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Community Appeal: Explanation Without Information

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Formal or categorical explanation involves the use of a label to explain a property of an object or group of objects. In four experiments, we provide evidence that label entrenchment, the degree to which a label is accepted and used by members of the community, influences the judged quality of a categorical explanation whether or not the explanation offers substantive information about the explanandum. Experiment 1 shows that explanations using unentrenched labels are seen as less comprehensive and less natural, independent of the causal information they provide. Experiment 2 shows that these intuitions persist when the community has no additional, relevant featural information, so the label amounts to a mere name for the explanandum. Experiment 3 finds a similar effect when the unentrenched label is not widely used, but is defined by a group of experts and the recipient of the explanation is herself an expert familiar with the topic. The effect also obtains for categories that lack a coherent causal structure. Experiment 4 further demonstrates the domain generality of the entrenchment effect and provides evidence against several interpretations of the results. A majority of participants in Experiments 3 and 4 could not report the impact of entrenchment on their judgments. We argue that this reliance on community cues arose because the community often has useful information to provide about categories. The common use of labels as conduits for this communal knowledge results in reliance on community cues even when they are uninformative.

Keywords: categorical, community of knowledge, explanation, formal, label entrenchment

> "Physicians think they do a lot for a patient when they give his disease a name."
>
> —Attributed to Immanuel Kant, from Lock, Last, and Dunea (2001)

There are different kinds of explanation. Perhaps the most compact and structurally simple ones are categorical explanations that use only a label to explain a property associated with the category that carries that label. For instance, if someone asks why Chewbacca is hairy, a natural answer would be "Because he is a Wookie."[1] Categorical explanations' simplicity and ease of use can explain their ubiquity, but the same qualities make them vague. There are a variety of reasons why a label might be deemed explanatory and it is not clear at first sight which, if any, is considered when interpreting and evaluating categorical explanations. Prasada and Dillingham (2006) have shown that there are reliable differences between the subjective goodness of categorical explanations, suggesting that whatever the criteria are, individuals apply them in a systematic way.

A natural way to understand categorical explanations is that they provide a communicative shortcut: Rather than stating a full and detailed explanation known to both sides of a conversation, labels can be used that are pointers to more complete accounts. For instance, calling an effect quantum suggests that certain properties of that effect are explained in exquisite detail by the theory of quantum mechanics and need not be discussed at length every time the effect is mentioned. Labels can also serve to simply summarize a category's properties, itself a form of explanation that, for many centuries, characterized the field of botany.

Research, however, has cast doubt on the idea that this is all there is to categorical explanations. Children as young as four expect that instances subsumed under a label share important, unknown properties, even in the absence of perceptual support (Gelman & Markman, 1986). A label loses some of its explanatory power when participants are told that it contains no causal information, suggesting that labels imply the existence of latent causal

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[1] Some researchers, such as Prasada and Dillingham (2006) and Lombrozo (2012), have called this type of explanation *formal explanation*, in reference to the Aristotelian theory of causes.

factors (Giffin, Wilkenfeld, & Lombrozo, 2017). Causal factors seem to be so readily implied by categorical explanations that belief in an underlying causal link between the label and the explanandum may persist even after receiving evidence to the contrary (Wilkenfeld, Asselin, & Lombrozo, 2016). Partly based on these findings, Giffin and colleagues (2017) propose that implied causal links between the category and the explanandum are a requirement for an acceptable categorical explanation.

Prasada and Dillingham (2006) propose a more inclusive theory of categorical explanation. They bring attention to the fact that explanations such as "It is three-sided because it is a triangle" can be convincing even though they do not involve causal links between the category and the explanandum. They suggest that the force of a categorical explanation comes from the attribution of an instance to a kind. Each kind is characterized by properties that have principled connections to being a member of that kind. People understand instances to have those properties by virtue of belonging to the kind in question, and, as such, the name of the kind can be used as an explanation for those properties. Thus, the necessary and sufficient requirement for the adequacy of a categorical explanation is that it appeals to the label of a kind to explain a principled connection of that kind. Principled connections go beyond mere statistical association and may include references to substances, reliable causal connections, and teleological considerations (Prasada, 2017).

These hypotheses all posit that for a factor to affect the subjective goodness of a categorical explanation, it needs to provide some new information to the inquirer that is relevant to the property to be explained, be it a kind, a causal link, or the more broadly defined principled connection. This is in line with the idea that humans are rational cognitive agents, who use available information in an approximately rational manner to solve problems and reach their goals (Chater & Oaksford, 1999). When evaluating categorical explanations, the goal is to determine why a label might shed light on the reason an entity has a certain property. Unless the label contains some information related to that property, it is worthless as a tool for explanation.

A fact overlooked in these accounts is that the information individuals may consider when processing categorical explanations is not limited to what is known by the cognizer. If it were, the value of the label would be severely limited, as individuals are largely ignorant about how even familiar objects work (Rozenblit & Keil, 2002). When we do learn relevant information, we are often quick to forget it (Fisher & Keil, 2016). By integrating cues about the presence of information in the community that is not personally known, we can take advantage of the vast knowledge that other members have collectively cultivated. There is accumulating evidence that individuals routinely make use of this communal knowledge in various settings (Sloman & Fernbach, 2017). In fact, integrating personal and community sources of information develops as early as five years of age (Danovitch & Keil, 2004) and happens so naturally that it can at times be difficult for individuals to distinguish between the knowledge that they themselves have and that which other community members possess (Fisher, Goddu, & Keil, 2015; Sloman & Rabb, 2016).

The importance of this social facet of labels has not gone unnoticed by thinkers in a variety of disciplines. Putnam (1979) spoke of a *division of linguistic labor*, whereby each individual has detailed knowledge of only a subset of categories that they are able to talk about. People are able to use labels beyond their area of expertise as long as there are individuals within the community who have the relevant information (for a related observation from the perspective of economics, see Hayek, 1945). Labels can serve as conduits or pointers that can be used in communication to refer via knowledge that sits in other people. Keil (2005) provides a nonexhaustive taxonomy for the heuristics individuals use to infer which pieces of information other members of the community may have.

Label entrenchment (henceforth entrenchment) can serve as the basis for one such heuristic. A label is entrenched in a linguistic community to the extent that it is used by community members. Entrenchment can serve as a prominent cue for the presence of information relevant to a categorical explanation in the greater community because it indexes the group's experience with the category and presumably its efforts to understand the category.

Wittgenstein (1953/2010) suggests a more fundamental role for entrenchment than serving as a cue for relevant, individually unknown featural knowledge. He argues that terms not defined in a linguistic community are inherently devoid of meaning. Other individuals must be able to independently affirm or reject the truth of statements involving a term. This view also predicts that entrenchment should affect the subjective goodness of categorical explanations. It suggests that the impact may stem from a linguistic community granting meaning to the label and thus legitimizing its use as an explanation, rather than the community storing specific explanatory content.

We will provide evidence that people's judgments of the quality of categorical explanations are sensitive to variations in entrenchment cues associated with the labels, independent of relevant causal information (Experiment 1). However, the community can be a source of various forms of knowledge. Experiment 2 suggests that community entrenchment influences the judged quality of a categorical explanation even when the community does not provide any featural information about the explanandum and the explanation amounts to reiterating the question. Experiment 3 tests Wittgenstein's (1953/2010) explanation that the result stems from meaninglessness of unentrenched terms for the recipient of an explanation. It also addresses whether intelligibility of the label, interlocutors' expertise, or suggested lack of causal structure for the proposed category can eliminate the effect. However, the role of the community need not be limited to providing featural information. It can authorize or inhibit the coinage and use of labels or help determine which ones refer to verified kinds in the outside world. Experiment 4 examines these alternative explanations for the entrenchment effect.

Experiment 1

Experiment 1 aimed to examine participants' sensitivity to the entrenchment of labels used in categorical explanations and to see whether this cue interacts with causal information about the categories. According to Wittgenstein (1953/2010), a label coined by a single person and not embedded in a linguistic community is bereft of meaning. If unentrenched labels are deemed meaningless, they cannot contain other relevant information and the subjective quality of the categorical explanation based on them should be uniformly low regardless of what else is known about the category. But when there is a communally agreed-upon label, providing

participants with relevant causal information should improve ratings, because a meaningful label can substitute for associated information.

Putnam's (1979) analysis suggests a different form of interaction. He believes that labels serve as pointers to personally unknown, but relevant information that other members of the community possess. Pragmatic speakers would be expected to rely on cues to the existence of this communal information in proportion to their assessment of how much relevant personal knowledge they lack. To the degree that relevant information is directly provided to participants, they should feel less inclined to rely on community cues such as entrenchment in their ratings of categorical explanations.

The relevant information provided by an explanation is frequently causal (Salmon, 1998; Woodward, 2003): Explanations reveal the causes or effects of properties. Thus, the perceived quality of a categorical explanation can be influenced by providing causal information. Giffin and colleagues (2017) go one step further and suggest that evidence of a reliable causal link should suffice for perceived goodness of a categorical explanation, potentially making entrenchment information obsolete.

To examine this possibility, we manipulate the number of possible causal pathways leading to the explanandum. This variable does affect explanation ratings, but the direction of the effect is not consistent. Some studies find a preference for fewer causes in explanations (Pacer & Lombrozo, 2017), others have found that more causes are preferred when mechanisms are provided (Zemla & Sloman, 2016). On one hand, introducing potential causes that may not have occurred for the instance at hand can add uncertainty and make an explanation seem less probable. On the other hand, more mechanistic information can suggest new avenues of manipulation and control as well as more in-depth knowledge on the part of the explainer. Experiment 1 examines the effect of entrenchment and how it interacts with the number of causal pathways.

Method

Participants. One hundred twenty participants were initially recruited using Amazon's Mechanical Turk. No data was recorded for 48 participants who failed an attention check before signing of informed consent. The average age of the remaining participants was 35 years ($SE = 11$; range: 21 to 69). Thirty were male and 42 female. The study was deemed exempt from Institutional Review Board review as it did not involve gathering identifying information, and there was no reasonable risk of liability or harm to participants.

Materials and dependent measures.

Unfamiliar category scenarios. Participants were provided with eight scenarios about made-up social, biological, and natural categories (see Appendix A for the full text of all scenarios). Entrenchment and number of causal pathways were manipulated within subjects. Two scenarios corresponded to each of the four conditions resulting from the manipulations. The order of the sentences associated with each independent variable was counterbalanced in various scenarios. Each scenario started with an unnamed character observing a few instances of a category, characterized by three prominent features. For the entrenchment manipulation, participants read that the character either found out about a commonly accepted name for the category (the entrenched condition), or coined a new name for it (the unentrenched condition). As a second manipulation, it was revealed to the character that either all instances of the category have a certain feature because of a single explicitly stated mechanistic cause (single pathway condition), or that instances can acquire that feature through three independent explicitly mentioned mechanisms (multiple pathways condition). For instance, in the unentrenched, multiple pathways condition, participants read:

> A person observes three bluish-white stars whose brightness varies greatly over time and that have massive flares constantly erupting from their poles. *She decides by herself to name stars with those attributes Evans stars. She learns that one of them has these qualities because of a special reaction in its core, another one due to a rare gravitational effect, and the third one as a consequence of a special form of electromagnetic instability.*

The same category was presented in the entrenched, single pathway condition as follows:

> A person observes three bluish-white stars whose brightness varies greatly over time and that have massive flares constantly erupting from their poles. *She learns that the accepted name for stars with such attributes is Evans star. She also learns that all of them have these attributes because of a special reaction in their cores.*

Participants then read about a conversation involving a categorical explanation that was identical across conditions:

> Later, while with a friend, she observes a new star with those qualities. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

After reading each of the scenarios, participants were required to answer two questions about the extent to which the second person has answered the question (called *extent answered* henceforth), and how natural the answer sounds (called *naturalness*). Separating the two questions was motivated by the idea that regular use in everyday dialogues may result in a sentence being considered natural, but perceived adequacy of an explanation does not necessarily follow from that quality. Participants circled a number from one to seven, with one labeled as "not at all," four described as "to a moderate degree," and seven labeled "completely."

Prasada (2017) has identified classes of features (e.g., body parts, functions, substances) that are most likely to have principled connections to categories in specific domains. Care was taken that features provided for categories in each domain of this experiment were instances of the relevant classes. The labels were chosen to be uninformative. The causes were chosen not to have clear interdependencies. For the single causal pathway condition, one of the three causes was chosen at random initially and used as the only cause for all participants. The characters' genders were counterbalanced.

Familiar category scenarios. Each participant was also shown four scenarios about familiar categories randomly chosen from Prasada and Dillingham (2006) as a benchmark for our judgments and to ensure that the scenario structure and the questions used are sensitive to the distinction between principled and nonprincipled properties. For instance, lemon's sourness was used as a principled and summer's humidity was employed as a nonprincipled property. The scenarios featured a character using the category label as an explanation as in the scenarios above. Partic-

ipants answered two questions similar to the ones described before after reading the scenarios. These scenarios were identical across conditions.

Design and procedure. A within-subjects design was used. After an attention check and signing of informed consent, participants were provided with instructions emphasizing that there is no right or wrong answer, and that they should respond with the first answer that comes to mind after reading the scenarios. Each participant was then shown 12 scenarios, two from each of the four conditions created by the entrenchment and number of pathways manipulations plus the four from Prasada and Dillingham (2006). A random pairing of unfamiliar categories and conditions was first created and then counterbalanced. For the order of presentation, an initial random order was determined for all 12 scenarios. Then a Latin square design was used to create six distinct orders across participants. A second attention check and demographic questions followed the scenarios. After the demographic questions, participants were asked if they noticed any factor significantly affecting their responses. The possible answers were "yes," "maybe," and "no." If one of the first two options was selected, they were asked to state the determining factors.

Results

The average rating per condition for each question across the two scenarios was calculated for every participant and treated as a single data point. A paired-samples t test showed a significant difference between *extent answered* and *naturalness* ratings, $t(71) = 10.87$, $p < .001$. However, the patterns across conditions were similar for the two questions and this effect was driven by higher *naturalness* ratings across the board (see Appendix B for the means and standard errors of conditions across domains, including for *naturalness* questions). Only results pertaining to *extent answered* questions will be reported here.

See Figure 1 for the means and confidence intervals of the different conditions. A repeated-measures 2 (unentrenched vs. entrenched) × 2 (single vs. multiple causal pathways) ANOVA was performed, with *extent answered* as the dependent variable. Significant differences were found between the *entrenched* and *unentrenched* conditions, $F(1, 71) = 100.10$, $p < .001$, $\eta_p^2 = 0.59$. The effect of number of pathways was also significant, $F(1, 71) = 15.88$, $p < .001$, $\eta_p^2 = 0.18$. There was no significant interaction between the two independent variables, $F(1, 71) = 0.23$, $p = .63$. A mixed-effects linear regression including participants and scenarios as random factors yielded similar results.[2]

All scenarios showed a between-subjects entrenchment effect in the hypothesized direction. Biological categories in the unentrenched condition did not show the number of pathways effect (see Appendix B).

When asked at the end of the study if they noticed any factor affecting their ratings ("yes," "maybe," and "no" were provided as options), 29 participants (40.3% of the sample) responded "yes." Twenty-five (34.7%) responded "maybe," whereas 18 (25%) indicated that they did not notice any factor. When added to ANOVA as a between-subjects independent variable, the answer to this question was not predictive of participant ratings, $F(2, 69) = 0.73$, $p = .49$. The only significant interaction was with number of causal pathways, $F(2, 69) = 4.12$, $p = .02$, $\eta_p^2 = 0.11$. Participants could not readily and accurately report the impact of entrenchment on their ratings.

Only 19% of the responses were at the midpoint of the scale. findings were consistent across domains.

We confirmed Prasada and Dillingham's (2006) distinction between principled and nonprincipled connections for ratings of familiar categories, $F(1, 71) = 18.56$, $p < .001$, $\eta_p^2 = 0.20$. The average ratings for principled properties were reliably higher than unfamiliar category scenarios, even in the entrenched, single-pathway condition, $t(71) = 5.01$, $p < .001$.

Discussion

We found a significant effect of label entrenchment on ratings of the degree to which a categorical explanation answers a request for an explanation of a property. This effect was not dependent on participants' conscious recollection of attending to entrenchment. This conforms to our hypothesis that people look to community-based cues to help evaluate categorical explanations, and that the entrenchment of a label can be one such cue. In addition, we replicated the results of Prasada and Dillingham (2006).

A second manipulation showed that, with few exceptions, increasing the number of possible causal pathways leading to the explanandum (even when accompanied by information about every causal mechanism involved) has a negative impact on the ratings, independent of label entrenchment. This confirms the results of earlier studies showing that people prefer simpler explanations (e.g., Wilkenfeld et al., 2016). The effect was found despite the multiple pathways condition being longer, a factor shown to increase ratings (Zemla, Sloman, Bechlivanidis, & Lagnado, 2017).[3]

The impact of number of causal pathways is in line with the importance of causal factors in evaluating categorical explanations. However, its independence from the entrenchment effect suggests that the presence of a reliable causal link is not a necessary and sufficient condition for favorability of categorical explanations as previously proposed (Giffin et al., 2017). Although not a direct result of community cues, the causal effect in Experiment 1 could also reflect the impact of community. The scenarios did not imply that causal information was provided to the inquirer. Thus, its effect on ratings either shows the expectation that this information can be accessed in the community, or our participants' confusion about what they know as opposed to what the characters in our stories know.

[2] The main effects of both fixed factors were significant (*entrenchment:* $t(498.2) = 10.57$, $p < 0.001$; *number of pathways*: $t(497.1) = 3.15$, $p = 0.002$). The interaction was not significant, $t(497.1) = 0.32$, $p = 0.75$. The marginal R^2 for fixed factors was 0.23. Adding participants and scenarios to the model as random factors resulted in a conditional R^2 value of 0.48. However, of this added explained variance only one percent was attributable to the independent effect of scenarios, suggesting that participants responded consistently across scenarios.

[3] Zemla and Sloman (2016) have shown preference for a greater number of causes in an explanation when information about the relevant mechanisms is provided, a result that may seem to contradict the current finding. However, that study provided participants with complete explanations, not just labels. In the current experiment, a greater number of causes means more information needs to be unpacked, and if a single mechanism can explain the property adequately, the cognitive costs of a more complex explanation might not outweigh its benefits.

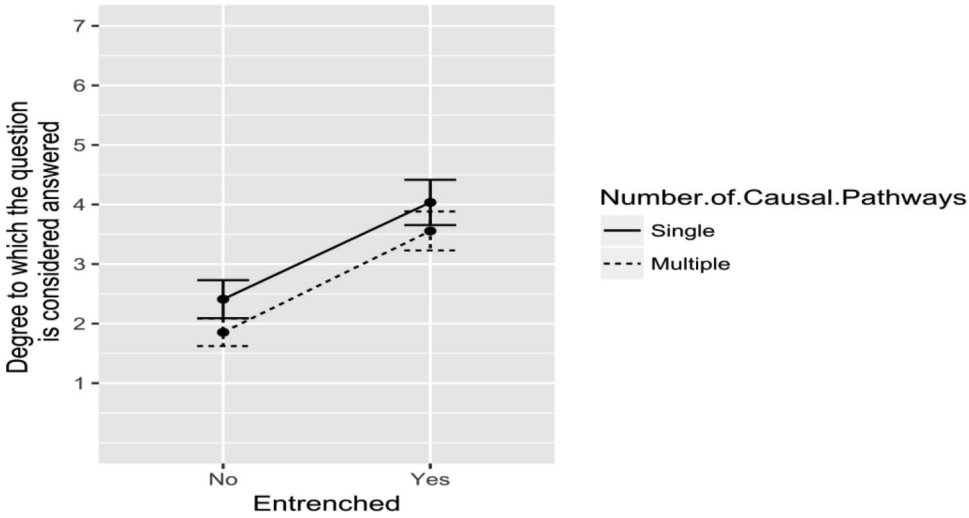

Figure 1. Average ratings for different levels of community entrenchment (horizontal axis) and number of causal pathways (different lines), with respect to the degree to which a question is answered by a categorical explanation. The error bars indicate 95% confidence intervals for marginal means of different conditions.

What is the most important contribution of the community to favorability ratings of categorical explanations? The answer does not seem to be that utterances without usage rules embedded in a community are meaningless (Wittgenstein, 1953/2010). That causal information improved ratings even in the unentrenched condition suggests that unentrenched labels do have semantic content. Even the unentrenched label can be used to ask for further information at least from the person who has coined the label.

If people strategically rely on community members for information whenever their personal knowledge is lacking, we would expect less reliance on the community when relevant causal information is directly provided to participants. The independence of the two effects seems to provide evidence against this hypothesis. Perhaps, however, the community can provide information that is more important to the task at hand than the mechanistic pathways linking the category and the explanandum.

The independence of the two effects may reflect the structure of the task. Given the within-subjects design of the experiment and the transparency of the manipulations, there may have been demand characteristics. Participants may have felt prompted to look at each manipulated element in the scenario in turn and add up their effects. However, most participants were unsure about being affected by any manipulation, casting doubt on this possibility.

Experiment 2

In Experiment 1, the reliance on entrenchment could reflect the belief that other members of the community often have information unknown to the inquirer that can potentially add depth to a categorical explanation. Attending to entrenchment cues may be strategic, with the goal of making the most informed evaluation based on all the available evidence.

However, community cues are generally reliable, meaning that a tendency may have evolved, biologically or culturally, to habitually rely on them. Given enough prominence, such cues may overshadow direct evidence and lead to reliance on the community even when it cannot provide any featural information.

If entrenchment effects primarily reflect strategic information seeking, they would be expected to disappear when the community has no featural information other than the category's identifying property, which also happens to be the explanandum. In such cases, as far as the explanandum is concerned, the response simply amounts to reiterating the question. For instance, if *Evans star* is just the label given to stars with variable brightness (no other feature of the category is known) and it is in turn used to explain the very same variability, the explanation will be clearly devoid of featural contribution. If, in contrast, different features of the category are known, at least by the person providing the categorical explanation—if not by the community at large—there is a possibility of the inquirer gaining some information from the label. That information may be helpful for clarifying the link between the category and the explanandum.

Experiment 2 aims to see whether the participants' response to entrenchment cues is sensitive to whether the community has featural information to provide. Categories are defined solely based on one feature, which later serves as the explanandum. The person providing the categorical explanation either has knowledge of other properties shared by the instances, or does not. It is explicitly stated that the community has no featural information beyond what is mentioned in the scenario. Will the entrenchment effect persist despite the community providing no novel featural information?

Method

Participants. One hundred twenty participants were initially recruited using Amazon's Mechanical Turk. Care was taken to exclude those participants who had participated in similar experiments. No data were recorded for 28 participants who failed an attention check before signing of informed consent. Of the remain-

ing participants included in the analyses, 46 were male and 31 female, with 15 participants choosing the "other" option for gender. The average age was 32.7 years (SD = 9.15; range: 21 to 69).

Materials and dependent measures. Twelve scenarios were used, including two unfamiliar social categories, six unfamiliar natural groups of entities (biological and inanimate), and four familiar categories modeled after Prasada and Dillingham (2006). See Appendix A for the full text of scenarios. The familiar category scenarios were identical to the ones used in Experiment 1. The unfamiliar category scenarios started with an unnamed character observing entities with a single prominent shared feature. Then either the accepted name for entities with that single property was provided (entrenched condition), or the character proceeded to coin a name for them (unentrenched condition). In multiple-features conditions (but not single-feature conditions), the character proceeded to learn two other prominent features of the category in question. These features were slightly modified from Experiment 1 to ensure that they were not obvious and it was plausible for them not to have been noticed the first time instances were observed, or not to be noticed every time a new instance is encountered. The order of presentation and the temporal gap between the character learning of the first feature and the other two was meant to reinforce the idea that the definition of the label only hinges on the first feature and having that quality alone makes an entity a member of the corresponding category with certainty. Afterward, it was indicated for all scenarios that nothing else is known about the category at hand. For instance, in the entrenched, single-feature condition, participants read:

> A person observes a number of stars whose brightness varies greatly over time. *She learns that the accepted name for stars with this quality is Evans star*. She realizes that nothing else is known about these stars.

Participants in the unentrenched, multiple-features condition instead read:

> A person observes a number of stars whose brightness varies greatly over time. *She decides by herself to use the name Evans star for stars with this quality. She later learns that these stars are also most clearly seen in the northwestern sky in the spring and have flares periodically erupting from their poles.* She realizes that nothing else is known about these stars.

This was followed by a conversation in which a categorical explanation was used, identical across conditions:

> Later, while with a friend, she observes a new star. They only manage to see that its brightness varies greatly over time. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an *Evans star*."

Design and procedure. The design and procedure were identical to Experiment 1.

Results

Figure 2 shows the main results of Experiment 2. As in Experiment 1, although *naturalness* ratings were significantly higher than the *extent answered* ratings, $t(91) = 10.42$, $p < .001$, the patterns of responses to the two dependent measures were similar. We will therefore only report *extent answered* ratings (see Appendix B for the means and confidence intervals of *naturalness* ratings). A 2 (*entrenched* vs. *unentrenched*) × 2 (*single-feature* vs. *multiple-features*) repeated measures ANOVA was performed. There was a significant main effect of entrenchment, $F(1, 91) = 101.02$, $p < .001$, $\eta_p^2 = 0.51$. All scenarios showed this effect in the hypothesized direction. There was also a small effect of number of features, $F(1, 91) = 5.15$, $p = .03$, $\eta_p^2 = 0.05$. This effect was in the opposite direction than hypothesized, with single-feature scenarios garnering slightly higher ratings on average than ones involving multiple features. The interaction between the two factors was not significant, $F(1, 91) = 0.42$, $p = .66$. A mixed-effects linear regression including participants and scenarios as random factors yielded similar results.[4]

No significant domain differences were found (see Appendix B). Only 8% of *extent answered* were 4, the midpoint of the scale. The results involving familiar categories were similar to Experiment 1.

Discussion

Label entrenchment increased ratings of the extent to which a categorical explanation answers a question to a mean slightly greater than the midpoint of the scale even when the community had no featural information to provide. This suggests that cues to the community affect evaluations of categorical explanations even when those explanations have no informational value regarding the explanandum.

We were surprised that categories with more features received lower explanation ratings. Participants may have focused only on the direct link between the category and the explanandum, rather than all of the category's properties. However, even if the other features were deemed unrelated to the explanandum, their presence was expected to render the lack of relevant featural information in the categorical explanation less obvious and thus increase ratings across the board. Another possibility is a misconstrual of the task as involving category membership judgments. Even though the scenarios were structured such that the first feature sufficed to identify the category, participants may have considered the membership of an instance in doubt when three features were known and only the first one was observed. This could lead to perceptions of degraded explanation quality in multiple-features conditions, overwhelming the positive impact of more potentially relevant knowledge about the category in those cases.

Experiment 3

The importance of entrenchment in Experiment 2 despite the absence of featural information in the community can be seen as evidence in favor of an entrenchment heuristic: a habitual response to entrenchment as a useful cue even when it offers no valid information. However, there are alternative explanations for these results based on conversational norms. These alternatives are not

[4] The main effects of both fixed factors were significant (*entrenchment:* $t[641] = 12.09$, $p < 0.001$; *number of features:* $t[641] = 2.02$, $p = 0.04$). The interaction was not significant, $t(641) = 0.67$, $p = 0.50$. The marginal R^2 for fixed factors was 0.18. Adding participants and scenarios to the model as random factors resulted in a conditional R^2 value of 0.52. However, removing the independent effect of scenarios from the model resulted in a drop of less than one percent in explained variance, suggesting that participants responded consistently across scenarios.

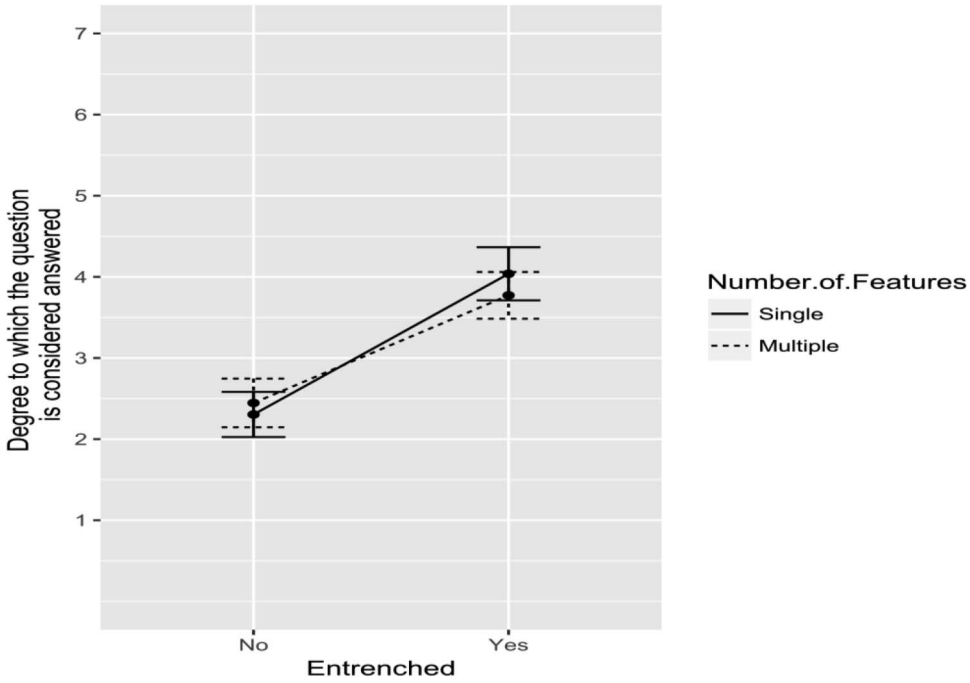

Figure 2. The effects of entrenchment of label in the community (horizontal axis) and number of features related to the label (different lines) on ratings for the extent to which a question is answered by a categorical explanation. The error bars indicate 95% confidence intervals for the marginal means of each condition.

necessarily incompatible with our hypothesis, but they do diminish its domain of applicability.

According to Wittgenstein (1953/2010), there can be no private language. Only the rules governing a word's usage in a community can provide that word with meaning. In the unentrenched conditions of both previous experiments, the term was coined by an individual in isolation and hence was meaningless based on this criterion. While this argument cannot predict the independence of the effects to other manipulations that we found in those studies, we have not tested it directly. It suggests that no difference will be observed when comparing labels embedded in two linguistic communities of different sizes, differing only in the breadth and frequency of use of each label. Our hypothesis predicts that use of entrenchment as a cue will depend on its reliability, so a label known and used by three people should evoke lower ratings than one used in a broader linguistic community. In both cases, the label is clearly meaningful within the relevant community. Using terms only known to members of a small group is a common and effective method of communication. In fact, coining of such in-group labels can easily be induced in experimental settings (Clark & Wilkes-Gibbs, 1986).

Relatedly, the results might reflect the immediate informational context of the dialogue. Interlocutors normally assume that participants are trying to be as informative as needed, but not more so (Grice, 1975). Such an assumption might lead to the belief that if a categorical explanation is the only response to a question, the user must consider the other person to be familiar with the label, and that the label carries information about the properties of the object or the kind of thing it is. But such familiarity is only possible in the entrenched, not the unentrenched condition, where the label is necessarily unintelligible to the recipient. In that sense, our appeal to the community of knowledge might be reducible to Grice's well-known conversational maxim.

A different set of norms may also account for the results. An implication of Putnam's (1979) *division of linguistic labor* is that because only experts are expected to know the exact definition of a category, its boundaries, and how to recognize its members, the reliance on community should hinge on expertise. How individuals identify this expertise is discussed by Keil (2005). Generally, the more expert knowledge is possessed by the inquirer about a certain category, the less extra information the community has to offer. It is possible that with enough expertise on the part of the characters, the effect of entrenchment will disappear. Experiment 2 provided some evidence against this possibility, as no extra featural information about the category could be gained regardless of expertise. However, because of the division of labor, there might be resistance to someone who is not an expert coining a new term for a category, leading to a large effect of entrenchment. There was no indication in either of the first two experiments that the characters were experts.

Inattentiveness is a more mundane explanation for some of the results. The absence of additional featural information in the community was subtly stated in Experiment 2. There might also be an interaction between a participant's tendency to be reflective and showing the entrenchment effect, where the more observant participants are more likely to notice the uninformative nature of the entrenchment manipulation.

All these alternative hypotheses assume that only information the community currently has can be relevant to the assessment of categorical explanations. However, being subsumed by the same

label often suggests that instances share other—possibly nonvisible and causally important—properties (Gelman, 2003; Heit, 2000). Even if nothing other than the defining feature is currently known about a category, a community can uncover other important facts about it at a faster pace than an individual, as long as the category is a well-formed one. Therefore, the entrenchment effect may reflect not the current state of our communal knowledge, but the promise of faster accumulation of relevant information in the future. If this is the case, information calling into question the existence of any coherent causal structure for the category may eliminate the effect.

So far, we have only discussed whether the community possesses or is expected to possess featural information about a category. However, the usefulness of a label as a pointer to knowledge is predicated on that information being accessible upon request. If further knowledge about a category is stored within the community, but the inquirer has no way of accessing it, that knowledge may as well not exist. There is evidence that while facts known to others can bolster one's sense of understanding, removing access to that information may eliminate their impact (Sloman & Rabb, 2016). A similar condition may apply to categorical explanations. This possibility can be examined by manipulating the inquirer's access to causal information available to others.

Experiment 3 aims to test these various possibilities. Characters were explicitly described as experts and familiar with the category. Because the familiarity was uniform across conditions, unintelligibility and Gricean maxims could not account for any difference we observe. It was clearly stated that the label only stands for the described appearance to make the uninformative nature of the explanation clearer. In some "causally unstable" conditions, participants were dissuaded from assuming instances shared a causal structure. We also tried to determine whether the recipient's plausible access to causal information is a requirement for that information to affect ratings. Furthermore, Experiment 3 included comprehension checks and a test of reflectiveness to see whether those could explain aspects of the findings. Our suggestion is that the effect stems from habitual, potentially misplaced responses to a generally reliable cue. If so, the effect should persist despite all controls.

Method

Participants. Two hundred participants were recruited via Amazon's Mechanical Turk and were compensated for their participation (96 males, 102 females, 2 other). It was ensured that the recruited participants were not among those who participated in Experiments 1 and 2. The average age was 34.39 years (SD = 10.8; range: 20 to 84).

Materials and dependent measures. Eight unfamiliar category scenarios similar to those of Experiment 1 were used. Latin names were chosen as labels to create a stronger impression of expertise in all conditions. Unlike previous experiments, no familiar category modeled after Prasada and Dillingham (2006) was included. Because *naturalness* questions had shown a similar pattern to *extent answered* questions in Experiments 1 and 2, they were omitted. Scenarios related to the two social categories along with one associated with a natural category (Drescher springs) were replaced with scenarios about primarily academic topics (a subatomic particle, a bacterium strain, and a psychiatric syndrome). See Appendix A for the full text of all scenarios.

Each scenario involved two individuals explicitly described as experts in a relevant discipline studying instances of the category in question. The characters looked up entities with the described appearance in reference books. They either discovered that a certain name has been used for them by other experts (entrenched condition), or failing to find a mention of them, decided to coin a name themselves for entities with the described qualities (unentrenched condition). In the entrenched condition, it was also highlighted that no information about the category other than the label could be found in reference books. In all conditions, it was explicitly stated that the name referred to the appearance of the instances and to nothing else. Then, the characters in all conditions mentioned the label and the associated appearance to a third colleague.

Following this manipulation, in causally unstable conditions, the characters discovered shortly after that the prominent qualities shared by the instances are in each case the result of a different, unpredictable environmental variable. In causally stable conditions, the characters discovered the singular process that led to the instances having the qualities in question. Unlike Experiment 1, it was highlighted that the causal information learned by the first two characters has not been shared with any other member of the community. For example, in unentrenched, causally unstable condition, participants read:

> Two astronomers are studying stars in an astronomy lab. They observe a number of stars whose size and brightness varies over time. *Failing to find any mention of them in astronomy reference books, they decide to name stars with such an appearance Carinaeric stars themselves.* The name only refers to the stars' appearance and to nothing else. They mention what they know about these stars to a fellow astronomer who did not know about them previously.
>
> The following day, studying the physical structure of these stars, they discover the *processes* that give rise to this appearance. *Each star has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the star's formation.* They have not mentioned this finding to anyone else yet.

Participants in the entrenched, stable condition, instead read:

> Two astronomers are studying stars in an astronomy lab. They observe a number of stars whose size and brightness varies over time. *Looking it up in astronomy reference books, the only thing they can discover is that stars with this appearance have been called Carinaeric stars.* The name only refers to the stars' appearance and to nothing else. They mention what they know about these stars to a fellow astronomer who did not know about them previously.
>
> The following day, studying the physical structure of these stars, they discover the *process* that gives rise to this appearance. *Every star has this appearance due to the same underlying process.* They have not mentioned this finding to anyone else yet.

The manipulations were followed by a paragraph—uniform across conditions—in which the third colleague who was previously informed of the label and the associated properties asked a question about a new instance of the category. One of the first two characters responded with a categorical explanation:

> While studying new stars, the colleague to whom they had mentioned stars with this appearance observes one whose size and brightness varies over time. She asks the other two astronomers: "Why does this star look like this?," to which one of them responds: "Because it is a Carinaeric star."

Note that no new information was gained from the response because all introduced characters knew that the label indicated nothing other than the observable features that the questioner asked about. The third character presumably does not have access to the causal information stated in the scenario either, as the other two experts have decided not to disclose it yet.

Comprehension check. A comprehension check question followed the last scenario for every participant, asking whether anybody aside from the characters knew anything about the category other than the described features. The possible choices were "yes," "maybe," and "no." If a participant chose a response other than no, they were shown an open-ended question asking them to describe what other information was available to other members of the community.

Cognitive Reflection Test. The Cognitive Reflection Test (Frederick, 2005) is designed to measure the degree to which individuals respond analytically as opposed to intuitively. It is composed of three questions whose intuitive answers are wrong. For instance, a question reads: "A bat and a ball cost $1.10 in total. The bat costs a dollar more than the ball. How much does the ball cost?" The intuitive answer to this question is 10 cents; the correct answer is five cents. We divided participants into high- versus low-CRT groups based on whether they responded to a majority of the questions correctly.

Design and procedure. A design and procedure similar to Experiment 1 was used with a few modifications. Because of evidence that attention checks may reduce data quality (Vannette, 2016), no attention checks were used in Experiment 3. After responding to the experimental scenario, participants were given the Cognitive Reflection Test (Frederick, 2005). The manipulations were not counterbalanced.

Results

One hundred twenty-six participants (63% of the sample) responded "no" to the comprehension check question, suggesting that the lack of extra information contained within the community was understood by most responders. The reported analyses were performed a second time excluding participants who responded with "maybe" or "yes," yielding similar results.

The ratings for the two scenarios per condition were averaged for every participant. Means are shown in Figure 3. A 2 (unentrenched vs. entrenched) × 2 (causally stable vs. causally unstable) × 2 (high CRT vs. low CRT) mixed-design ANOVA was performed. Even though CRT score was related to ratings ($F(1, 198) = 5.80, p = .02, \eta_p^2 = 0.004$), it had no significant interaction with any other factor, with higher CRT associated with lower ratings across the board. Therefore, the results of a second ANOVA excluding this variable are reported.

There was a significant main effect of entrenchment on ratings, $F(1, 199) = 32.80, p < .001, \eta_p^2 = 0.14$. There was no main effect of causal stability, $F(1, 199) = 0.79, p = .38, \eta_p^2 = 0.004$. As in Experiment 1, the interaction between the two factors was not significant, $F(1, 199) < 1$.

All scenarios showed the entrenchment effect in the hypothesized direction. However, there was a significant effect of scenarios on ratings after applying the Greenhouse-Geisser correction for violation of sphericity, $F(5.64,1393) = 3.63, p = .002, \eta_p^2 = 0.02$, owing to higher ratings for the mental disorder scenario across the board (see Appendix B). A linear mixed-effects regression analysis including participants and scenarios as random factors yielded similar results regarding the fixed independent variables.[5]

When asked at the end of the study if they noticed any factor affecting their ratings, 126 participants (63% of the sample) responded with "no." This result suggests that task demands cannot account for the observed effects. Furthermore, only 16% of the responses were at the middle of the scale, suggesting that most participants had a definite opinion.

Discussion

Experiment 3 replicated the entrenchment effect in several domains, including psychiatric syndromes. Because both the coiners and the recipient of the categorical explanation were cognizant of what the label stood for, meaninglessness or unintelligibility of the label cannot account for the entrenchment effect. The coiners in the unentrenched condition were also experts who knew more about the category than the broader community, further confirming that contribution of information is not required for the effect to happen, and it is not attributable to the role of expertise in authorizing coining of terms. It was stated in the scenarios that either no mention of the category's existence could be found in the community (unentrenched condition), or that the community failed to provide any information other than the label and the appearance it stood for (entrenched condition). This is in contrast to the coiners who had studied the phenomenon and gained unreported, relevant causal knowledge.[6]

The text of scenarios in Experiment 3 made it clear that the labels stood for nothing other than the explanandum. Although a belief may linger that instances subsumed by an accepted label share other properties, a comprehension check confirmed that most participants accepted the absence of other featural knowledge by the community. Their intuition that the entrenched label was a better explanation persisted despite their conscious realization that entrenchment provided no featural information. That most subjects did not recognize the impact of entrenchment on their ratings and no effect was observed for the stability manipulation suggests that these ratings reflect intuitions and are not the result of task demands.

[5] The main effect of entrenchment was significant, $t(1390.8) = 5.26$, $p < 0.001$. There was no effect of causal stability, $t(1390.4) = 0.78$, $p = 44$. The interaction was not significant either, $t(1390.4) = 0.24$, $p = 0.81$. The marginal R^2 for fixed factors was 0.17. Adding participants and scenarios to the model as random factors resulted in a conditional R^2 value of 0.54. However, removing the independent effect of scenarios from the model resulted in a drop of less than one percent in explained variance, suggesting that participants responded consistently across scenarios.

[6] The impact of expertise on the entrenchment effect was further studied in a separate within-subjects experiment not reported here. The entrenchment effect was replicated, but no significant difference was found between stating that the common populace uses a label as opposed to a community of experts, providing further evidence that expertise does not account for the entrenchment effect.

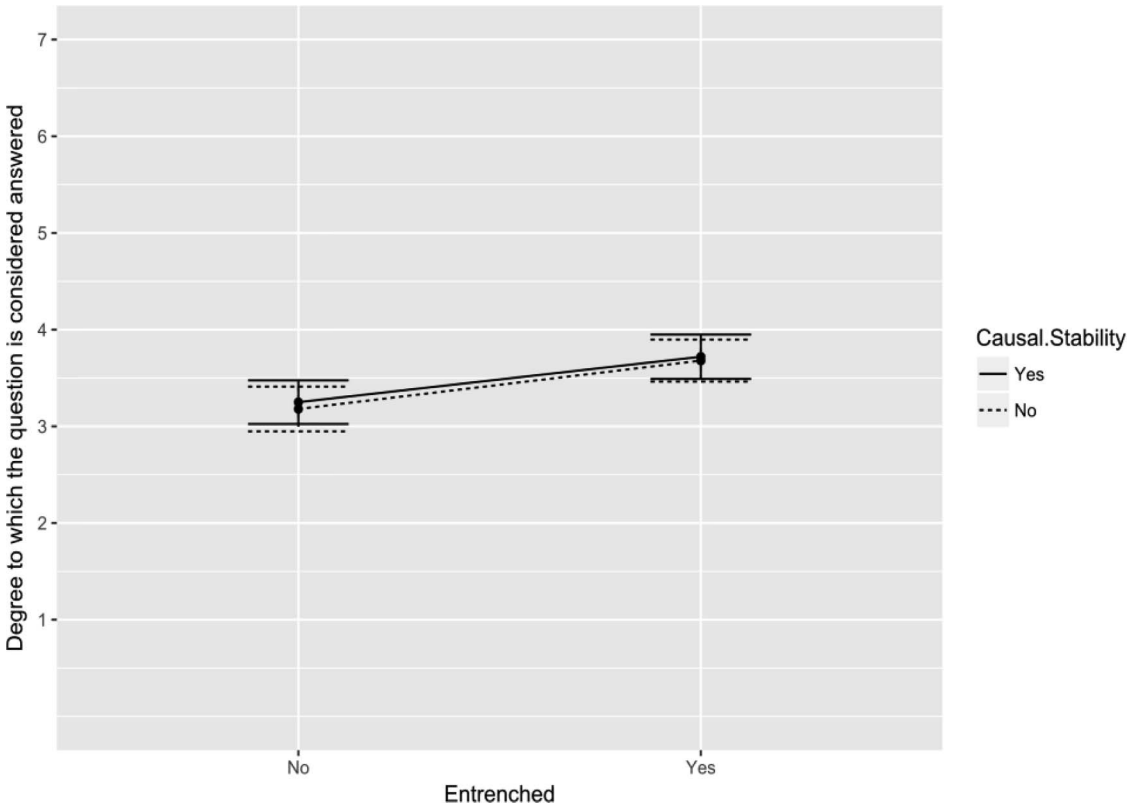

Figure 3. Effects of manipulating community entrenchment (horizontal axis) and causal stability (different lines) on ratings of the degree to which a question is considered answered after the use of a categorical explanation. The error bars indicate 95% confidence intervals for marginal means of different conditions.

The entrenchment effect persisted despite information calling into question a coherent structure for the proposed category, undermining its inductive potential. However, there is an alternative explanation for this finding. Wilkenfeld and colleagues (2016) showed that causality may be so central to conceptions of labels and categories that belief in a reliable shared causal structure for instances may persist despite explicit information to the contrary. If so, perceived inductive potential in the future may still provide an explanation for why the entrenchment effect has developed. Experiment 4 examines this possibility.

It is noteworthy that the entrenchment effect was diminished in Experiment 3 compared with the previous experiments, and the means in most conditions were below the midpoint of the scale. This suggests that participants were sensitive to the changes in the scenarios, including the characters' expertise and the intelligibility of the labels. However, the persistence of the effect suggests that the contribution of entrenchment is not reducible to these factors.

Unlike Experiment 1, causal information provided to participants had no significant impact on ratings. This is despite the fact that the causal property manipulated, the stability of a connection under changes in background conditions, is known to impact the perceived goodness of explanations (Vasilyeva, Blanchard, & Lombrozo, 2016; Wilkenfeld et al., 2016; Woodward, 2003). One difference between Experiments 1 and 3 was the inclusion of mechanism information in the former. However, if knowledge that is accessible through the community is treated like personally known facts when evaluating categorical explanations, vague pointers to the same knowledge in the community should be just as effective. Wilkenfeld et al. (2016) have provided some evidence that such abstract pointers can affect ratings in the domain of mental disorders.[7] It is possible that the subtle nature of the manipulation has caused it to escape participants' notice. However, a more likely explanation for the absence of an effect is the inquirer's access to the provided information. In Experiment 3, the characters studying the phenomenon had not shared their causal knowledge with anyone yet, implying that the inquirer would not be able to access them either. Thus, the impact of others on one's sense of understanding may be dependent on access to their knowledge, an interpretation supported by prior research (Sloman & Rabb, 2016).

Experiment 4

The aims of Experiment 4 are twofold: To contrast several explanations for the entrenchment effect, and to further test its generality.

[7] A separate experiment not reported here further confirmed this hypothesis. Aside from replicating the entrenchment effect, we found that simply stating that an explanation is known can make a significant difference to ratings.

Label entrenchment can be a reliable cue for various kinds of information. Prasada and Dillingham (2006) single out a specific quality that might enjoy special status: kindhood. They suggest that categorical explanations can be deemed acceptable only if the category used as an explanation is considered a kind, a nonarbitrary grouping of instances imposed on the cognizer by the world. A second requirement is the existence of a principled connection between that kind and the explanandum. Widespread use of a label may signal that it is picking out a kind, authorizing the label's use in categorical explanations. If kindhood is the crucial piece of information that an entrenched label cues, confirming the kind status of the category in some other way should make entrenchment—and the label itself—redundant. To examine this possibility, Experiment 4 manipulates the presence of labels while making the kind explicit. The features of each kind are chosen from the classes that have been theorized to be most likely to have principled connections to a kind in each domain (Prasada, 2017).

Alternatively, the results may reflect the promise of greater information accumulation in the future for entrenched categories. Experiment 4 tests this possibility by ensuring that the only difference between the entrenched and unentrenched conditions concerns whether the discoverers have reported their findings yet or not. It stands to reason that once the findings are reported, there will be no discernible difference between conditions in the rate at which relevant communal information is collected in the future.

Experiment 4 tests another concern as well. Kripke (1972) has argued persuasively that the first people who identify a kind or phenomenon are given the right to label it (to "baptize" it). Merely being a leading expert may not grant authority to coin a new term. Because reference books included no mention of the category in the unentrenched conditions of Experiment 3, it was implied that the coiners were indeed the discoverers of the phenomenon. However, it is possible that this subtle implication escaped participants' notice. Hence, participants might not have considered the labels authorized to support inferences. Experiment 4 tests this by explicitly introducing characters as discoverers of the category to be named.

Whatever the explanation for the entrenchment effect may be, certain conditions may reduce its domain of application. One candidate is the intelligibility of the label for the explanation's recipient. In Experiments 1 and 2, the recipient in the unentrenched condition could not have heard of the label beforehand, although it was possible for her to have encountered it in the entrenched condition. Experiment 3 equalized the recipients' prior access to the label by making it familiar in all conditions. However, the possibility that the label needs to be intelligible at least in the entrenched case for the effect to occur has not been explored. In Experiment 4, the recipient's prior experience with the label was denied in all conditions.

So far, comparable effects have been observed for social, biological, natural, and psychiatric disorder categories, but none have been basic-level categories (Rosch, 1978); they have all been more specific. To see whether the effect holds for categories at the level of abstraction that is most natural, Experiment 4 uses basic-level categories from several domains including artifacts.

Method

Participants. Two hundred participants were recruited via Amazon's Mechanical Turk and were compensated for their participation (80 males, 118 females, 2 other). It was ensured that the recruited participants are not among those who participated in similar experiments. The average age was 36.79 years (SD = 11.16; range: 19 to 69).

Materials and dependent measures. Eleven new scenarios were used, corresponding to eight unfamiliar and three familiar categories (see Appendix A for the full text). The familiar categories were different from those of Experiments 1 and 2, but the structure of the scenarios was identical to those experiments. The unfamiliar categories included two from each of four domains: social, biological, artifact, and disorder. Care was taken that all categories correspond to several operational definitions of the basic level, including naming preference (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). Like the previous experiments, the explananda consisted of features most likely to have principled connections to the category in question based on the domain (Prasada, 2017). Uninformative names were used as labels for unfamiliar categories.

Each unfamiliar category scenario started with either two experts discovering instances of a category on a remote island (unentrenched condition), or asserting that many members of a community of experts knows about their existence (entrenched condition). The choice of a remote setting was meant to reduce the impact of knowledge about similar, known categories. After this manipulation, in labeled conditions, either two experts named the category they had discovered (unentrenched condition), or an individual expert found the accepted label in a reference book (entrenched condition). In unlabeled conditions, it was either stated that the two discoverers have not proceeded to name the category yet (unentrenched condition), or that the individual expert has learned that the category is a recognized kind in the eyes of the expert community despite lacking an agreed-upon label (entrenched condition). In unentrenched conditions, regardless of the labeling manipulation, participants were told that the results have not been shared with the broader expert community yet. Like Experiment 3, it was stated that nothing else is known about the category. A conversation followed, with a new expert unfamiliar with the category asking a question about a clear instance of it. A previously introduced character responded using a categorical explanation, either with the previously mentioned label (labeled condition), or with the name for the abstract superordinate category (e.g., reptile; unlabeled condition).

For example, in the unentrenched, unlabeled condition, participants read:

> *Two biologists discover* that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.
>
> *The two biologists are the first to document the existence of these reptiles. They have not chosen a name for creatures with these qualities or reported their results yet.*
>
> Later, a third biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks one of the first two biologists: "Why is this animal like this?" He responds: "*Because of the kind of reptile it is*."

The text was changed to the following for the unentrenched, labeled condition:

> *Two biologists discover* that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.
>
> *The two biologists are the first to document the existence of these reptiles and decide to name creatures with these qualities gharials themselves. They have not reported their results yet.*
>
> Later, a third biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks one of the first two biologists: "Why is this animal like this?" He responds: *"Because it is a gharial."*

The following scenario provides an example of the entrenched, unlabeled condition:

> *Many biologists know* that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.
>
> *A biologist looks them up in reference books, finding that despite being a recognized kind of animal, a name has not been chosen for creatures with these qualities yet.*
>
> Later, a second biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks the first biologist: "Why is this animal like this?" He responds: *"Because of the kind of reptile it is."*

An example of the entrenched, labeled condition is as follows:

> *Many biologists know* that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.
>
> *A biologist looks them up in reference books, finding that the accepted name for animals with these qualities is gharial.*
>
> Later, a second biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks the first biologist: "Why is this animal like this?" He responds: *"Because it is a gharial."*

Design and procedure. The design and procedure were identical to Experiment 3.

Results

One hundred forty-nine participants (74.50% of the sample) responded "no" to a question asking whether the community knew anything about the category beyond the identifying feature, suggesting that the lack of extra information was understood by most responders. The reported analyses were performed a second time excluding participants who responded with "maybe" or "yes" to either question, yielding similar results.

The average rating for each question across the two scenarios per condition was calculated for every participant and treated as a single data point in tests (see Figure 4). A 2 (entrenched vs. unentrenched) × 2 (labeled vs. unlabeled) × 2 (low-CRT vs. high-CRT) mixed design ANOVA was performed. Because none of the main or interaction terms involving CRT were significant, only the results of a second ANOVA excluding CRT will be reported here.

There was a significant main effect of entrenchment, $F(1, 199) = 78.48$, $p < .001$, $\eta_p^2 = 0.28$. The main effect of labeling was also significant, $F(1, 199) = 77.33$, $p < .001$, $\eta_p^2 = 0.28$. There was a reliable interaction between the two independent variables, $F(1, 199) = 55.29$, $p < .001$, $\eta_p^2 = 0.22$. As Figure 4 shows, the interaction is a result of a weaker entrenchment effect in unlabeled conditions, $t(199) = 2.06$, $p = .04$, compared with labeled conditions, $t(199) = 9.22$, $p < .001$. All unfamiliar category scenarios showed a between-subjects entrenchment effect in the hypothesized direction.

A significant domain-based difference was observed, with scenarios involving disorder categories garnering higher ratings, $t(199) = 8.18$, $p < .001$. There was no significant difference between the ratings for social, biological and artifact categories after applying the Greenhouse-Geisser correction for violation of sphericity, $F(2, 398) = 2.23$, $p = .12$. The statistics for each domain can be found in Appendix B. A mixed-effects linear regression including participants and scenarios as random factors yielded similar results.[8]

Similar to Experiment 3, 140 participants (70% of the sample) indicated that they were unaware of any factor affecting their ratings for scenarios. Only 16% of the responses were at the middle of the scale. The results involving familiar categories were similar to previous experiments.

Discussion

Experiment 4 replicated the results of Experiment 3. The entrenchment of a label influenced evaluation of a categorical explanation even when the label provided no information. The effect was obtained using basic level categories, including artifacts, highlighting the generality of the entrenchment effect.

This pattern was observed despite the label being unfamiliar to the recipient in all conditions, providing evidence that intelligibility of the label is not a prerequisite for the entrenchment effect. Apparently, unfamiliar terms can be meaningful when thought to be entrenched. Hearing a novel label for a disorder while visiting a physician's office is rarely an indication that one's physician has spoken in gibberish.

The use of explicit kinds and features likely to have principled connections to those kinds did not defeat the entrenchment manipulation. This contradicts the account derived from Prasada and Dillingham (2006), according to which the role of entrenchment is only to signal the presence of a kind. The much smaller effect in the unlabeled conditions suggests that labels play a major role in the impact of entrenchment on ratings. Admittedly, the distinction between principled and unprincipled connections was meant to explain why categorical explanations are satisfactory for some

[8] Significant main effects of entrenchment and labeling were observed (*entrenchment:* $t[1390] = 11.48$, $p < 0.001$; *labeling:* $t[1390.1] = 5.42$, $p < 0.001$). The interaction between the two factors was significant, $t(1390.1) = 7.159$, $p < 0.001$. The marginal R^2 for fixed factors was 0.10. Adding participants and scenarios to the model as random factors resulted in a conditional R^2 value of 0.53. Removing the independent effect of scenarios from the model resulted in a drop of 5 percent in explained variance, suggesting some impact of scenarios independent of the main manipulations.

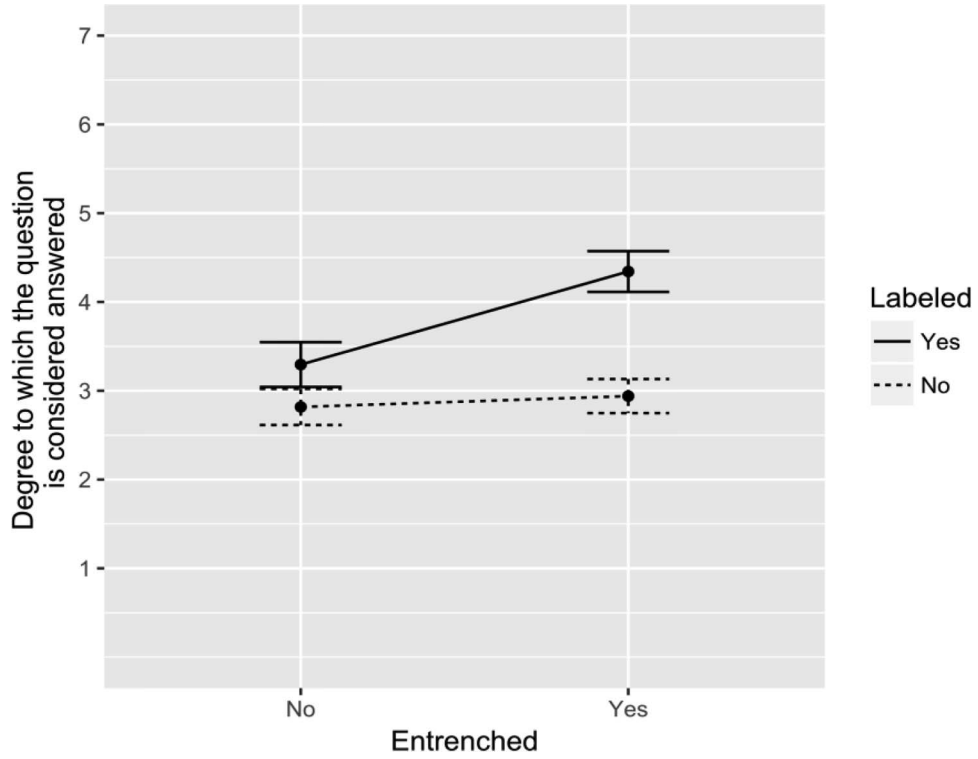

Figure 4. The effects of community entrenchment (horizontal axis) and presence or absence of a label (different lines) on ratings for the extent to which a question is answered by a categorical explanation. The error bars indicate 95% confidence intervals for the marginal means of each condition.

features of familiar categories but not others. The entrenchment effect is silent on this issue, which in combination with the inability of the kind hypothesis to account for the results of Experiment 4 suggests the two effects may be orthogonal.

Experiment 4 provided more evidence that the authority to coin terms is not responsible for the entrenchment effect. The characters in the unentrenched condition were the expert discoverers of the phenomena, people who have more authority than anyone else to coin terms for them. Still, the categorical explanations they provided were seen as inferior to ones employing commonly used labels.

The only distinguishing feature of the unentrenched condition in Experiment 4 was that the discoverers' findings were not reported yet. Because the scenarios did not cast doubt on the reliability of their information, it is unlikely that a change in the category's future inductive potential can account for the results. Entrenchment alone inducing a belief in a label's inductive potential without corroborating evidence would provide further support for the importance of this cue.

General Discussion

The experiments reported suggest that the explanatory value of labels arises in part from their ability to point to knowledge in the community. This is essentially a way of outsourcing cognitive effort by the individual to the community. The experiments also show that entrenched labels are treated as explanatorily virtuous even if there is no additional information in the community for them to point to. This effect obtained even though most participants were unaware of the impact of entrenchment on their ratings.

This is not to say that individuals are incapable of processing pertinent information. Prasada and colleagues have shown that participants can reliably distinguish principled and nonprincipled connections between categories and explananda, adjusting their ratings in response to a variety of causal, statistical, and definitional information (Prasada, 2016, 2017; Prasada & Dillingham, 2006). In line with previous studies highlighting the importance of causal factors (Giffin et al., 2017; Wilkenfeld et al., 2016), Experiment 1 found that ratings of categorical explanations are affected by the number of possible pathways resulting in the explananda.

Experiment 1 showed that, independent of this effect, the entrenchment of a category label in a community can improve both ratings of the degree to which a label answers a question and how natural a label sounds as a response to a request for an explanation. In scenarios covering a range of natural, biological, and social categories, labels that were coined by a character and later used as a categorical explanation (unentrenched condition) were rated lower on both measures, compared with labels that the participants were told are commonly used by community members (entrenched condition).

It is possible that the information participants seek from the community is not causal in nature, explaining the independence of entrenchment and causal effects in Experiment 1. It is also reasonable to assume that the community as a whole possesses more knowledge about categories than even the most prominent expert.

Experiment 2 sought to determine whether reliance on community cues is dependent on the possibility that the community can provide any featural information relevant to the explanandum. The effect persisted even when the label amounted to only a description of the explanandum and participants learned that nothing other than the identifying feature is known about the category.

The impact of expertise may go beyond reducing information gain from the community and reflect greater authority to coin terms. But Experiment 3 showed that it does not eliminate the entrenchment effect. Unentrenched labels coined by experts who had more information about the category than any other community member were rated as less explanatory. A separate unreported study showed that entrenchment of the label within an expert community does not invoke significantly higher ratings than its entrenchment among the general population, further confirming that expertise cannot account for the findings.

Whether an explanation's recipient was familiar with the label also failed to account for the results of Experiment 3. Therefore, the inadequacy of unentrenched terms does not appear to stem from lack of semantic content (Wittgenstein, 1953/2010). The persistence of the effect despite familiarity on the part of participants in all conditions also contradicts accounts based on intelligibility and informativity of the explanation (Grice, 1975). This experiment replicated the results of Experiment 1 in a situation where the comparison was between entrenchment and meaningful use of labels within two communities of different sizes.

Accounts that consider explicit or implied causal knowledge as a requirement for acceptable categorical explanations are unable to explain the persistence of the entrenchment effect when explanations provide no featural information (Giffin et al., 2017). Participants in Experiment 3 were told explicitly that the label stands only for the appearance of the instances and nothing else and comprehension checks confirmed that most understood.

Even if nothing other than how to identify the kind's members is known, a label accepted by the community may still suggest the existence of a kind, that is, a nonarbitrary grouping of entities. Using labels of kinds to explain properties that have principled connections to them has been suggested as the necessary and sufficient requirement for acceptability of categorical explanations (Prasada & Dillingham, 2006). Experiment 4 showed that making the kind explicit and encouraging perception of the explanandum as a principled property of that kind does not eliminate the effect of entrenchment. This result obtained even when the characters in the unentrenched condition were the discoverers of the phenomenon, thus having the greatest authority to coin a new term (Kripke, 1972).

It is possible that the community's current knowledge of the category is not of the greatest import to participants when evaluating explanations. They may prefer to focus on the greater potential for future accumulation of knowledge that entrenched labels may suggest. Experiment 3 eliminated any causal structure in the category used as an explanation, suggesting that such structured information will never be gained. In Experiment 4, the only difference between the entrenched and unentrenched conditions was that the discoverers had not reported their results yet, suggesting that the future accumulation of knowledge will be similar across conditions. Neither of these changes eliminated the entrenchment effect.

The generality of the results was further demonstrated by using basic-level categories in Experiment 4, including artifacts and medical disorders. Experiments 1–3 used more specific categories. The effect did not depend on the tendency of participants to reflect or the intelligibility of the label for the explanation's recipient. A significant effect of entrenchment persisted even in the absence of a label. However, the effect was greatly diminished in unlabeled conditions, suggesting that the impact of entrenchment is largely mediated by labels.

The size of the entrenchment effect was affected by some of the variables we manipulated, suggesting that people can and will unpack the information in a label when they are aware of it. However, the entrenchment effect survived the elimination of relevant information, implying that people at least sometimes assign the task of maintaining explanatory information to the community. The community outperforms the individual because of its vastly superior combined knowledge and processing power, which can lead to reliance on entrenchment cues even when the community cannot contribute any featural information.

Given the range of explanations that cannot account for the entrenchment effect, the most likely interpretation of the findings is that explanations using labels elicit a heuristic appealing to community knowledge, even when the community has no knowledge to appeal to.

Regardless of its origins, the entrenchment effect can have far-reaching consequences. Using a label in conjunction with a property within a community—even without properly justifying a concrete link between the two—can imbue that label with subjective explanatory power. New labels are coined by socially influential nonexperts, purporting to reveal important health-related distinctions. For instance, online personalities may suggest that drinking "raw" water is conducive to health, a term that refers to unprocessed spring water that could include or lack manifold substances, good and bad. Taking advantage of the ease of communication afforded by modern technologies, such labels spread quickly through communities. Most individuals relegate the fact-checking of the purported link between a new label and a desirable outcome to communal wisdom and rely on the frequent association between the two in their social circles to evaluate explanations, thus contributing to public health crises (Bowles, 2017). Widespread adoption of seemingly technical labels can aid the spread of new professions in the absence of strong evidence for their efficacy, shaping the very definition of who is deemed an expert on a certain issue. Purported therapeutic methods like Reiki may have this quality. In the sociopolitical arena, change-resistant attitudes toward entire groups can be shaped by frequent uses of labels to explain properties that in reality have a weak link to the group in question. For instance, race continues to be commonly used as a major explanation for a variety of biological traits, despite the growing body of scientific evidence that it is a weak predictor of genetic variability (Yudell, Roberts, DeSalle, & Tishkoff, 2016).

Even when labels do provide important information, community cues can result in unfounded assumptions about the entities subsumed under the category. Labeling a bundle of psychological symptoms can lead to beliefs in laypeople that they share a causal core, even when explicitly told otherwise (Cooper & Marsh, 2015; Giffin et al., 2017). Such beliefs can go on to affect our attitudes about their treatment, prognosis, and the role of environmental factors, among other things (Ahn, Kim, & Lebowitz, 2017). Experts are not immune to such effects. For instance, when a *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition

(*DSM–5*) Working Group decided to remove schizoid personality disorder from their respected classification scheme because of a lack of validity and clinical utility, most experts argued against the decision, with "frequency of use" being one of their arguments (Pull, 2013).

Does this mean that our reliance on community cues in labels is misguided? Not at all. Labels are indispensable for organizing our knowledge and interacting with others. They allow communities to coordinate information distributed among individuals, even though no single person may know all the pertinent properties associated with them. Entrenchment is often a reliable indicator of the important information subsumed under a label. But entrenched labels come to have a life of their own, making us feel more competent, even if they carry no real information for anyone. Therein lies perhaps the most dangerous outcome of overreliance on the community: Our overconfidence keeps us from seeking information when it is most needed. As Kant suggested (Lock et al., 2001), by giving a malady a name, we might be tempted to consider it cured.

Context of Research

This article is based on research conducted as partial requirement for a doctoral degree by the first author under the supervision of the second. The broader research program seeks to flesh out the ways in which knowledge or perceived knowledge in the community informs individual cognition. More specifically, we are interested in how everyday and expert causal reasoning are impacted by what a reasoner does not know, but has access to through the community. The idea for this paper originated from observations that this knowledge is often transmitted using labels and even if the contribution of the label is negligible, an intuitive sense of satisfaction tends to follow a categorical explanation. The initial examples involved use of medical terms that on closer inspection simply refer to the symptom described by the patient. One area for future research involves the role of entrenchment in perceptions of psychodiagnostic categories. Such categories showed a distinctive pattern in the studies, suggesting that they might enjoy special cognitive status. Another area of future development involves whether community cues like entrenchment contribute to the development and persistence of extreme political beliefs. A person who has heightened sensitivity to entrenchment cues originating from a group they strongly affiliate with may perceive less need for independent confirmation of the purported links, thus potentially contributing to the dissemination of extreme beliefs.

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Appendix A

Scenarios Used in Experiments 1–4

Experiment 1

Principled connections.

1. Cheetah. Two people are on a safari. They observe a fast-moving animal. The first person asks: "Why is it so fast?," to which the second person responds: "Because it is a cheetah."

2. Lemon. Two people are tasting some fruit slices. One of them tastes a sour one. He asks: "Why is this so sour?," to which the second person responds: "Because it is a lemon."

Nonprincipled connections.

1. Summer. Two people are walking through the country. One of them makes an observation. She asks: "Why is it so humid?," to which the second person responds: "Because it is summer."

2. Cat. Two people are passing through an alley. They observe an animal drinking milk. One of them asks: "Why does it like milk so much?," to which the second person responds: "Because it is a cat."

Unfamiliar categories. The text in italics varied across conditions. A slash (/) separates the text associated with the number of pathways (first) and the entrenchment (second) manipulations. The order of the manipulations was counterbalanced in the experiment.

Biological categories.

1. Vargas bird.

Unentrenched, multiple pathways. A person observes three birds with protrusions on top of their heads, a featherless patch of skin on their backs and long wide beaks with a big hole on the tip. *She learns that one of them has acquired these qualities because of the presence of a mutagen in the environment, while the second one has gained these attributes due to the lack of a certain protein in its egg and the third one because of an accident early during its development./She decides by herself to name birds with such qualities Vargas birds.*

(*Appendices continue*)

Later, while with a friend, she observes a new bird with those qualities. Her friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Unentrenched, single pathway. A person observes three birds with protrusions on top of their heads, a featherless patch of skin on their backs and long wide beaks with a big hole on the tip. *She learns that all of these birds have acquired these qualities because of the presence of a certain mutagen in the environment./She decides by herself to name birds with such qualities Vargas birds.*

Later, while with a friend, she observes a new bird with those qualities. Her friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Entrenched, multiple pathways. A person observes three birds with protrusions on top of their heads, a featherless patch of skin on their backs and long wide beaks with a big hole on the tip. *She learns that one of them has acquired these qualities because of the presence of a mutagen in the environment, while the second one has gained these attributes due to the lack of a certain protein in its egg and the third one because of an accident early during its development./She also learns that the accepted name for birds with these qualities is Vargas bird.*

Later, while with a friend, she observes a new bird with those qualities. Her friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Entrenched, single pathway. A person observes three birds with protrusions on top of their heads, a featherless patch of skin on their backs and long wide beaks with a big hole on the tip. *She learns that all of these birds have acquired these qualities because of the presence of a certain mutagen in the environment./She also learns that the accepted name for birds with these qualities is Vargas bird.*

Later, while with a friend, she observes a new bird with those qualities. Her friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

2. Larsson flower.

Unentrenched, multiple pathways. A person observes three plants with large unbranched red-green inflorescence and sac-like protrusions on the stalk that release noxious chemicals when the leaves move. *She learns that one of them has these qualities because of a rare chemical present in the soil, another one because of a certain microscopic parasite and the third one due to the lack of a certain nutrient./She decides by herself to name plants with such attributes Larsson flowers.*

Later, while with a friend, she observes a new plant with those qualities. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Unentrenched, single pathway. A person observes three plants with large unbranched red-green inflorescence and sac-like protrusions on the stalk that release noxious chemicals when the leaves move. *She learns that all of them have these qualities because of a rare chemical present in the soil./She decides by herself to name plants with such attributes Larsson flowers.*

Later, while with a friend, she observes a new plant with those qualities. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Entrenched, multiple pathways. A person observes three plants with large unbranched red-green inflorescence and sac-like protrusions on the stalk that release noxious chemicals when the leaves move. *She learns that one of them has these qualities because of a rare chemical present in the soil, another one because of a certain microscopic parasite and the third one due to the lack of a certain nutrient./She also learns that the accepted name for plants with those attributes is Larsson flower.*

Later, while with a friend, she observes a new plant with those qualities. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Entrenched, single pathway. A person observes three plants with large unbranched red-green inflorescence and sac-like protrusions on the stalk that release noxious chemicals when the leaves move. *She learns that all of them have these qualities because of a rare chemical present in the soil./She also learns that the accepted name for plants with those attributes is Larsson flower.*

Later, while with a friend, she observes a new plant with those qualities. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Social categories.

1. Malinist.

Unentrenched, multiple pathways. A person observes three individuals who wear a certain color of body paint and have clothes made of tweed. They also drink a particular plant oil. *He learns that one of these individuals acts in these ways because of a religious belief, while the behavior of another one is simply due to the availability of these resources in the environment, and the third one does so in order to make herself resistant to certain environmental hazards./He decides by himself to name individuals who act in these ways Malinists.*

Later, while with a friend, he observes a new person who acts in these ways. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

(*Appendices continue*)

Unentrenched, single pathway. A person observes three individuals who wear a certain color of body paint and have clothes made of tweed. They also drink a particular plant oil. *He learns that all of these individuals act in these ways because of a religious belief./He decides by himself to name individuals who act in these ways Malinists.*

Later, while with a friend, he observes a new person who acts in these ways. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

Entrenched, multiple pathways. A person observes three individuals who wear a certain color of body paint and have clothes made of tweed. They also drink a particular plant oil. *He learns that one of these individuals acts in these ways because of a religious belief, while the behavior of another one is simply due to the availability of these resources in the environment, and the third one does so in order to make herself resistant to certain environmental hazards./He also learns that the accepted name for individuals who act in these ways is Malinist.*

Later, while with a friend, he observes a new person who acts in these ways. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

Entrenched, single pathway. A person observes three individuals who wear a certain color of body paint and have clothes made of tweed. They also drink a particular plant oil. *He learns that all of these individuals act in these ways because of a religious belief./He also learns that the accepted name for individuals who act in these ways is Malinist.*

Later, while with a friend, he observes a new person who acts in these ways. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

2. Alamist.

Unentrenched, multiple pathways. A person observes three individuals who wear rocks with strong scents around their neck, cover themselves with dirt, and keep a rare canine creature as a pet. *She learns that one of these individuals acts in these ways because of a certain cultural belief, while another one does so in order to protect herself from a certain parasite, and the third one behaves that way to hunt better./She decides by herself to name individuals who do so Alamists.*

Later, while with a friend, she observes a new person who acts in these ways. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

Unentrenched, single pathway. A person observes three individuals who wear rocks with strong scents around their neck, cover themselves with dirt, and keep a rare canine creature as a pet. *She learns that all of these individuals act in these ways because of a certain cultural belief./She decides by herself to name individuals who do so Alamists.*

Later, while with a friend, she observes a new person who acts in these ways. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

Entrenched, multiple pathways. A person observes three individuals who wear rocks with strong scents around their neck, cover themselves with dirt, and keep a rare canine creature as a pet. *She learns that one of these individuals acts in these ways because of a certain cultural belief, while another one does so in order to protect herself from a certain parasite, and the third one behaves that way to hunt better./She also learns that the accepted name for individuals who act in these ways is Alamist.*

Later, while with a friend, she observes a new person who acts in these ways. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

Entrenched, single pathway. A person observes three individuals who wear rocks with strong scents around their neck, cover themselves with dirt, and keep a rare canine creature as a pet. *She learns that all of these individuals act in these ways because of a certain cultural belief./She also learns that the accepted name for individuals who act in these ways is Alamist.*

Later, while with a friend, she observes a new person who acts in these ways. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

Natural categories.

1. Bergeron cloud.

Unentrenched, multiple pathways. A person observes three cloud formations with staircase-like double layered shapes, semitransparent light blue masses, and round holes that slowly grow bigger. *He learns that one of them has these qualities because of the presence of a rare chemical in the atmosphere, another one as a result of a special pattern of cold and hot spots in the air, and the third one as a consequence of a rare combination of wind direction and terrain slope./He decides by himself to name cloud formations with those attributes Bergeron clouds.*

Later, while with a friend, he observes a new cloud formation with those qualities. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

(*Appendices continue*)

Unentrenched, single pathway. A person observes three cloud formations with staircase-like double layered shapes, semitransparent light blue masses, and round holes that slowly grow bigger. *He learns that all of them have these attributes because of the presence of a rare chemical in the atmosphere./He decides by himself to name cloud formations with those attributes Bergeron clouds.*

Later, while with a friend, he observes a new cloud formation with those qualities. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

Entrenched, multiple pathways. A person observes three cloud formations with staircase-like double layered shapes, semitransparent light blue masses, and round holes that slowly grow bigger. *He learns that one of them has these qualities because of the presence of a rare chemical in the atmosphere, another one as a result of a special pattern of cold and hot spots in the air, and the third one as a consequence of a rare combination of wind direction and terrain slope./He also learns that the accepted name for cloud formations with those attributes is Bergeron clouds.*

Later, while with a friend, he observes a new cloud formation with those qualities. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

Entrenched, single pathway. A person observes three cloud formations with staircase-like double layered shapes, semitransparent light blue masses, and round holes that slowly grow bigger. *He learns that all of them have these attributes because of the presence of a rare chemical in the atmosphere./He also learns that the accepted name for cloud formations with those attributes is Bergeron clouds.*

Later, while with a friend, he observes a new cloud formation with those qualities. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

2. Realgar rock.

Unentrenched, multiple pathways. A person observes three rocks with iridescent surfaces over opaque cores. They are covered in sparse purple dots and shallow, almost equally distanced troughs. *He learns that one of them has these qualities because of long-term contact with a rare corrosive chemical, another one as a result of a special combination of pressure and changes in temperature, and the third one as a consequence of a reaction that requires a rare catalyst./He decides by himself to name rocks with those attributes realgars.*

Later, while with a friend, he observes a new rock with those qualities. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar rock."

Unentrenched, single pathway. A person observes three rocks with iridescent surfaces over opaque cores. They are covered in sparse purple dots and shallow, almost equally distanced troughs. *He learns that all of them have these qualities because of a long-term contact with a certain rare corrosive chemical./He decides by himself to name rocks with those attributes realgars.*

Later, while with a friend, he observes a new rock with those qualities. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar rock."

Entrenched, multiple pathways. A person observes three rocks with iridescent surfaces over opaque cores. They are covered in sparse purple dots and shallow, almost equally distanced troughs. *He learns that one of them has these qualities because of long-term contact with a rare corrosive chemical, another one as a result of a special combination of pressure and changes in temperature, and the third one as a consequence of a reaction that requires a rare catalyst./He learns that the accepted name for rocks with those attributes is realgar.*

Later, while with a friend, he observes a new rock with those qualities. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar rock."

Entrenched, single pathway. A person observes three rocks with iridescent surfaces over opaque cores. They are covered in sparse purple dots and shallow, almost equally distanced troughs. *He learns that all of them have these qualities because of a long-term contact with a certain rare corrosive chemical./He learns that the accepted name for rocks with those attributes is realgar.*

Later, while with a friend, he observes a new rock with those qualities. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar rock."

3. Evans star.

Unentrenched, multiple pathways. A person observes three bluish-white stars whose brightness varies greatly over time and that have massive flares constantly erupting from their poles. *She learns that one of them has these qualities because of a special reaction in its core, another one due to a rare gravitational effect, and the third one as a consequence of a special form of electromagnetic instability./She decides by herself to name stars with those attributes Evans stars.*

Later, while with a friend, she observes a new star with those qualities. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

(*Appendices continue*)

Unentrenched, single pathway. A person observes three bluish-white stars whose brightness varies greatly over time and that have massive flares constantly erupting from their poles. *She learns that all of them have these attributes because of a special reaction in their cores./She decides by herself to name stars with those attributes Evans stars.*

Later, while with a friend, she observes a new star with those qualities. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

Entrenched, multiple pathways. A person observes three bluish-white stars whose brightness varies greatly over time and that have massive flares constantly erupting from their poles. *She learns that one of them has these qualities because of a special reaction in its core, another one due to a rare gravitational effect, and the third one as a consequence of a special form of electromagnetic instability./She learns that the accepted name for stars with such attributes is Evans star.*

Later, while with a friend, she observes a new star with those qualities. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

Entrenched, single pathway. A person observes three bluish-white stars whose brightness varies greatly over time and that have massive flares constantly erupting from their poles. *She learns that all of them have these attributes because of a special reaction in their cores./She learns that the accepted name for stars with such attributes is Evans star.*

Later, while with a friend, she observes a new star with those qualities. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

4. Drescher Spring.

Unentrenched, multiple pathways. A person observes three mineral springs with opaque salmon-colored water, out of which a number of large and long-lasting bubbles emerge periodically. Contact with the spring water causes long-lasting stinging sensations. *She learns that one of them has these qualities because of an abundance of a rare strain of bacteria in the water, another one due to a special compound, and the third as a consequence of a reaction that requires rare ingredients and a specific temperature./She decides by herself to name springs with those attributes Drescher springs.*

Later, while with a friend, she observes a new mineral spring with those qualities. Her friend asks: "Why is this mineral spring like this?," to which she responds: "Because it is a Drescher spring."

Unentrenched, single pathway. A person observes three mineral springs with opaque salmon-colored water, out of which a number of large and long-lasting bubbles emerge periodically. Contact with the spring water causes long-lasting stinging sensations. *She learns that all of them have these qualities because of an abundance of a rare strain of bacteria./She decides by herself to name springs with those attributes Drescher springs.*

Later, while with a friend, she observes a new mineral spring with those qualities. Her friend asks: "Why is this mineral spring like this?," to which she responds: "Because it is a Drescher spring."

Entrenched, multiple pathways. A person observes three mineral springs with opaque salmon-colored water, out of which a number of large and long-lasting bubbles emerge periodically. Contact with the spring water causes long-lasting stinging sensations. *She learns that one of them has these qualities because of an abundance of a rare strain of bacteria in the water, another one due to a special compound, and the third as a consequence of a reaction that requires rare ingredients and a specific temperature./She learns that the accepted name for springs with those attributes is Drescher spring.*

Later, while with a friend, she observes a new mineral spring with those qualities. Her friend asks: "Why is this mineral spring like this?," to which she responds: "Because it is a Drescher spring."

Entrenched, single pathway. A person observes three mineral springs with opaque salmon-colored water, out of which a number of large and long-lasting bubbles emerge periodically. Contact with the spring water causes long-lasting stinging sensations. *She learns that all of them have these qualities because of an abundance of a rare strain of bacteria./She learns that the accepted name for springs with those attributes is Drescher spring.*

Later, while with a friend, she observes a new mineral spring with those qualities. Her friend asks: "Why is this mineral spring like this?," to which she responds: "Because it is a Drescher spring."

Experiment 2

Scenarios for familiar categories were identical to Experiment 1. The text in italics varied across conditions. A slash (/) separates the text associated with the entrenchment (first) manipulation and the additional text shown in multiple features condition (second).

Biological categories.

1. Larsson flower.

Unentrenched, multiple features. A person observes a number of plants with large unbranched red-green leaves. *She decides by herself to call plants with this quality Larsson flowers./She later learns that they also have seasonal sac-like protrusions on the stalk and release noxious chemicals from their leaves whenever they are moved.* She realizes that nothing else is known about these plants.

(*Appendices continue*)

Later, while with a friend, she observes a new plant. They only manage to see that it has large unbranched red-green leaves. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Unentrenched, single feature. A person observes a number of plants with large unbranched red-green leaves. *She decides by herself to call plants with this quality Larsson flowers.* She realizes that nothing else is known about these plants.

Later, while with a friend, she observes a new plant. They only manage to see that it has large unbranched red-green leaves. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Entrenched, multiple features. A person observes a number of plants with large unbranched red-green leaves. *She learns that the accepted name for plants with this quality is Larsson flowers./She later learns that they also have seasonal sac-like protrusions on the stalk and release noxious chemicals from their leaves whenever they are moved.* She realizes that nothing else is known about these plants.

Later, while with a friend, she observes a new plant. They only manage to see that it has large unbranched red-green leaves. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

Entrenched, single feature. A person observes a number of plants with large unbranched red-green leaves. *She learns that the accepted name for plants with this quality is Larsson flowers.* She realizes that nothing else is known about these plants.

Later, while with a friend, she observes a new plant. They only manage to see that it has large unbranched red-green leaves. Her friend asks: "Why is this plant like this?," to which she responds: "Because it is a Larsson flower."

2. Vargas bird.

Unentrenched, multiple features. A person observes a number of birds with horn-like protrusions on top of their heads. *He decides by himself to call birds with this quality Vargas birds./He later learns that they also have a featherless patch of skin on their backs and seem to only eat the seeds of a certain tree.* He realizes that nothing else is known about these birds.

Later, while with a friend, he observes a new bird. They only manage to see that it has a horn-like protrusion on top of its head. His friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Unentrenched, single feature. A person observes a number of birds with horn-like protrusions on top of their heads. *He decides by himself to call birds with this quality Vargas birds.* He realizes that nothing else is known about these birds.

Later, while with a friend, he observes a new bird. They only manage to see that it has a horn-like protrusion on top of its head. His friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Entrenched, multiple features. A person observes a number of birds with horn-like protrusions on top of their heads. *He learns that the accepted name for birds with this quality is Vargas bird./He later learns that they also have a featherless patch of skin on their backs and seem to only eat the seeds of a certain tree.* He realizes that nothing else is known about these birds.

Later, while with a friend, he observes a new bird. They only manage to see that it has a horn-like protrusion on top of its head. His friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Entrenched, single feature. A person observes a number of birds with horn-like protrusions on top of their heads. *He learns that the accepted name for birds with this quality is Vargas bird.* He realizes that nothing else is known about these birds.

Later, while with a friend, he observes a new bird. They only manage to see that it has a horn-like protrusion on top of its head. His friend asks: "Why is this bird like this?," to which he responds: "Because it is a Vargas bird."

Social categories.

1. Alamist.

Unentrenched, multiple features. A person observes a number of individuals who carry green rocks with strong scents around their necks. *She decides by herself to use the name Alamist for people who act in this way./She later learns that they also cover themselves with dirt while hunting, and keep a rare kind of canine creature as pets.* She realizes that nothing else is known about these individuals.

Later, while with a friend, she observes a new individual. They only manage to see that the person carries a green rock with a strong scent around his neck. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

Unentrenched, single feature. A person observes a number of individuals who carry green rocks with strong scents around their necks. *She decides by herself to use the name Alamist for people who act in this way.* She realizes that nothing else is known about these individuals.

Later, while with a friend, she observes a new individual. They only manage to see that the person carries a green rock with a strong scent around his neck. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

(*Appendices continue*)

Entrenched, multiple features. A person observes a number of individuals who carry green rocks with strong scents around their necks. *She learns that the accepted name for people who act in this way is Alamist./She later learns that they also cover themselves with dirt while hunting, and keep a rare kind of canine creature as pets.* She realizes that nothing else is known about these individuals.

Later, while with a friend, she observes a new individual. They only manage to see that the person carries a green rock with a strong scent around his neck. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

Entrenched, single feature. A person observes a number of individuals who carry green rocks with strong scents around their necks. *She learns that the accepted name for people who act in this way is Alamist.* She realizes that nothing else is known about these individuals.

Later, while with a friend, she observes a new individual. They only manage to see that the person carries a green rock with a strong scent around his neck. Her friend asks: "Why is this person like this?," to which she responds: "Because he is an Alamist."

2. Malinist.

Unentrenched, multiple features. A person observes a number of individuals who only wear clothes made of tweed. *He decides by himself to call people who act in this way Malinists./He later learns that they also wear a certain body paint at specific times of the day and drink a particular plant oil regularly.* He realizes that nothing else is known about these individuals.

Later, while with a friend, he observes a new individual. They only manage to see that the person's clothes are all made of tweed. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

Unentrenched, single feature. A person observes a number of individuals who only wear clothes made of tweed. *He decides by himself to call people who act in this way Malinists.* He realizes that nothing else is known about these individuals.

Later, while with a friend, he observes a new individual. They only manage to see that the person's clothes are all made of tweed. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

Entrenched, multiple features. A person observes a number of individuals who only wear clothes made of tweed. *He learns that the accepted name for people who act in this way is Malinist./He later learns that they also wear a certain body paint at specific times of the day and drink a particular plant oil regularly.* He realizes that nothing else is known about these individuals.

Later, while with a friend, he observes a new individual. They only manage to see that the person's clothes are all made of tweed. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

Entrenched, single feature. A person observes a number of individuals who only wear clothes made of tweed. *He learns that the accepted name for people who act in this way is Malinist.* He realizes that nothing else is known about these individuals.

Later, while with a friend, he observes a new individual. They only manage to see that the person's clothes are all made of tweed. His friend asks: "Why is this person like this?," to which he responds: "Because she is a Malinist."

Natural categories.

1. Bergeron cloud.

Unentrenched, multiple features. A person observes a number of cloud formations with staircase-like double layered shapes. *He decides by himself to call cloud formations with this quality Bergeron clouds./He later learns that these formations also have a lot of mass due to high water content and dissipate quickly in the early hours of morning.* He realizes that nothing else is known about these cloud formations.

Later, while with a friend, he observes a new cloud formation. They only manage to see that it has a staircase-like double layered shape. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

Unentrenched, single feature. A person observes a number of cloud formations with staircase-like double layered shapes. *He decides by himself to call cloud formations with this quality Bergeron clouds.* He realizes that nothing else is known about these cloud formations.

Later, while with a friend, he observes a new cloud formation. They only manage to see that it has a staircase-like double layered shape. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

Entrenched, multiple features. A person observes a number of cloud formations with staircase-like double layered shapes. *He learns that the accepted name for cloud formations with this quality is Bergeron cloud./He later learns that these formations also have a lot of mass due to high water content and dissipate quickly in the early hours of morning.* He realizes that nothing else is known about these cloud formations.

Later, while with a friend, he observes a new cloud formation. They only manage to see that it has a staircase-like double layered shape. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

(*Appendices continue*)

Entrenched, single feature. A person observes a number of cloud formations with staircase-like double layered shapes. *He learns that the accepted name for cloud formations with this quality is Bergeron cloud.* He realizes that nothing else is known about these cloud formations.

Later, while with a friend, he observes a new cloud formation. They only manage to see that it has a staircase-like double layered shape. His friend asks: "Why is this cloud formation like this?," to which he responds: "Because it is a Bergeron cloud."

2. Realgar rock.

Unentrenched, multiple features. A person observes a number of rocks with iridescent surfaces over opaque cores. *He decides by himself to call rocks with this quality realgar./He later learns that they are also covered in sparse small purple dots and very shallow, almost equally distanced troughs.* He realizes that nothing else is known about these rocks.

Later, while with a friend, he observes a new rock. They only manage to see that it has an iridescent surface over an opaque core. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar."

Unentrenched, single feature. A person observes a number of rocks with iridescent surfaces over opaque cores. *He decides by himself to call rocks with this quality realgar.* He realizes that nothing else is known about these rocks.

Later, while with a friend, he observes a new rock. They only manage to see that it has an iridescent surface over an opaque core. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar."

Entrenched, multiple features. A person observes a number of rocks with iridescent surfaces over opaque cores. *He learns that the accepted name for rocks with this quality is realgar./He later learns that they are also covered in sparse small purple dots and very shallow, almost equally distanced troughs.* He realizes that nothing else is known about these rocks.

Later, while with a friend, he observes a new rock. They only manage to see that it has an iridescent surface over an opaque core. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar."

Entrenched, single feature. A person observes a number of rocks with iridescent surfaces over opaque cores. *He learns that the accepted name for rocks with this quality is realgar.* He realizes that nothing else is known about these rocks.

Later, while with a friend, he observes a new rock. They only manage to see that it has an iridescent surface over an opaque core. His friend asks: "Why is this rock like this?," to which he responds: "Because it is a realgar."

3. Drescher spring.

Unentrenched, multiple features. A person observes a number of mineral springs with opaque salmon-colored water. *She decides by herself to call springs with this quality Drescher springs./She later learns that a number of large and long-lasting bubbles also emerge periodically from these springs and contact with their water causes long-lasting stinging sensations.* She realizes that nothing else is known about these springs.

Later, while with a friend, she observes a new spring. They only manage to see that it has opaque salmon-colored water. Her friend asks: "Why is this spring like this?," to which she responds: "Because it is a Drescher spring."

Unentrenched, single feature. A person observes a number of mineral springs with opaque salmon-colored water. *She decides by herself to call springs with this quality Drescher springs.* She realizes that nothing else is known about these springs.

Later, while with a friend, she observes a new spring. They only manage to see that it has opaque salmon-colored water. Her friend asks: "Why is this spring like this?," to which she responds: "Because it is a Drescher spring."

Entrenched, multiple features. A person observes a number of mineral springs with opaque salmon-colored water. *She learns that the accepted name for springs with this quality is Drescher springs./She later learns that a number of large and long-lasting bubbles also emerge periodically from these springs and contact with their water causes long-lasting stinging sensations.* She realizes that nothing else is known about these springs.

Later, while with a friend, she observes a new spring. They only manage to see that it has opaque salmon-colored water. Her friend asks: "Why is this spring like this?," to which she responds: "Because it is a Drescher spring."

Entrenched, single feature. A person observes a number of mineral springs with opaque salmon-colored water. *She learns that the accepted name for springs with this quality is Drescher springs.* She realizes that nothing else is known about these springs.

Later, while with a friend, she observes a new spring. They only manage to see that it has opaque salmon-colored water. Her friend asks: "Why is this spring like this?," to which she responds: "Because it is a Drescher spring."

4. Evans star.

Unentrenched, multiple features. A person observes a number of stars whose brightness varies greatly over time. *She decides by herself to use the name Evans star for stars with this quality./She later learns that these stars are also most clearly seen in the northwestern sky in the spring and have flares periodically erupting from their poles.* She realizes that nothing else is known about these stars.

Later, while with a friend, she observes a new star. They only manage to see that its' brightness varies greatly over time. Her

(*Appendices continue*)

friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

Unentrenched, single feature. A person observes a number of stars whose brightness varies greatly over time. *She decides by herself to use the name Evans star for stars with this quality.* She realizes that nothing else is known about these stars.

Later, while with a friend, she observes a new star. They only manage to see that its' brightness varies greatly over time. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

Entrenched, multiple features. A person observes a number of stars whose brightness varies greatly over time. *She learns that the accepted name for stars with this quality is Evans star./She later learns that these stars are also most clearly seen in the northwestern sky in the spring and have flares periodically erupting from their poles.* She realizes that nothing else is known about these stars.

Later, while with a friend, she observes a new star. They only manage to see that its' brightness varies greatly over time. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

Entrenched, single feature. A person observes a number of stars whose brightness varies greatly over time. *She learns that the accepted name for stars with this quality is Evans star.* She realizes that nothing else is known about these stars.

Later, while with a friend, she observes a new star. They only manage to see that its' brightness varies greatly over time. Her friend asks: "Why is this star like this?," to which she responds: "Because it is an Evans star."

Experiment 3

The text in italics varied across conditions. The first paragraph includes text related to the entrenchment manipulation, while the second paragraph contains text associated with the causal stability manipulation.

Biological categories.

1. Viridibus ovatis bacterium.

Unentrenched, causally unstable. Two bacteriologists are studying a sample in a bacteriology lab. They observe a number of bacteria that appear with oval subterminal spores and an opaque green membrane. *Failing to find any mention of them in bacteriology reference books, they decide to name bacteria with such an appearance viridibus ovatis themselves.* The name only refers to the bacterium's appearance and to nothing else. They mention what they know about these bacteria to a fellow bacteriologist who did not know about them previously.

The following day, studying the biological structure of these bacteria, they discover the processes that give rise to this appearance. *Each bacterium has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the bacterium's formation.* They have not discussed this finding with anyone else yet.

While studying a new sample, the colleague to whom they had mentioned bacteria with this appearance observes a bacterium with oval subterminal spores and an opaque green membrane. She asks the other two bacteriologists: "Why does this bacterium look like this?," to which one of them responds: "Because it is a viridibus ovatis."

Unentrenched, causally stable. Two bacteriologists are studying a sample in a bacteriology lab. They observe a number of bacteria that appear with oval subterminal spores and an opaque green membrane. *Failing to find any mention of them in bacteriology reference books, they decide to name bacteria with such an appearance viridibus ovatis themselves.* The name only refers to the bacterium's appearance and to nothing else. They mention what they know about these bacteria to a fellow bacteriologist who did not know about them previously.

The following day, studying the biological structure of these bacteria, they discover the process that gives rise to this appearance. *Every bacterium has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying a new sample, the colleague to whom they had mentioned bacteria with this appearance observes a bacterium with oval subterminal spores and an opaque green membrane. She asks the other two bacteriologists: "Why does this bacterium look like this?," to which one of them responds: "Because it is a viridibus ovatis."

Entrenched, causally unstable. Two bacteriologists are studying a sample in a bacteriology lab. They observe a number of bacteria that appear with oval subterminal spores and an opaque green membrane. *Looking it up in bacteriology reference books, the only thing they can discover is that bacteria with such an appearance have been called viridibus ovatis.* The name only refers to the bacterium's appearance and to nothing else. They mention what they know about these bacteria to a fellow bacteriologist who did not know about them previously.

The following day, studying the biological structure of these bacteria, they discover the processes that give rise to this appearance. *Each bacterium has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the bacterium's formation.* They have not discussed this finding with anyone else yet.

(*Appendices continue*)

While studying a new sample, the colleague to whom they had mentioned bacteria with this appearance observes a bacterium with oval subterminal spores and an opaque green membrane. She asks the other two bacteriologists: "Why does this bacterium look like this?," to which one of them responds: "Because it is a viridibus ovatis."

Entrenched, causally stable. Two bacteriologists are studying a sample in a bacteriology lab. They observe a number of bacteria that appear with oval subterminal spores and an opaque green membrane. *Looking it up in bacteriology reference books, the only thing they can discover is that bacteria with such an appearance have been called viridibus ovatis.* The name only refers to the bacterium's appearance and to nothing else. They mention what they know about these bacteria to a fellow bacteriologist who did not know about them previously.

The following day, studying the biological structure of these bacteria, they discover the process that gives rise to this appearance. *Every bacterium has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying a new sample, the colleague to whom they had mentioned bacteria with this appearance observes a bacterium with oval subterminal spores and an opaque green membrane. She asks the other two bacteriologists: "Why does this bacterium look like this?," to which one of them responds: "Because it is a viridibus ovatis."

2. Vaillantius bird.

Unentrenched, causally unstable. Two zoologists are inspecting bird specimens in a zoology lab. They observe a number of birds with pink feathers over their heads and red patches under their chins. *Failing to find any mention of them in zoology reference books, they decide to name birds with such an appearance vailantius themselves.* The name only refers to the birds' appearance and to nothing else. They mention what they know about these birds to a fellow zoologist who did not know about them previously.

The following day, studying the biological structure of these birds, they discover the processes that give rise to this appearance. *Each bird has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the bird's formative years.* They have not discussed this finding with anyone else yet.

While studying new specimens, the colleague to whom they had mentioned birds with this appearance observes one that has pink feathers over its head and a red patch under its chin. He asks the other two zoologists: "Why does this bird look like this?," to which one of them responds: "Because it is a vailantius."

Unentrenched, causally stable. Two zoologists are inspecting bird specimens in a zoology lab. They observe a number of birds with pink feathers over their heads and red patches under their chins. *Failing to find any mention of them in zoology reference books, they decide to name birds with such an appearance vailantius themselves.* The name only refers to the birds' appearance and to nothing else. They mention what they know about these birds to a fellow zoologist who did not know about them previously.

The following day, studying the biological structure of these birds, they discover the process that gives rise to this appearance. *Every bird has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new specimens, the colleague to whom they had mentioned birds with this appearance observes one that has pink feathers over its head and a red patch under its chin. He asks the other two zoologists: "Why does this bird look like this?," to which one of them responds: "Because it is a vailantius."

Entrenched, causally unstable. Two zoologists are inspecting bird specimens in a zoology lab. They observe a number of birds with pink feathers over their heads and red patches under their chins. *Looking it up in zoology reference books, the only thing they can discover is that birds with this appearance have been called vailantius.* The name only refers to the birds' appearance and to nothing else. They mention what they know about these birds to a fellow zoologist who did not know about them previously.

The following day, studying the biological structure of these birds, they discover the processes that give rise to this appearance. *Each bird has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the bird's formative years.* They have not discussed this finding with anyone else yet.

While studying new specimens, the colleague to whom they had mentioned birds with this appearance observes one that has pink feathers over its head and a red patch under its chin. He asks the other two zoologists: "Why does this bird look like this?," to which one of them responds: "Because it is a vailantius."

Entrenched, causally stable. Two zoologists are inspecting bird specimens in a zoology lab. They observe a number of birds with pink feathers over their heads and red patches under their chins. *Looking it up in zoology reference books, the only thing they can discover is that birds with this appearance have been called vailantius.* The name only refers to the birds' appearance and to nothing else. They mention what they know about these birds to a fellow zoologist who did not know about them previously.

The following day, studying the biological structure of these birds, they discover the processes that gives rise to this appearance. *Every bird has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new specimens, the colleague to whom they had mentioned birds with this appearance observes one that has pink feathers over its head and a red patch under its chin. He asks the other two zoologists: "Why does this bird look like this?," to which one of them responds: "Because it is a vailantius."

(*Appendices continue*)

3. Amorphophallus titanum plant.

Unentrenched, causally unstable. Two botanists are studying plants in a botany lab. They observe a number of plants with large unbranched inflorescence and a strong noxious smell. *Failing to find any mention of them in botany reference books, they decide to name plants with such an appearance amorphophallus titanum themselves.* The name only refers to the plants' appearance and to nothing else. They mention what they know about these plants to a fellow botanist who did not know about them previously.

The following day, studying the biological structure of these plants, they discover the processes that give rise to this appearance. *Each plant has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the plant's formation.* They have not discussed this finding with anyone else yet.

While studying new plants, the colleague to whom they had mentioned plants with this appearance observes one with large unbranched inflorescence and a strong noxious smell. She asks the other two botanists: "Why does this plant look like this?," to which one of them responds: "Because it is an amorphophallus titanum."

Unentrenched, causally stable. Two botanists are studying plants in a botany lab. They observe a number of plants with large unbranched inflorescence and a strong noxious smell. *Failing to find any mention of them in botany reference books, they decide to name plants with such an appearance amorphophallus titanum themselves.* The name only refers to the plants' appearance and to nothing else. They mention what they know about these plants to a fellow botanist who did not know about them previously.

The following day, studying the biological structure of these plants, they discover the process that gives rise to this appearance. *Every plant has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new plants, the colleague to whom they had mentioned plants with this appearance observes one with large unbranched inflorescence and a strong noxious smell. She asks the other two botanists: "Why does this plant look like this?," to which one of them responds: "Because it is an amorphophallus titanum."

Entrenched, causally unstable. Two botanists are studying plants in a botany lab. They observe a number of plants with large unbranched inflorescence and a strong noxious smell. *Looking it up in botany reference books, the only thing they can discover is that plants with this appearance have been called amorphophallus titanum.* The name only refers to the plants' appearance and to nothing else. They mention what they know about these plants to a fellow botanist who did not know about them previously.

The following day, studying the biological structure of these plants, they discover the processes that give rise to this appearance. *Each plant has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the plant's formation.* They have not discussed this finding with anyone else yet.

While studying new plants, the colleague to whom they had mentioned plants with this appearance observes one with large unbranched inflorescence and a strong noxious smell. She asks the other two botanists: "Why does this plant look like this?," to which one of them responds: "Because it is an amorphophallus titanum."

Entrenched, causally stable. Two botanists are studying plants in a botany lab. They observe a number of plants with large unbranched inflorescence and a strong noxious smell. *Looking it up in botany reference books, the only thing they can discover is that plants with this appearance have been called amorphophallus titanum.* The name only refers to the plants' appearance and to nothing else. They mention what they know about these plants to a fellow botanist who did not know about them previously.

The following day, studying the biological structure of these plants, they discover the process that gives rise to this appearance. *Every plant has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new plants, the colleague to whom they had mentioned plants with this appearance observes one with large unbranched inflorescence and a strong noxious smell. She asks the other two botanists: "Why does this plant look like this?," to which one of them responds: "Because it is an amorphophallus titanum."

Natural categories.

1. Carinaeric star.

Unentrenched, causally unstable. Two astronomers are studying stars in an astronomy lab. They observe a number of stars whose size and brightness varies over time. *Failing to find any mention of them in astronomy reference books, they decide to name stars with such an appearance Carinaeric stars themselves.* The name only refers to the stars' appearance and to nothing else. They mention what they know about these stars to a fellow astronomer who did not know about them previously.

The following day, studying the physical structure of these stars, they discover the processes that give rise to this appearance. *Each star has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the star's formation.* They have not mentioned this finding to anyone else yet.

While studying new stars, the colleague to whom they had mentioned stars with this appearance observes one whose size and brightness varies over time. She asks the other two astronomers: "Why does this star look like this?," to which one of them responds: "Because it is a Carinaeric star."

(*Appendices continue*)

Unentrenched, causally stable. Two astronomers are studying stars in an astronomy lab. They observe a number of stars whose size and brightness varies over time. *Failing to find any mention of them in astronomy reference books, they decide to name stars with such an appearance Carinaeric stars themselves.* The name only refers to the stars' appearance and to nothing else. They mention what they know about these stars to a fellow astronomer who did not know about them previously.

The following day, studying the physical structure of these stars, they discover the process that gives rise to this appearance. *Every star has this appearance due to the same underlying process.* They have not mentioned this finding to anyone else yet.

While studying new stars, the colleague to whom they had mentioned stars with this appearance observes one whose size and brightness varies over time. She asks the other two astronomers: "Why does this star look like this?," to which one of them responds: "Because it is a Carinaeric star."

Entrenched, causally unstable. Two astronomers are studying stars in an astronomy lab. They observe a number of stars whose size and brightness varies over time. *Looking it up in astronomy reference books, the only thing they can discover is that stars with this appearance have been called Carinaeric stars*. The name only refers to the stars' appearance and to nothing else. They mention what they know about these stars to a fellow astronomer who did not know about them previously.

The following day, studying the physical structure of these stars, they discover the processes that give rise to this appearance. *Each star has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the star's formation.* They have not mentioned this finding to anyone else yet.

While studying new stars, the colleague to whom they had mentioned stars with this appearance observes one whose size and brightness varies over time. She asks the other two astronomers: "Why does this star look like this?," to which one of them responds: "Because it is a Carinaeric star."

Entrenched, causally stable. Two astronomers are studying stars in an astronomy lab. They observe a number of stars whose size and brightness varies over time. *Looking it up in astronomy reference books, the only thing they can discover is that stars with this appearance have been called Carinaeric stars*. The name only refers to the stars' appearance and to nothing else. They mention what they know about these stars to a fellow astronomer who did not know about them previously.

The following day, studying the physical structure of these stars, they discover the processes that gives rise to this appearance. *Every star has this appearance due to the same underlying process.* They have not mentioned this finding to anyone else yet.

While studying new stars, the colleague to whom they had mentioned stars with this appearance observes one whose size and brightness varies over time. She asks the other two astronomers: "Why does this star look like this?," to which one of them responds: "Because it is a Carinaeric star."

2. Realgar rock.

Unentrenched, causally unstable. Two geologists are inspecting rocks in a geology lab. They observe a number of rocks with red surfaces speckled with purple dots. *Failing to find any mention of them in geology reference books, they decide to name rocks with such an appearance realgar themselves.* The name only refers to the rocks' appearance and to nothing else. They mention what they know about these rocks to a fellow geologist who did not know about them previously.

The following day, studying the chemical composition of these rocks, they discover the processes that give rise to this appearance. *Each rock has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the rock's formation.* They have not discussed this finding with anyone else yet.

While studying new samples, the colleague to whom they had mentioned rocks with this appearance comes across one that has a red surface specked with purple dots. He asks the other two geologists: "Why does this rock look like this?," to which one of them responds: "Because it is a realgar."

Unentrenched, causally stable. Two geologists are inspecting rocks in a geology lab. They observe a number of rocks with red surfaces speckled with purple dots. *Failing to find any mention of them in geology reference books, they decide to name rocks with such an appearance realgar themselves.* The name only refers to the rocks' appearance and to nothing else. They mention what they know about these rocks to a fellow geologist who did not know about them previously.

The following day, studying the chemical composition of these rocks, they discover the process that gives rise to this appearance. *Every rock has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new samples, the colleague to whom they had mentioned rocks with this appearance comes across one that has a red surface specked with purple dots. He asks the other two geologists: "Why does this rock look like this?," to which one of them responds: "Because it is a realgar."

Entrenched, causally unstable. Two geologists are inspecting rocks in a geology lab. They observe a number of rocks with red surfaces speckled with purple dots. *Looking it up in geology reference books, the only thing they can discover is that rocks with this appearance have been called realgar.* The name only refers to the rocks' appearance and to nothing else. They mention what they know about these rocks to a fellow geologist who did not know about them previously.

(*Appendices continue*)

The following day, studying the chemical composition of these rocks, they discover the processes that give rise to this appearance. *Each rock has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during the rock's formation.* They have not discussed this finding with anyone else yet.

While studying new samples, the colleague to whom they had mentioned rocks with this appearance comes across one that has a red surface specked with purple dots. He asks the other two geologists: "Why does this rock look like this?," to which one of them responds: "Because it is a realgar."

Entrenched, causally stable. Two geologists are inspecting rocks in a geology lab. They observe a number of rocks with red surfaces speckled with purple dots. *Looking it up in geology reference books, the only thing they can discover is that rocks with this appearance have been called realgar.* The name only refers to the rocks' appearance and to nothing else. They mention what they know about these rocks to a fellow geologist who did not know about them previously.

The following day, studying the chemical composition of these rocks, they discover the process that gives rise to this appearance. *Every rock has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new samples, the colleague to whom they had mentioned rocks with this appearance comes across one that has a red surface specked with purple dots. He asks the other two geologists: "Why does this rock look like this?," to which one of them responds: "Because it is a realgar."

3. Nfermion particle.

Unentrenched, causally unstable. Two physicists are studying particles in a physics lab. They observe a number of particles that are paired with fermions and are not subject to the strong interaction. *Failing to find any mention of them in physics reference books, they decide to name particles with this presentation nfermions themselves.* The name only refers to the particles' presentation and to nothing else. They mention what they know about these particles to a fellow physicist who did not know about them previously.

The following day, studying the physical structure of these particles, they discover the processes that give rise to this appearance. *Each particle has this presentation due to one of many underlying processes that arise because of unpredictable environmental factors present during the particle's formation.* They have not discussed this finding with anyone else yet.

While studying new particles, the colleague to whom they had mentioned particles with this presentation observes one that is paired with a fermion and is not subject to the strong interaction. He asks the other two physicists: "Why does this particle look like this?," to which one of them responds: "Because it is a nfermion."

Unentrenched, causally stable. Two physicists are studying particles in a physics lab. They observe a number of particles that are paired with fermions and are not subject to the strong interaction. *Failing to find any mention of them in physics reference books, they decide to name particles with this presentation nfermions themselves.* The name only refers to the particles' presentation and to nothing else. They mention what they know about these particles to a fellow physicist who did not know about them previously.

The following day, studying the physical structure of these particles, they discover the process that gives rise to this appearance. *Every particle has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new particles, the colleague to whom they had mentioned particles with this presentation observes one that is paired with a fermion and is not subject to the strong interaction. He asks the other two physicists: "Why does this particle look like this?," to which one of them responds: "Because it is a nfermion."

Entrenched, causally unstable. Two physicists are studying particles in a physics lab. They observe a number of particles that are paired with fermions and are not subject to the strong interaction. *Looking it up in physics reference books, the only thing they can discover is that particles with this presentation have been called nfermions.* The name only refers to the particles' presentation and to nothing else. They mention what they know about these particles to a fellow physicist who did not know about them previously.

The following day, studying the physical structure of these particles, they discover the processes that give rise to this appearance. *Each particle has this presentation due to one of many underlying processes that arise because of unpredictable environmental factors present during the particle's formation.* They have not discussed this finding with anyone else yet.

While studying new particles, the colleague to whom they had mentioned particles with this presentation observes one that is paired with a fermion and is not subject to the strong interaction. He asks the other two physicists: "Why does this particle look like this?," to which one of them responds: "Because it is a nfermion."

Entrenched, causally stable. Two physicists are studying particles in a physics lab. They observe a number of particles that are paired with fermions and are not subject to the strong interaction. *Looking it up in physics reference books, the only thing they can discover is that particles with this presentation have been called nfermions.* The name only refers to the particles' presentation and to nothing else. They mention what they know about these particles to a fellow physicist who did not know about them previously.

(*Appendices continue*)

The following day, studying the physical structure of these particles, they discover the process that gives rise to this appearance. *Every particle has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new particles, the colleague to whom they had mentioned particles with this presentation observes one that is paired with a fermion and is not subject to the strong interaction. He asks the other two physicists: "Why does this particle look like this?," to which one of them responds: "Because it is a nfermion."

4. Cumulocalvus cloud.

Unentrenched, causally unstable. Two meteorologists are studying cloud formations on a plain. They observe a number of clouds with highly regular pouches underneath the base that remain static for long periods. *Failing to find any mention of them in meteorology reference books, they decide to name formations with such an appearance cumulocalvus clouds themselves.* The name only refers to the formations' appearance and to nothing else. They mention what they know about these cloud formations to a fellow meteorologist who did not know about them previously.

The following day, studying the composition of these clouds, they discover the processes that give rise to this appearance. *Each formation has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during its formation.* They have not discussed this finding with anyone else yet.

While studying new cloud formations, the colleague to whom they had mentioned clouds with this appearance observes one with highly regular pouches underneath the base that remain static for long periods. She asks the other two meteorologists: "Why does this formation look like this?," to which one of them responds: "Because it is a cumulocalvus cloud."

Unentrenched, causally stable. Two meteorologists are studying cloud formations on a plain. They observe a number of clouds with highly regular pouches underneath the base that remain static for long periods. *Failing to find any mention of them in meteorology reference books, they decide to name formations with such an appearance cumulocalvus clouds themselves.* The name only refers to the formations' appearance and to nothing else. They mention what they know about these cloud formations to a fellow meteorologist who did not know about them previously.

The following day, studying the composition of these clouds, they discover the process that gives rise to this appearance. *Every formation has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new cloud formations, the colleague to whom they had mentioned clouds with this appearance observes one with highly regular pouches underneath the base that remain static for long periods. She asks the other two meteorologists: "Why does this formation look like this?," to which one of them responds: "Because it is a cumulocalvus cloud."

Entrenched, causally unstable. Two meteorologists are studying cloud formations on a plain. They observe a number of clouds with highly regular pouches underneath the base that remain static for long periods. *Looking it up in meteorology reference books, the only thing they can discover is that formations with this appearance have been called cumulocalvus clouds.* The name only refers to the formations' appearance and to nothing else. They mention what they know about these cloud formations to a fellow meteorologist who did not know about them previously.

The following day, studying the composition of these clouds, they discover the processes that give rise to this appearance. *Each formation has this appearance due to one of many underlying processes that arise because of unpredictable environmental factors present during its formation.* They have not discussed this finding with anyone else yet.

While studying new cloud formations, the colleague to whom they had mentioned clouds with this appearance observes one with highly regular pouches underneath the base that remain static for long periods. She asks the other two meteorologists: "Why does this formation look like this?," to which one of them responds: "Because it is a cumulocalvus cloud."

Entrenched, causally stable. Two meteorologists are studying cloud formations on a plain. They observe a number of clouds with highly regular pouches underneath the base that remain static for long periods. *Looking it up in meteorology reference books, the only thing they can discover is that formations with this appearance have been called cumulocalvus clouds.* The name only refers to the formations' appearance and to nothing else. They mention what they know about these cloud formations to a fellow meteorologist who did not know about them previously.

The following day, studying the composition of these clouds, they discover the process that gives rise to this appearance. *Every formation has this appearance due to the same underlying process.* They have not discussed this finding with anyone else yet.

While studying new cloud formations, the colleague to whom they had mentioned clouds with this appearance observes one with highly regular pouches underneath the base that remain static for long periods. She asks the other two meteorologists: "Why does this formation look like this?," to which one of them responds: "Because it is a cumulocalvus cloud."

(*Appendices continue*)

5. Ganser's syndrome.

Unentrenched, causally unstable. Two psychiatrists are observing patients in a psychiatry ward. They observe a number of patients that present with approximate answers to questions and reduced self-awareness. *Failing to find any mention of this combination of symptoms in psychiatry reference books, they decide to name the combination Ganser's syndrome themselves.* The name only refers to the combination of symptoms and to nothing else. They mention what they know about this combination to a fellow psychiatrist who did not know about it previously.

The following day, studying the psychological profile of patients with this combination of symptoms, they discover the processes that give rise to this presentation. *Each patient has this combination of symptoms due to one of many underlying processes that arise because of unpredictable environmental factors present during their formative years.* They have not discussed this finding with anyone else yet.

While observing new patients, the colleague to whom they had mentioned this combination of symptoms observes a patient who gives approximate answers to questions and shows reduced self-awareness. He asks the other two psychiatrists: "Why does this patient behave like this?," to which one of them responds: "Because he has Ganser's syndrome."

Unentrenched, causally stable. Two psychiatrists are observing patients in a psychiatry ward. They observe a number of patients that present with approximate answers to questions and reduced self-awareness. *Failing to find any mention of this combination of symptoms in psychiatry reference books, they decide to name the combination Ganser's syndrome themselves.* The name only refers to the combination of symptoms and to nothing else. They mention what they know about this combination to a fellow psychiatrist who did not know about it previously.

The following day, studying the psychological profile of patients with this combination of symptoms, they discover the process that gives rise to this presentation. *Every patient has this combination of symptoms due to the same underlying process.* They have not discussed this finding with anyone else yet.

While observing new patients, the colleague to whom they had mentioned this combination of symptoms observes a patient who gives approximate answers to questions and shows reduced self-awareness. He asks the other two psychiatrists: "Why does this patient behave like this?," to which one of them responds: "Because he has Ganser's syndrome."

Entrenched, causally unstable. Two psychiatrists are observing patients in a psychiatry ward. They observe a number of patients that present with approximate answers to questions and reduced self-awareness. *Looking it up in psychiatry reference books, the only thing they can discover is that this combination of symptoms has been called Ganser's syndrome.* The name only refers to the combination of symptoms and to nothing else. They mention what they know about this combination to a fellow psychiatrist who did not know about it previously.

The following day, studying the psychological profile of patients with this combination of symptoms, they discover the processes that give rise to this presentation. *Each patient has this combination of symptoms due to one of many underlying processes that arise because of unpredictable environmental factors present during their formative years.* They have not discussed this finding with anyone else yet.

While observing new patients, the colleague to whom they had mentioned this combination of symptoms observes a patient who gives approximate answers to questions and shows reduced self-awareness. He asks the other two psychiatrists: "Why does this patient behave like this?," to which one of them responds: "Because he has Ganser's syndrome."

Entrenched, causally stable. Two psychiatrists are observing patients in a psychiatry ward. They observe a number of patients that present with approximate answers to questions and reduced self-awareness. *Looking it up in psychiatry reference books, the only thing they can discover is that this combination of symptoms has been called Ganser's syndrome.* The name only refers to the combination of symptoms and to nothing else. They mention what they know about this combination to a fellow psychiatrist who did not know about it previously.

The following day, studying the psychological profile of patients with this combination of symptoms, they discover the process that gives rise to this presentation. *Every patient has this combination of symptoms due to the same underlying process.* They have not discussed this finding with anyone else yet.

While observing new patients, the colleague to whom they had mentioned this combination of symptoms observes a patient who gives approximate answers to questions and shows reduced self-awareness. He asks the other two psychiatrists: "Why does this patient behave like this?," to which one of them responds: "Because he has Ganser's syndrome."

Experiment 4

Principled connections.

1. Cheetah. While with a friend, someone sees a fast-moving animal. The friend asks: "Why is this animal like this?" She responds: "Because it is a cheetah."

2. Journalist. While with a friend, someone sees a person reporting news. The friend asks: "Why does he act like this?" She responds: "Because he is a journalist."

(*Appendices continue*)

3. Diaper. While with a friend, someone sees an absorbent piece of cloth. The friend asks: "Why is this cloth like this?" He responds: "Because it is a diaper."

Unfamiliar categories. The text in italics represents major points of variation between conditions. The first paragraph first introduces text related to the entrenchment manipulation. The role of the characters throughout the scenarios was adjusted to reflect the relevant entrenchment condition, most prominently in the second paragraph where the text associated with the labeling manipulation is first introduced. The final sentence is determined based on the labeling condition.

Biological categories.

1. Markhor (animal).

Unentrenched, unlabeled. Two zoologists discover that on an island in the Pacific isolated from the rest of the world, there is a kind of animal with serpentine horns that grow downward from under the skull. Nothing else is known about this animal.

The two zoologists are the first to document the existence of this kind of animal. They have not chosen a name for creatures with this quality or reported their results yet.

Later, a third zoologist previously unfamiliar with this kind of animal comes across a specimen of it. He asks one of the first two zoologists: "Why is this animal like this?" She responds: *"Because of the kind of animal it is."*

Unentrenched, labeled. Two zoologists discover that on an island in the Pacific isolated from the rest of the world, there is a kind of animal with serpentine horns that grow downward from under the skull. Nothing else is known about this animal.

The two zoologists are the first to document the existence of this kind of animal and decide to name creatures with this quality markhor. They have not reported their results yet.

Later, a third zoologist previously unfamiliar with this kind of animal comes across a specimen of it. He asks one of the first two zoologists: "Why is this animal like this?" She responds: *"Because it is a markhor."*

Entrenched, unlabeled. Many zoologists know that on an island in the Pacific isolated from the rest of the world, there is a kind of animal with serpentine horns that grow downward from under the skull. Nothing else is known about this animal.

A zoologist looks this kind of animal up in reference books, finding that despite being a recognized kind, a name has not been chosen for creatures with this quality yet.

Later, a second zoologist previously unfamiliar with this kind of animal comes across a specimen of it. He asks the first zoologist: "Why is this animal like this?" She responds: *"Because of the kind of animal it is."*

Entrenched, labeled. Many zoologists know that on an island in the Pacific isolated from the rest of the world, there is a kind of animal with serpentine horns that grow downward from under the skull. Nothing else is known about this animal.

A zoologist looks this kind of animal up in reference books, finding that the accepted name for it is markhor.

Later, a second zoologist previously unfamiliar with this kind of animal comes across a specimen of it. He asks the first zoologist: "Why is this animal like this?" She responds: *"Because it is a markhor."*

2. Gharial (reptile).

Unentrenched, unlabeled. Two biologists discover that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.

The two biologists are the first to document the existence of these reptiles. They have not chosen a name for creatures with these qualities or reported their results yet.

Later, a third biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks one of the first two biologists: "Why is this animal like this?" He responds: *"Because of the kind of reptile it is."*

Unentrenched, labeled. Two biologists discover that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.

The two biologists are the first to document the existence of these reptiles and decide to name creatures with these qualities gharial themselves. They have not reported their results yet.

Later, a third biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks the one of the first two biologists: *"Why is this animal like this?" He responds: "Because it is a gharial."*

Entrenched, unlabeled. Many biologists know that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.

A biologist looks them up in reference books, finding that despite being a recognized kind of animal, a name has not been chosen for creatures with these qualities yet.

Later, a second biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks the first biologist: "Why is this animal like this?" He responds: *"Because of the kind of reptile it is."*

Entrenched, labeled. Many biologists know discover that on an island in the Atlantic Ocean isolated from the rest of the world, there are reptiles with long, thin jaws and a black spherical nasal growth. Nothing else is known about these reptiles.

A biologist looks them up in reference books, finding that the accepted name for animals with these qualities is gharial.

(*Appendices continue*)

Later, a second biologist previously unfamiliar with this kind of animal comes across one specimen of it. She asks the first biologist: "Why is this animal like this?" He responds: *"Because it is a gharial."*

Social categories.

1. Rootfather (profession).

Unentrenched, unlabeled. Two anthropologists discover that on an island in the Atlantic Ocean isolated from the rest of the world, there are people whose job is to determine which tree to chop down based on observed patterns in the beach sands. Nothing else is known about these individuals.

The two anthropologists are the first to document the existence of these individuals. They have not chosen a name for individuals with this quality or reported their results yet.

Later, a third anthropologist previously unfamiliar with this group of people comes across a member of it. She asks one of the first two anthropologists: "Why is this person like this?" She responds: *"Because of the kind of person he is."*

Unentrenched, labeled. Two anthropologists discover that on an island in the Atlantic Ocean isolated from the rest of the world, there are people whose job is to determine which tree to chop down based on observed patterns in the beach sands. Nothing else is known about these individuals.

The two anthropologists are the first to document the existence of these individuals and decide to name people with these qualities rootfather themselves. They have not reported their results yet.

Later, a third anthropologist previously unfamiliar with this group of people comes across a member of it. She asks one of the first two anthropologists: "Why is this person like this?" She responds: *"Because he is a rootfather."*

Entrenched, unlabeled. Many anthropologists know that on an island in the Atlantic Ocean isolated from the rest of the world, there are people whose job is to determine which tree to chop down based on observed patterns in the beach sands. Nothing else is known about these individuals.

An anthropologist looks them up in reference books, finding that despite being a recognized group of people, a name has not been chosen for individuals with this quality yet.

Later, a second anthropologist previously unfamiliar with this group of people comes across a member of it. She asks the first anthropologist: "Why is this person like this?" She responds: *"Because of the kind of person he is."*

Entrenched, labeled. Many anthropologists know that on an island in the Atlantic Ocean isolated from the rest of the world, there are people whose job is to determine which tree to chop down based on observed patterns in the beach sands. Nothing else is known about these individuals.

An anthropologist looks them up in reference books, finding that the accepted name for people with this quality is rootfather.

Later, a second anthropologist previously unfamiliar with this group of people comes across a member of it. She asks the first anthropologist: "Why is this person like this?" She responds: *"Because he is a rootfather."*

2. Tawhirian (religious identity).

Unentrenched, unlabeled. Two sociologists discover that on an island in the Indian Ocean isolated from the rest of the world, there are people who figure out how high above the trees the wind blows in order to interpret what their main deity wants. Nothing else is known about these individuals.

The two sociologists are the first to document the existence of these individuals. They have not chosen a name for people with this quality or reported their results yet.

Later, a third sociologist previously unfamiliar with this group of people comes across a member of it. He asks one of the first two sociologists: "Why is she like this?" He responds: *"Because of the kind of person she is."*

Unentrenched, labeled. Two sociologists discover that on an island in the Indian Ocean isolated from the rest of the world, there are people who figure out how high above the trees the wind blows in order to interpret what their main deity wants. Nothing else is known about these individuals.

The two sociologists are the first to document the existence of these individuals and decide to name people with this quality Tawhirian themselves. They have not reported their results yet.

Later, a third sociologist previously unfamiliar with this group of people comes across a member of it. He asks one of the first two sociologists: "Why is she like this?" He responds: *"Because she is a Tawhirian."*

Entrenched, unlabeled. Many sociologists know that on an island in the Indian Ocean isolated from the rest of the world, there are people who figure out how high above the trees the wind blows in order to interpret what their main deity wants. Nothing else is known about these individuals.

A sociologist looks them up in reference books, finding that despite being a recognized group of people, a name has not been chosen for people with this quality yet.

Later, a second sociologist previously unfamiliar with this group of people comes across a member of it. He asks the first sociologist: "Why is she like this?" He responds: *"Because of the kind of person she is."*

(*Appendices continue*)

Entrenched, labeled. Many sociologists know that on an island in the Indian Ocean isolated from the rest of the world, there are people who figure out how high above the trees the wind blows in order to interpret what their main deity wants. Nothing else is known about these individuals.

A sociologist looks them up in reference books, finding that the accepted name for people with these qualities is Tawhirian.

Later, a second sociologist previously unfamiliar with this group of people comes across a member of it. He asks the sociologist: "Why is she like this?" He responds: *"Because she is a Tawhirian."*

Disorder categories.

1. Woolen mouth syndrome.

Unentrenched, unlabeled. Two physicians discover that on an island in the Pacific isolated from the rest of the world, there are people with fissured tongues and swollen lips who have difficulty swallowing. Nothing else is known about this condition.

The two physicians are the first to document the existence of this condition. They have not chosen a name for this combination of symptoms or reported their results yet.

Later, a third physician previously unfamiliar with this condition comes across a person who suffers from it. He asks one of the first two physicians: "Why is she like this?" She responds: *"Because of the kind of condition she has."*

Unentrenched, labeled. Two physicians discover that on an island in the Pacific isolated from the rest of the world, there are people with fissured tongues and swollen lips who have difficulty swallowing. Nothing else is known about this condition.

The two physicians are the first to document the existence of this condition and decide to name it woolen mouth syndrome themselves. They have not reported their results yet.

Later, a third physician previously unfamiliar with this condition comes across a person who suffers from it. He asks one of the first two physicians: "Why is she like this?" She responds: *"Because she has woolen mouth syndrome."*

Entrenched, unlabeled. Many physicians know that on an island in the Pacific isolated from the rest of the world, there are people with fissured tongues and swollen lips who have difficulty swallowing. Nothing else is known about this condition.

A physician looks it up in reference books, finding that despite being a recognized condition, a name has not been chosen for it yet.

Later, a second physician previously unfamiliar with this condition comes across a person who suffers from it. He asks the first physician: "Why is she like this?" She responds: *"Because of the kind of condition she has."*

Entrenched, labeled. Many physicians know that on an island in the Pacific isolated from the rest of the world, there are people with fissured tongues and swollen lips who have difficulty swallowing. Nothing else is known about this condition.

A physician looks the symptoms up in reference books, finding that the accepted name for this condition is woolen mouth syndrome.

Later, a second physician previously unfamiliar with this condition comes across a person who suffers from it. He asks the first physician: "Why is she like this?" She responds: *"Because she has woolen mouth syndrome."*

2. Swiss lung syndrome.

Unentrenched, unlabeled. Two physicians discover that on an island in the Indian Ocean isolated from the rest of the world, there are people who suffer from severe shortness of breath, cough up mucus constantly, and have several characteristic holes in their lungs. Nothing else is known about their condition.

The two physicians are the first to document the existence of this condition. They have not chosen a name for it or reported their results yet.

Later, a third physician previously unfamiliar with this condition comes across a person who is suffering from it. She asks one of the first two physicians: "Why is this person like this?" He responds: *"Because of the kind of condition he has."*

Unentrenched, labeled. Two physicians discover that on an island in the Indian Ocean isolated from the rest of the world, there are people who suffer from severe shortness of breath, cough up mucus constantly, and have several characteristic holes in their lungs. Nothing else is known about their condition.

The two physicians are the first to document the existence of this condition and decide to name it Swiss lung syndrome themselves. They have not reported their results yet.

Later, a third physician previously unfamiliar with this condition comes across a person who is suffering from it. She asks one of the first two physicians: "Why is this person like this?" He responds: *"Because he has Swiss lung syndrome."*

Entrenched, unlabeled. Many physicians know that on an island in the Indian Ocean isolated from the rest of the world, there are people who suffer from severe shortness of breath, cough up mucus constantly, and have several characteristic holes in their lungs. Nothing else is known about their condition.

A physician looks this combination of symptoms up in reference books, finding that despite being a recognized condition, a name has not been chosen for it yet.

Later, a second physician previously unfamiliar with this condition comes across a person who is suffering from it. She asks the first physician: "Why is this person like this?" He responds: *"Because of the kind of condition he has."*

Entrenched, labeled. Many physicians know that on an island in the Indian Ocean isolated from the rest of the world, there are people who suffer from severe shortness of breath, cough up mucus constantly, and have several characteristic holes in their lungs. Nothing else is known about their condition.

A physician looks them up in reference books, finding that the accepted name for this condition is Swiss lung syndrome.

Later, a second physician previously unfamiliar with this condition comes across a person who is suffering from it. She asks the first physician: "Why is this person like this?" He responds: *"Because he has Swiss lung syndrome."*

(*Appendices continue*)

Artifact categories.

1. Ishango stick.

Unentrenched, unlabeled. Two archaeologists discover that on an island in the Indian Ocean isolated from the rest of the world, there are sticks with slightly curved prongs at one end that are inserted into tree trunks to take out the insects within. Nothing else is known about these artifacts.

The two archaeologists are the first to document the existence of these sticks. They have not chosen a name for artifacts with this quality or reported their results yet.

Later, a third archaeologist previously unfamiliar with this tool comes across an instance of it. She asks one of the first two archaeologists: "Why is this thing like this?" He responds: *"Because of the kind of artifact it is."*

Unentrenched, labeled. Two archaeologists discover that on an island in the Indian Ocean isolated from the rest of the world, there are sticks with slightly curved prongs at one end that are inserted into tree trunks to take out the insects within. Nothing else is known about these artifacts.

The two archaeologists are the first to document the existence of these sticks and decide to name artifacts with these qualities ishango sticks themselves. They have not reported their results yet.

Later, a third archaeologist previously unfamiliar with this tool comes across an instance of it. She asks one of the first two archaeologists: "Why is this thing like this?" He responds: *"Because it is an ishango stick."*

Entrenched, unlabeled. Many archaeologists know that on an island in the Indian Ocean isolated from the rest of the world, there are sticks with slightly curved prongs at one end that are inserted into tree trunks to take out the insects within. Nothing else is known about these artifacts.

An archaeologist looks them up in reference books, finding that despite being a recognized kind of tool, a name has not been chosen for artifacts with this quality yet.

Later, a second archaeologist previously unfamiliar with this tool comes across an instance of it. She asks the first archaeologist: "Why is this thing like this?" He responds: *"Because of the kind of artifact it is."*

Entrenched, labeled. Many archaeologists know that on an island in the Indian Ocean isolated from the rest of the world, there are sticks with slightly curved prongs at one end that are inserted into tree trunks to take out the insects within. Nothing else is known about these artifacts.

An archaeologist looks them up in reference books, finding that the accepted name for artifacts with these qualities is ishango stick.

Later, a second archaeologist previously unfamiliar with this tool comes across an instance of it. She asks the first archaeologist: "Why is this thing like this?" He responds: *"Because it is an ishango stick."*

2. Engkrabun (ring).

Unentrenched, unlabeled. Two historians discover that on an island in the Pacific isolated from the rest of the world, there are rings with chitinous ovals covered in wave-like patterns that are believed to disperse malevolent spirits. Nothing else is known about these rings.

The two historians are the first to document the existence of these rings. They have not chosen a name for artifacts with these qualities or reported their results yet.

Later, a third historian previously unfamiliar with this kind of artifact comes across an instance of it. He asks one of the first two historians: "Why is this thing like this?" She responds: *"Because of the kind of artifact it is."*

Unentrenched, labeled. Two historians discover that on an island in the Pacific isolated from the rest of the world, there are rings with chitinous ovals covered in wave-like patterns that are believed to disperse malevolent spirits. Nothing else is known about these rings.

The two historians are the first to document the existence of these rings and decide to name artifacts with these qualities engkrabun themselves. They have not reported their results yet.

Later, a third historian previously unfamiliar with this kind of artifact comes across an instance of it. He asks one of the first two historians: "Why is this thing like this?" She responds: *"Because it is an engkrabun."*

Entrenched, unlabeled. Many historians know that on an island in the Pacific isolated from the rest of the world, there are rings with chitinous ovals covered in wave-like patterns that are believed to disperse malevolent spirits. Nothing else is known about these rings.

A historian looks them up in reference books, finding that despite being a recognized kind of artifact, a name has not been chosen for artifacts with these qualities yet.

Later, a second historian previously unfamiliar with this kind of artifact comes across an instance of it. He asks the first historian: "Why is this thing like this?" She responds: *"Because of the kind of artifact it is."*

Entrenched, labeled. Many historians know that on an island in the Pacific isolated from the rest of the world, there are rings with chitinous ovals covered in wave-like patterns that are believed to disperse malevolent spirits. Nothing else is known about these rings.

A historian looks them up in reference books, finding that the accepted name for artifacts with these qualities is engkrabun.

Later, a second historian previously unfamiliar with this kind of artifact comes across an instance of it. He asks the first historian: "Why is this thing like this?" She responds: *"Because it is an engkrabun."*

(*Appendices continue*)

Appendix B

Domain Statistics in Experiments 1–4

Extent Answered

Table B1
Means and Standard Errors of Extent Answered Ratings in Various Conditions of Experiments 1–2, Divided by Domain

	Experiment 1								Experiment 2							
	Single pathway, unentrenched		Multiple pathways, unentrenched		Single pathway, entrenched		Multiple pathways, entrenched		Single feature, unentrenched		Multiple features, unentrenched		Single feature, entrenched		Multiple features, entrenched	
Scenarios	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Overall	2.41	0.16	1.85	0.12	4.04	0.19	3.56	0.17	2.45	0.15	2.30	0.14	4.04	0.17	3.77	0.15
Biological	1.90	0.24	1.92	0.22	3.66	0.25	4.00	0.26	2.10	0.18	2.08	0.20	4.26	0.27	3.83	0.27
Social	1.84	0.20	2.66	0.31	3.78	0.29	4.66	0.30	2.50	0.24	2.33	0.21	4.07	0.26	3.90	0.26
Natural Disorder	1.72	0.12	2.54	0.20	3.39	0.19	3.72	0.26	2.57	0.21	2.38	0.19	3.99	0.20	3.72	0.20

Table B2
Means and Standard Errors of Extent Answered Ratings in Various Conditions of Experiments 3–4, Divided by Domain

	Experiment 3								Experiment 4							
	Unstable, unentrenched		Stable, unentrenched		Unstable, entrenched		Stable, entrenched		Unlabeled, unentrenched		Labeled, unentrenched		Unlabeled, entrenched		Labeled, entrenched	
Scenarios	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Overall	3.18	0.12	3.25	0.11	3.68	0.11	3.72	0.12	2.81	0.10	3.29	0.13	2.94	0.10	4.34	0.12
Biological	3.10	0.14	3.30	0.15	3.59	0.15	3.64	0.16	2.64	0.17	2.91	0.19	2.81	0.18	4.02	0.18
Social									2.54	0.15	3.47	0.19	2.62	0.15	4.52	0.16
Natural Artifact	3.14	0.13	3.19	0.12	3.69	0.13	3.64	0.13	2.74	0.16	2.82	0.18	2.73	0.15	3.80	0.19
Disorder	3.62	0.30	3.33	0.25	3.90	0.23	4.22	0.22	3.33	0.18	4.03	0.19	3.57	0.16	5.09	0.17

Table B3
Means and Standard Errors of Extent Answered Ratings for Principled and Nonprincipled Connections in Experiments 1, 2, and 4

	Experiment 1		Experiment 2		Experiment 4	
Scenarios	*M*	*SE*	*M*	*SE*	*M*	*SE*
Principled	4.99	0.17	4.68	0.16	4.83	0.09
Nonprincipled	4.31	0.17	4.16	0.15		

(*Appendices continue*)

Naturalness

Table B4
Means and Standard Errors of Naturalness Ratings for Various Conditions in Experiments 1 and 2, Divided by Domain

	Experiment 1								Experiment 2							
	Single pathway, unentrenched		Multiple pathways, unentrenched		Single pathway, entrenched		Multiple pathways, entrenched		Single feature, unentrenched		Multiple features, unentrenched		Single feature, entrenched		Multiple features, entrenched	
Scenarios	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Overall	3.36	0.19	3.65	0.19	4.59	0.17	4.89	0.17	3.92	0.16	3.79	0.16	4.73	0.16	4.55	0.15
Biological	3.40	0.36	3.65	0.33	4.63	0.28	4.95	0.28	3.52	0.25	3.60	0.22	4.98	0.20	4.52	0.24
Social	3.41	0.32	3.57	0.29	4.43	0.28	5.23	0.24	3.72	0.26	4.02	0.24	4.59	0.25	4.67	0.24
Natural	3.23	0.22	3.69	0.22	4.65	0.20	4.65	0.24	4.14	0.19	3.79	0.22	4.80	0.19	4.54	0.18

Table B5
Means and Standard Errors of Naturalness Ratings for Principled and Nonprincipled Connections in Experiments 1, 2, and 4

	Experiment 1		Experiment 2		Experiment 4	
Scenarios	*M*	*SE*	*M*	*SE*	*M*	*SE*
Principled	5.65	0.15	5.56	0.14	5.19	0.09
Nonprincipled	5.90	0.13	5.79	0.12		

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