual combination as it pertains to social categories.

We propose that the combination of social concepts, especially those with conflicting implications, involves causal reasoning and explanatory

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Correspondence and requests for reprints should be sent to Ziva Kunda, Psychology Department, Green Hall, Princeton University, Princeton, NJ 08544-1010.

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hypothesis formation. When confronted with a person who belongs to social
categories with conflicting implications, people are surprised or puzzled. To
resolve this puzzlement, they might ask themselves questions of the form:
How could a Harvard-educated person become a carpenter? That is, what
might have caused a person belonging to one of the categories to acquire
membership in the other? To answer such questions, people will draw upon
their knowledge of the categories to be combined, as well as on their broader
world knowledge to construct an explanatory causal account of the reasons
for the dual category membership. For example, a Harvard-educated per-
son may have become a carpenter because the radical climate of the sixties
fostered disillusionment with the materialistic competitive world encountered
at Harvard. Guided by such causal accounts, one may include in the com-
bined and unified image of the person some of the attributes associated with
each of the original categories as well as some novel or, what we will term,
emergent attributes. The Harvard-educated carpenter may be intelligent
and of an upper-middle-class background like Harvard-educated people,
handy and rugged like carpenters, and may also possess some attributes
such as nonmaterialistic that emerge from the causal reasoning used to
resolve the puzzle of membership in both categories.

Causal relations have been shown to play a central role in a wide variety
of cognitive tasks, including the comprehension of utterances (Clark &
Clark, 1979), the detection of correlations (Chapman & Chapman, 1967,
1969), and the categorization of objects (Barsalou, 1983). And it has recently
been argued that causal relations play an important role in the coherence of
concepts (Medin, 1989; Murphy & Medin, 1985). Thus, the representation of
a bird includes not only the attributes “has wings” and “can fly,” but also
the causal relations between these attributes: It is the wings that make flying
possible. This latter idea seems especially worthy of further investigation
because the way concepts are combined may provide greater insight into the
structure of concepts than could be gained through examination of individual
concepts themselves (cf. Murphy, 1988).

Surprisingly, research on the conceptual combination of nonsocial con-
cepts has largely ignored the role of causal reasoning and inference. As an
example, consider the elegant and explicit modification model developed by
Smith and Osherson (1984; Smith, Osherson, Rips, & Keane, 1988). The
modification model assumes that the combination of simple adjective-noun
pairs such as red apple is achieved by restricting the range of possible values
for the noun (apple) on the dimension implied by the adjective (to the color
red, in this case) and boosting the importance of that dimension. This
model, which does not postulate any causal reasoning, successfully accounted
for typicality judgments involving simple adjective-noun pairs (colors and
shapes paired with fruits and vegetables). Medin and Shoben (1988) have
criticized this model, arguing that it is limited even in the simple domain to
which it was applied in that it does not take into account the possibility that
some attributes are correlated with other attributes (e.g., a red apple will also be sweet). And, more important from our point of view, Medin and Shoben point out that the modification model does not recognize that attributes equally true of two concepts may be more central (and hence less mutable) for one concept than for the other. So, although being curved is equally true of bananas and boomerangs, it is more central to the essence of boomerang: A straight banana may still be a banana, but a straight boomerang may no longer be a boomerang. Such differences in centrality seem to result from the causal relations that associate attributes with concepts.

We believe that, in addition to reliance upon intraconcept causal relations, conceptual combination may also entail reliance upon causal relations that are external to the concepts in question and are derived from broader world knowledge. We know of no direct support for this proposition but there is some suggestive evidence. Rokeach and Rothman (1965) and Higgins and Rholes (1976) both showed that people's evaluations of combined concepts (e.g., immoral priest) could not be predicted entirely from their evaluations of the constituent concepts, suggesting that a simple elementaristic model (e.g., Anderson, 1968) cannot fully account for the combination of concepts. Unfortunately, neither of these studies explored in depth the nature of the causal reasoning underlying the evaluations of combined concepts.

In other relevant research Hampton (1987) found that noun–noun combinations sometimes contain novel attributes not found in either of the constituent concepts. For example, birds that are pets are believed to live in cages, a property not true for birds or for pets. One possible account of these novel attributes is that they reflect causal reasoning involving broader world knowledge (e.g., the birds might escape otherwise). Of course, it is also possible that this belief stems from people's familiarity with birds that are pets, in which case the emergent attribute comes from retrieval of stored knowledge about where pet birds live rather than from causal reasoning. Similarly, mere familiarity with the combined concepts may also account for Murphy's (1988) finding that an attribute may be viewed as more typical of a combination than of either of its constituents. Since the combined concepts studied by Hampton and by Murphy seem familiar, it is impossible to say whether the novel attributes that emerged in the combinations resulted from retrieval or from causal inference. The process of retrieval is not always a plausible account for novel attributes, however. Instead of a pet bird, imagine a hippopotamus that is a pet. If you assume, as we do, that this creature is not kept indoors, we doubt that you arrived at this assumption by retrieving existing knowledge about hippopotamuses that are pets; more likely, you did so instead by engaging in causal reasoning based on your knowledge about hippopotamuses, pets, and houses.

In the present studies we attempt to secure more direct evidence for the claim that conceptual combination involves causal reasoning that relies upon world knowledge outside the constituent concepts. We believe that the
investigation of how social concepts are combined is particularly likely to reveal evidence of causal reasoning. Social concepts are rich and complex, and therefore highly flexible and capable of stretching in order to accommodate a wide variety of modifications and contradictions. Indeed, it has been shown that people can easily explain how a person may possess two semantically opposite trait adjectives such as cheerful and gloomy (Asch & Zukier, 1984). Therefore, people should be readily able to construct explanations to account for the combination of broader social stereotypes that have conflicting implications even though they do not stand in direct semantic opposition to each other. Unlike many nonsocial nouns of the sort investigated by Hampton, (1987, 1988), social concepts typically involve few, if any, attributes considered necessary or impossible for category membership. This increases their malleability, and leaves more room for their modification through causal reasoning. More important, the nature of discourse about people seems particularly conducive to causal reasoning—questions about how people might have become what they are, and about the consequences of membership in a given social category—are encountered and dwelled upon quite frequently. It seems much more likely to wonder spontaneously how a person obtained a profession than how an object obtained its color. This complexity should be revealed when exploring how people combine social concepts. We therefore chose to examine the role of causal reasoning in the combination of social concepts.

**STUDY 1**

Our first study seeks to show that when people encounter a person who belongs to a surprising combination of social categories, they attempt to create a unified image of the person. Furthermore, we propose that in doing this they engage in causal reasoning, drawing inferences based upon causal relations contained within the categories in question as well as on causal relations stemming from knowledge outside these categories. We decided to focus initially on surprising combinations because it has been shown that causal reasoning is facilitated when people encounter surprising or unexpected events or objects (Hastie, 1984; Pyszczynski, & Greenberg, 1981; Wong & Weiner, 1981). We anticipated that the puzzlement aroused by these surprising combinations would be especially likely to trigger causal reasoning as subjects attempt to resolve the puzzle.

For each combination, different groups of subjects provided written descriptions of their expectations about a person who belonged to one or the other of two constituent categories or to both categories. We expected that causal reasoning would be evident in individual descriptions of members of combined categories. We also expected that it would be possible to
infer casual reasoning and reliance upon broad world knowledge from comparisons of the consensual content of combinations to that of constituents: The appearance of novel, emergent attributes in the combinations would imply that their representations were constructed through reliance upon information not contained in the constituents.

Method
Subjects were 85 undergraduates at Gettysburg College who participated voluntarily in a classroom setting.

Each subject received a booklet in which a target person was named on the top of each page. They were instructed to speculate, in as much detail as they could, about what each target person would be like. Subjects were divided into three groups: Those who described members of combined categories (e.g., a person who is Harvard-educated and a carpenter), those who described one set of constituent members (e.g., a person who is Harvard-educated) and those who described the other set of constituent members (e.g., a person who is a carpenter). Half of the subjects described one set of constituents or combinations (leftist businessman, blind marathon runner, and gay construction worker), and half of the subjects described another set (feminist bank teller, blind lawyer, Harvard-educated carpenter, and communist ex-Marine). Within each set, two fixed orders were used. The number of subjects receiving each type of phrase was 9 to 12 for constituents and 20 to 24 for combinations. For the subjects describing combinations, the order of constituents within each combination was counterbalanced. (We obtained larger numbers for the combinations to determine whether the order in which the categories were presented in a given combination would affect the content of descriptions. Since no such order effects were found, this possibility will not be discussed further.)

After completing their descriptions, subjects describing the combinations were asked to rate how surprised they would be to hear about a person who belonged to each combination, on a 7-point scale ranging from “not at all surprised” to “very surprised.”

1 In the absence of order effects in this and the following studies, our findings differ from those obtained by Hampton (1988). Hampton found an asymmetry in the combination of concepts such as “sports which are games” so that greater weight was given to the concept in the relative clause-qualifier position. The difference between the two sets of studies may have resulted from the use of somewhat different methodologies as well as from the use of different kinds of concepts. Unlike Hampton, who used the wording “A which are B,” our wording, “a person who is A and B,” did not indicate that one of the concepts should be used to qualify the other. Furthermore, our subjects were asked to describe or rate the attributes of a person belonging to both categories, whereas Hampton’s subjects were asked to indicate the extent to which various instances belonged to both categories. Finally, our social categories may have involved different kinds of conceptual combinations than did Hampton’s nonsocial categories.
Results and Discussion

*Ease of Resolution.* Subjects had no trouble describing the members of our incongruous social categories. Of the 156 descriptions of persons belonging to combined categories, there were only four instances in which subjects left a blank page or expressed problems with forming an impression.

*Causal Narratives.* Clear evidence that at least some subjects engaged in causal reasoning to form impressions of members of combined categories came from the detailed narratives provided by some subjects. For example, one subject wrote of a person who is a lawyer and blind:

...the person is obviously very hard working. I mean, people with no handicaps have a hard enough time making it through law school, let alone someone who is blind.

And another subject wrote of a person who is gay and a construction worker:

This person is most likely sublimating, he is in a position that commands masculinity, however, he himself does not fit the stereotype. Possibly he is hiding his true identity behind the image of a tough and rugged construction worker.

These examples suggest that the attributes contained in the representations of social categories are embedded in a network of causal relations that allow people to make sense of a person's membership in two seemingly incongruous categories.

The narratives tended to be structured as answers to a question of the form: "How could a person belonging to one category (e.g., blind) come to acquire membership in another category (e.g., lawyer)?" Apparently, the surprising combination triggers such questions, and people engage in causal reasoning to answer these questions.

Often, there was more than one way of answering such questions in order to resolve the apparent contradictions stemming from dual category membership. For example, one subject wrote of a Harvard-educated carpenter:

Someone who has inherited a lot of money and is working at what he enjoys, rather than where the money is. A nice person, rather than money grubbing.

Another subject wrote of the same combination:

...high class (status); earns big bucks. Carpentry is his hobby. His life is fulfilled and has nothing more to accomplish in life....

And yet another subject wrote:

Has ambitions to become a master carpenter and design new methods and objects in carpentry.
The fact that there were different ways of forming impressions of members of combined categories limits what can be discovered from examining consensual modes of resolution, across subjects. Nevertheless, interesting patterns emerge from such analyses, as reported below.

**Emergent Attributes.** More often than not, subjects' descriptions of members of combined categories were in the form of lists of attributes rather than in narrative form. Such attribute listing does not rule out the possibility that causal reasoning was used to combine the concepts, because subjects may have been writing only the end products of their causal reasoning without bothering to specify the causal chains that led them to these end products.

One type of evidence that causal reasoning was involved in producing subjects' attribute lists would be the presence of emergent attributes; that is, attributes that were used to describe a member of a combination but were not used to describe either of its constituents. Such emergent attributes would indicate that, in forming an impression of the combination, subjects relied not only upon the information contained within each constituent, but also upon broader world knowledge.

To explore this possibility, we counted the number of times each attribute was mentioned in the descriptions of each constituent and combination. Different attributes used to express the same meaning were counted as the same. Two independent coders sorted subjects' descriptions into attributes, and disagreements were resolved by a third coder. We counted as emergent any attribute that was used by at least three subjects to describe a member of the combination, but that was not used by any subject to describe either of the constituents. Using this criterion, every one of the combinations yielded at least two emergent attributes, as shown in Table 1.

The presence of so many emergent attributes is particularly striking because our criterion for emergent attributes, namely that at least three subjects mention each, requires that several subjects resolve the conflict among constituents in the same way. Since, as described above, there were different ways of combining each pair of categories, it is reasonable to assume that the results presented in Table 1 greatly underestimate both the number of subjects relying upon knowledge outside the constituents to form impressions of the combinations, and the number of ways in which such impressions could be formed. Nevertheless, these findings do provide strong evidence that subjects relied upon world knowledge outside the constituent categories in their combination. Since the combinations seem relatively unfamiliar and unlikely to be stored as existing knowledge structures, the emergent attributes probably resulted from causal inference, and reveal the rich causal network in which the representations of social categories are embedded.

**Surprise and the Generation of Causal Antecedents.** To obtain a better understanding of the causal reasoning involved in creating images of members of surprising combinations, we coded each subject's descriptions for
TABLE 1
Emergent Attributes Used by at Least 3 Subjects to Describe a Combination, but Not Used by any Subject to Describe its Constituents

<table>
<thead>
<tr>
<th>Combination</th>
<th>Emergent Attributes</th>
</tr>
</thead>
</table>
| Blind & Lawyer                   | Determined (23)
|                                  | Confident (8)                         |
|                                  | Good lawyer (4)                       |
| Blind & Marathon runner          | Courageous (10)                       |
|                                  | Confident (8)                         |
|                                  | Enjoys life (4)                       |
| Communist & Ex-Marine            | Troublemaker (6)                      |
|                                  | Anti-American (5)                     |
|                                  | Independent (3)                       |
| Feminist & Bank teller           | Hypocritical (9)                      |
|                                  | Anti-Male (5)                         |
|                                  | Unmarried (5)                         |
| Gay & Construction worker        | Hiding homosexuality (6)              |
|                                  | Independent (3)                       |
| Harvard-educated & Carpenter     | Nonconformist (6)                     |
|                                  | Nonmaterialistic (6)                  |
|                                  | Enjoys work (5)                       |
|                                  | Easy going (4)                        |
|                                  | Well rounded (4)                      |
|                                  | Independent (3)                       |
| Leftist & Businessman            | Difficult (3)                         |
|                                  | Powerful (3)                          |
|                                  | Serious (3)                           |

Note. Numbers in parentheses represent number of subjects mentioning a given attribute in their descriptions of the combination.

the presence of causal antecedents, that is, descriptions that could be construed as accounting for what caused a member of one category to become a member of the other category. For the most part, these causal antecedents were not as detailed as the narratives illustrated above. An example of an antecedent given in a description of a person who is gay and a construction worker was:

Might be compensating for his "unusual tendencies" by taking a job that is considered "manly".

An example written as a description of a blind marathon runner was

Have a lot of faith in God and himself to be able to run without sight.

An example, written as a description of a Communist ex-Marine was

Had bad experiences in the Marine Corps. Now doesn't like country.
To be counted as a causal antecedent, a description had to contain explicit mention of causal relations. Thus, we did not count as an antecedent a mere listing of "courageous" as a descriptor of a person who is blind and a marathon runner, even though such a descriptor probably results from causal reasoning. Rather, we required that descriptions contain additional information making the causal relations clear, such as

\[ \text{...must have much courage and ability to overcome their handicap} \]

We employed such stringent criteria to ensure that coders did not read causal reasoning that was not intended by subjects into subjects' descriptions, but our resulting coding probably underestimates the pervasiveness of antecedents. One coder coded all descriptions for presence of antecedents. A second, independent coder, coded a random subset of 40 descriptions, and agreed with the first coder on 90% of these. Using these strict criteria, we found numerous examples of causal antecedents. Seventy-five percent of the subjects who described the combinations used at least one antecedent in their descriptions. This suggests that causal reasoning was pervasive in subjects' attempts to combine these conflicting social categories.

There is some indication that causal reasoning was triggered by surprise. The combinations we used differed in the extent to which subjects found them surprising. The mean surprise ratings ranged from 2.29 for a person who was feminist and a bank teller to 5.25 for a person who was blind and a marathon runner. We counted, for each combination, the number of subjects who used antecedents in their descriptions, and correlated this measure with the average surprise rating given for each combination. The moderately high correlation obtained, $r = .46$, suggests that people were more likely to search for and construct explanations for why a member of one category became a member of the other when they found the joint membership more surprising. This method is clearly rather crude, and the resulting correlation could be subject to more than one interpretation. Nevertheless, the finding that causal antecedents may be generated in response to surprise is important, because it lends credence to the notion that the representations of members of combinations were constructed on line, through causal reasoning triggered by surprise, rather than retrieved from stored exemplars of persons belonging to these combinations.

**STUDY 2**

Study 1 suggests that when people form impressions of persons who belong to social categories that have conflicting implications for what a person might be like, they rely upon the causal relations within the categories and upon broader world knowledge to form unified impressions. Perhaps the
strongest evidence of subjects’ reliance upon knowledge outside the categories comes from the presence of emergent attributes, ones used to describe persons belonging to a combination of categories but not used to describe persons belonging to each of the constituent categories. Our interpretation of this finding rests on the assumption that these emergent attributes were in fact not part of subjects’ stored knowledge or beliefs about the constituents. This assumption is crucial to our view of emergent attributes as resulting from causal reasoning and explanatory hypothesis formation. The support for this assumption is problematic, however, because the fact that the subjects did not spontaneously mention certain attributes when listing descriptions of constituent categories does not mean that they did not consider these attributes to be descriptive. This possibility would be ruled out if it could be shown that emergent attributes are also found when people rate members of combined categories and their constituents for the likelihood that they possess relevant attributes.

Such ratings would also permit closer examination of how subjects resolve conflicts between the two constituents on specific attributes. For example, if intelligence is very likely for a Harvard-educated person but only slightly likely for a carpenter, how likely is intelligence for a Harvard-educated carpenter? Some have suggested that such conflicts would be resolved through weighted averaging (e.g., Anderson, 1968), and others have suggested that when such conflicts occur, one constituent may completely dominate the other, so that the combination generally will inherit the attributes of the dominant constituent in cases of conflict (e.g., Goffman, 1963). Our view of conceptual combination as guided by causal reasoning leads us to expect that neither averaging nor total domination would be pervasive. Rather, the causal accounts generated to explain how a person could hold dual category membership would have different implications for different attributes. Therefore, in a given combination, some of the conflicting attributes may be inherited from one of the constituents, some from the other, some averaged across both, and some may become more extreme than either.

To explore these issues we asked subjects to rate a subset of the combinations used in Study 1 on attributes culled from its subjects’ descriptions.

Method
Subjects were 98 undergraduates at Gettysburg College who participated voluntarily in a classroom setting.

We used the descriptions obtained in Study 1 for two of the combinations, that of Harvard-educated and carpenter, and that of blind and lawyer, to construct a list of 24 attributes for each of these combinations that had been used to describe members of the combination of its constituents. Each list included all the attributes listed by at least three subjects to describe a member of a constituent or a combination, as well as several additional attributes that seemed to capture the essence of subjects’ narratives. Subjects
TABLE 2
Emergent Attributes Rated Higher by Subjects Rating Combinations than by Subjects Rating Either Constituent

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Constituent Pair</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Harvard</td>
<td>Carpenter</td>
</tr>
<tr>
<td>Nonconformist</td>
<td>4.71</td>
<td>4.46</td>
</tr>
<tr>
<td>Nonmaterialistic</td>
<td>3.43</td>
<td>4.62</td>
</tr>
<tr>
<td>Compassionate</td>
<td>Blind</td>
<td>Lawyer</td>
</tr>
<tr>
<td></td>
<td>4.69</td>
<td>4.36</td>
</tr>
<tr>
<td>Courageous</td>
<td>5.85</td>
<td>4.86</td>
</tr>
<tr>
<td>Male</td>
<td>3.77</td>
<td>4.43</td>
</tr>
<tr>
<td>Outgoing</td>
<td>4.38</td>
<td>5.21</td>
</tr>
</tbody>
</table>

rated the likelihood that a member of a given category or combination would possess each of the provided set of attributes on a 7-point scale ranging from "not at all likely" to "very likely."

Different groups of subjects rated each constituent and combination. Numbers per cell ranged from 13 to 14 for constituents, and from 18 to 26 for combinations. The numbers were larger for the combinations because we wanted to allow for examination of the effects of the order in which the two constituents were presented in the combination. For subjects rating combinations, the order of constituents within each combination was counterbalanced. Since there were no order effects on ratings, this variable will not be discussed further.

Results and Discussion

Emergent Attributes. We defined as emergent any attribute that yielded an average rating for the combination that was significantly higher than both or significantly lower than both average ratings obtained for the constituents. As shown in Table 2, there was a reasonable match between the attributes that emerged here and those that emerged in Study 1, suggesting that the presence of emergent attributes in this study did not result merely from statistical flukes. For the combination of Harvard-educated and carpenter, the two emergent attributes mentioned most often in Study 1, nonconformist and nonmaterialistic, were both emergent in Study 2 as well, and no other attributes emerged in Study 2. For the combination of blind and lawyer, the match between the two studies was not quite as strong. The emergent attribute mentioned most often in Study 1 for this combination, determined, was not classified as emergent in the Study 2, even though the mean ratings were in the predicted direction. This was probably because of a ceiling effect produced by the rating for lawyer (6.21; the rating for the combination was 6.61). It should also be noted that a less than perfect match between the attributes emerging in the generation task and in the rating task.
may have occurred because the different tasks facilitated different ways of combining the concepts in question and tapped different aspects of related knowledge.

These data suggest that the presence of emergent attributes in the combinations explored in Study 1 cannot be explained away as resulting merely from subjects' failure to mention these attributes when describing the constituents. It appears that subjects do consider persons belonging to a surprising combination of social categories to possess some attributes that persons belonging to each of the constituents do not possess (or possess to a lesser degree). Such attributes probably emerge as a result of causal reasoning.

There are, however, possible alternative accounts for the presence of emergent attributes. One class of alternative explanations involves the summation of activation: It is possible that an attribute may be below some threshold of activation in each of the constituents, but when the constituents are combined, the attribute may receive enough activation to push it above the threshold. However, this seems somewhat unlikely because of the restricted number and nature of emergent attributes obtained. There must be many other attributes that are weakly activated by both constituents (e.g. shy, red haired) but do not become emergent in the combination. The attributes which do emerge, all seem to be related to causal accounts used to combine the concepts. A second class of alternative accounts allows for reliance upon knowledge outside the constituents, but poses alternative mechanisms for accessing this knowledge. Thus, subjects may have accessed higher level categories from which the emergent attributes were inherited. For example, the combination of Harvard-educated and carpenter may have led to the accessing of the general category "off beat, hip person." Similarly, emergent attributes may have resulted from an analogy between the combination in question and a preexisting category. Although it is difficult to rule out this kind of alternative account, one wonders whether the choice among the many potentially relevant higher level categories or analogs would not itself need to be guided by causal reasoning.

**Modes of Conflict Resolution.** We examined cases in which the constituents of each combination differed from one another significantly in the average ratings obtained for a given attribute. Using Scheffe's $t$ test, we found 12 such attributes for the combination of Harvard-educated and carpenter, and 10 for the combination of blind and lawyer. We then examined how these conflicting attributes were resolved in the combinations. There were three possible modes of resolution:

1. An attribute could be inherited from one of the constituents. We defined as *inherited* cases where the rating of the combination was significantly different from that of one of the constituents, but not from that of the other.
2. An attribute could be averaged across both constituents. We defined as *averaged*, cases where the ratings of the combination fell between those of the constituents and differed significantly from both, or from neither of the constituents.

3. An attribute could be *emergent*, as defined above.

In each combination, at least one attribute was inherited from each constituent, and at least one was averaged, suggesting that neither constituent dominated the combination completely. Of the 22 conflicting attributes, only 3 cases were resolved through averaging, suggesting that averaging was not the pervasive mode of conflict resolution. But what determines which mode of resolution is applied to a given attribute? If conflict resolution is obtained through an algebraic combination of the typicality or likelihood ratings given to constituents, the ratings of the combination should be fully predicted from those of the constituents. On the other hand, if the mode of conflict resolution and the resulting rating of the combination cannot be fully predicted from the ratings of the constituents, some other process, possibly causal reasoning, must be involved.

Although mode of conflict resolution was influenced by the magnitudes of the likelihood ratings of the constituents, it was not fully determined by these. Collapsing across both combinations yielded a total of 22 attributes for examination. Fourteen (63%) of these were inherited from the constituent category rated more highly on that attribute. But there were also a sizeable number of cases where attributes were inherited from the constituent rated less highly (14%), as well as cases of averaging (14%) and emergence (9%), suggesting that the magnitude of the likelihood ratings alone cannot fully determine mode of conflict resolution. The number of attributes in these latter three categories was too small to explore the relations between magnitude of rating and mode of resolution in greater depth. It is important to undertake such an exploration, however, because to the extent that magnitudes of constituent ratings cannot predict how conflicts between the constituents will be resolved in the combination, we have reason to believe causal reasoning is implicated. We shall return to these issues in Study 4.

**STUDY 3**

Studies 1 and 2 establish that causal reasoning is used in the combination of surprising social categories. Evidence for causal reasoning comes from narratives generated by some subjects, from the explicit generation of causal antecedents by most subjects, and from the presence of emergent attributes both in open-ended descriptions of members of combinations and in ratings of such members on attributes provided by the experimenter. These findings
suggest that the representations of social categories are embedded in a rich network of causally related knowledge which is drawn upon to form impressions of people belonging to incongruent categories.

We believe, however, that the role of causal reasoning in the combination of social categories is even more pervasive than appears from these data. We propose that causal reasoning not only leads to the emergence of novel attributes in combinations, but also plays a role in determining how conflicts between attributes characterizing each constituent are resolved. In other words, causal reasoning also helps to determine which attributes will be inherited from which constituent and which will be averaged across the two. Thus, causal reasoning may be responsible not only for the finding that a Harvard-educated carpenter is more likely to be viewed as nonmaterialistic than either a Harvard-educated person or a carpenter, but also for the finding that a Harvard-educated carpenter is considered to be as intelligent as a Harvard-educated person and as rugged as a carpenter. Study 2 provides some initial evidence for this, in that four different modes of conflict resolution were found for each combination, and these modes were not fully predicted from the likelihood ratings of the constituents, suggesting that causal reasoning played a role in determining mode of conflict resolution.

To explore the role of causal reasoning in influencing patterns of attribute inheritance and conflict resolution further, we replicated Studies 1 and 2, but this time we crossed each of two categories (feminist and Harvard-educated) with each of three other categories (bank teller, carpenter, and lawyer). This design permits examination of how the attributes of one category are meshed with those of several other categories, and should shed light on the role of causal reasoning in the process. Study 3 examines the different patterns of attribute inheritance and emergence in open-ended descriptions; Study 4 examines the role of causal reasoning in resolving conflicts among attributes by investigating ratings of the likelihood that attributes characterize constituent and combinations.

**Method**

Subjects were 95 Princeton University undergraduates who participated voluntarily in a classroom setting.

Instructions to subjects were identical to those given in Study 1. Open-ended descriptions were obtained from five groups of subjects. The two groups describing constituents described either a Harvard-educated person and a feminist or a bank-teller, a carpenter, and a lawyer. The three groups describing combinations each described two combinations involving four different constituents. Numbers per cell ranged from 17 to 21. Each constituent or combination appeared on a different page. Two page orders were used for each group. For combination groups, the order of constituents within each combination was counterbalanced.
After completing their descriptions, all subjects rated how surprised they would be to hear about each of two combinations (involving four different constituents) on a 7-point scale ranging from "not at all surprised" to "very surprised." Combination subjects rated the combinations they had described, and constituent subjects were randomly assigned to rate one of the three sets of combinations.

Results and Discussion
We examined first the extent to which results were consistent with those obtained in Study 1.

Causal Narratives. As in Study 1, subjects had no trouble combining the sometimes incongruous social categories. There were no cases in which subjects reported difficulty or failed to complete the task. Once again, some subjects spontaneously provided causal narratives that seemed designed to address the question of how a member of one category acquired membership in the other. And once again these narratives suggested that different subjects answered these questions differently.

For example, a person who was Harvard-educated and a carpenter was considered by some to have failed at a career suggested by a Harvard education:

Couldn't handle the expectations to succeed in a corporate job...

The same person was considered by others to have rejected the life-style expected for a Harvard graduate:

...attempted to get a job in academia but became disgruntled with the political scheming, so he bought an ax, a book on carpentry, and went off to the woods to live self-sufficiently on his own.

And the same person was considered by still others to have become a carpenter within the system implied by Harvard:

He will run a business which does construction. He will be the head of the business and will tell the others (his employees) what to do. He will do carpentry for high society (fellow class members from Harvard and the like)...

Emergent Attributes. As in Study 1, each combination yielded at least one emergent attribute, that is, an attribute not mentioned by any of the subjects describing the constituents, but mentioned by at least three of the subjects describing the combination. We did not always obtain the same attributes obtained in Study 1, probably because subjects in the two studies came from different populations and may have differed in their representations of categories and in their general world knowledge.
**Surprise and the Generation of Causal Antecedents.** As in Study 1, a substantial number of subjects (45%) used at least one explicit causal antecedent, that is, a descriptor accounting for how a member of one category became a member of the other. This number was lower than the 75% obtained in Study 1, probably because each subject described only two rather than three combinations in the present study, and because we included some less surprising combinations, such as Harvard-educated and lawyer. Once again we found that the number of subjects generating antecedents for a given combination was correlated with the extent to which subjects, on average, found the combination to be surprising, \( r = .83, \ p < .05 \), implying that the generation of causal antecedents was triggered by surprise.

Thus, it appears that all the key findings obtained in Study 1 were replicated nicely in the Study 3. We turn next to the examination of patterns of attribute inheritance.

**Attribute Inheritance.** We considered first the combinations obtained from pairing feminist with bank teller, carpenter, or lawyer. We examined attributes unique to feminist, that is, those attributes used by three or more subjects to describe feminist, but not used by any subject to describe any of the three constituents crossed with feminist. We then determined whether each of these attributes was inherited into each of the three combinations. An attribute was considered to be inherited into the combination if it was used by three or more subjects to describe that combination.

We found that different aspects of being a feminist were inherited by each of the combinations in which feminist participated. Members of all three combinations were viewed as opinionated, but only feminist lawyers were viewed as aggressive and as supporting the ERA; only feminist carpenters were viewed as independent, and only feminist bank tellers were viewed as activists. Thus, it was clearly not the case that attributes characterizing feminist were all inherited by every combination. This suggests that attribute inheritance was guided by causal reasoning.

Comparable analyses cannot be made for the combinations in which Harvard-educated was crossed with the same three constituents because lawyer was characterized by almost all of the attributes that characterized Harvard-educated. Nevertheless, there were some interesting findings here, too. The attribute that seemed most strongly characteristic of a person who is Harvard-educated, snobby, mentioned in the majority of the descriptions of such a person (14), was not mentioned by a single subject to describe a Harvard-educated bank teller or a Harvard-educated carpenter. On the other hand, the attribute mentioned with the second greatest frequency for Harvard-educated, intelligent (10), was viewed as characteristic of members of both these combinations. Apparently, causal reasoning guided subjects' belief that Harvard-educated bank tellers and carpenters would resemble Harvard-educated persons in intelligence but not in snobbiness. Thus, intelli-
gence is probably viewed as a necessary condition for obtaining a Harvard education, whereas being snobby is viewed as a likely but avoidable cause or consequence of a Harvard education which can be precluded by those factors that lead a Harvard-educated person to become a carpenter.

The differing emergent attributes in these two combinations were also instructive. Although Harvard-educated bank tellers and carpenters are similar in that both hold occupations of lower socioeconomic status than might be expected, it appears that different causal scenarios were constructed in each case. In both cases the attribute, nonmaterialistic, was emergent, but for a Harvard-educated bank teller this was accompanied by underachiever; whereas for Harvard-educated carpenter this was accompanied by nonconformist, liberal, responsible, good at job, and runs a business. Thus the Harvard-educated bank teller was construed as some kind of loser, but the Harvard-educated carpenter was construed alternatively as an offbeat, hip person or as a successful business man. These differing patterns of emergent attributes suggest, once again, that in forming impressions of members of incongruent categories, people draw upon knowledge of the categories as well as upon broader world knowledge.

STUDY 4

The patterns of attribute inheritance obtained in Study 3 imply that causal reasoning is involved in determining which of a given category's attributes will be inherited by the combinations the category is part of. Only a subset of a given category's unique attributes is inherited by combinations in which it is included, and a different subset is inherited when the category is combined with different categories. This suggests that inheritance is not determined merely by the extent to which a given attribute is typical of a category. Rather, inheritance appears to be determined by the extent to which the attribute is causally related to the categories in question, as well as by the causal account generated to explain how a person could acquire membership in the two categories.

Study 4 was designed to provide additional evidence that causal reasoning plays a role in determining patterns of attribute inheritance and modes of resolving conflicts among attributes in the combination of concepts. To do this, we replicated Study 2 and asked subjects to rate the extent to which various attributes were likely for each constituent or combination. We obtained such ratings for all the constituents and combinations used in Study 3. By employing a larger number of combinations rated on a larger number of attributes, we should have a larger pool of incongruent attributes than that obtained in Study 2, and should be able to explore in greater depth the relations between the magnitude of constituent ratings and the mode of conflict resolution.
Our evidence for the role of causal reasoning will be indirect. We will attempt to show, in various ways, that the likelihood ratings of combinations and the modes of resolving conflicts among constituents cannot be fully predicted from the likelihood ratings of the constituents. We believe that such demonstrations would imply that processes other than algebraic combinations of constituent ratings are involved in conceptual combination, and propose that these processes probably involve causal reasoning. At the very least, such demonstrations would underscore the limitations of those models of conceptual combination in which combinations are predicted only from the likelihood or typicality ratings of constituents (e.g., Smith & Osherson, 1984; Thagard, 1984).

Method

Subjects were 367 Princeton University undergraduates who participated voluntarily or for pay, in large group settings.

Using procedures comparable to those used in Study 2, we culled from the responses of Study 3 subjects a list of 62 attributes that had been used to describe the various constituents and combinations. Each subject rated one of the constituents or one of the combinations used in Study 3 on all 62 of these attributes, allowing for comparisons among all constituents and combinations. For subjects rating combinations, the order of constituents within each combination was counterbalanced. Numbers per cell ranged from 29 to 38. After completing their descriptions, all subjects rated how surprised they would be to hear about each of two combinations (involving four different constituents) on a 7-point scale ranging from “not at all surprised” to “very surprised.”

Results and Discussion

Modes of Conflict Resolution. To determine whether mode of conflict resolution could be predicted from constituent ratings, we examined the attributes on which the average ratings for the constituents of a given combination differed significantly from each other. As in Study 2, we defined as inherited, cases where the rating of the combination was significantly different from that of one of the constituents but not from that of the other; we defined as averaged, cases where the rating of the combination fell between those of the constituents and differed significantly from both or from neither of the constituents. We found that each combination contained at least three attributes that were inherited from each constituent and at least three that were averaged across the constituents. Thus, as in Study 2, it was never the case that one constituent completely dominated the combination, and averaging was not pervasive.

As in Study 2, the most common pattern of conflict resolution was inheritance from the more highly rated constituent, although in the present
study less than half of the conflicts were resolved in this manner. Collapsing across all combinations, there were 188 cases of conflicting attributes. Of these, 42% of the conflicts were resolved through inheritance from the higher rated constituent, 26% were resolved through inheritance from the lower rated constituent, 29% were resolved through averaging, and 3% became emergent attributes. Thus, although the mere direction of the difference among attributes does appear to influence mode of conflict resolution, it is clear that it alone cannot account for the process.

It is possible, however, that mode of resolution is determined by the relative extremity of the two constituent ratings, defined as absolute deviations from the scale midpoint, rather than by their magnitude. But we found essentially the same pattern of results when we performed a comparable analyses based on extremity ratings. We found that 46% of the conflicts were resolved through inheritance from the more extreme constituent, and 22% were resolved through inheritance from the less extreme constituent. Thus, the extremity of likelihood ratings, like their magnitude, cannot alone predict the mode of conflict resolution. Understanding how such conflicts are resolved requires us to know more than the extent to which each attribute is viewed as likely for each constituent. We believe that that additional knowledge consists of causal relations linking each attribute to its category as a whole, to other attributes, and to broader world knowledge.

Further evidence that the rating of combinations cannot be fully predicted from ratings of the constituents comes from cases in which constituents received identical ratings but combinations were rated differently. Two kinds of such examples are presented in Table 3 (p. 570). In the top half of the table, we present cases where two attributes were rated equally likely for one constituent and equally likely for the other constituent, and yet in the combination of these two constituents, the ratings of the two attributes differed significantly from each other. For example, a feminist was viewed as equally likely to be competitive as she was to be well educated, and so was a bank teller. But a feminist bank teller was more likely to be competitive than she was to be well educated: Despite the equal ratings of the two attributes, the attribute competitive was inherited from feminist, whereas the attribute well educated was averaged across the two constituents. Since it is clear that these different modes of resolution cannot be accounted for by the magnitude of the ratings of the constituents, which were identical, it seems reasonable to assume that the differences resulted from the causal accounts generated to explain how a person could be both a feminist and a bank teller.

The illustrative examples in the bottom half of Table 3 make the same point in a slightly different manner. Here a given attribute is rated as equally likely for two constituents, and yet rated differently when these constituents are each combined with a third constituent. Thus, bank tellers and lawyers are viewed as equally likely to be reclusive, yet Harvard-educated bank tellers are viewed as more likely to be reclusive than are Harvard-educated lawyers.
TABLE 3
Examples of Different Modes of Conflict Resolution for the Same Constituent Ratings

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Constituent Pair</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive</td>
<td>Feminist, Bank Teller</td>
<td>5.21</td>
</tr>
<tr>
<td>Well educated</td>
<td>Feminist, Lawyer</td>
<td>4.24</td>
</tr>
<tr>
<td>Enjoys work</td>
<td>Feminist, Lawyer</td>
<td>5.58</td>
</tr>
<tr>
<td>Has a family</td>
<td>Feminist, Lawyer</td>
<td>3.12</td>
</tr>
<tr>
<td>Male</td>
<td>Harvard, Bank Teller</td>
<td>4.56</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Harvard, Bank Teller</td>
<td>3.24</td>
</tr>
<tr>
<td>Friendly</td>
<td>Harvard, Carpenter</td>
<td>5.21</td>
</tr>
<tr>
<td>Reclusive</td>
<td>Harvard, Bank Teller</td>
<td>4.00</td>
</tr>
<tr>
<td>Problems in relationship</td>
<td>Carpenter, Feminist</td>
<td>4.53</td>
</tr>
<tr>
<td></td>
<td>Harvard, Carpenter</td>
<td>3.74</td>
</tr>
</tbody>
</table>

Once again, it appears that causal reasoning is necessary to account for these differences.

**Category Dominance.** Further evidence for the role of causal reasoning in combining concepts comes from analysis of the extent to which combinations were dominated by individual constituents. If category dominance cannot be fully predicted from the magnitude of ratings obtained for each category, this would imply that causal reasoning is involved in determining which category will be more dominant. For each combination we carried out a stepwise regression in which the average ratings of the combination's 62 attributes were predicted from those of the two constituents. As shown in Table 4, this analysis indicated, once again, that no combination was completely dominated by either constituent: In all cases, each constituent made significant independent contributions to the prediction of the combination. Nevertheless, examination of the beta weights indicated that in each case one of the constituents appeared to contribute more than the other.
TABLE 4
Standardized Regression Coefficients ($\beta$) for the Prediction of Mean Likelihood Ratings of Each Combination from those of its Constituents

<table>
<thead>
<tr>
<th>Constituent Pair</th>
<th>$\beta$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feminist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank teller</td>
<td>.85</td>
<td>.83</td>
</tr>
<tr>
<td>Lawyer</td>
<td>.69</td>
<td>.85</td>
</tr>
<tr>
<td>Carpenter</td>
<td>.78</td>
<td>.79</td>
</tr>
<tr>
<td>Harvard-educated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank teller</td>
<td>.23</td>
<td>.38</td>
</tr>
<tr>
<td>Lawyer</td>
<td>.31</td>
<td>.53</td>
</tr>
<tr>
<td>Carpenter</td>
<td>.37</td>
<td>.95</td>
</tr>
</tbody>
</table>

Note. All 3 values are significant at $p < .05$ or less.

It was not possible to predict which constituent would dominate the combination from the average ratings of individual constituents. It may be seen in Table 4 that the constituent, feminist, dominated all three constituents it was combined with (average beta weights across the three combinations were .77 for feminist and .37 for the other constituents). The constituent Harvard-educated, on the other hand, was dominated by the same three constituents (average beta weights were .30 for Harvard-educated and .63 for the other constituents). Yet feminist and Harvard-educated did not differ significantly in their average ratings, which were, respectively, 4.20 and 4.37. This suggests that the extent to which attributes are viewed as likely for each category does not determine which of the two categories will be dominant when they are combined. Patterns of dominance must therefore be influenced by causal reasoning.

**Surprise and the Prediction of Combinations.** As shown in Table 4, the combinations differed in the extent to which the average ratings of constituent attributes predicted those of combination attributes. The $R^2$s ranged from .38 to .95. We correlated these $R^2$s with the extent to which subjects rated the combinations as surprising. We obtained a strong negative correlation, $- .93$: The more surprising a combination, the less well predicted it was from its constituents. This suggests that the causal reasoning and narrative generation, which were triggered by surprise, served to shape the representation of members of combined categories. As a result, ratings of members of surprising combinations were not well predicted by ratings of constituent members. These findings may help explain why regression analyses conducted

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2 These results differ from those of Hampton (1987) who found that the attributes of dominant concepts were rated as more important than were those of dominated concepts. This difference may be due to the fact that, unlike Hampton, we used social categories in which no attributes are necessarily true or necessarily false.
by Hampton (1988) on conceptually similar ratings yielded considerably higher predictability of combinations from constituents than we obtained. Hampton explored the combinations of concepts that appear unsurprising, and do not appear to have important conflicting implications (e.g., sports and games, machines and vehicles, food and plants). Our findings suggest that such unsurprising combinations should be well predicted from their constituents.

**GENERAL DISCUSSION**

We have found extensive evidence for the role of causal reasoning in the combination of social categories. As well as finding direct and explicit evidence for the operation of causal reasoning in combining social concepts, we report indirect evidence suggesting that noncausal aspects of constituents alone cannot account for the content of the combinations which, we argue, implies that causal relations are involved in conceptual combination. Many of the subjects in Studies 1 and 3, who were required to generate open-ended descriptions of members of two incongruent categories, provided detailed causal narratives explaining how a member of one of these categories could acquire membership in the other, and most provided less detailed but explicit causal antecedents that appeared to serve the same purpose. For each combination, both the open-ended descriptions and the more reactive ratings of members of the combined categories (Studies 2 and 4) contained emergent attributes that were not viewed as characterizing members of the constituent categories, suggesting that information outside the constituents was called upon to form impressions of the combination. It was not possible to predict which attributes of a given category would be inherited into combinations of that category with other categories solely from the extent to which the attributes were associated with the categories: The same category contributed different attributes to each combination when combined with different categories. And, finally, in cases where the two constituents conflicted on a given attribute, that is, were viewed as differentially likely to be characterized by that attribute, the likelihood ratings obtained for the two constituents could not alone predict which of several possible modes for resolving the conflict would be employed in the combination.

All of these findings indicate that subjects relied upon causal reasoning to combine the categories. These findings have implications that go beyond the nature of conceptual combination: They speak to the very nature of the representation of social categories. Our findings would not have been possible if social categories were represented as bundles of unrelated attributes differing only in their typicality. Yet, with few exceptions (Cantor & Kihlstrom, 1987), researchers typically view social categories as consisting of unrelated attributes (e.g., Cantor & Mischel, 1979), and implicit personality theories as consisting of bundles of unrelated traits (e.g., Park, 1986). It is
especially surprising that theory and research concerned with the representation of persons (for review see Fiske & Taylor, 1984) has tended to ignore the role of causal reasoning since the descriptions of persons elicited from subjects in this research are often rich with instances of causal reasoning (e.g., Park, 1986). The role causal relations play in the combination of social concepts implies that the organization of information within such categories is imbued with causal relations, contrary to the prevailing view of social categories. Attributes must differ in their centrality or importance to the category, in their implications for the values of other attributes, and in their implications for what additional behaviors and choices are likely for a member of a given category. Furthermore, the representation of a given category is embedded in a broader network of causal relations about other categories and about the world in general, and this broader knowledge can be readily accessed and used when thinking about members of that category.

We also found some intriguing indications that the use of causal reasoning, and the reliance upon broader world knowledge in the formation of impressions of members of combined categories, may be triggered or enhanced when dual membership in the categories is viewed as surprising. The extent to which a combination was considered surprising was positively correlated with the number of subjects generating causal antecedents in their descriptions of combination members, and was negatively correlated with the extent to which the average attribute ratings of combinations were predicted by those of their constituents. These findings lend support to the notion that representations of members of surprising combinations were constructed on-line in response to the surprise, rather than retrieved from stored exemplars of persons belonging to the combined categories.

Taken together, these findings suggest that the surprise aroused by an encounter with a person belonging to incongruent social categories leads people to ask themselves a question of the form: How could a member of one of these categories acquire membership in the other? Causal reasoning may play a role even at this stage, in determining the direction of the question that people will ask themselves. Some of our combinations appeared to trigger only one directional question. For example, all the narratives and antecedents generated for a Harvard-educated carpenter appeared to answer the question: How could a Harvard-educated person become a carpenter? The converse question, namely, how could a carpenter become Harvard-educated, never seemed to be asked. Other combinations appeared to trigger different questions in different subjects. For example, some subjects appeared to be answering the question: How could a feminist become a bank teller (she needed the money to support her kids), and others appeared to be answering the question: How could a bank teller become a feminist (she encountered discrimination on the job). Naturally, the member of the combination will have very different attributes if different questions are asked. The issue of which of the possible questions will be asked is intriguing and
worth pursuing in its own right. Having posed a question, people then gen-
erate a causal narrative, or chain of events that could lead to the outcome
implied by the question, by drawing upon the causal relations contained
within the categories as well as upon broader world knowledge. Some of the
characteristics of a combination member are contained explicitly in this
causal account, and others may be inferred from it.

It is important to note that not all of the attributes of the combination
member need be contained directly or indirectly in this causal narrative.
There may be some spheres of life that remain untouched by it. It is possible
that other processes will be used to generate expectations about what the
person might be like in such domains, and these may include processes that
have little to do with causal reasoning. This may explain the relatively high
$R^2$s obtained in the prediction of combinations from constituents. Models
of conceptual combination that do not incorporate causal reasoning (e.g.,
Anderson, 1968; Holland, Holyoak, Nisbett, & Thagard, 1986; Smith et al.,
1988; Thagard, 1984, 1988) may therefore be able to account for much of
the cognitive work involved in combining concepts, although they cannot
account for all of it. Thus our argument is not that causal reasoning deter-
mines every aspect of a combination. Rather, by providing existence proofs
for the role of causal reasoning in combining categories, we wish to suggest
that causal reasoning is involved in the process, and that such involvement
has important implications for category representation.

It is also important to note that narrative construction is not the only
means through which causal reasoning may guide conceptual combination. It
is also possible that the application of causal knowledge will lead to a modi-
fication in the meaning of one or both of the constituents. Such processes
were documented by Asch and Zukier (1984) and appear to have guided
some of the findings obtained by Hampton (1988). Our own data also pro-
vide some instances of this mode of resolving conflict among constituents.
For example, when combining the categories Harvard-educated and carpen-
ter, some subjects modified the category of carpenter to mean a manager of
a furniture manufacturing firm.

By recognizing the role of causal reasoning in conceptual combination, it
may appear that a very attractive aspect of many of these earlier models is
lost, namely, the ability to predict combinations from constituents, or indeed
to predict them at all. Since an almost unlimited range of information may
be accessed and used to construct combinations, predicting the combination
may require assessment of a huge amount of world knowledge. However,
prediction of combinations need not be completely impossible. It should be
possible to assess some of the relevant causal relations in advance, in partic-
ular those relating attributes to other attributes within a concept and to the
concept as a whole, by assessing aspects such as enabling relations among
attributes and the centrality of attributes to concepts. It may also be possible
to identify factors that enhance and reduce the mutability of attributes and
concepts (Kahneman & Miller, 1986). Thus, it may be possible to gain some advanced insight into the representations of combinations, even though it may be impossible to predict them fully in advance.

Our results bear upon other important social psychological issues. Our finding that, in all cases, both constituents contributed to the combination, has implications for the understanding of the effects of belonging to a stigmatized group on how one is viewed. It has been suggested that stigmatized categories are so powerful that they may engulf the representations of stigmatized individuals. For example, blind persons will be viewed primarily as blind, no matter what other social categories they belong to (Goffman, 1963). Our results suggest otherwise. Subjects' conception of a blind marathon runner was clearly distinguishable from their conception of a blind lawyer. Thirty-seven percent of the subjects describing a blind lawyer described that person as intelligent, whereas not a single subject described the blind marathon runner as intelligent. And the blind marathon runner was far more likely to be viewed as courageous (50%) than was the blind lawyer (17%). Thus the other social category that the blind person belonged to clearly played a role in constructing an impression of that person.

Our findings also have implications for what people do when their beliefs, or stereotypes about a category conflict with individuating information about a particular member of that category. To date, it has been suggested that one or the other type of information will be ignored: People will only rely upon the individuating information and discredit the stereotype (Kahneman & Tversky, 1973; Locksley, Borgida, Brekke, & Hepburn, 1980), or they will only rely upon the stereotype and discredit the individuating information (Deaux, 1976; Duncan, 1976). Our data suggest, instead, that people may creatively combine the two types of information as they create an explanatory account to resolve the conflicting implications. The end result will be a stereotype tailor-made for the particular individual, containing elements of the original stereotype, elements of the individuating information, and novel elements drawn from broader world knowledge.

Recognition of the important role that causal relations play in the combination of social categories may lead to deeper understanding of how such categories are represented and used, and could shed new light on classic social psychological issues, as well as on more general issues related to cognitive science. Since the representations of categories, or stereotypes are so basic to many areas of psychology and cognitive science, we hope that these issues will receive further attention.

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