Explanation Fiends and Foes: How Mechanistic Detail Determines Understanding and Preference

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ABSTRACT

We demonstrate that people differ in their threshold for satisfactory causal understanding and therefore in the type of explanation that will engender understanding and maximize the appeal of a novel product. Explanation foes dislike detailed explanations because the detail shatters their sense of understanding by revealing its coarseness. In contrast, explanation fiends are dissatisfied with surface understanding and resonate to detailed explanations. Consumer attitude toward explanation is predicted by performance on the Cognitive Reflection Test. For consumers low in cognitive reflection, understanding and preference are highest for shallow explanations and decline with increasing detail, while those high in cognitive reflection show the opposite pattern. Cognitive reflection also predicts susceptibility to the illusion of explanatory depth, overconfidence in judged understanding of how things work. Attempting to explain therefore decreases explanation foes’ willingness to pay because it shatters the illusion, but explaining has the opposite effect on explanation fiends. (148 words)
Causal processes, causal interactions, and causal laws provide the mechanisms by which the world works; to understand why certain things happen we need to see how they are produced by these mechanisms.

Wesley Salmon, 1984

One of the key sources of knowledge that all people draw on to predict the behavior of a physical system is an understanding of how the system works (Norman 1983). Mechanistic explanation can therefore be a powerful marketing tool when deployed effectively since it can engender a sense of understanding and increase trial. This is especially true for a novel product, a case where consumers often doubt that the product will deliver promised benefits. Consider the ‘Magic Eraser,’ a cleaning product made from melamine foam that does not possess the normal indicators of cleaning effectiveness (e.g. no chemicals, no foaming, no odor). In fact, the name of the product (‘magic’) implies that there is no mechanism. The tension this creates is that most consumers do not believe in magic and might therefore doubt the product will be an effective cleaner. This may be one reason that the product concept met with consumer pushback in early testing (Stark 2004). We suggest that this is a case where consumer understanding and adoption can be facilitated through explanation of the mechanism. Indeed, when the positioning was altered to focus on the ‘erasing’ mechanism (i.e. removal of stains via abrasion as opposed to chemical reactions) consumer response to the product improved markedly.

A challenge for designing compelling explanations is achieving the right balance between informativeness and understandability. Consumers may tune out an explanation if it is too detailed or technical (or even be intimidated by it; Mukherjee and Hoyer 2001). Conversely, consumers might not be convinced by an explanation that is too sparse or
shallow. The question we address in this paper is how the level of mechanistic detail in an explanation influences the consumer’s sense of understanding and how it impacts preference.

LEVELS OF DETAIL

Our working definition of a causal mechanism is the set of variables or events that lie on a spatio-temporally contiguous path from cause to effect (Dowe 2000; Walsh & Sloman 2011). On this definition, many products (and artifacts more generally) can be thought of as sets of mechanisms leading to one or more benefits. To take one example, a ballpoint pen has inner workings that convey ink from a reservoir to the tip and then deposit it on paper. As Cook and Campbell (1979) point out, causal mechanisms have a recursive structure; a mechanism can always be described at a more detailed level of “micro-mediation.” For instance an explanation about the flow of ink could be couched at a very detailed level in terms of the interactions of molecules, at a coarser level in terms of fluid dynamics or at an even coarser level still, in terms of the conditions of use (e.g. ‘ink comes out when the point is pressed to the paper’). More generally, any causal mechanism can be described at differing levels of detail, and marketers therefore have a choice about the level of detail at which to explain how their products work.

There is no simple answer to the question of the optimal level. More detailed explanations are inherently complex and complexity is sometimes a virtue, sometimes a vice. One of the tenets of research on innovation diffusion is that “the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of
adoption (Rogers 2003, p. 257).” Complexity is thought to diminish comprehension, which in turns makes adoption less likely. This is one reason that comprehension has been an important target of consumer research (Mick 1992; Moreau, Lehmann, and Markman 2001). There is currently a great deal of interest among public policy makers to create regulations that simplify the descriptions of complex products to increase uptake of beneficial options (e.g., for financial products; Barr, Mullainathan, and Shafir 2008).

Moreover, a more detailed explanation draws attention to the attributes of a product at the expense of benefits, whereas a coarse explanation draws more attention to the benefits. Marketers and advertisers are usually advised to focus messaging on benefits rather than features (Anderson, Narus, and van Rossum 2006).

In contrast, a substantial literature demonstrates that too little detail can be detrimental. People downgrade products when they notice that information is missing suggesting that an explanation can be too sparse if it draws attention to aspects of the product’s mechanisms that are conspicuously absent (Jaccard and Wood 1988; Simmons and Lynch 1991). Likewise, variables like expertise and motivation moderate the relative effectiveness of attribute-based versus benefit-based advertisements suggesting that focusing on benefits at the expense of explanations is not always the most effective approach (Maheswaran and Sternthal 1990).

**EXPLANATORY DEPTH**

Our inquiry is inspired by an intriguing set of studies conducted by Rozenblit and Keil (2002; Keil 2003; also see Alter, Oppenheimer, and Zemla 2010) showing that
people experience an “illusion of explanatory depth” when thinking about everyday objects like ballpoint pens and toilets. People think they understand them to a much greater level of detail and sophistication than they actually do. For instance, before deliberating many people rate their understanding of the inner workings of a toilet with a level of precision equivalent to an annotated diagram in a plumbing manual. If they are subsequently asked to describe in detail how a toilet works and then re-rate their understanding, judged understanding plummets. Evidently, the attempt to explain shatters the illusion by making the complexity of the underlying mechanisms apparent and revealing the coarseness of their true understanding.

A critical lesson from this work is that true understanding of a causal mechanism and a sense that one understands it are often dissociated, a theme that is analogous to investigations in several areas of consumer research documenting dissociations between objective and subjective knowledge (Alba and Hutchinson 2000; Brucks 1985; Carlson et al. 2009; Moorman et al. 2004). This insight suggests that the sense of understanding will not always increase in the face of a more complete explanation. In the same way that attempting to explain can reveal the coarseness of one’s true understanding, adding details to an explanation might reveal that a seemingly simple object embodies one or more complex mechanisms governed by physical, chemical, or biological laws. Given a description with a shallow level of detail, a consumer might experience a sense that he or she understands quite deeply. Additional detail might shatter the illusion of explanatory depth, even if the added detail makes an explanation ‘objectively better’ in the sense of capturing everything the shallower explanation does and more. This predicted effect is reminiscent of “comparative ignorance” effects demonstrated by Fox and Weber (2002;
Fox and Tversky 1995). Confidence in betting on an uncertain prospect depends on the extent to which one feels knowledgeable about the gamble. Adding objectively useful details to a gambling scenario can actually lower confidence by making the complexity of the scenario more transparent thus making the decision-maker feel ignorant. Because comprehension usually increases adoption we also predict that the decrement in understanding from too much detail will be detrimental to preference.

H1: Consumer perceived understanding is non-monotonic in explanatory detail.

H2: Preference correlates positively with judged understanding. The level of explanatory detail that maximizes understanding will also maximize preference.

**COGNITIVE REFLECTION**

Another factor that may influence how an individual reacts to varying levels of explanatory detail is cognitive style. Stanovich (2011) makes a compelling case that people differ substantially in their degree of reflection, how much they deliberate about the outputs of their intuitive processes before they offer a response in a cognitive task. The data he reviews show that the tendency to reflect is not the same as executive processing power, working memory capacity, or what an intelligence test measures. Indeed, Stanovich claims that reflection is better thought of as a measure of rationality than a measure of intelligence, a hypothesis also offered by Frederick (2005).

As a measure of reflectiveness, we will rely on the Cognitive Reflection Test (CRT; Frederick 2005)). The CRT is a three-question test in which each question has an intuitive answer that is incorrect and a less obvious correct answer that takes some
deliberative thought to appreciate (see Appendix). The deliberative answer is obtainable however, and most participants would be able to answer correctly if they were not misled by the incorrect intuitive answer. Nonetheless a large proportion of respondents do poorly. Frederick argues that this is because they never look past their initial response. He notes that participants often write down the intuitive answer, then later erase or cross it out as they realize they are mistaken. Moreover, participants who are given analogous problems that do not offer an intuitive answer are more likely to answer correctly.

Performance on the CRT predicts reduced susceptibility to the conjunction fallacy, base rate neglect, and conservatism in updating responses (Oechssler, Roider, and Schmitz 2008; see also Toplak, West, and Stanovich 2011) and predicts preference for products depending on whether they have an articulable rule (Sloman et al. 2011). The preponderance of evidence suggests that the CRT is measuring the tendency to reflect, to deliberate about information rather than emitting a readily available intuitive response. The fact that CRT is only weakly related to measures of intelligence and working memory suggest that it is not merely a measure of executive processing capacity or any sort of mathematical ability. What is unknown is what aspect of reflection it is picking up on. It could be measuring impulsivity to report the first response that comes to mind, willingness or ability to deliberate, metacognition about how much one knows or does not know, or some combination of these tendencies and capacities.

We expect that cognitive reflection will moderate people's sense of their own understanding and thus how they respond to detail in explanations. Previous studies have found that those more likely to engage in deliberative processing are less likely to be persuaded by peripheral attributes (Haugtvedt, Petty and Caccioppo 1992) and less likely
to use metacognitive difficulty as a heuristic for judging a product (Cho and Shwarz 2006). Further, experts and those with high motivation to engage in detailed processing are relatively more responsive to attribute-based than benefit-based advertisements, suggesting that deliberative processing is related to wanting to know how something works, not just that it will deliver a benefit (Maheswaran and Sternthal 1990). Thus we expected more reflective participants to be less responsive to coarse explanations, and more willing to engage in the deeper thought required to integrate mechanistic details into their concept of the product. We also expected them to be less likely to misjudge their own understanding (c.f. Kruger and Dunning 1999) and therefore not as prone to the illusion of explanatory depth; they should have a better sense whether their understanding reflects the truth.

H3: The optimal level of detail will interact with cognitive style such that those low on cognitive reflection will be relatively more responsive to coarse explanations than those high on cognitive reflection.

H4: Those low in cognitive reflection will be more susceptible to the illusion of explanatory depth than those high in cognitive reflection.

CURRENT EXPERIMENTS

In Experiment 1 we explored how increasing mechanistic detail affects understanding and if the effect is moderated by cognitive style. In Experiment 2 we embedded the explanations in a preference paradigm to test how varying the level of detail influences preference. In Experiment 3 we assessed whether the results of
Experiment 1 are specific to detail about the causal mechanism or whether they arise even with non-causal details. A secondary objective of Experiment 3 was to explore whether scores on the NFC scale predict how people react to detail. Finally, in Experiment 4 we extended Rozenblit and Keil’s (2002) explanation-generation method to provide direct evidence about the relation between the illusion of explanatory depth and cognitive reflection for novel products. Participants were asked to judge their understanding of several products, attempt to explain how those objects work and then re-rate their understanding and willingness to pay.

EXPERIMENT 1: UNDERSTANDING

In Experiment 1 we evaluated how judged understanding varies with mechanistic detail and cognitive reflection. Participants were introduced to four products, each with a novel attribute purported to be responsible for a benefit. We created explanations at four levels of detail describing the same mechanism by which the attribute leads to the benefit (see Table 1). The explanations were constructed from information found on Wikipedia and other Internet resources so that they were plausible and consistent with scientific laws. Participants read all of the explanations and rated how much understanding each one provided. A separate group of participants rated how detailed each explanation was as a manipulation check. After the ratings participants completed the CRT.

Methods
One hundred and sixty-seven residents of the United States (58% female, mean age = 36) were recruited using Amazon Mechanical Turk (AMT) and participated online for a small payment. They were assigned at random to either the ‘detail rating’ or the ‘understanding’ condition. After completing demographic questions, participants read the following instructions (Italicized sentences differed between conditions. Instructions for the detail-rating condition are in parentheses):

“In the following page you will read sets of explanations about how some items work. Your job is to rate the explanations in terms of how much understanding they provide for you (detail they provide). For each item, first read all four explanations, then rate each of the explanations. Then, move on to the next item. Please rate each explanation on a scale of 1-7, with 1 indicating ‘very little understanding’ (‘not at all detailed’) and 7 indicating ‘complete understanding’ (‘very detailed’).”

Each participant then saw explanations at all four levels of detail for each of the four products (16 explanations in total). The order of products was the same for each participant but the order of explanations within each product was randomized. Above each set of explanations were further instructions that introduced the novel attribute. The explanations and novel attributes for each of the four products are shown in Table 1. After providing ratings for each of the explanations participants proceeded to another page where they completed the CRT.

Results
**CRT Results.** The distribution of CRT scores was as follows: 42%, 23%, 25% and 10% got 0, 1, 2 and 3 questions correct, respectively. The 3-item scale had good internal consistency, Cronbach’s $\alpha = 0.8$ and score distributions did not differ across conditions, $p > 0.1$.

**Detail Rating Results.** The detail rating data were analyzed with a GLM including level of detail as a repeated-measures factor and CRT score as a covariate. As intended, all CRT groups saw the explanations as increasing in detail as we added details of the mechanism. This was reflected by a highly significant main effect of detail, $F(3, 135) = 49.6$, $p < .001$. Unexpectedly there was a small but significant interaction between CRT score and level of mechanistic detail, $F(3, 135) = 2.5$, $p < .05$; low CRT participants saw the no mechanism explanations as relatively more detailed but the detailed condition as relatively less detailed. Nonetheless both groups showed the same ascending pattern and there was no main effect of CRT score, $F(1, 45) = 1.2$, $ns$.

**Understanding Results.** The results for the understanding condition showed a substantially different pattern depicted in Figure 1. The understanding data were analyzed with a GLM including level of detail as a repeated-measures factor and CRT score as a covariate. For those scoring low on the CRT, understanding peaked at the shallow level of detail and decreased as detail increased. The pattern was reversed among those scoring high on the CRT, where understanding increased with detail. These differences are reflected by a highly significant interaction between CRT score and level of detail, $F(3, 354) = 7.4$, $p < .001$. As expected there was also a highly significant main effect of level of detail, $F(3, 354) = 26.5$, $p < .001$, but no main effect of CRT score, $F(1, 118) < 1$, $ns$. 
To further interpret the interaction between CRT score and level of detail we performed a regression on the difference between the detailed and shallow levels of explanation using CRT score as the independent variable, and then performed spotlight analyses (Irwin and McClelland 2001) at the different levels of CRT score to assess the effect of ascending detail on understanding. (For an introduction to this analysis, see Spiller et al. 2012.) The spotlight analysis at the low end (zero-scorers) revealed a significant and negative intercept, $B = -0.58$, $t = -2.5$, $p = .01$. This verifies that for low CRT participants understanding decreased as level of detail increased. Conversely the spotlight analysis at the high end of CRT scores (three-scorers) showed the opposite pattern, a significant positive intercept, $B = 1.0$, $t = 2.9$, $p < .01$, verifying that high CRT participants saw the explanations as providing more understanding as detail increased. Spotlight analyses at the other levels of CRT score revealed intermediate effects. Among one-scorers the intercept was negative but non-significant, $B = -0.05$, $t < 1$, ns. Among two-scorers it was positive and just significant, $B = 0.48$, $t = 2.1$, $p < .05$.

**Education Level.** We considered the possibility that differences in understanding and CRT performance were due to differing education levels. If this were true we would expect an interaction between education level and level of detail for understanding judgments. Participants were categorized into four education levels: High school diploma or less (16% of sample; only 2 participants had less than a high school diploma), some college (33% of sample), college degree (37% of sample) and post-graduate (14% of
A GLM with education level and level of explanatory detail as factors yielded no interaction, $F(3, 354) < 1, \text{ns}$.

Discussion

The effect of mechanistic detail on judged understanding was moderated by cognitive reflection. Both groups showed the same ascending pattern in judging how detailed the explanations were but they differed in how much understanding they derived from different levels of detail. For those scoring 0 or 1 on the CRT (62% of the sample) understanding peaked at the shallow level of detail and declined with additional detail. For those scoring 2 or 3 more mechanistic details led to greater understanding. Education level did not interact with level of detail in determining understanding.

There was also some evidence that low cognitive reflection participants were relatively more satisfied with the no mechanism condition. However the interaction remains significant even if the no mechanism condition is removed from the GLM, suggesting that high and low cognitive reflection participants also differed at the other levels of explanatory detail. More evidence for this claim comes from the spotlight analyses, which show that understanding decreased with detail for low cognitive reflection participants while the opposite was true for those high in cognitive reflection.

Two follow-up studies were conducted to address potential alternatives explanations. For the sake of brevity we merely mention the main results but do not report the full methods and results. First, we considered that the interaction between CRT and understanding might be due to the presence of more difficult-to-understand words in
the detailed explanations. In all CRT groups the number of words that participants did not know the meaning of was low (about 0.3 words per explanation in the detailed condition). There was an effect for the number of unknown words to increase as detail was added but there was no main effect of CRT performance or an interaction between CRT performance and level of detail. These results suggest that differences in understanding are not due simply to high and low CRT participants differentially failing to understand particular words. In a second study we assessed beliefs about source expertise (Cooper, Bennett, and Sukel 1996; Karmarkar and Tormala 2010; Petty, Cacioppo and Goldman 1981; Ratneshwar and Chaiken 1991) by asking participants to rate how knowledgeable they considered the explanation-writer. All CRT groups judged source expertise similarly, with judgments increasing as detail increased.

**EXPERIMENT 2: PREFERENCE**

In Experiment 2, we explored whether level of mechanistic detail affects preference and if so in what direction. We expected preference to differ based on cognitive reflection. Based on our review of the literature there are two reasons for this prediction: First, product adoption typically covaries with comprehension (Rogers 2003). Second, people downgrade products when they do not feel they understand them, i.e. when information seems to be missing (Simmons and Lynch 1991). We predicted that a sense of understanding would lead participants to believe in the benefit, and therefore that low cognitive reflection participants would prefer products described at a shallow level while the opposite would be true for those high in cognitive reflection.
To test this prediction we embedded the novel attributes and explanations in a preference task where participants were asked to choose between a premium product with the novel attribute and a generic product that was cheaper but did not have the attribute. The level of detail provided in explaining how the attribute leads to the benefit was manipulated between participants. As before, the CRT was administered after the judgments.

Methods

Two hundred and one residents of the United States (58% female, mean age = 40) were recruited using AMT and participated online for a small payment. They were assigned at random to one of four conditions: “no mechanism”, “shallow”, “intermediate” or “detailed.” After answering demographic questions, all participants were instructed that they would be asked to make preference judgments between generic and premium products. After reading the instructions they proceeded to the preference task. Four of the preference judgments used the categories and novel attributes from Experiment 1 (the test items). There were four additional preference judgments with distracter items, interspersed with the test items.

Each preference judgment was presented on a separate screen with the presentation order randomized. The judgment screen was comprised of two product descriptions separated by a line. The premium product with the novel attribute was always on the left and the generic product on the right. Each product description consisted of a title (e.g. “premium bandages” vs. “generic bandages”) and a set of bullets.
describing product features. For the test items, the premium products had four bulleted attributes. The first bullet introduced the novel attribute and also had a sub-bullet with an explanation at the relevant level of detail, identical to those used in Experiment 1. The second and third bullets were distracter attributes that also appeared in the generic product. The fourth attribute was the price, which was always greater for the premium product. The generic product had three attributes, two identical to the premium product and a lower price. Below the products was a 7-point response scale labeled from “Strongly Prefer Premium Product” to “Strongly Prefer Generic Product.” (Product names were filled in accordingly). An example of one of the judgment screens from the shallow condition is shown in Figure 3. Distracter items were identical except they contained no explanations. After completing the preference judgments participants completed the CRT.

Results

**CRT Results.** The distribution of CRT scores was similar to Experiment 1: 39%, 23%, 19% and 19% got 0, 1 2 and 3 questions correct, respectively. The 3-item scale had adequate internal consistency, Cronbach’s α = 0.69, and as before, score distributions did not differ across conditions, p > 0.1.

**Preference Results.** Results by condition and CRT score are shown in Figure 3, where higher judgments indicate a preference for the premium product. We analyzed the
data with a GLM with level of detail as a between participants factor and CRT score as a covariate. The critical prediction was that there would be an interaction between CRT performance and level of detail, which indeed there was, $F(3, 193) = 4.2, p < .01$. There was also a main effect of level of detail, $F(3, 193) = 3.3, p < .05$, but no main effect of CRT score, $F(1, 193) < 1, ns$. The interaction reflects a similar pattern to Experiment 1; for those scoring low on the CRT, preference peaked at a shallow level of mechanistic detail and decreased with additional detail whereas for High CRT participants, preference increased with additional detail.

To support this interpretation we performed spotlight analyses at the low and high end of the CRT scores. We first looked at the contrast between shallow and detailed explanations. Among the zero-scorers the analysis revealed a significant negative intercept, $B = -.92, t = -2.6, p < .01$. This verifies that for low CRT participants, preference decreased as level of detail increased from shallow to detailed. Conversely the spotlight analysis at the high end of CRT scores showed the opposite pattern, a positive intercept, though the effect was short of significance, $B = .65, t = 1.5, p = .13$. Spotlight analyses at the other levels of CRT revealed intermediate effects. Among one-scorers the intercept was negative and marginally significant, $B = -.40, t = -1.6, p = .10$, and among two-scorers the intercept was positive but non-significant, $B = .12, t < 1, ns$.

We also wanted to know whether any explanation led to higher preference compared to no explanation. For high CRT participants the detailed level was preferred to no mechanism, $B = 1.1, t = 2.4, p < .05$, as was the intermediate level, $B = 1.1, t = 2.4, p < .05$, but the shallow level was no different from no mechanism $B = .47, t = 1.1, ns$. Conversely, for low CRT participants the shallow level of detail was the only level that
was preferred to the no mechanism condition, though the contrast was short of significance, $B = -.61$, $t = 1.5$, $p = .14$. The intermediate and detailed levels were both rated lower than no mechanism, though neither comparison was significant, both $p$-values $> .1$.

Discussion

The level of mechanistic detail provided in an explanation influenced preference in a way comparable to how it affected understanding. The level of detail interacted with CRT score such that low CRT participants showed a relative preference for the premium products when they were explained at the shallow level but not at the detailed or intermediate level. High CRT participants showed the opposite pattern, a relative preference for the premium products when they were described at the detailed level, but not at the shallow level. Taken together with Experiment 1, these results imply that participants preferred products they felt they understood. On this account, low cognitive reflection participants felt a sense of understanding from the shallow explanation, but that sense of understanding degraded when the explanation was too detailed. High cognitive reflection participants were willing to put in the extra work to evaluate the detailed explanation, leading them to feel more confident that the product would deliver its benefit when the explanation was detailed.
EXPERIMENT 3: NON-CAUSAL DETAIL, NFC AND UNDERSTANDING

The primary purpose of Experiment 3 was to assess whether our results are contingent on the details being explanatory of the causal mechanism in particular or whether high and low CRT participants react differently to the complexity of details in general. To address this question we created descriptions for each novel product that differed in the level of non-causal detail. To manipulate non-causal detail we changed the amount of detail about what the object is made of. We also included a condition that replicated Experiment 1 so that we could compare causal to non-causal detail directly. The secondary objective was to evaluate whether the effects on understanding predicted by cognitive reflection are also predicted by responses to the NFC scale. To that end we administered the NFC scale after the CRT.

Methods

223 residents of the United States (60% female, mean age = 36.9) were recruited using AMT and participated online for a small payment. The methods were identical to the understanding condition of Experiment 1 except that half the participants received descriptions with non-causal details and the other half received the same mechanistic explanations from Experiment 1. The non-causal details for each of the products are shown in Table 2. Also, after completing the CRT participants were presented with the NFC scale (Cacioppo, Petty, and Kao 1984; see Appendix) with the following instructions: “Please read the following statements and decide to what extent the
Mechanistic Detail

statements are characteristic of you.” They were then shown the 18 statements (e.g. “Thinking is not my idea of fun.”) and asked to respond on a 5-point scale that ranged from “extremely uncharacteristic of me” to “extremely characteristic of me.” Nine of the 18 statements were reverse-coded.

Results

Mean understanding judgments by CRT score are presented in Figure 4a and 4b (the no mechanism condition is not shown in the chart but is included in the analysis). Overall, the results of Experiment 1 were largely replicated in the causal condition but not the non-causal condition. This was reflected by a three-way interaction, $F(3, 657) = 3.1, p < .01$, indicating that the two-way interaction between CRT score and level of detail was moderated by whether the detail was causal or not. The pattern of results in the causal condition was similar to Experiment 1. For those scoring low on the CRT, understanding peaked at the shallow level of detail and decreased as detail increased. The pattern was reversed among those scoring high on the CRT, where understanding increased with detail. As before these differences are reflected by a highly significant interaction between CRT score and level of detail, $F(3, 399) = 12.8, p < .001$, and the same pattern of results for spotlight tests.

Results in the non-causal condition showed a markedly different pattern, which is depicted in Figure 4b. There was no interaction between CRT score and level of detail, $F(3, 258) < 1, ns$. There was however a main effect of detail, $F(3, 258) = 5.8, p < .01$, and
a main effect of CRT score, \((1, 86) = 5.4, p < .05\). All CRT groups saw the non-causal
details as providing a little more understanding as detail increased, and the low CRT
participants generally gave higher judgments than the high CRT participants across all
levels of detail. The spotlight analysis confirmed that among both the low and high CRT
groups the linear trend of increasing detail was positive: zero-scorers; \(B = .82, t = 2.8, p <
.01\); three-scorers; \(B = .83, t = 2.1, p < .05\).

NFC scores yielded a different pattern shown in Figures 4c and 4d. High and low
NFC groups were chosen to equate the number of participants in the high and low NFC
group to the number of participants in the high and low CRT groups, amounting to cut
points at a mean NFC score of 3.3 at the low end and 4.2 at the high end. Unlike for CRT
scores there was no significant three-way interaction, \(F (3, 657) < 1, ns\), suggesting that
the influence of NFC score on understanding did not depend on whether the details were
causal. For both causal and non-causal details the high NFC group preferred the detailed
to the shallow explanations, both \(p\)-values < .05. In both cases there was a trend of the
low NFC group to prefer the shallow explanations to the detailed ones, but neither of
these comparisons reached significance, both \(p\)-values > .1.

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Discussion

Experiment 3 replicates the interaction between cognitive reflection and level of
detail for mechanistic explanations but not for non-causal details. At all levels of CRT
score, the non-causal details provided a little more understanding as detail increased.
Critically, preference for level of non-causal detail did not depend on CRT score; for all groups understanding increased a little as detail increased. This squares with Rozenblit and Keil’s (2002) findings. They demonstrated that the illusion of explanatory depth is specific to knowledge about how things work; people are not as overconfident about their knowledge of facts or procedures.

NFC had a different profile. In the non-causal condition, unlike High CRT participants, High NFC participants derived more understanding from the detailed descriptions than the shallow ones, whereas low NFC participants showed no differences across the levels of detail. These results suggest that CRT captures how people will react specifically to mechanistic details and NFC may be a better measure of preference for detail in general. Average scores on the two scales were weakly but significantly correlated, $r = .25$, $p < .001$. Because NFC, unlike CRT, is a self-report measure, differences could reflect that NFC makes a greater self-presentation demand.
EXPERIMENT 4: ILLUSION OF EXPLANATORY DEPTH

The objective of Experiment 4 was to directly test the relation between cognitive reflection and the illusion of explanatory depth proposed in the introduction. We hypothesized that low CRT participants feel a sense of understanding with sparse details and react negatively to additional detail because it makes them realize how little they know. Conversely, those high on cognitive reflection are less satisfied with their understanding with only shallow detail, and use additional detail to try to gain a deeper understanding of the phenomenon. This suggests that those low on cognitive reflection should experience a more robust illusion of explanatory depth after assessing a product with a shallow explanation. Low cognitive reflection participants should rate their initial understanding highly because they feel a sense of understanding despite only having a shallow explanation. A subsequent attempt to explain will make them realize how little they know. Conversely those high on cognitive reflection should show an attenuated or reversed effect. They will be dissatisfied with their understanding initially but when they subsequently try to explain they may do so successfully leading to greater understanding, or unsuccessfully leading to no change or at least a smaller negative change than those low on cognitive reflection.

A second question we address in this study is whether changes in understanding induced by explanation generation will influence judgments of willingness to pay. Demonstrating the influence of understanding on preference is critical to establishing the marketing relevance of our result. Taken together, studies 1 and 2 provide some evidence that preference depends on understanding, but here we test the relation more directly.
Our method was adapted from Rozenblit and Keil (2002). We created stimuli based on real novel products and explanations drawn from advertisements or marketing materials. Participants were first trained on a rating scale to judge understanding and were then asked to rate their understanding of the products. After this they were asked to generate mechanistic explanations for a subset of the products and then re-rate understanding and willingness to pay. Finally, they completed the CRT. A separate group judged the products on willingness to pay without generating explanations to facilitate a between-participants comparison on this measure.

Methods

Participants and Design. 132 residents of the United States (44% female, mean age = 36.4) were recruited using AMT and participated online for a small payment. Twenty were excluded from the analysis because they failed an attention check, and four were excluded as outliers because they gave willingness to pay judgments that were more than three standard deviations outside the mean or gave zero for all willingness to pay judgments.

In keeping with Rozenblit and Keil’s (2002) method, we used a within-participants design for judged understanding. Participants in the “explanation generation” condition first judged their understanding of novel products, were then asked to generate a mechanistic explanation for a subset of the products, and then re-rated understanding. We also assessed a dependent variable that is more directly relevant to consumer decisions, willingness to pay (WTP). Since downstream effects of the illusion of explanatory depth
on behavioral measures like this have not been tested before, we chose to assess changes in WTP using a between-participants design. Therefore those in the explanation generation condition only judged WTP once, after explanation. Participants in a second “pre-rating” condition judged WTP for the same products but did not engage in the explanation generation portion of the experiment.

**Stimuli and Procedure.** Participants in the pre-rating condition were shown four novel products and asked to judge WTP in dollars for each item. They then completed the CRT. The stimuli consisted of an image, a description of a benefit, and a shallow explanation. Where possible, the benefit and explanation were taken verbatim from real advertisements for the product. An example stimulus is shown in Figure 5. This product, the Aqua Globe, is a self-watering system for plants. The other stimuli were the Maxi Electronic Lighter manufactured by Bic, SmarTouch gloves, gloves that can be worn while manipulating touch screen devices, and the Tibet Almond Stick, a product for repairing scratches in wood flooring and furniture.

Participants in the explanation generation condition first received training on how to rate level of understanding. The training materials were adapted from Rozenblit and Keil (2002) and described different levels of understanding of a crossbow using annotated diagrams and verbal descriptions. After learning about the rating scale participants were asked to rate their level of understanding of how the four products work.

After completing these ratings participants proceeded to another screen where they were shown the Aqua Globe stimulus and the following instructions (also adapted from Rozenblit and Keil):
“Now, we'd like to probe your knowledge in a little more detail about two of the items. This is the first one. Please describe all the details you know about how this product works, that is, how aqua globes deliver the appropriate amount of water as the soil becomes dry. Your explanation should go from the first step to the last, and provide the causal connection between the steps. That is, your explanation should state precisely how each step causes the next step in one continuous chain from start to finish. In other words, try to tell as complete a story as you can, with no gaps. Please take your time, as we expect your best explanation.”

After writing their explanation, participants were asked to re-rate their understanding and to judge WTP. After this they repeated the process for the Tibet Almond Stick. Finally, they completed the CRT.

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Insert Figure 5 about here

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Results

Effect of Explanation Generation on Understanding. Our critical prediction was that participants that scored low on the CRT would be more prone to the illusion of explanatory depth than participants that scored high on the CRT. Based on the results of Experiment 1 we expected them to have a low threshold for understanding and thus judge understanding as high when given the shallow explanations. Subsequently the attempt to explain should shatter this sense of understanding leading to lower judgments. Conversely High CRT participants should have a higher threshold, judge understanding lower initially, and thus be less susceptible to a shattering of the illusion of depth.
We tested these predictions by analyzing the average understanding judgments for the two test items with a GLM with timing of the judgment (pre-explanation vs. post-explanation) as a within-participants factor and CRT as a covariate. To reduce error variance we also included average understanding judgments for the two filler items as a covariate. The understanding results are shown in Figure 6a.

First, replicating Rozenblit and Keil (2002) there was an overall main effect of whether the judgment was made before or after explanation, $F(1, 53) = 6.6, p = .01$; understanding decreased after explanation, demonstrating the illusion of explanatory depth effect in the domain of novel products. Critically, our key prediction was also confirmed: There was a significant interaction between CRT score and whether the judgment was made before or after explanation, $F(1, 53) = 5.7, p < .05$. This interaction reflects the predicted pattern; low CRT participants began with a high feeling of understanding, which was subsequently shattered when they attempted to explain. High CRT participants were more conservative initially and their judgments did not change after explanation. Spotlight analyses at the high and low ends of the CRT scale confirmed this interpretation. Low CRT participants showed a robust illusion of explanatory depth effect, judging understanding lower after explanation than before, $B = .72, t = 3.6, p < .001$ while High CRT participants showed no difference between conditions, $B = -.001, t < 1, ns$. 

______________________________

Insert Figure 6 about here
Effect of Explanation on Willingness to Pay. We now assess whether the illusion of depth effect on understanding influenced WTP. First, within the explanation generation condition, we assessed the correlation between WTP and the magnitude of the illusion of depth effect over participant-item pairs. This correlation was negative and significant, $r = -.21, p < .05$. This demonstrates that as the decrement in understanding after explanation increased, WTP went down.

We also assessed the effect of explanation on WTP by comparing WTP judgments in the pre-rating condition to the post-explanation ratings in the explanation generation condition. Those results by CRT group are shown in Figure 6b. We subjected the average WTP judgments to a GLM with condition (pre-rating vs. post explanation rating) as a between-participants factor and CRT score as a covariate. Confirming that high and low CRT WTP judgments were differentially influenced by explanation generation, there was a significant interaction between condition and CRT score, $F (1, 104) = 4.5, p < .05$. We further analyzed this interaction with spotlight analyses at the high and low end of CRT scores. For those scoring low on the CRT, WTP was marginally higher in pre-rating than after explanation, $B = -2.0, t = -1.8, p = .07$. The pattern was the opposite for the high CRT group, but just short of significance, $B = 2.0, t = 1.6, p = .11$.

Discussion

The results of Experiment 4 show that the illusion of explanatory depth is moderated by cognitive reflection. Those low on cognitive reflection experienced a
robust illusion, beginning with a high sense of understanding, which was subsequently shattered when they attempted to explain. Those high on cognitive reflection were less satisfied with their initial understanding and showed no decrement in understanding after explaining.

The experiment also demonstrates the influence of the shattering of the illusion of depth on willingness to pay. First, WTP correlated with the magnitude of the change in understanding after explanation. Second, there was an interaction between CRT score and whether the WTP judgment was made before or after attempting to explain. Low CRT participants were willing to pay more before explanation but less afterwards, presumably because their sense of understanding was reduced. In contrast, high CRT participants increased their WTP after explanation. Perhaps the process of explanation increased familiarity and thus desire for the products.

The results add to those from Experiments 1-3 in showing that explanation fiends and foes differ in their threshold for satisfactory causal understanding. Explanation foes are satisfied by shallow explanations, and react negatively to additional detail and to attempts to explain. In contrast, explanation fiends are less easily satisfied. They react positively to additional details and attempts to explain, leading to greater understanding, preference and willingness to pay.

**GENERAL DISCUSSION**

Four experiments revealed how explanatory detail influences understanding and preference. Experiment 1 showed that the effect of mechanistic detail on understanding is
moderated by cognitive reflection; Participants that scored low on cognitive reflection derived greater understanding from shallow explanations. Participants who scored highly on the CRT derived greater understanding when additional mechanistic details were included in the explanation. In Experiment 2 these effects were shown to transfer to a preference task, suggesting that different levels of mechanistic detail are optimal for consumers that differ in cognitive reflection. All participants appreciated some information about the mechanism, but too much detail was detrimental to those low in cognitive reflection. Experiment 3 showed that the interaction between CRT score and level of detail is specific to explanatory mechanistic details and does not generalize to non-causal details about what the product is made of. Another finding from Experiment 3 is that CRT appears to be a better predictor of attitudes toward explanatory detail than NFC. NFC captures a more general preference for complexity.

We hypothesized that cognitive reflection represents a threshold for what constitutes a satisfactory explanation. On this account, low cognitive reflection participants have their sense of understanding shattered by too much detail, which drives the understanding and preference results. In contrast, high cognitive reflection participants have a higher threshold and are therefore not satisfied by shallow explanations; they are willing to engage in the additional deliberation required to appreciate the details, which in turn leads them to feel more confident the product will deliver its benefit. This explanation predicts that low cognitive reflection participants should be more susceptible to the illusion of explanatory depth, which was verified in Experiment 4. Low cognitive reflection participants were overconfident in their understanding of novel products initially and their sense of understanding was shattered.
when they tried to explain. High cognitive reflection participants were more conservative about their understanding initially and their efforts to explain did not degrade their sense of understanding. These effects on understanding also influenced willingness to pay, providing direct evidence for the marketing relevance of these effects.

New Product Marketing

Introducing a new product is a challenging undertaking with a high likelihood of failure. One reason for the difficulty is that very new products can be hard to reconcile with consumers’ understanding of the category (Jhang, Grant, and Campbell 2011) and can induce ‘technophobia’ (Mukherjee and Hoyer 2001). Conversely, for new products that are not as obviously different, consumers may fail to notice that a new product is substantively different than its predecessors (Wood and Lynch 2002). Our results suggest that explaining how a product works at the right level of detail can engender a sense of understanding and inspire confidence that it will deliver a promised benefit, and thus can be helpful in establishing a new product.

The diffusion model (Rogers 2003) has provided a useful framework for making predictions about the likely success of new products (Gatignon & Robertson, 1985). Our work is consistent with the model in supporting the idea that comprehension, or at least the feeling of comprehension, is positively related to adoption. However, unlike the model, we do not assume that comprehension and complexity always oppose one another. For instance, Moreau, Lehmann and Markman (2001) have shown that experts report lower comprehension for novel products that are discontinuous in the category than do
novices and also report that those novel products provide fewer net benefits. The fact that experts report lower comprehension is somewhat counterintuitive, but it is consistent with our results. Expertise in a category may function like cognitive reflection in spurring the consumer to have a higher threshold for satisfactory understanding. Our results suggest that for explanation fiends, this lack of comprehension can be overcome by providing a detailed explanation, which allows the consumer to resolve the lack of comprehension. In other words, we are recommending *increasing* complexity to achieve comprehension, but only for explanation fiends or category experts. A detailed explanation also may help overcome the pitfalls explored by Wood and Lynch (2002). Experts and explanation fiends may be less likely to tune out information about a new product that appeals to their desire for mechanistic understanding.

Our data also speak to the relation between comprehension and complexity for explanation foes. Unlike explanation fiends whose feeling of comprehension tracks their true comprehension, explanation foes show a dissociation between the two. This explains why they rate their comprehension of discontinuous innovations higher than experts despite having less domain knowledge. Nevertheless, our results show that even for explanation foes comprehension and complexity are not perfectly anti-correlated. Instead there is a ‘sweet spot’ at which a shallow explanation provides a feeling of understanding but is not so detailed that it shatters the illusion of explanatory depth. We suggest that appealing to explanation foes does not mean eschewing explanation altogether but rather finding the sweet spot.

The explanation fiend/foe distinction may also be useful in concept development. Hoffman, Kopalle and Novak (2010) have shown that some consumers have greater
success in ideation due to an ‘emergent nature.’ They measure this individual difference variable with a self-report scale and do not report correlations to measures of cognitive style, but it is possible that the latent traits responsible for reaction to explanation and success in new concept ideation are similar.

Relations to Dual Process Theories of Persuasion

How do our findings relate to prior work on dual process models of persuasion, such as the Heuristic-Systematic Model (Chaiken 1980) and the Elaboration Likelihood Model (Petty and Cacioppo 1986)? That work also proposes that differences in cognitive style determine how people react to product descriptions. Previous research has shown that those low in NFC are less likely to process and utilize the content of an argument when forming judgments and are more likely to use peripheral attributes as a basis for judgment (Cacioppo et al. 1996). For instance a low NFC person would be more likely to be persuaded by argument number where the number of arguments does not improve the argument in a substantive way, whereas a high NFC person would be more responsive to the quality of the argument (Chaiken et al. 1985; Chaiken 1987). Those low in NFC are also more likely to use source expertise as a proxy for the quality of argument (Haukvedt et al. 1992; Kaufman, Stasson, and Hart, 1999), an effect that strengthens as the complexity of the argument increases (Cooper et al. 1996). These results differ from ours in that complexity, length and source expertise tend to be positively related to persuasion for low NFC participants. In our studies these variables are negatively related to understanding and preference for those low in cognitive reflection. The illusion of depth
explains why this is the case: Persuasion attempts that appeal to explanatory details of the causal mechanism have very specific downstream consequences because they have the potential to shatter the illusion of explanatory depth. These consequences sometimes depart from the typical effects in the dual process literature.

One kind of peripheral cue that has drawn a great deal of attention is ease of processing. Ease of processing is usually manipulated by changing contextual factors like the difficulty of reading the font. In our studies we manipulate the content of the explanations, not contextual factors. Still, one could argue that we are also manipulating ease of processing. Consistent with the fact that low CRT participants react negatively to detailed explanations, dual process research has shown that those low in NFC are more likely to use metacognitive difficulty as a proxy for judgment. However, metacognitive difficulty can be beneficial or detrimental to persuasion. In some studies processing difficulty is substituted for innovativeness and uniqueness leading to better appraisals (Cho and Schwarz 2006; Pocheptsova, Labroo, and Dhar 2010). In other studies people prefer targets that are processed more fluently (Lee and Labroo 2004, Winkielman et al. 2003). Our results have more in common with the latter studies in that explanation foes react negatively to the metacognitive difficulty associated with detailed explanations. However, the results of Experiment 3 show that this pattern holds only for explanatory details. These effects follow from the illusion of explanatory depth but cannot be predicted on the basis of ease of processing without additional assumptions.

Conclusions
One might be tempted to draw the conclusion that the attitude of high cognitive reflection participants toward explanation is in some sense better or more justified. We would caution against such a conclusion. It is useful for an auto mechanic to understand how a carburetor works, but for a layperson such an interest might lead to tinkering away hours in the garage that could be more profitably spent on some other activity. Taken to the extreme, interest in mechanistic detail can be maladaptive: Obsession with how things work is a symptom of autism (Baron-Cohen and Wheelwright 1999). The illusion of explanatory depth can be useful if it gets us to focus on the critical level at which we need to know (e.g. the conditions of use for a product), and avoid getting wrapped up in details that we can always look up on Wikipedia if we need to.

While we believe there is probably no normatively correct answer to the question of how much detail a consumer should desire in an explanation, this work does suggest prescriptions for marketers. More detail is not always better, but some information about the mechanism is warranted, at least for novel products like the ones in our experiments; mechanistic details can persuade a consumer that the product will deliver its benefit. The optimal amount of detail depends on the consumer’s cognitive style and the objective quality of the explanation that can be marshaled in favor of the product.
APPENDIX

The Cognitive Reflection Test

1. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?

Correct Answer: $0.05; Typical Incorrect Answer: $0.10

2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

Correct Answer: 5 minutes; Typical Incorrect Answer: 100 minutes

3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Correct Answer: 47 days; Typical Incorrect Answer: 24 days

The Need For Cognition Scale*

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun. (R)
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities. (R)
5. I try to anticipate and avoid situations where there is likely chance I will have to think in depth about something. (R)
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to. (R)
8. I prefer to think about small, daily projects to long-term ones. (R)
9. I like tasks that require little thought once I've learned them. (R)
10. The idea of relying on thought to make my way to the top appeals to me.
11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn't excite me very much. (R)
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort. (R)
17. It's enough for me that something gets the job done; I don't care how or why it works. (R)
18. I usually end up deliberating about issues even when they do not affect me personally.

*(R) denotes reverse coding
REFERENCES


Cacioppo, John T., Richard E. Petty, Jeffrey A. Feinstein, and W. Blair G. Jarvis (1996), "Dispositional Differences in Cognitive Motivation: The Life and Times of


and Their Relations to Ad Perceptions, Attitudes, and Memory,” *Journal of Consumer Research*, 18 (March), 411-424


<table>
<thead>
<tr>
<th>Category</th>
<th>Novel Attribute</th>
<th>No Mechanism</th>
<th>Shallow</th>
<th>Intermediate</th>
<th>Detailed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandages</td>
<td>Bandages have bubbles in the padding.</td>
<td>The bubbles help cuts heal faster.</td>
<td>The bubbles increase air circulation around the wound, thereby killing bacteria. This causes cuts to heal faster.</td>
<td>The bubbles decrease contact with the wound, allowing air to circulate. Oxygen in the air kills many bacteria causing the wound to heal faster.</td>
<td>The bubbles push the padding away from the wound allowing air to circulate. Oxygen in the air interferes with the metabolic processes of many bacteria, killing them and allowing the wound to heal faster.</td>
</tr>
<tr>
<td>Cling Wrap</td>
<td>Cling wrap is tinted white.</td>
<td>The white coloring keeps food fresh for longer.</td>
<td>The white coloring protects food from light that causes it to spoil, thereby keeping food fresh for longer.</td>
<td>The white coloring reflects light waves that would otherwise break down the amino acids that maintain the structure and freshness of the food, thereby keeping food fresh for longer.</td>
<td>Atoms in the tinting agent oscillate when hit by light waves causing them to absorb the energy and reflect it back rather than reaching food where it would break the bonds holding amino acids together, thereby keeping food fresh for longer.</td>
</tr>
<tr>
<td>Detergent</td>
<td>Detergent contains natural enzymes.</td>
<td>The enzymes make clothes cleaner.</td>
<td>The enzymes help break down stains chemically so they can be removed more easily, making clothes cleaner.</td>
<td>The enzymes act as catalysts in a chemical reaction in which stain-fighting chemicals react with common stains so they dissolve in water, thereby making clothes cleaner.</td>
<td>Enzyme molecules bond to common stain molecules changing their physical shape. This allows other chemicals to react with them and change their chemical structure so that they can dissolve in water, thereby making clothes cleaner.</td>
</tr>
<tr>
<td>Mixer</td>
<td>Mixer beaters are designed without a central post, which is present in standard beaters.</td>
<td>The post-free design reduces mixing time.</td>
<td>Without a center post to hinder mixing within the beater, ingredients are blended more easily thereby reducing mixing time.</td>
<td>Without a center post to hinder movement of the ingredients, a vortex is created within the beater that forces dry ingredients to dissolve more easily, thereby reducing mixing time.</td>
<td>Without a center post to interfere with movement, liquid molecules move uniformly within the beater creating a lot of spin. This forces dry particles into suspension in the liquid, thereby reducing mixing time.</td>
</tr>
</tbody>
</table>
Table 2: Non-Causal Details in Experiments 3

<table>
<thead>
<tr>
<th>Category</th>
<th>Novel Attribute</th>
<th>No Detail</th>
<th>Shallow</th>
<th>Intermediate</th>
<th>Detailed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandages</td>
<td>Bandages have bubbles in the padding.</td>
<td>The bubbles help cuts heal faster.</td>
<td>The bubbles are made of a soft foam. This causes cuts to heal faster.</td>
<td>The bubbles are made of a soft foam, which is composed of polyurethane. This causes cuts to heal faster.</td>
<td>The bubbles are made of chains of polyurethane molecules, which interweave with one another to form a soft foam. This causes cuts to heal faster.</td>
</tr>
<tr>
<td>Cling Wrap</td>
<td>Cling wrap is tinted white.</td>
<td>The white coloring keeps food fresh for longer.</td>
<td>The cling wrap uses a white tinting agent, thereby keeping food fresh for longer.</td>
<td>The cling wrap uses a white tinting agent, which is made mainly of titanium dioxide, thereby keeping food fresh for longer.</td>
<td>The cling wrap uses a white tinting agent which is composed of a mixture of titanium dioxide molecules and other binding agents. This keeps food fresh for longer.</td>
</tr>
<tr>
<td>Detergent</td>
<td>Detergent contains natural enzymes.</td>
<td>The enzymes, make clothes cleaner.</td>
<td>The detergent has enzymes, which are chemicals that make clothes cleaner.</td>
<td>The detergent has enzymes, which are proteins called alcalase and esperase, which make clothes cleaner.</td>
<td>The detergent has enzymes. Grains made of alcalase and esperase protein molecules are dissolved in the detergent, thereby making clothes cleaner.</td>
</tr>
<tr>
<td>Mixer</td>
<td>Mixer beaters are designed without a central post, which is present in standard beaters.</td>
<td>The post-free design reduces mixing time.</td>
<td>The post-free beater is made from a steel alloy thereby reducing mixing time.</td>
<td>The post-free beater is made from a steel alloy, which contains small amounts of chromium and aluminum, thereby reducing mixing time.</td>
<td>The post-free beater is made from a steel alloy, which is made by combining iron ore with small amounts of chromium and aluminum under very high heat. This reduces mixing time.</td>
</tr>
</tbody>
</table>
Figure 1: Understanding Ratings by Condition and CRT Score from Experiment 1.
**Figure 2: A Preference Judgment From the Shallow Explanation Condition of Experiment 2.**

**Premium Bandages**
- Bandages have bubbles in the padding.
  - The bubbles increase air circulation around the wound, thereby killing bacteria. This causes cuts to heal faster.
- Waterproof
- 25 Per Pack
- $4.00

**Generic Bandages**
- Waterproof
- 25 Per Pack
- $2.00

Which product would you be more likely to buy?
Figure 3: Preference Ratings by Condition and CRT Performance from Experiment 2.
Figure 4: Judged Understanding For High and Low CRT And NFC Groups for Causal And Non Causal Detail Conditions of Experiment 3: (a) CRT/Causal, (b) CRT/Non-Causal, (c) NFC/Causal, (d) NFC, Non-Causal.
Figure 5: One of the Stimuli From Experiment 4.

Aqua Globes

Automatically waters plants for 2 weeks.

As soil becomes dry, it releases oxygen into Aqua Globes watering bulbs, which releases the exact amount of water your plant needs.
Figure 6: Results of Experiment 4: Effect of Explanation Generation on Understanding (6a) and on Willingness to Pay (6b).

6a.

![Understanding Graph](image)

6b.

![Willingness to Pay Graph](image)