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What matters in scientific explanations: Effects of elaboration and content

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ABSTRACT

Given the breadth and depth of available information, determining which components of an explanation are most important is a crucial process for simplifying learning. Three experiments tested whether people believe that components of an explanation with more elaboration are more important. In Experiment 1, participants read separate and unstructured components that comprised explanations of real-world scientific phenomena, rated the components on their importance for understanding the explanations, and drew graphs depicting which components elaborated on which other components. Participants gave higher importance scores for components that they judged to be elaborated upon by other components. Experiment 2 demonstrated that experimentally increasing the amount of elaboration of a component increased the perceived importance of the elaborated component. Furthermore, Experiment 3 demonstrated that elaboration increases the importance of the elaborated information by providing insight into understanding the elaborated information; information that was too technical to provide insight into the elaborated component did not increase the importance of the elaborated component. While learning an explanation, people piece together the structure of elaboration relationships between components and use the insight provided by elaboration to identify important components.

1. Introduction

A hallmark of modern culture is dramatically increased access to information. People are often confronted with an overwhelming breadth and depth of information for a given explanation. For example, consider how many news reports you have heard and pieces of information you have amassed about global warming; is it most important to focus on carbon dioxide emissions from humans, sun spots, the ice-albedo positive feedback loop, etc.? In such cases, one accumulates bits and pieces of information from multiple sources (e.g., newspaper, television, radio, and personal conversations) that one must integrate to form an intuitive explanation. In order to limit one's search for useful information and decide which information to try to understand and remember and which to ignore, one must focus on the components of explanations one judges to be most important.

To examine these issues, we start by summarizing the literature on identifying important components in text. Next, we discuss what makes certain components more important than others. Finally, we introduce the current research.

1.1. Important information in text

The ability to discriminate important from unimportant information has long been viewed as critical for a variety of cognitive tasks. Identifying important information – understanding the main point or gist – is the central goal for reading comprehension (e.g. Aulls, 1978; Axelrod, 1975; Dishner & Readence, 1973; Donlan, 1980; Harris & Sipay, 1980; Jolly, 1974). Students who are more sensitive to important information tend to be better readers (Eamon, 1978; Winograd, 1984). Students who are better at identifying important information also produce better

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summaries (Winograd, 1984). Though summarization skills develop gradually during adolescence (Brown, Day, & Jones, 1983; Garner, 1985), helping students identify important information facilitates their ability to summarize material (e.g., Armbruster, Anderson, & Ostertag, 1987; Chou Hare & Borchardt, 1984; Rinehart, Stahl, & Erickson, 1986; Sjostrom & Hare, 1984; Taylor, 1986).

Being able to discriminate important information from unimportant information is also critical for simplifying learning. People remember important textual components better than unimportant components. For example, Johnson (1970) found that components of stories that were judged by one set of college students to be more important for the "essence of the story" were more likely to be recalled by another set of participants anywhere from 15 min to 63 days later. Better recall for important than unimportant components of texts (both as judged by other participants and relative to normative standards) has been found repeatedly (e.g., Binet & Henri, 1894; Freebody & Anderson, 1986; Newman, 1939; Omanson, 1982; Rumelhart, 1977; Trabasso, Secco, & van dan Broek, 1984), even amongst kindergarteners (Smiley, Oakely, Worthen, Campione, & Brown, 1977).

One reason that people remember important information better than unimportant information is because they selectively focus on learning information they judge to be important, which is a critical ability for simplifying learning (Selective Attention Strategy; SAS; see Hidi, 1995; Reynolds, 1992; Reynolds & Shirey, 1988; Reynolds, Wade, Trathen, & Lapan, 1989; for reviews). For example, Brown and Smiley (1978) found that when given extra time to study a passage, college students focus on the most important information, as evidenced by underlining and note-taking. Compared to before the extra study time, the students showed a selective increase in memory for important components of the text (as judged by a separate group of participants), but their memory for the unimportant components did not increase. Fifth graders and college students also selectively chose the most important passages of stories (as determined by separate group of college students) to use as cues for later recall (Brown, Smiley, & Lawton, 1978).

Despite the utility of being able to identify important information, learning this skill requires extensive experience and development (see Hidi and Anderson, 1986, for a summary). The components of stories that third graders view as important are almost completely unrelated to those of college students, and college students distinguish more fine-grained levels of importance (Brown & Smiley, 1977). In short, there is a long-standing tradition of research looking at skills related to extracting and remembering important information from bodies of text. Although aspects of such skills have early origins, in many cases the most dramatic improvements occur in late childhood and adolescence when the skill becomes natural and pervasive. This skill is becoming ever more essential as more and more information becomes available.

1.2.

One common theoretical position is that information higher up in the hierarchical structure of a text is more important (e.g., Grimes, 1975; Kintsch, 1977; Mandler & Johnson, 1977; Rumelhart, 1975; Thorndyke, 1977). Such information has been shown to be rated as more important (Marcu, 1999), is more likely to be included in a summary of the text (Rumelhart, 1977; Thorndyke, 1977), and is also recalled better (e.g., Black & Bower, 1980; Britton, Meyer, Hodge, & Glynn, 1980; Britton, Meyer, Simpson, Holdredge, & Curry, 1979; Cirilo & Foss, 1980; Grimes, 1975; Kintsch & Keenan, 1973; Kintsch, Kozminsky, Streby, McKoon, & Keenan, 1975; Meyer, 1975; Meyer & McConkie, 1973; Thorndike, 1917). Consider a modern theory developed by Marcu (1999, 2000; see also Mann & Thompson, 1988) to identify important components of texts based on the discourse structure and the rhetorical relations in the text. For example, consider a text about Mars presented by Marcu (1999); "With its distant orbit (50% farther from the sun than the Earth) and slim atmospheric blanket, Mars experiences frigid weather conditions." Marcu argues that the first half of the sentence "with... blanket" is subordinate to the second half "Mars ... conditions," which expresses what is more essential to the writer's purpose and is *comprehensible independently of the first half*. In fact, Marcu's algorithm for identifying important components based on which components rely upon others for comprehension predicts peoples' importance judgments.

Extrapolating Marcu's (1999) hypothesis about text to explanations, it seems likely that people view components of explanations that are independently comprehensible to be more important than components that are incomprehensible without first knowing the independent component. For example, one must understand the basic concept of global warming (the average temperature of the earth is increasing) before understanding how greenhouse gasses contribute to global warming. Here we refer to components of an explanation that provide additional details about a first component and require understanding the first component in order to be comprehensible as "elaborating" upon the component that is independently comprehensible.[1] In our studies, we assess whether components of explanations that elaborate upon and are incomprehensible without first understanding other components are less important than the components that are elaborated upon. Additionally, do people identify important components of explanations as those that have the most elaboration?

1.3. Motivation for and outline of current experiments

In the current experiments, we examined what information people view as most important for peoples' intuitive understanding of scientific phenomena. Instead of judging importance based on a textual explanation of the sort one might read in an encyclopedia, we were interested in situations when a person learns many facts and develops an explanation by combining the different pieces of knowledge (see Kintsch, Mandel, and Kozminsky, 1977, for research on scrambled stories). For example, a person might accumulate bits of related knowledge over time

[1] Marcu (1999) presents a much richer typology of different relations including elaboration, background justification, conclusion, antithesis, evidence, etc.

from multiple sources including testimony, direct experience, or even through induction and deduction and then combine these fragments of knowledge into an explanation. Such a process may occur constantly in our daily experiences as we update our explanatory interpretations of the world, discarding unimportant information and retaining central concepts.

Investigating how people identify important information in unstructured explanations is essential for two reasons. First, much of the previous work on importance has focused on intact text. However, intact text contains many cues to importance such as topic sentences and conclusions that are absent when one is building up an understanding of a phenomenon on one's own. Because of these cues, in previous experiments it has been unclear whether people were necessarily using the hierarchical structure of the text to identify important information or whether people might have used simpler text-based heuristics without necessarily comprehending the content in much detail (e.g., Chesla, 1983; Chou Hare & Borchardt, 1984; McCarthy et al., 2008). Thus, studying explanations for which people construct the structure themselves, as we do here, can help to isolate the non-textual factors that people use to identify import components of explanations.

Second, much of the previous research on how people identify important parts of texts have focused on stories. However, narrative stories often follow one individual character on a causal and temporal journey, and much of the work on stories has focused on differences between "story grammar" categories such as settings, goals, and internal responses (e.g., Omanson, 1982; van den Broek, Lorch, & Thurlow, 1996), making it unclear how importance in stories would translate to explanations. In contrast, explanations have richer, more interconnected, and less linear structures compared to stories (Keil, 2006).

In the current experiments, we focus on whether the importance of a component can be predicted by the amount of elaboration on the component – the hierarchical position of the component within the explanation. We focused on elaboration because it has often been found to predict importance for intact texts. However, it is not a forgone conclusion that elaboration would predict importance for unstructured explanations. Previous research on text has identified a number of other factors that also influence perceived importance such as textual variables (e.g., information density, coherence, metaphorical language, and text position), reader variables (interest, background knowledge, and motivation), and task variables (questions, objectives, and instructions; see Reynolds, 1992). Additionally, the rhetorical relations between textual components would likely be easier to identify for intact texts compared to unstructured explanations; for unstructured explanations, participants would need to reconstruct the elaboration relations themselves.

Another critical question is the extent to which causal knowledge plays an essential role in guiding judgments about core elements in an explanation. For example, events in stories that influence many other events are judged to be particularly important (van den Broek, 1988, 1989; see also O'Brien and Myers, 1987; Trabasso & Sperry, 1985; Trabasso & van den Broek, 1985). Causal relations also influence which features are most central for categorization (e.g., Ahn, Kim, Lassaline, & Dennis, 2000; Carey, 1985; Keil, 1979, 1989; Murphy & Medin, 1985; Rehder & Hastie, 2004; Sloman, Love, & Ahn, 1998). However, unlike in the work cited above, the unstructured components of explanations that we have chosen to investigate do not lend themselves to a causal analysis because they were not primitive causal events or variables. That is, a single component could contain multiple causal and non-causal relations within it, and the relations between components could be non-causal. For this reason, we have chosen to limit this initial investigation of the importance of unstructured components of explanations to the influence of elaboration relationships. We discuss potential roles of causal relationships in Section 5.

In the present experiments, we ask whether people use the hierarchical structure of the elaboration relationships to determine the most important parts of an explanation, even when presented in fragments. In Experiment 1, we examined whether elaboration relations between components predict which components people think are important. In Experiment 2, we experimentally manipulated the amount of elaboration to determine if increased elaboration leads people to view the elaborated-upon information as more important. In Experiment 3, we manipulated the type of elaboration to examine whether elaboration increases the importance of the elaborated information by providing insight or clarity into the elaborated information.

2. Experiment 1: correlations between elaboration and importance

In Experiment 1, participants rated the importance of components of explanations and drew elaboration graphs showing which components they thought elaborated upon which other components. We investigated two questions. First, among pairs of components in which one elaborates upon the other, are the elaborated components judged to be more important than the elaborating components? Second, is it possible to predict the relative importance of different components of an explanation based on the overall amount of elaboration of the component? Additionally, we compared the overall amount of elaboration to another metric, the number of direct asymmetric elaboration relationships a component engages in.

2.1. Method

2.1.1. Participants

Sixteen college students in New Haven participated either for course credit or pay at a rate of $10 per hour.

2.1.2. Materials

Four explanations (Diabetes, GPS, Fiber Optics, and the Circadian Rhythm) were written. They were broken up into components (between 17 and 26 per explanation) and presented to participants on individual cards ($M = 26$ words per card, $SD = 12$). Breaking up the text simulated how

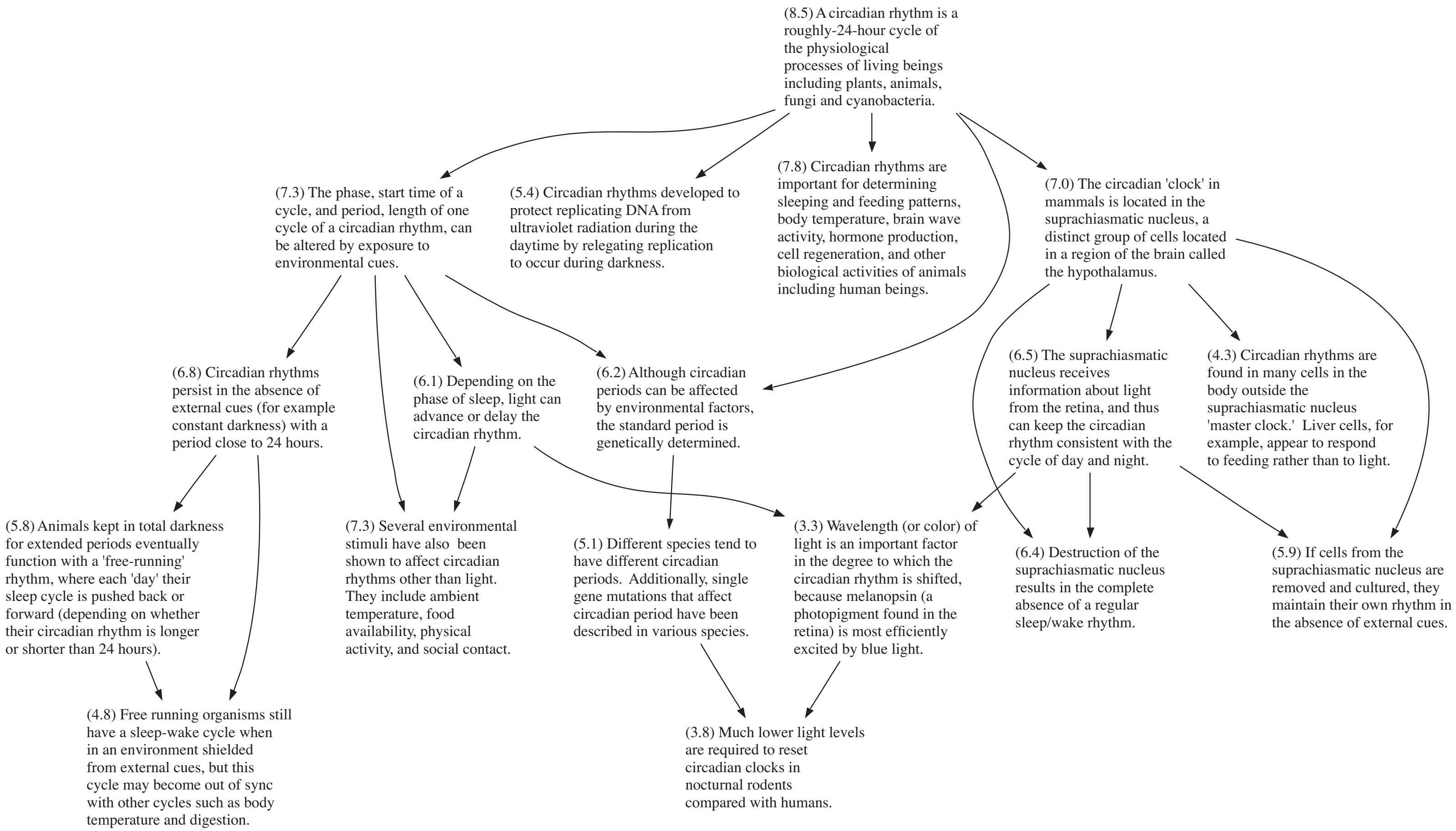

Fig. 1. Consensus elaboration graph for Circadian Rhythm in Experiment 1. *Note*: Numbers represent average importance rating for a given card. Arrows point from elaborated to elaborating components.

people learn by aggregating information and also eliminated cues to importance present in intact texts such as topic, subtopic, and concluding sentences.

The text on each card was constructed such that it could be understood individually; however, textual components naturally refer to concepts introduced on other cards. Thus, some cards are not understandable without first understanding another card. In these cases the dependent card in some way adds more information that is relevant to the independent card. We call this "elaborating." The cards used for the Circadian Rhythm explanation appear in Fig. 1. The cards for the other three explanations are included in the Supplementary materials.

2.1.3. Procedure

Participants were first given a packet of cards and told that collectively the cards comprise an explanation for a scientific phenomenon such as "Diabetes" or "Fiber Optics;" each packet of cards had a title card with the name of the phenomenon. Participants were asked to read the cards thoroughly until they felt satisfied that they understood the explanation inherent in the cards. Participants were told that the order of the cards was random, that they might need to read the cards repeatedly for the cards to make sense, and that they were allowed to spread out the cards on a desk to read simultaneously. In fact, the cards were randomly sorted, like shuffling a deck of cards, for each participant.

After reading the first set of cards, participants answered the following question: "How important for understanding how the phenomenon works is this card compared to the other cards?" Participants rated each card on a scale from one (not important) to nine (extremely important). Participants then performed the same tasks on a second set of cards pertaining to another phenomenon. Participants either worked with the Diabetes and GPS explanations, or the Circadian Rhythm and Fiber Optics Explanations.

Next, participants produced elaboration graphs to show which cards they thought elaborated on which other cards for both explanations that they had previously rated for importance. Participants were instructed both verbally and in text that "In general, some cards are elaborated by many other cards. Cards with lots of elaboration go at the top. The cards that elaborate upon them go underneath them with arrows pointing downwards to the cards that elaborate upon the cards above. Cards that are elaborated less, or not at all, get placed near the bottom." After determining the elaboration relationships between cards, participants wrote down the identification numbers of the cards and drew lines showing which cards elaborated upon which other cards. (See Appendix A for the full instructions.)

Participants performed the importance rating task before the elaboration task because we thought that it was more probable that the elaboration task would influence importance ratings than the reverse. For between subject analyses, a second group of 11 participants drew elaboration graphs for all four explanations without previously rating importance.

2.2. Results and discussion

2.2.1. Consensus graphs

Fig. 1 presents a consensus elaboration graph for the Circadian Rhythm as well as the average importance rating for each card (see the Supplemental materials for graphs of the other explanations). Consensus graphs were created to display the elaboration relationships between cards that participants most frequently endorsed. A given elaboration relationship between two cards was included in the graph if at least three out of eight participants endorsed the link. This percentage was chosen by finding a high enough threshold such that lowering the threshold would not connect many more cards to the graph but would greatly increase the number of links (e.g., White, 2006). The graphs were created with Graphviz software.

These graphs informally confirm the hypothesis that cards with more elaboration are generally rated as more important. As can be seen in Fig. 1, cards near the top of the graph with many elaborating cards generally have higher importance ratings than cards near the bottom of the graph with fewer elaborating cards. The consensus graphs were not involved in the formal analyses.

2.2.2. Within-subject analyses

2.2.2.1. Analysis of pairs of cards. Are cards that are elaborated judged to be more important than the cards that elaborate upon them? Based on the elaboration graphs, we identified all pairs of cards such that one card elaborated upon another. Across both explanations seen by a given participant, we compared the average difference in importance ratings of all elaborated cards minus their elaborating cards. On average, participants rated elaborated cards more important than elaborating cards ($M_{difference}$ = .88, SD = .53), $t(15) = 6.56$, $p < .01$.

2.2.2.2. Predicting the overall importance of each card. We developed two metrics to predict the overall importance of cards. The amount of elaboration for a given card (asymmetric metric) was defined as the number of cards that could be reached by traversing down the elaboration graph including itself. For example, the card at the bottom of Fig. 1 starting with "Much lower light..." receives a score of 1 because it has no elaboration cards. The card in the middle starting with "Although circadian periods..." receives a score of 3. This metric roughly captures the place in the elaboration hierarchy (c.f. Marcu, 1999) and is also ordinally similar to other asymmetric measures of dependence of features in categories (c.f. Sloman et al., 1998).

The "number of links" metric was simply the number of direct elaboration relationships between a given components and all other components regardless of direction. For example, the card at the bottom of Fig. 1 starting with "Much lower light..." receives a score of 2, and the card in the middle starting with "Although circadian periods..." receives a score of 3. We test this metric as well because a component may be viewed as important if is simply *associated* with many other parts of the explanation (e.g., Bradshaw & Anderson, 1982; Edmundson, 1968; Luhn, 1958).

Each participant gave importance ratings and drew elaboration graphs for two out of the four explanations.

For each elaboration graph that participants drew, we calculated two Spearman Rank Order correlations; the correlation between the importance scores and both metrics. We used Spearman correlations because the asymmetric elaboration scores were skewed (there were a few cards with very high elaboration scores). This produced four correlation coefficients per participant. We then averaged[2] the correlations for the two explanations that a participant worked with that used the same metric. In sum, each participant had one correlation coefficient reflecting the relationship between the importance scores and the total elaboration metric, and another correlation coefficient reflecting the relationship between the importance scores and the number of links metric. Overall, the average correlations were higher for the asymmetric elaboration metric ($M = .42$, $SD = .26$) than the number of links metric ($M = .26$, $SD = .21$), $t(15) = 5.68$, $p < .01$. This finding suggests that the total amount of elaboration, or the place in an elaboration hierarchy, predicts importance.

2.2.3. Influence of task order

All the above analyses compared an individual participant's importance ratings with his or her own elaboration graphs. The within-subjects analysis was important to have enough detail to examine differences between the two metrics. However, we desired to test whether performing the importance rating task first had an influence on the elaboration graphs.

We used pairwise Spearman correlations as a measure of inter-rater reliability to test whether there was a difference in reliability between the main group of participants and the separate group of participants who never rated importance. For the total elaboration metric, the average pairwise inter-rater reliability within the main group of participants was $r = .55$. This was significantly higher than the average pairwise inter-rater reliability for participants who never rated importance, $r = .44$, $t(25) = 2.85$, $p < .01$. For the number of links metric, the average inter-rater reliability for the main group, $r = .35$, was also significantly higher than the group who never rated importance, $r = .21$, $t(25) = 3.23$, $p < .01$. It is possible that the importance rating task led to more detailed processing of the stimuli and thus higher inter-rater reliability when participants later made the elaboration graphs. Even so, there is no reason that rating importance first biased them to attend specifically to elaboration relations; participants did not know that they were going to be asked to judge elaboration relations while producing the importance ratings. If anything, the higher inter-rater reliability after rating importance may support our claim that when judging importance, people naturally focus on elaboration relations.

2.2.4. Between-subjects analyses

2.2.4.1. Predicting the overall importance of each card. Because of this order effect, we also ran between-subject correlations between the average importance score for a given card as rated by participants in the main group of participants and the average scores on the two metrics derived from the elaboration graphs of the second group of participants. The average spearman correlation across all four explanations was $r = .65$ for the total elaboration metric and was $r = .60$ for the asymmetric metric. These analyses clearly suggest that there is a fairly robust relationship between elaboration and judged importance. However, unlike the within-subjects analyses, the between-subjects analysis is too coarse to distinguish between the two metrics. Indeed, the average between-subjects correlation between the two metrics is $r = .81$.

2.2.4.2. Analysis of pairs of cards. We also conducted a between-subjects test of whether, amongst pairs of cards for which one elaborates on the other, elaborated cards are judged to be more important than the elaborating cards. We performed a pairwise analysis of every pair of cards for which participants in the second group (who never rated importance) judged that one card directly elaborated upon another card. For each pair of cards from the second group of participants, we took the difference of the average importance scores from the main group of participants. For the eleven participants in the second group, we then averaged over all the pairs of cards across all four explanations that they worked with. On average, the elaborated cards were significantly more important than the elaborating cards ($M_{difference} = .77$, $SD = .17$), $t(10) = 15.10$, $p < .01$.[3]

In sum, Experiment 1 demonstrated that the elaboration relationships between the components of an explanation predict the perceived importance of the components. Both within-subjects and between-subjects analyses strongly suggest that elaborated components are judged to be more important than elaborating components. Additionally, within-subjects analyses suggest that the total elaboration metric predicts a component's importance better than the number of links metric, a measure of association.

3. Experiment 2: manipulating the amount of elaboration on a component

So far we have argued that people identify important components in an explanation as those that have more elaboration. Components with elaboration must be understood in order to understand the elaboration. However, because there was not any experimental manipulation of elaboration in Experiment 1, we could not identify elaboration as a cause of the importance ratings. Specifically, our participants may have already had beliefs about which components of these real-world explanations were more

[2] Throughout the manuscript, all correlation coefficients were Fisher transformed before being averaged or being used in inferential tests. All reported average correlation coefficients have been inversely transformed.

[3] This analysis is not typical because the same average importance ratings from the first group were used for each of the eleven participants in the second group, so the observations in this analysis are not independent. In order to get around this issue, we computed separate comparisons for each of the 11 participants and each of the four explanations. Within each of these comparisons, elaborated cards were more important on average than elaborating cards. Additionally, 51% of these comparisons were statistically significant, whereas one would only expect 5% of these comparisons to be significantly different by chance ($\alpha = .05$)!.

Table 1
Partial stimuli for the Circadian Rhythm in Experiment 2.

Key Card A	*Key Card B*
The circadian "clock" in mammals is located in the suprachiasmatic nucleus, a distinct group of cells located in a region of the brain called the hypothalamus.	The phase (start time of a cycle) and period (length of one cycle) of a Circadian Rhythm can be altered by exposure to environmental cues.
Cards that elaborate on key Card A	*Cards that elaborate on key Card B*
Destruction of the suprachiasmatic nucleus results in the complete absence of a regular sleep/wake rhythm.	Much lower light levels are required to reset circadian clocks in nocturnal rodents compared with humans.
If cells from the suprachiasmatic nucleus are removed and cultured, they maintain their own rhythm in the absence of external cues.	Depending on the phase of sleep, light can advance or delay the Circadian Rhythm.
The suprachiasmatic nucleus receives information about light from the retina, and thus can keep the Circadian Rhythm consistent with the cycle of day and night.	Several environmental stimuli have also been shown to affect Circadian Rhythms other than light. They include ambient temperature, food availability, physical activity, and social contact.
Circadian Rhythms are found in many cells in the body outside the suprachiasmatic nucleus "master clock." Liver cells, for example, appear to respond to feeding rather than to light.	Wavelength (or color) of light is an important factor in the degree to which the clock is shifted, because melanopsin (a photopigment found in the retina) is most efficiently excited by blue light.

Note: Key Cards A and B were presented to all participants. Half the participants were presented with the cards that elaborate on key Card A, and the other half were presented with the cards that elaborate on key Card B. Other Circadian Rhythm cards not included in this table were also presented to all participants.

important. Furthermore, we the experimenters may have naturally chosen to include more cards to elaborate upon cards that we viewed to be important.

In Experiment 2, we tested whether elaboration actually causes people to view the elaborated-upon component as more important. To accomplish this goal, we manipulated the amount of elaboration on certain key components and observed whether participants rated these key components as more important when elaborated than unelaborated.

3.1. Method

3.1.1. Participants

There were 34 participants from the same population as Experiment 1.

3.1.2. Materials and design

The explanations were similar to those in Experiments 1, but were modified in one critical way. In each explanation, two key cards were chosen, each of which could be elaborated upon by adding three or four additional cards to the explanation. Here we refer to these two key cards as "A" and "B," but in the experiment they were not distinguished from the other cards. For Fiber Optics, both A and B had three elaborating cards. For the other three explanations, both A and B had four elaborations.[4] The key cards and elaborating cards for the Circadian Rhythm can be found in Table 1. The stimuli for the other explanations are included in the Supplementary materials.

There were two between-subject conditions. In both conditions, participants worked with the A and B key cards along with a number of other cards. Additionally, in one condition, Card A was elaborated by three or four additional cards, but Card B was not elaborated. In the other condition, Card B but not Card A was elaborated. If elaboration leads to higher importance ratings, then the card that is elaborated would be judged to be more important than the unelaborated card. In any explanation there are some components that are elaborated and others that are not. Thus, these added elaborations simply became part of the larger structure of elaboration relationships between cards; there was no way for participants to be aware that different elaborations were present for different participants.

3.1.3. Procedure

Participants were randomly assigned to the condition in which only the A key cards or only the B key cards were elaborated. For each of the four explanations in a counterbalanced order, participants thoroughly read a set of shuffled cards and subsequently rated *all* cards on importance. The A and B key cards and elaborating cards were embedded within the entire set of randomly shuffled cards. The key cards and elaborating cards were treated the same way as all the other cards and were not identified as being the subject of investigation.

3.2. Results and discussion

We performed a 2 Elaboration (elaborated key card vs. unelaborated key card) $\times$ 4 Explanation (Diabetes, GPS, Fiber Optics, and the Circadian Rhythm) repeated-measures ANOVA. Most critically, there was a main effect of elaboration such that elaborated cards ($M = 6.73$, $SD = 0.19$) were rated more important than unelaborated cards ($M = 6.12$, $SD = 0.20$), $F(1,31) = 6.45$, $p = .02$, $\eta_p^2 = .17$. There was also a main effect of explanation such that the key cards for some explanations were in general more important than others, $F(3,93) = 5.86$, $p < .01$, $\eta_p^2 = .16$. (We never attempted to control for this factor in designing the stimuli.) There was no interaction between explanation and elaboration, $F(3,93) = 2.02$, $p = .12$, $\eta_p^2 = .06$.

Additionally, we tested whether participants judged the key cards to be more important to the extent that they thought that the elaborating cards were important. For each of the four explanations, we computed the correlation

[4] For Diabetes, one of the elaborations was accidentally included in both conditions. This mistake works against our hypothesis by diluting the manipulation. Also, the effect becomes stronger if Diabetes is excluded from the analysis.

between the importance of the key card and the average of the importance scores of the elaborating cards. Across all four explanations, the average importance of the elaborating cards strongly predicted the importance of their respective key cards (Circadian Rhythm, $r = 0.50$; Diabetes, $r = 0.55$; Fiber Optics, $r = 0.75$; GPS, $r = 0.66$; all $ps < .01$).

In sum, this experiment demonstrates that experimentally elaborating upon a component makes it more important. Furthermore, the degree of importance of the elaborating components linearly predicts the importance of the elaborated component.

4. Experiment 3: why elaboration increases importance

In Experiment 3, we examined why elaboration increases the importance of the information that is elaborated upon. Normally, an explainer would elaborate on a component to provide insight into or clarity about the elaborated component. For example, consider two components used in Experiment 2. One key card was: "The circadian "clock" in mammals is located in the suprachiasmatic nucleus. . .." One card that elaborated on this key card was: "The suprachiasmatic nucleus receives information about light from the retina, and thus can keep the Circadian Rhythm consistent with the cycle of day and night." The elaborating card explains a critical aspect of the suprachiasmatic nucleus; how the suprachiasmatic nucleus keeps the Circadian Rhythm in sync with the day/night cycle. Without the elaborating card, it is not clear how the suprachiasmatic nucleus performs its function. Thus, it makes sense that the elaborating card makes the key card more important by providing insight into the key card.

In order to test whether elaboration increases the importance of the elaborated information by providing insight into the elaborated information, we manipulated the content of the elaboration. The first type of elaboration we call "mechanistic;" it further explains details of how the elaborated information works. The mechanistic elaborations were the same sort of elaboration in the example above and in all the previous experiments.[5] We expected mechanistic information to increase the importance of the elaborated information.

The second type of elaboration conveyed information that was *too technical* or *too complicated* to comprehend. These cards were carefully constructed so that they referred to concepts in the elaborating cards, but used terminology that was likely far beyond the comprehension level of a non-specialist. Too technical information is likely viewed as relevant to understanding how the phenomenon works and potentially important, but does not actually provide the novice reader with any better insight or understanding of how the phenomenon works. Thus, the too technical elaborations test whether information needs to *personally add to the comprehension of the phenomenon*, not just potentially add to the comprehension of the phenomenon, in order to influence the importance of the elaborated component.

Finally, there are two other reasons why elaboration might increase the importance of the elaborated information. It is possible that any type of elaboration simply draws attention to the elaborated information (c.f., Reynolds, 1992). It is also possible that people use a simple pragmatic rule that "important components of explanations are more frequently elaborated than unimportant components." To test these possibilities, we created a third type of elaboration that conveyed *historical* or *sociological* information that clearly elaborated upon a given component but did not provide insight or clarity into how these biological and technological phenomena work.

In sum, the *historical, too technical,* and *mechanistic* elaborations were designed to distinguish alternative possibilities for why elaboration increases the importance of elaborated information. Critically, if the reason is that elaboration provides insight into the elaborated component, then only the key cards with mechanistic elaborations would have elevated importance scores.

4.1. Method

4.1.1. Participants

There were 36 participants from the same population.

4.1.2. Materials

The explanations were similar to those in Experiment 2. Four key cards were identified that could be elaborated upon. For each of these four key cards, 12 elaborating cards were created, four elaborating cards of each of the three types (mechanistic, historical, and too technical). Sample stimuli for one Circadian Rhythm key card and its elaborating cards appear in Table 2. All of the stimuli are available in the Supplementary materials. For a given key card, the three types of elaborating cards had the same total word length, ensuring that no type of elaboration was generally longer than another across participants.

4.1.3. Procedure and design

All participants worked with all four explanations. Participants were randomly assigned to one of four conditions to counterbalance the order in which they worked with the explanations and which key cards were paired with which type of elaboration.

For a given explanation, the key cards and some other cards were present for all participants. However, different participants worked with different elaborating cards. For a given participant, one key card was elaborated by four mechanistic cards, a second key card was elaborated by four historical or sociological cards, a third by four too technical cards, and the fourth was not elaborated upon. Across participants, each of the key cards was sometimes elaborated upon by each of the types of elaboration (or no elaboration). All the cards that a participant worked with were mixed up together in a random order; the key cards and elaborating cards were not identified as the subject of investigation in any way.

[5] The term "mechanistic" is not intended to be interpreted in the narrow sense of a process Y that explains the causal relationship between two events X and Z. Often the mechanistic elaborations did contain causal information. But as discussed in the General Discussion they could convey many other types of relationships. Here we merely use the word to describe any elaboration that further explains how something works.

Table 2
One Circadian Rhythm key Card and elaborations in Experiment 3.

Key Card		
The circadian "clock" in mammals is located in the suprachiasmatic nucleus, a distinct group of cells located in a region of the brain called the hypothalamus.		
Mechanistic elaborating cards	Historical/sociological elaborating cards	Too complicated/technical elaborating cards
The suprachiasmatic nucleus receives information about light from the retina, and thus can keep the Circadian Rhythm consistent with the cycle of day and night. The process of aligning the cycle of the suprachiasmatic nucleus with the cycle of day and night is called "entrainment".	The discovery that the suprachiasmatic nucleus represents a major circadian pacemaker occurred simultaneously in two laboratories, one headed by Robert Y. Moore (then at the University of Chicago) and the other headed by Irving Zucker at the University of California, Berkeley.	The suprachiasmatic nucleus is situated in the anterior part of the hypothalamus, immediately dorsal and superior to the optic chiasm and bilateral to the third ventricle. The suprachiasmatic nucleus sends information to other hypothalamic nuclei and the pineal gland to regulate body temperature and production of cortisol and melatonin.
If cells from the suprachiasmatic nucleus are removed from the brain and cultured, they maintain their own rhythm in the absence of external cues. This shows that the suprachiasmatic nucleus can serve as an autonomous clock.	To celebrate the 25th anniversary of the discovery of the suprachiasmatic nucleus as the circadian clock, Charles A. Czeisler and Steven M. Reppert organized a meeting at Harvard Medical School in 1997.	Neurons in the ventrolateral suprachiasmatic nucleus have the ability for light-induced gene expression. Melanopsin-containing ganglion cells in the retina have a direct connection to the ventrolateral suprachiasmatic nucleus via the retinohypothalamic tract.
Destruction of the suprachiasmatic nucleus results in the complete absence of a regular sleep/wake rhythm.	Though Irving Zucker contributed to the discovery of the suprachiasmatic nucleus, his advisor Robert Moore, suggested that Zucker leave graduate school. Moore later recanted.	The suprachiasmatic nucleus is composed of densely packed, parvocellular neurons and is nearly always identifiable by cytoarchitectonic criteria.
Circadian Rhythms are found in many cells in the body outside of the suprachiasmatic nucleus "master clock." Liver cells, for example, appear to respond to feeding rather than light.	One of the first major papers on the role of the suprachiasmatic nucleus was submitted to the journal Science, but rejected, and later published in a lower-tier journal.	One division of the suprachiasmatic nucleus has a large population of vasoactive intestinal polypeptide-containing neurons. The second division is characterized by a population of vasopressin-containing neurons.

Note: Key Cards were presented to all participants. Each key card was elaborated by either mechanistic cards, historical cards, too complicated cards, or no cards, and the pairing of a given card with the types of elaboration was counter-balanced between subjects. Other Circadian Rhythm cards not included in this table were also presented to all participants.

For each explanation, participants thoroughly read the cards until they felt that they understood the explanation. Then, participants rated *all* the cards for importance for understanding the explanation.

To ensure that participants actually thought that the elaborating cards elaborated upon the key cards as intended, a separate groups of 16 participants read the same explanations as the main group of participants and drew elaboration graphs of all the cards (see Experiment 1 and Appendix A for the elaboration graph instructions).

4.2. Results and discussion

The main results were that only the mechanistic elaborations increased the importance of the key cards. Additionally, the degree of importance of the mechanistic elaborations strongly predicted the importance of their key cards, but this relationship was much weaker for the historical and too technical elaborations.

4.2.1. Manipulation checks

We performed a manipulation check to ensure that participants actually thought that the elaborating cards elaborated on the key cards as intended. To assess this, we looked at the separate group of participants' elaboration graphs. For each explanation with which a participant worked, we counted the number of elaboration cards of each type that participants thought directly or indirectly elaborated upon its intended key card (4 is the maximum). Participants thought that most of the elaborating cards did elaborate on the intended key cards; ($M = 3.13$, $SD = 0.71$) for mechanistic elaborations, ($M = 3.19$, $SD = 1.24$) for historical explanations, and ($M = 3.28$, $SD = 0.69$) for too technical elaborations. A one-way repeated-measures ANOVA did not find a main effect of explanation type, $F(2,30) < 1$. This ensures that any differences in importance across the three elaboration types are not the product of participants' failing to recognize elaboration relationships for certain types.

We also analyzed the importance of the elaborating cards per se. The mechanistic elaborations were generally viewed as somewhat important ($M = 5.78$, $SD = 1.20$; 5 is the middle of the scale.) The historical elaborations were intended to not actually facilitate understand how the phenomena work. As expected, these cards were rated as fairly unimportant ($M = 2.00$, $SD = 0.78$), and significantly less important than the mechanistic cards $t(35) = 18.37$, $p < .01$. We were not entirely sure whether the too technical cards would be viewed as important or not. If participants had extensive knowledge of the phenomena and could understand these cards, they would be viewed as important, but even if participants did not understand these cards, they still might be viewed as potentially important. The too technical cards were viewed as somewhat important ($M = 4.29$, $SD = 1.08$), less important than the mechanistic cards, $t(35) = 6.36$, $p < .01$, but more important than the historical cards, $t(35) = 11.63$, $p < .01$.

4.2.2. Elaborated cards

The main question was whether the historical and too technical elaborations increased the importance of the

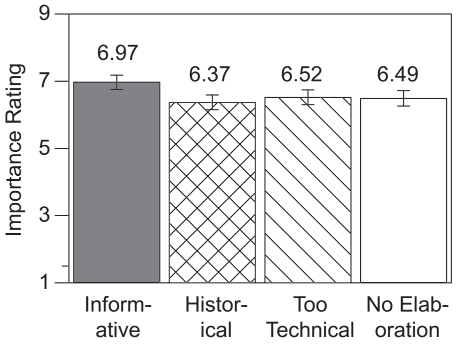

Fig. 2. Average importance (and std. errors) of key cards by elaboration type in Experiment 3.

elaborated key cards as the mechanistic elaborations did in Experiment 2. We used a 4 Elaboration Type (mechanistic, historical, too technical, and no elaboration) $\times$ 4 Explanation (Diabetes, GPS, Fiber Optics, and Circadian Rhythm) repeated-measures ANOVA to test for differences in importance scores of the key cards (see Fig. 2 for means). This ANOVA revealed a main effect of elaboration type, $F(3,105) = 3.91$, $p = .01$, $\eta_p^2 = .10$; at least two of the elaboration types differed in their effect upon the importance of the key cards. Additionally, there was a main effect of explanation such that some of the explanations generally had more important key cards than others, $F(3,105) = 3.47$, $p = .03$, $\eta_p^2 = .09$. (We did not intend to control for this in designing the stimuli.) There was no interaction between explanation and elaboration type, $F(9,315) < 1$.

This omnibus test was followed-up with a series of comparisons. First, replicating Experiment 2, the key cards with mechanistic elaborations were rated as more important than those with no elaboration, $t(35) = 2.61$, $p = .01$. Second, the key cards with mechanistic elaborations were also rated as more important than those with too technical elaborations, $t(35) = 2.82$, $p < .01$, and those with historical elaborations, $t(35) = 3.22$, $p < .01$. Finally, the key cards with historical elaborations, $t(35) < 1$, and too technical elaborations, $t(35) < 1$, were not judged to be any more important than the key cards with no elaboration. In sum, these results suggest that elaboration boosts the importance of the elaborated information by providing clarity or insight into the key card.

4.2.3. Relationship between elaborated and elaborating cards

For each of the four explanations and for each of the three types of elaborations, we computed correlations between the average importance score of the four elaborating cards and the importance score of the key cards. We then averaged these correlation coefficients across the four explanations (the main pattern holds for all four explanations). Replicating Experiment 2, the importance scores for mechanistic elaborations strongly predicted the importance of their key cards ($r = .61$, $p < .01$). The correlations for the too technical elaborations ($r = .28$, $p = .05$) were marginally weaker ($Z = 1.71$, $p = .08$, non-directional), and the correlations for the historical elaborations ($r = .14$, $p = .21$) were significantly weaker, ($Z = 2.30$, $p = .02$).[6]

These correlational findings, do not necessarily imply that the elaborations determine the importance of the key cards; perhaps when a key card is viewed as important, its elaborations are also viewed as important. However, the finding that key cards with mechanistic elaborations were viewed as more important than those with historical and too technical does suggest a causal direction.

In sum, Experiment 3 suggests that elaboration increases the importance of elaborated information by providing insight into understanding the elaborated information. Mechanistic elaborations were the only type that increased the importance of the key cards, and mechanistic elaborations had the strongest relationship between the importance of the key card and elaborating cards.

5. General discussion

We are frequently confronted with complex scientific explanations of phenomena such as global warming, Diabetes, and nuclear reactors. Given the immense potential breadth and depth of such explanations, we need ways to avoid being overwhelmed by the information. People routinely selectively focus on information they judge to be important, which leads to greater memory for that information (e.g., Brown & Smiley, 1978; Hidi, 1995; Reynolds, 1992).

What determines which components are deemed important for understanding scientific explanations? In three experiments, we consistently found that the amount of elaboration on a component predicted its importance. Experiment 1 found that components that directly elaborated upon another component were judged to be less important than the elaborated component. Additionally, components with more elaboration tended to be rated as more important than components with less elaboration. Experiment 2 manipulated the amount of elaboration upon a given component and found that components were judged to be more important when they were elaborated vs. when they were not elaborated. Additionally, the importance of the elaborating components predicted the importance of the elaborated components.

Experiment 3 suggested that elaboration increases importance by providing insight and clarity to the elaborated-upon component. In contrast to mechanistic elaborations, elaborations that were too technical to contribute insight to the elaborated information failed to increase the importance of the elaborated information. This finding suggests that *understanding* the elaboration leads to the elaborated information being viewed as important. This result could also be interpreted as a bias of discounting the importance of a particular piece information merely

[6] Steiger (1980; see Chen and Popovich (2002), for a summary) presents a Z test for calculating whether there is a significant difference of two correlation coefficients with the null hypothesis of the form $\rho_{jk} = \rho_{hm}$, where j, k, h, and m are four variables each observed on the same set of participants. Because each participant worked on four explanations, we performed this calculation for the four explanations, then averaged the Z values, and computed the associated significances.

because one does not understand the details of the information.

Together, these results suggest that in the normal course of learning an explanation, even when the explanation comprises fragments of knowledge that are not encountered in a single connected body of discourse, people piece together information into a structure of elaboration relationships and use the insight provided by elaboration to infer which components of the explanation are most important.

5.1. What elaboration is

Throughout the paper we have defined elaboration as occurring when one component adds relevant information to another component and when the elaborating component is not comprehensible without first understanding the elaborated component. This definition is inspired by Rhetorical Structure Theory (Mann & Thompson, 1988; Marcu, 1999) that defines relationships between components of text, one of which is more essential and comprehensible independently, but not vice versa. Though Rhetorical Structure theory is much more nuanced, we used the word "elaboration" as a convenient and rough proxy for this relationship between components.

We believe that Experiment 3 provides the most informative understanding of why elaboration on a component can influence the importance of the component. Experiment 3 found that only elaboration that added insight into understanding how the elaborated information works increased the importance of the elaborated information. Elaboration that was too complicated to understand, or was on a topic irrelevant to the purpose of the explanation (in these experiments how the phenomenon works) did not influence the importance of the elaborated information. In sum, people are more likely identify a component of an explanation as important if it is necessary to understand other components of the explanation that are also view as important and that provide insight into understanding how the phenomenon works.

5.2. What elaboration is not

5.2.1. Pragmatics

Could elaboration serve as a pragmatic cue to importance? Grice's (1975; see also Wilson & Sperber, 2004) maxims suggest that people favor communications that are economical, relevant, and informative, but not more informative than required by the current situation. Thus, elaboration upon a concept would be a signal by the communicator of its importance – if someone devotes considerable time to a given topic it is probably an important topic. Furthermore, there may be situations in which an unimportant concept is elaborated (e.g., a poor teacher mechanically reading from a text without thinking about the content), which may mislead learners' attempts to understand an explanation.

We believe that Experiment 3 provides the best evidence that the current results are not simply due to a pragmatic belief that "important things are more frequently elaborated upon." In Experiment 3, only mechanistic information that provided insight into the workings of the elaborated-upon component increased the importance of the elaborated-upon component. Historical elaborations did not increase the importance of the elaborated components, yet according to this simple pragmatic account, any sort of elaboration would increase the importance of the elaborated components.

5.2.2. Other findings related to explanatory dependency

Consider some related but distinct findings that clarify elaboration's role in the current experiments. Preston and Epley (2005) found that when a phenomenon is viewed to explain other phenomena, it is judged to be more important than when it is viewed as explained by other phenomena. For example, Preston and Epley asked people to consider either causes or implications of homophily (that people are attracted to people who are similar to themselves). When they considered implications of homophily (perhaps slow assimilation of immigrant communities) as opposed to causes of homophily (perhaps a biological cause like pheromones), they thought that homophily was more important. Lombrozo (2009) found that a concept's most important features are those that explain other features. For example, a Tiger's stripes may be explained due to the proximal cause, a chemical pigmentation process, or a functional reason, that stripes provide camouflage. If one uses pigmentation, then one would view the pigmentation process as a more important feature of being a tiger than stripes. But if one explains the stripes with camouflage, then stripes are a more important feature than the chemical process. Sloman et al. (1998; see also Ahn, Kim, Lassaline, & Dennis, 2000) found that features of a concept with many other features that depend upon them are more important. They proposed that it is easy to imagine a robin that does not chirp – chirping is not a core feature of a robin. But it is much more difficult to imagine a robin that does not eat, because eating is necessary for life, and necessary for chirping, and all the other things that a robin does.

In all of these experiments, one feature Y *metaphysically* depends upon another feature X for its existence. Homophily may cause slow assimilation. Chirping depends upon eating. Stripes depend upon both the proximal cause and on the functional role of camouflage for evolutionary fitness. Additionally, the dependent variables of importance in the previous work were metaphysical (e.g., which feature is the core feature of being a bird).

In contrast, in the current experiments, elaborating components *epistemically* depended upon the elaborated component; the elaborated component must be understood first before the elaborating component would make sense because the elaborating components reference concepts introduced by the elaborated components.[7] For example, "a circadian rhythm is a roughly 24-h cycle of physiological processes of living beings" must be understood before "circadian rhythms are important for determining sleeping and feeding patterns, body temperature, etc." can be understood. Furthermore, our dependent variable of "importance for understanding" was also epistemic. In

[7] We thank Tania Lombrozo for suggesting the epistemic terminology.

contrast, all of the features (e.g., chirping and eating) or phenomena (e.g., homophily and assimilation) in the reviewed experiments above were comprehendible independently of one another.

Thus, the current work suggests that elaboration, a form of epistemic dependence, influences which components of an explanation are most important for understanding the explanation. The results suggest that adding components that (1) epistemically depend upon a component X and (2) provide insight into understanding X, make X more important relative to other components.

5.3. Causal information

Much of the previous literature on stories (e.g., van den Broek, 1988, 1989; see also O'Brien & Myers, 1987; Trabasso & Sperry, 1985; Trabasso & van den Broek, 1985) and categories (e.g., Ahn et al., 2000; Carey, 1985; Keil, 1979, 1989; Murphy & Medin, 1985; Rehder & Hastie, 2004; Sloman et al., 1998) has investigated the role of causal relations for determining importance. There were two primary reasons why we did not focus on causal relations here. First, as explained above, our goal was to investigate epistemic importance of components of explanations. It was not obvious to us how causal relations would impact epistemic importance. Consider the causal relationship between smoking and lung cancer; one does not need to be understood first, and it is not obvious why one would be more epistemically important. In contrast, causes are often viewed as metaphysically important; causes can be useful for predicting effects. Another reason that causes may be viewed as metaphysically important is that they may be viewed as an essence of a category (e.g., Ahn, 1998; Ahn et al., 2000, 2001; Medin & Ortony, 1989). However, explanations are not like categories with essences. Perhaps there is an assumed essence for Diabetes as a disease natural kind, but we do not normally evaluate explanations of Diabetes as having essences.

The second reason we did not focus on causal relations is that components of explanations involve many sorts of relations that are not causal (e.g. explain a component, part, or type, define a term, explain a mathematical algorithm, contrast two other pieces of information, explain a function, convey a temporal sequence, or identify similarities or differences to other processes). Thus, the components used in the current experiments were not primitive causal variables or events, as is typical in most research on causal relations. We believe that it will be important in future work to bridge the gap between causal primitives and the higher-level of components of explanations we have examined.

5.4. Goals of explanations

In the current experiments, the goal of the explanations was to understand how the phenomena worked. We believe that this is a fairly general goal that applies in many different explanations such as understanding scientific phenomena like those investigated here, historical phenomena like understanding World War II (e.g., causes, consequences, strategies, and weapons of war), and even organizational phenomena such as the structure of the US Congress and how a bill becomes law. However, there are many different types of goals for explainers and reasoners. For example, someone might desire to know about GPS so that he or she can *use* a handheld GPS instead of understanding more generally how GPS works. Or, someone might want to know how to best control his or her Type 1 Diabetes, instead of understanding more generally how Diabetes works. Importance for understanding how a phenomenon works (as we asked in the current experiments) is just one such goal, and people with different goals may judge importance differently from our participants.

Still, elaboration may well play a role in most cases. If one is learning about Type 1 Diabetes so as to avoid negative symptoms, one will likely focus on insulin and glucose if one is presented with extensive evidence that maintaining stable glucose levels through insulin injections leads to better long term outcomes. That is, the parts of the explanation with considerable elaboration *relative to those goals* may be judged to be particularly important.

Another common goal for explanation is to understand why an event happened. For example, consider an explanation for why World War I occurred (e.g., due to mutual defense alliances, imperialism, nationalism, and the assassination of Franz Ferdinand). Still, the findings from the current experiments would likely apply. For example, if nationalism was extensively elaborated upon, one might view it as more important than imperialism. Additionally, Experiment 3 suggests that elaborating with irrelevant information would not increase peoples' view of the importance of the elaborated information. For example, discussing nationalism with regards to literature would not increase the importance of nationalism in regards to understanding the causes of World War I. Most importantly, in order for elaboration on nationalism to increase the perceived importance of nationalism, the elaboration would actually have to facilitate the reasoner's understanding of nationalism. Merely using political jargon about nationalism would not be sufficient. In sum, even though there are many different types of explanations with different goals, the findings of the current study may still be relevant.

6. Summary

Our goal was to examine how people identify important parts of explanations when building an explanatory understanding by merging diverse and fragmented knowledge into a coherent unit. We found that people identify which components of an explanation elaborate on which others and use these structural relationships as well as the insight provided by elaborations to infer importance. These processes may be essential and continuous in everyday cognition and may play a critical role in helping us prune down an overwhelming thicket of information into a more digestible form.

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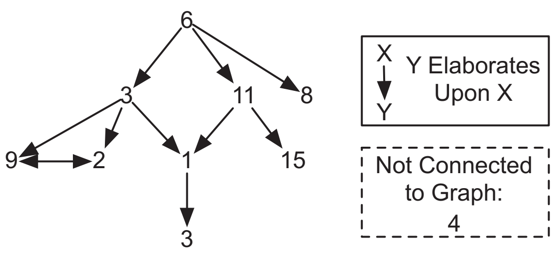
Appendix A. Instructions for Experiment 1

This section explains how to draw an elaboration graph. In general, some cards are elaborated by many other cards. Cards with lots of elaboration go at the top. The cards that elaborate upon them go underneath them with arrows pointing downwards to the cards that elaborate upon the cards above. Cards that are elaborated less, or not at all, get placed near the bottom.

For example, please look at the graph below:

- Card 6 is elaborated by all the cards below it.
- Cards 3, 11, and 8 *directly* elaborate on Card 6.
- Cards 9, 2, and 1 *directly* elaborate on Card 3. Cards 9, 2, and 1 also *indirectly* elaborate on Card 6.
- Cards 9 and 2 *both elaborate on each other*.
- Cards 3, 15, and 8 *are not elaborated* by any other cards.
- Card 1 elaborates on *both* Cards 3 and 11.
- Card 4 does not elaborate on any of the other cards and none of the other cards elaborate upon Card 4. Card 4 is *not connected* to the elaboration graph.

Example Elaboration Graph:



To make this process as easy as possible, you should first arrange the cards on the desk keeping in mind which cards elaborate upon others. Once you have arranged the cards, simply copy down the number of each card onto the corresponding piece of paper and fill in the arrows. Please make sure to include each card, either connected to the graph or not, and draw all arrows.

Appendix B. Supplementary material

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.cognition.2011.08.009.

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