Understanding How Language, Design, and Processing Fluency Affect Cognition

by

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Dissertation submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy in the Department of
Psychology & Neuroscience in the Graduate School
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2018
ABSTRACT

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Abstract

Judgment and decision-making in a healthcare context often involve complex information and difficult tradeoffs. In order to understand key concepts and receive help with difficult decisions, patients may turn to written materials, like informed consent forms. Unfortunately, these materials can actually increase confusion. This dissertation explores the relationship between written health materials and cognitive processes, specifically comprehension, memory, judgment, and decision-making. The first goal was to investigate how language and design affect cognition for informed consent forms. We developed a Standard informed consent form and two Enhanced versions that had simplified language and modified design, and compared comprehension and memory between the three versions. As written health materials undergo changes to make their content more accessible to readers, they also become more fluent. The second goal was to explore how this fluency affects judgments and decision-making, especially for materials that have a negative valence. This question was studied in the context of two competing fluency theories, the Hedonic Fluency Model and the Fluency Amplification Model. We manipulated the fluency of various materials, including medications, diseases, and risks, and asked participants to make several judgments about the fluent and disfluent materials. Our results highlight the complexities and nuances that characterize fluency’s effects.
Dedication

To my boys, K + G + LG. You are my whole world.
Contents

Abstract ................................................................................................................................. iv

List of Tables ......................................................................................................................... xi

List of Figures ......................................................................................................................... xii

Acknowledgements .............................................................................................................. xiv

1. Introduction ....................................................................................................................... 1

1.1 Elements that Affect Cognition ......................................................................................... 2

1.1.1 Language ....................................................................................................................... 2

1.1.1.1 How Language Affects Cognition ........................................................................... 2

1.1.1.2 Past Research and Remaining Gaps in the Language Literature ............................ 3

1.1.2 Design .......................................................................................................................... 6

1.1.2.1 How Design Affects Cognition ............................................................................... 6

1.1.2.2 Past Research and Remaining Gaps in the Design Literature ............................... 10

1.1.3 Processing Fluency ........................................................................................................ 11

1.1.3.1 How Processing Fluency Affects Cognition ............................................................... 11

1.1.3.2 Past Research and Remaining Gaps in the Fluency Literature ............................... 13

1.1.3.3 Two Fluency Models ................................................................................................ 14

1.1.3.4 Support for the Hedonic Fluency Model (HFM) with Negative Materials ........... 16

1.1.3.5 Support for the Fluency Amplification Model (FAM) with Negative Materials ....... 17

1.1.3.6 Inconsistent Effects of Fluency on Judgments of Negative Materials ................. 17

1.1.3.7 Summary .................................................................................................................. 19
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.1.1</td>
<td>Participants</td>
<td>36</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Materials, Design, and Procedure</td>
<td>36</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Results and Discussion</td>
<td>37</td>
</tr>
<tr>
<td>3.2</td>
<td>Experiment 2B</td>
<td>39</td>
</tr>
<tr>
<td>3.2.1</td>
<td>Method</td>
<td>39</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Participants</td>
<td>39</td>
</tr>
<tr>
<td>3.2.3</td>
<td>Materials, Design, and Procedure</td>
<td>39</td>
</tr>
<tr>
<td>3.2.4</td>
<td>Results and Discussion</td>
<td>40</td>
</tr>
<tr>
<td>3.3</td>
<td>Experiment 3A</td>
<td>42</td>
</tr>
<tr>
<td>3.3.1</td>
<td>Method</td>
<td>43</td>
</tr>
<tr>
<td>3.3.2</td>
<td>Participants</td>
<td>43</td>
</tr>
<tr>
<td>3.3.3</td>
<td>Materials, Design, and Procedure</td>
<td>44</td>
</tr>
<tr>
<td>3.3.4</td>
<td>Results and Discussion</td>
<td>46</td>
</tr>
<tr>
<td>3.4</td>
<td>Experiment 3B</td>
<td>49</td>
</tr>
<tr>
<td>3.4.1</td>
<td>Method</td>
<td>49</td>
</tr>
<tr>
<td>3.4.2</td>
<td>Results and Discussion</td>
<td>50</td>
</tr>
<tr>
<td>3.5</td>
<td>Experiment 4A</td>
<td>57</td>
</tr>
<tr>
<td>3.5.1</td>
<td>Method</td>
<td>57</td>
</tr>
<tr>
<td>3.5.2</td>
<td>Participants</td>
<td>57</td>
</tr>
<tr>
<td>3.5.3</td>
<td>Materials, Design, and Procedure</td>
<td>57</td>
</tr>
<tr>
<td>3.5.4</td>
<td>Results and Discussion</td>
<td>60</td>
</tr>
<tr>
<td>3.6</td>
<td>Experiment 4B</td>
<td>62</td>
</tr>
</tbody>
</table>
3.6.1 Method ......................................................................................................................... 62
3.6.1.1 Participants ................................................................................................................ 62
3.6.1.2 Materials, Design, and Procedure ............................................................................. 62
3.6.2 Results and Discussion ............................................................................................... 64
3.7 Discussion of Experiments 2, 3, and 4 ........................................................................ 67
4. Experiments 5, 6, and 7 ..................................................................................................... 71
4.1 Experiment 5A ................................................................................................................. 71
4.1.1 Method .......................................................................................................................... 72
4.1.1.1 Participants ................................................................................................................ 72
4.1.1.2 Materials, Design, and Procedure ............................................................................. 72
4.1.2 Results and Discussion ............................................................................................... 74
4.2 Experiment 5B .................................................................................................................. 75
4.2.1 Method .......................................................................................................................... 76
4.2.1.1 Participants ................................................................................................................ 76
4.2.1.2 Materials, Design, and Procedure ............................................................................. 76
4.2.2 Results and Discussion ............................................................................................... 76
4.3 Experiment 6 .................................................................................................................... 79
4.3.1 Method .......................................................................................................................... 79
4.3.1.1 Participants ................................................................................................................ 79
4.3.1.2 Materials, Design, and Procedure ............................................................................. 79
4.3.2 Results and Discussion ............................................................................................... 80
4.4 Experiment 7 .................................................................................................................... 82
4.4.1 Method ......................................................................................................................... 82
  4.4.1.1 Participants ........................................................................................................... 82
  4.4.1.2 Materials, Design, and Procedure ........................................................................ 82
  4.4.2 Results and Discussion ............................................................................................. 83
  4.5 Discussion of Experiments 5, 6, and 7 ..................................................................... 85
5. Conclusion ......................................................................................................................... 87
Appendix A: Materials (informed consent forms) for Experiments 1A and 1B .......... 94
Appendix B: Questions for Experiments 1A and 1B...................................................... 110
Appendix C: Materials for Experiments 2A and 2B ...................................................... 114
Appendix D: Materials for Experiments 3A and 3B ....................................................... 116
Appendix E: Materials for Experiments 4A and 4B ....................................................... 121
Appendix F: Materials for Experiments 5A and 5B ....................................................... 124
Appendix G: Materials for Experiment 6 ........................................................................ 127
Appendix H: Materials for Experiment 7 ........................................................................ 128
References ............................................................................................................................ 130
Biography ............................................................................................................................... 139
List of Tables

Table 1: Examples of commonly used fluency manipulations.............................................. 11

Table 2: Comparison of linguistic and design characteristics of the Standard and Enhanced Informed Consent Forms used in Experiment 1A...................................................... 24

Table 3: Means and standard deviations of judgments about the likelihood that a medication will cure or cause side effects................................................................. 48

Table 4: Means and standard deviations of judgments about the likelihood that a surgical procedure will cure or cause complications....................................................... 53
List of Figures

Figure 1: Side effects presented in a paragraph format (left) vs. tree diagram. The tree diagram is an example of how spatial layout can enhance content and help the reader mentally organize the information. ................................................................. 9

Figure 2: Predictions of how fluency will affect judgments of positively and negatively valenced materials according to the Hedonic Fluency Model (green) and Fluency Amplification Model (yellow). ......................................................... 15

Figure 3: A sample page from the Standard (left) and Enhanced Informed Consent Forms used in Experiment 1A. ............................................................................................................. 25

Figure 4: Schematic for Experiment 1A. ................................................................................................................................. 26

Figure 5: Metacognitive judgments in the Standard, Enhanced-Language, and Enhanced-Both conditions in Experiment 1B. ............................................................................................................. 31

Figure 6: Percentage of comprehension and memory questions answered correctly in the Standard, Enhanced-Language, and Enhanced-Both conditions in Experiment 1B....... 32

Figure 7: Judgments of offensiveness and hurtfulness for fluent and disfluent insults... 38

Figure 8: Judgments of offensiveness and hurtfulness for fluent and disfluent insults... 41

Figure 9: Design schematic for Experiment 3A. Participants were randomized to answer questions about the likelihood that each medication would cure or cause side effects. .. 45

Figure 10: Judgments of how likely medications are to cure when medication names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce) ......................................................... 47

Figure 11: Judgments of how likely medications are to cause side effects when medication names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce).. 47

Figure 12: Judgments of how likely procedures are to cure when procedure names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce) ......................................................... 52

Figure 13: Judgments of how likely procedures are to cause complications when procedure names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce) ...... 53
Figure 14: Design schematic for Experiment 4A. Two fluency manipulations were used: Handwriting and pronounceability (pron).

Figure 15: Schematic for Experiment 4B. Participants responded to questions in both the STI scenario and Flu scenario.

Figure 16: Judgments of how scared participants would be, how stressed participants would be, and how bad participants think the disease is for the STI scenario.

Figure 17: Judgments of how scared participants would be, how stressed participants would be, and how bad participants think the disease is for the flu scenario.

Figure 18: Percent of participants who judged the fluent (black), disfluent (grey), and neither (white) list of risks as riskier and would participate in a research study with the associated list of risks.

Figure 19: Judgments of riskiness and willingness to participate in a research study with the associated list of risks.

Figure 20: Judgments of riskiness (risks), likelihood (risks), appeal (benefits), and willingness to participate in a research study (both risks and benefits).
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1. Introduction

Human judgment and decision-making often involve complex information and difficult tradeoffs. One area where this is especially true is in the context of healthcare. Health-related decisions often have high stakes, and decision-makers must weigh the risks and benefits of several options. In order to understand key concepts and receive help with difficult decisions, patients may turn to written health materials. One example of a written health material is an informed consent form. This is a form that explains details about research studies, such as the purpose, procedures, benefits, and risks (OHRP – 45 CFR 46 Subpart A, 2010). Patients must review and sign an informed consent form before participating in a research study. Because patients may rely on written health materials to guide them, it is important that concepts are explained clearly and at the patient’s comprehension level. It is also important for these materials to be designed in a way that fosters good judgment and decision-making. Unfortunately, several studies have found that written health materials can actually increase confusion (e.g. Palmer, Lanouette, & Jeste, 2012; Flory & Emmanuel, 2004; Kerr et al., 2004; Agre & Rapkin, 2003), and this confusion can lead to adverse health outcomes (Wolf et al., 2016). To understand why written health materials don’t always help patients in the way they intend to, it is important to understand the elements of these materials that affect patient cognition. Specifically, this dissertation will focus on the cognitive processes of comprehension, memory, judgment, and decision-making.
1.1 Elements that Affect Cognition

Three elements of written health materials that affect patient cognition are language, design, and processing fluency. When these elements are not carefully planned and executed to enhance patient cognition, it can be difficult for patients to understand and remember the information, and use it to make important health decisions. The remainder of Chapter 1 provides a comprehensive background on language, design, and processing fluency. It will explore how these elements affect cognition, review past research findings in the context of written health materials, and describe the gaps that remain in these areas of research. The empirical chapters of this dissertation will explore how language and design affect comprehension and memory (Chapter 2) and how processing fluency affects judgment and decision-making (Chapters 3 and 4) in a healthcare context.

1.1.1 Language

1.1.1.1 How Language Affects Cognition

The language of written health materials is a key contributor to patient cognition, beginning with text comprehension. Contemporary text comprehension models recognize “word identification” as the foundation upon which text comprehension is built (Kintsch, 1988; Perfetti, 1999; Verhoeven & Perfetti, 2008). According to the Literacy Information and Communication System, “rapid and effortless word recognition is the main component of fluent reading” (Assessment Strategies, 2016). This process of instant
word identification or recognition is largely affected by word frequency. The “word frequency effect” refers to the robust finding that commonly used words are easier to recognize than less commonly used words across a wide range of tasks (e.g. Howes & Solomon, 1951; Whaley, 1978; Taft, 1979; Forster & Chambers, 1973; Hartley, 2013). On the other hand, low frequency words in text are recognized more slowly and have a negative effect on comprehension (Nation & Coady, 1988: Marks, Doctorow, & Wittrock 1974; Kameenui, Carnine, & Fresch, 1982; Freebody & Anderson, 1983).

1.1.1.2 Past Research and Remaining Gaps in the Language Literature

Unfortunately, written health materials often contain technical, low frequency words that make it difficult to understand the text (Pandiya, 2010). One widely used approach to enhancing cognition is to simplify the language. Many studies have compared original written health materials with simplified versions to determine whether the more “readable” text facilitates better comprehension and/or memory. These types of studies have yielded mixed results. In one study, researchers edited a written health material (a handout explaining a bronchoscopy) from its original readability grade level (9th grade level) to a 5th grade level. Comprehension was better for the simplified version than the original version (Estey, Musseau, & Keehn, 1991). However, another similar study found no such effect: Researchers examined memory for two versions of an informed consent form 2-3 weeks after reading it. Subjects either received a standard version of the form (Flesch readability score of 50 and Fry
readability scale at the 12th grade level) or a revised form (Flesch readability score of 77 and Fry readability score at the 6th-7th grade level), and the two versions were equal in length and layout. Version of the form had no effect on the memory test (Taub, 1980).

Research comparing original and simplified versions of written health materials often measures linguistic changes using a readability formula like Flesch-Kincaid (F-K) Grade Level (Kincaid, Fishburne, Rogers, & Chissom, 1975). Regarding readability formulas, consider the difference between these two sentences:

A. This sentence is easy to read (F-K Grade Level = 2.4)

B. The current sentence may contain unnecessary linguistic properties.

(F-K Grade Level = 12.0)

This approach to measuring linguistic complexity can be done quickly and easily with standard word processing software, making it attractive to health professionals who are trying to make their written materials more reader friendly. However, it also has serious shortcomings. First, traditional readability formulas only use two to five text variables to determine a score, such as average sentence and word length or number of words on a familiar word list (Flesch, 1948; Dale & Chall, 1948). This limited scope of text variables often produces a score that does not reflect a text’s actual difficulty. For example, text with short sentences or words may contain grammatical complexities that are not picked up by readability formulas.
A second shortcoming is that readability formulas were designed for use on a finished written product and can be misleading when used during the development of a text. “Writing to the formula,” or writing specifically to improve the readability score, may actually hurt comprehension; for example, shortening words and sentences may remove contextual information that helps the reader organize the material (Hochhauser, 1997; Reid et al., 1995; Redish & Selzer, 1985; Davison & Kantor, 1982).

A third shortcoming lies specifically in readability formulas that offer “grade level scores” such as Flesch-Kincaid (Kincaid, Fishburne, Rogers, & Chissom, 1975) and Gunning fog index (Gunning, 1952). Readability grade level scores were initially developed for a K-12 setting where reading skills vary greatly between grades. The difference between a Grade 2 reading level and a Grade 4 reading level is clear since students in Grade 2 have not yet acquired the skills necessary to read at a Grade 4 level. However, what is the difference between a Grade 13 reading level (equivalent to one year of college) and a Grade 15 reading level (equivalent to three years of college)? After reading skills have been acquired, literal grade levels lose meaning. Redish and Selzer (1985) argue that readability formulas are not reliable or valid predictors of how understandable a technical, scientific, or legal document will be for adults. Additionally, grade levels are often interpreted incorrectly. Research has shown that people typically read three to four grade levels lower than their highest education level (Hochhauser, 1997). One study of 120 community clinic patients showed that although the average
education level was 10th grade, average reading level was between 5th and 6th grade (Davis et al., 1993).

The results of research comparing original and simplified versions of written health materials have been mixed; while some simplified texts have led to cognitive improvements, others have had no effect on cognition (e.g. Paris et al., 2010; Walters & Hamrell, 2008; Estey, Musseau, & Keehn, 1991). These mixed results could be due in part to the shortcomings of traditional readability measures described above.

### 1.1.2 Design

#### 1.1.2.1 How Design Affects Cognition

Another element that affects cognition for written health materials is design. In order to comprehend and remember complex written information, the reader must be able to grasp the underlying structure or organization of the text (Hartley, 2013). Text design can either help or hurt with this process. The design literature offers several design principles that can be used to clarify the structure of the text, including the following:

- **Clustering** is putting similar information in the same place (Bousfield & Cohen, 1953). For example, in an informed consent form, this means placing all the risks together.

- **Chunking** is separating information from nearby but different information (Miller, 1956; Simon, 1974). Creating meaningful chunks can organize
information and decrease the strain on working memory. In an informed consent form, this means separating risks from benefits. In the design literature, clustering and chunking are referred to as *proximity*, which is defined as using closeness or distance to establish relationships in content (Williams, 2014).

- **Strategic use of white space** can help readers perceive the underlying structure of the document, thus helping them understand its organization (Hartley, 2013). Strategic white space can result from effective clustering and chunking.

- **Lists** can improve comprehension and recall, and reduce the time needed to draw inferences (Morrow, Leirer, Andrassy, Hier, & Menard, 1998). Items in a list should be separated rather than in continuous prose. Within the list, numbers help clarify the structure of sequential items, while bullets are appropriate when points are of equal rank (Lorch & Chen, 1986; Seki, 2000; Hartley, 2013).

- **Line length** can affect both reading speed and comprehension of the text (Tinker, 1963; Dyson & Haselgrove, 2001). Lines should be between 40-70 characters, or 8-12 words (Raynor & Dickinson, 2009).

- Displaying text in narrow **columns** can help people read faster and comprehend the text better (Tinker, 1963; Wilson, 1974; McMullin, Varnhagen, Heng, & Apedoe, 2002).

- **Order of information** can influence reader comprehension and memory, and should match the order that the reader expects. In written drug information
specifically, Morrow, Leirer, Altieri, & Tanke (1991) found that patients tend to organize information into three categories, in the following order: Purpose of the drug, directions for use, and outcomes. Memory for drug information improved when the information followed this categorization and order.

- **Advance organizers** provide a big picture of the upcoming content and can help with the learning and retention of unfamiliar material (Ausubel, 1960). For example, a **table of contents** can be useful for long pieces of text and can help orient the reader to the information they are about to read (Raynor & Dickinson, 2009).

- **Content-based spatial layout** means using a spatial arrangement of text that conveys the underlying structure of information (Day, 2017; Day & Santistevan-Swett, in press). For example, potential side effects can be formatted in a tree diagram, with each arm of the tree representing a different severity level (see Figure 1). This can help the reader mentally organize the side effects.
Figure 1: Side effects presented in a paragraph format (left) vs. tree diagram. The tree diagram is an example of how spatial layout can enhance content and help the reader mentally organize the information.

- **Titles and subtitles** can aid recall of what a text is about (Niegemann, 1982; Hartley & Trueman, 1985). Concrete titles rather than abstract ones can improve readers’ recall, comprehension, search-and-find, and interest (Sadoski, Goetz, & Rodriguez, 2000; Hartley & Trueman, 1985).

- **Font** style and size can affect text comprehension and rate of reading (Poulton, 1959). Font sizes between 10-11 point are better comprehended than 9 point, and some design recommendations suggest 12-14 point.

- **Boxes** and **bold text** can be useful for emphasizing key points (Krass, Svarstad, & Bultman, 2002).

- **Color** can attract readers to text, but should be used sparingly. Within written health materials specifically, the color red is useful to indicate topics like warnings or risks (Raynor & Dickinson, 2009; Bernardini et al., 2001).
1.1.2.2 Past Research and Remaining Gaps in the Design Literature

Research evaluating written health materials has found that they often violate design principles that have been shown to improve reader cognition. For example, in a study of written drug information, researchers evaluated the design of 36 patient drug leaflets using the Medication Information Design Assessment Scale (MIDAS) (Krass, Svarstad, & Bultman, 2002). Fewer than half of the leaflets evaluated met the MIDAS criteria for white space (42% for adequate line spacing and 36% for margins), headings on a separate line from text (28%), appropriate line length (28%), bolding or box to highlight important points (17%), and use of bullet points (3%). The same results have also been found for informed consent forms. An assessment of 14 forms found that the forms were poorly organized and relevant information was not properly highlighted or easy to find (Terranova et al., 2012). In a review of drug label designs, Sless (2001) summarized his findings by stating that there is a general lack of awareness of information design among health professionals.

While the design principles described above are widely supported in the design literature, very little empirical research has investigated how their use affects comprehension and memory of written health materials. The few studies that have been conducted in this area have supported the idea that well-designed information can improve cognition, but the generalizability of these studies is limited due to small sample sizes, subject reading levels that do not accurately reflect the general population,
and oral presentation of information rather than written (Langewitz et al., 2015; Nishimura et al., 2013; Davis et al., 1993). Although various books, articles, and guidances have suggested design principles specifically for written health materials, there is little empirical work that has tested the effects of these suggestions on cognition (Raynor & Dickinson, 2009; Walsh & Shaw, 2000).

The experiments described in Chapter 2 aim to explore the effects of language and design on readers’ comprehension and memory of written health materials using informed consent forms.

1.1.3 Processing Fluency

1.1.3.1 How Processing Fluency Affects Cognition

Processing fluency (referred to hereafter as simply fluency) is the subjective ease of processing information (Jacoby & Dallas, 1981). Fluency can be manipulated in a variety of ways. Some of the most common manipulations used in the fluency literature are font, pronounceability, figure-ground contrast, and exposure (priming, repetition, or exposure time) (see Table 1 for examples) (e.g. Topolinski, 2014; Song & Schwarz, 2008; Reber, Winkielman, & Schwarz, 1998; see Alter & Oppenheimer, 2009, for a review).

<table>
<thead>
<tr>
<th>Fluency manipulation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Font</td>
<td>Fluent vs. Disfluent</td>
</tr>
<tr>
<td>Pronounceability</td>
<td>Calotropisin vs. Ribozoxltp</td>
</tr>
<tr>
<td>Figure-ground contrast</td>
<td>High contrast vs. Low contrast</td>
</tr>
</tbody>
</table>

Table 1: Examples of commonly used fluency manipulations
A key characteristic of fluency is that it is a “unified phenomenon”; that is, research has shown that regardless of how fluency is manipulated, the subjective experience of ease is the same (Alter & Oppenheimer, 2009). Additionally, the effects of that ease on judgments are remarkably similar across different fluency manipulations. For example, several studies have demonstrated that fluent materials are judged as truer than disfluent materials, and this finding has been supported by instantiating fluency through semantic priming, visual clarity, and rhyming (Schwarz & Newman, 2017; Schwarz, 2017; Kelley & Lindsay, 1993; Reber & Schwarz, 1999; McGlone & Tofighbakhsh, 2000). Because fluency is a unified phenomenon, we are able to compare studies that use different manipulations to study it.

The fluency literature overwhelmingly agrees on the effects of fluency on judgments: The experience of fluency increases positive judgments of materials. Here are several examples:

- Fluent jokes (written in an easy-to-read font) are judged as funnier than disfluent jokes (written in a hard-to-read font) (Topolinski, 2014).
- Wine is judged as tasting better when the label is fluent (easy-to-read font) rather than disfluent (hard-to-read font) (Gmuer, Siegrist, & Dohle, 2015).
- Fluent statements (written in highly visible color on white background) such as “Lima is in Peru” are judged as truer than disfluent statements (Reber & Schwarz, 1999).
• Forms of currency that are fluent (familiar) are judged as having greater purchasing power than disfluent forms of currency (Alter & Oppenheimer, 2008).

• Both healthy and unhealthy foods yield higher anticipated enjoyment judgments when nutrition facts are fluent (easy-to-read) rather than disfluent (hard-to-read) (Gomez, Werle, & Corneille, 2017).

• Fluent college course syllabi (easy-to-read font) yielded higher forecasted grades and lower judgments of course difficulty than disfluent syllabi (hard-to-read font) (Guenther, 2012, Exp. 2).

1.1.3.2 Past Research and Remaining Gaps in the Fluency Literature

The experiments described above comprise a small sample of the literature demonstrating fluency’s effects on judgments. As shown in this sample, the materials used in the fluency literature appear to be diverse, and thus should be adequate for generalizing findings to other types of materials. However, the vast majority of previously studied materials have something in common: They have a positive or neutral valence, or evoke a positive or neutral response. Among studies using positively or neutrally valenced materials, the effects of fluency appear to be one cohesive phenomenon: Fluency increases positive judgments.

In terms of negatively valenced materials, or materials that evoke a negative response, fluency’s effects are not as firmly established. It is easy to imagine that the effects of fluency could differ between positive materials and negative ones. For
example, while a fluent joke is judged as funnier, fluency may have a different effect on judgments of tragic news or disturbing images. Interestingly, little empirical research has investigated the effects of fluency on judgments of negative materials.

The question of how fluency affects judgments of negative materials is especially salient in a healthcare context, where written materials often contain negative concepts like risks, diagnoses, and symptoms. As health professionals use language and design principles to make written health information simpler and clearer for patients, these materials become more fluent. It is critical to understand the effects of this increased fluency on subsequent judgments and decisions.

### 1.1.3.3 Two Fluency Models

Two models, the Hedonic Fluency Model and Fluency Amplification Model, offer predictions for the effects of fluency on judgments of negative materials.

1. **Hedonic Fluency Model**: This model assumes that fluency yields positive affect, which then serves as an information aid in subsequent judgments. Thus fluency leads to more positive judgments, mediated through the affective response (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). According to this theory, fluent positive and negative materials would yield higher positive judgments (and lower negative judgments) than disfluent materials.

2. **Fluency Amplification Model**: This model assumes that fluency amplifies the original affective response to the materials. Like the Hedonic Fluency Model, fluent
positive materials would be judged more positively. However, according to the Fluency Amplification Model, fluent negative materials would be judged more negatively than disfluent ones (Albrecht & Carbon, 2014).

These two models agree on the literature’s well-established findings regarding positive materials: Fluency yields more positive judgments. However, what makes these models interesting to compare is that they predict opposite effects for negative materials (see Figure 2 for a graphic representation of each model’s predictions).

![Figure 2: Predictions of how fluency will affect judgments of positively and negatively valenced materials according to the Hedonic Fluency Model (green) and Fluency Amplification Model (yellow). The models predict similar effects of fluency for positive materials, but opposite effects for negative materials.](image-url)
The literature exploring the effects of fluency on negative materials is sparse. To our knowledge, only two published works have systematically manipulated valence to test its interactions with fluency: The set of experiments that led to the proposal of the Fluency Amplification Model (Albrecht & Carbon, 2014), and an experiment using positive and negative pieces of music (Witvliet & Vrana, 2007, described in more detail in section 1.1.3.5). Another small collection of studies has tested the effects of fluency using what could be considered negative materials, though none of these studies intentionally manipulated the materials’ valence. These studies offer mixed support for the Hedonic Fluency Model and Fluency Amplification Model.

1.1.3.4 Support for the Hedonic Fluency Model (HFM) with Negative Materials

Several published works have used ostensibly negative materials, or both negative and positive materials, and demonstrated support for the HFM (Labroo & Lee, 2006; Song & Schwarz, 2008; Dohle & Siegrist, 2014; Manley, Lavender, & Smith, 2015; Bahnik & Vranka, 2017). That is, fluency increased positive judgments and decreased negative judgments for both positive and negative materials. In one experiment, participants viewed a prime product and target product that were either goal compatible (both prevention-focused; fluent) or incompatible (one prevention-focused, one neither prevention- nor promotion-focused; disfluent) (Labroo & Lee, 2006). Fluency yielded higher purchase intent for the fluent product than the disfluent product, even when targets had a negative valence. In line with the HFM, this experiment
demonstrated that fluency can increase positive judgments (purchase intent) when materials are negative.

1.1.3.5 Support for the Fluency Amplification Model (FAM) with Negative Materials

Several other works have demonstrated the opposite effect of fluency on judgments of negative materials (Albrecht & Carbon, 2014; Rennekamp, 2012; Witvliet & Vrana, 2007; Schwarz, Sanna, Skurnik, & Yoon, 2007; Rothman & Schwarz, 1998; Grush, 1976; Brickman, Redfield, Harrison, & Crandall, 1972). That is, fluent negative materials yielded lower positive judgments and higher negative judgments than disfluent ones. One such study used positive and negative pieces of music to determine how fluency (repeated exposure) affects liking and pleasantness ratings (Witvliet & Vrana, 2007). The music materials varied in both valence (positive and negative) and arousal (high or low). During the initial evaluation phase, participants listened to twelve pieces of music (26 seconds each) and rated each on pleasantness, liking, familiarity, and arousal. Participants then listened to the twelve pieces again, four times each, and repeated the evaluations for each piece. In line with the FAM, fluency amplified initial judgments; after multiple exposures, participants liked the positive music more but liked the negative music less.

1.1.3.6 Inconsistent Effects of Fluency on Judgments of Negative Materials

The effects of fluency on judgments of negative materials appear to be inconsistent. One possible explanation is that of the studies cited above supporting
either HFM or FAM, only two studies systematically varied valence (Witvliet & Vrana, 2007; Albrecht & Carbon, 2014). This suggests that in order to disentangle these two theories, more empirical research is needed. Such research should systematically vary valence and test the effects of fluency on judgments.

Another explanation for these inconsistent effects is that the relationship between fluency, valence, and judgments is not straightforward. Rather, there are moderators within the context of fluency (as well as factors beyond fluency) that also affect judgments. One such moderator is naïve theories, or context-specific interpretations of fluency (Schwarz, 2004). Naïve theories determine how people interpret the experience of fluency, and they bridge the gap between fluency and judgments. For example, consider the following two attitudes or naïve theories about effort. The first attitude says that effort or difficulty while completing a task indicates that skills are lacking; the second attitude says that effort indicates the person has been working hard to improve skills. When faced with a challenging assignment, those with the first naïve theory will interpret disfluency as evidence of their ineptitude or inferiority. On the other hand, those with the second naïve theory will interpret disfluency as evidence of improvement and growth. This example demonstrates how naïve theories can affect the interpretation of fluency in a particular setting and subsequent judgments. Considering the relationship between naïve theories, fluency, and judgments could help explain the inconsistent effects of fluency on judgments of negative materials.
1.1.3.7 Summary

It is simplistic to think that one model, either the HFM or FAM, could cleanly predict the effects of fluency on judgments of negative materials. It is more likely that these effects depend on more than a single fluency manipulation. Chapters 3 and 4 of this dissertation explore several questions regarding fluency and negative materials. The purpose of the experiments in these chapters is not to seek definitive support for either the HFM or FAM under all circumstances, but rather to investigate the circumstances under which one model may predict better than the other.

1.2 Overview of Current Experiments

The first goal of this dissertation was to explore how language and design affect comprehension and memory of written health materials. Experiments 1A and 1B address this question using an informed consent form for a research study. In Experiment 1A, we simplified the language and modified the design of a Standard informed consent form to create an Enhanced form. Participants read one of the two forms, then completed a series of comprehension and memory tasks. Compared with the Standard form, those who read the Enhanced form demonstrated significantly better comprehension, memory, and more accurate metacognition. In Experiment 1B, we investigated whether design modifications contribute to comprehension and memory improvements beyond those fostered by simplifying language. A third informed consent form was tested where the language was simplified but design remained the same as the
Standard form. It should be noted that the goal of Experiment 1B was not to establish whether language modifications alone yield significant cognitive improvements; rather, the goal was to compare potential cognitive improvements with those found in Experiment 1A (which used a form with both language and design modifications). We found that improvements were greater for participants who read the Enhanced - Language and Layout form compared to the Enhanced - Language Only form. These data show that in addition to simplifying language, applying design principles can improve cognition in a healthcare context.

The second goal of this dissertation was to investigate how fluency affects judgment and decision-making with negative materials. In Experiments 2A and 2B, participants read a series of fluent and disfluent insults and judged how offensive and hurtful they were. In both experiments, fluent insults were judged as worse. Experiments 3A and 3B were designed to generalize these findings to materials that were less emotionally charged than insults but still had a negative valence (names of prescription medications and surgical procedures). Our findings were contrary to those of Experiment 2, and Experiments 4A and 4B were designed to resolve the discrepancies in our findings between Experiments 2 and 3.

The third goal of this dissertation was to examine the nuances of fluency’s effects specifically in the context of research study risks. Experiments 5A and 5B served as an initial investigation of how fluency affects judgments of riskiness for study risks and
whether these effects are consistent across different communicators. Experiment 6 was
designed to generalize our findings to another judgment, risk likelihood. Finally,
Experiment 7 explored whether the findings of Experiments 5 and 6 were consistent if
positive information (benefits) was presented alongside the negative information (risks).
2. Experiment 1

The purpose of Experiment 1 was to explore the effects of language and design on readers’ comprehension and memory of written health materials using informed consent forms. Participants read either the Standard form (original form used in a research study) or an Enhanced form, then completed measures of comprehension and memory. Participants also completed measures of metacognition. We expected that modifying language and design would result in higher metacognition scores (higher perceived comprehension and memory) as well as higher actual comprehension and memory in the Enhanced conditions relative to the Standard condition.

2.1 Experiment 1A

2.1.1 Method

2.1.1.1 Participants

Participants were 70 undergraduates at Duke University. They were randomly assigned to read one of the two informed consent forms, with 35 per condition. Participants volunteered as part of a general research requirement.

2.1.1.2 Materials, Design, and Procedure

Two informed consent forms were used as materials, the Standard form and Enhanced form. The Standard form was based on the Duke University Health System template for informed consent forms. It was written for an actual research study to investigate a new ultrasound method. We did not make any changes to the language or
design. The only change was removing identifying information (e.g. names and phone numbers of the investigators).

The language in the Standard form had a Flesch-Kincaid Grade Level of 10.8. A conventional format was used throughout the form. Main topics started with a bolded question subtitle (e.g., Are there benefits to taking part in the study?) with a single blank line after each subtitle and paragraph. All text was in the same font (Times New Roman 12 pt.) and the only variation was bolded subtitles. There were two bulleted lists in the form. Additional linguistic characteristics are provided in Table 2.

The Enhanced form was created by simplifying the language and modifying the design of the Standard form. The Enhanced form contained all the same information as the Standard form. To simplify language, we defined medical terms using simple language, broke long sentences into two or more sentences, and eliminated complex grammatical structures. The language of the Enhanced form had a Flesch-Kincaid Grade Level of 8.4, at the upper end of the recommended range.

To improve the design, we applied the following design principles:

- Titles: Main topics were labeled with a bolded, capitalized title (e.g. STUDY DOCTOR) in addition to the question subtitles from the Standard form.

- Text: Different fonts and text styles were used to signal different types of information (titles, subtitles, and text body).
• Boxes: Key topics (e.g. Purpose of the Study, Risks) were outlined in a black or red box for emphasis.

• Lists: When lists occurred within the text, each item was placed on a separate line. Items were numbered when they were sequential and bulleted when they were of the same rank. This resulted in 10 formatted lists.

• White space was used to create meaningful chunks of related information that were separated from unrelated information.

• Content-based spatial layout was used to enhance the underlying structure of information. For example, related topics were provided on the same page, while topics without any highly related information were given their own page. Complementary topics like Costs and Compensation were displayed in a two-column format to emphasize their relationship. Key topics were centered on the page.

Table 2 compares several language and design features of the Standard and Enhanced forms. Figure 3 shows a sample page from each form, and Appendix A contains a full version of each form.

Table 2: Comparison of linguistic and design characteristics of the Standard and Enhanced Informed Consent Forms used in Experiment 1A

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Standard Form</th>
<th>Enhanced Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pages</td>
<td>4.5</td>
<td>5.5</td>
</tr>
</tbody>
</table>
The study will involve obtaining detailed images of your arthritis through various diagnostic techniques. To perform the ultrasound, a small amount of warm jelly will be placed on your skin. A transducer, which is held firmly against your skin, will emit sound waves that are reflected back to the transducer in the form of an image. This image will be displayed on a computer monitor, and you will be able to view the ultrasound in real-time.

How long will the study last?

The study will be performed during your regular procedure, and it will not extend the duration of your treatment plan. You may also be asked to return for a follow-up assessment of your surgery. If you are unable to participate in this follow-up study, you will be provided with additional options, such as scheduling the procedure and answering questions during that study.

You can choose to not participate in this study. However, if you choose to not participate in the study, we encourage you to talk to your doctor first.

What are the risks of the study?

This novel ultrasound technique involves minimal discomfort to you. The name of some women's phrases that will be used to describe your health condition is similar to that which is commonly used in the medical ultrasound examination. This method is safe and well-tolerated for all participants.

As a result of not participating in this study, you may be at risk for the following side effects: nausea, vomiting, and headache. If you choose not to participate in this study, you may choose to participate in other studies or continue with your regular care.

Figure 3: A sample page from the Standard (left) and Enhanced Informed Consent Forms used in Experiment 1A. The Enhanced form had simplified language
and used established design principles in order to improve cognition for the information.

We used a two-group posttest-only randomized design. See Figure 4 for a schematic.

Figure 4: Schematic for Experiment 1A. Participants were randomized to read one of two informed consent forms (Standard or Enhanced), then responded to a series of questions about the information they read.

Participants were randomized to one of the two conditions (Standard or Enhanced form). They were asked to imagine they had been diagnosed with a medical condition (tissue mass) and were eligible to participate in a research study. They were told they would see an informed consent form for this study and were asked to read the form exactly how they would in real life. They were informed they would be asked some questions about the form after reading it.
Participants had eight minutes to read the form and were asked to continue reading until time was up. Time was controlled so that potential differences in comprehension and memory could not be attributed to time spent reading the form.

After reading, participants answered two types of questions: Metacognition questions (how well participants thought they understood and could remember the information in the form) and comprehension/memory questions (tested actual comprehension and memory of the information in the form). All questions are contained in Appendix B.

2.1.2 Results

2.1.2.1 Metacognition

Metacognition questions were answered on a scale from one to five. Participants’ responses to the metacognition questions were averaged to create an overall metacognition score for each participant. Between the two conditions, metacognitive judgments were significantly higher in the Enhanced condition ($M = 4.13$, $SD = 0.42$) than the Standard condition ($M = 3.69$, $SD = 0.55$), $t(68) = -3.71, p < .001, d = 0.9$. When language and design were enhanced, participants thought they understood the information better and would remember more.

2.1.2.2 Comprehension and Memory

All comprehension and memory questions were scored as either correct or incorrect. An overall percentage of correct responses was calculated for each participant.
Participants in the Enhanced condition answered significantly more comprehension and memory questions correctly ($M = 64.9\%$, $SD = 8.7\%$) than those in the Standard condition ($M = 58.7\%$, $SD = 14.2\%$), $t(68) = -2.18$, $p = .03$, $d = .54$. Enhanced language and design improved comprehension and memory for the information in the form.

**2.1.3 Discussion of Experiment 1A**

Experiment 1A demonstrated that simplifying language and implementing design principles can influence metacognitive judgments; compared with the Standard form, those who read the Enhanced form judged their comprehension and memory for information in the form to be higher. In fact, these judgments reflected actual comprehension and memory; those who read the Enhanced form demonstrated significantly better comprehension and memory for the information than those in the Standard form condition.

Previous experiments have tried to improve comprehension and memory of informed consent forms by only simplifying language. These experiments have yielded mixed results; while some have led to improvements, others have had no effect. The results of Experiment 1A demonstrate that language and design modifications together can raise metacognitive judgments and improve actual cognition.

**2.1.3.1 Shortcomings**

In Experiment 1A, both language and design were modified together; this made it unclear whether each had its own significant effect on metacognitive judgments and
cognition. The next experiment aimed to distinguish between the effects of modified language and design in the Enhanced form.

2.2 Experiment 1B

The purpose of Experiment 1B was to investigate whether design modifications contribute to comprehension and memory improvements beyond those fostered by simplifying language. A third informed consent form was tested where the language was simplified but design remained the same as the Standard form. We expected that changes to language alone would raise metacognitive judgments and improve comprehension and memory, but the effect would be smaller than that of language and design modifications together (as in the Enhanced form in Experiment 1A).

It should be noted that the goal of Experiment 1B was not to establish whether language modifications alone yield significant cognitive improvements; rather, the goal was to compare potential cognitive improvements with those found in Experiment 1A (which used a form with both language and design modifications).

2.2.1 Method

2.2.1.1 Participants

Thirty-five undergraduates volunteered to participate as part of a general research requirement. Because of a limited pool of participants, we added this third group and compared them with the first two groups from Experiment 1A.
2.2.1.2 Materials, Design, and Procedure

In this experiment, a third informed consent form was designed (Enhanced-Language). In this form, language was simplified just like the Enhanced form from Experiment 1A, but the design remained exactly the same as the Standard form. To avoid confusion, the Enhanced form from Experiment 1A will be referred to here as Enhanced-Both since both language and design were modified. A full version of the Enhanced-Language form is included in Appendix A.

The procedures in this experiment were the same as Experiment 1A. Participants were asked to read the informed consent form, then they answered the same questions as in Experiment 1A (metacognition and comprehension/memory).

2.2.2 Results

A one-way ANOVA was conducted to compare metacognitive judgments and comprehension and memory across the three conditions: Standard, Enhanced-Language, and Enhanced-Both.

2.2.2.1 Metacognition

Comparing the metacognitive judgments across the 3 conditions revealed a significant difference between the three conditions (Standard $M = 3.69, SD = 0.55$; Enhanced-Language $M = 3.81, SD = 0.56$; Enhanced-Both $M = 4.13, SD = 0.42$), $F(2, 102) = 6.69, p < .001, \eta^2 = .12$. Post-hoc comparisons using the Tukey HSD test indicated that participants who read the Enhanced-Both form judged their understanding and memory
to be significantly higher than those who read either the Standard or Enhanced-Language form (see Figure 5). However, there was no significant difference in metacognition between the Standard and the Enhanced-Language conditions. These data show that design modifications did affect metacognitive judgments, and the metacognition effects in Experiment 1A were not due to language alone.

![Figure 5: Metacognitive judgments in the Standard, Enhanced-Language, and Enhanced-Both conditions in Experiment 1B. Each participant responded to three metacognition questions and the responses were averaged into one overall metacognition score. Judgments were made on a scale from 1 (low metacognition) to 5 (high metacognition). Error bars represent standard error of the mean.](image)

**2.2.2.2 Comprehension and Memory**

Regarding comprehension and memory, a one-way ANOVA revealed a significant difference between the three conditions (Standard $M = 58.7\%$, $SD = 14.2\%$; Enhanced-Language $M = 65.4\%$, $SD = 12.6\%$; Enhanced-Both $M = 64.9\%$, $SD = 8.7\%$), $F(2, 102) = 3.33, p = .04, \eta^2 = .06$. However, post-hoc comparisons using the Tukey HSD test
were not significant for any pair of means at the \( p = .05 \) level (though the comparison between the Standard and Enhanced-Language conditions approached significance, \( p = .06 \)) (see Figure 6).

![Figure 6: Percentage of comprehension and memory questions answered correctly in the Standard, Enhanced-Language, and Enhanced-Both conditions in Experiment 1B. Error bars represent standard error of the mean.](image)

These data suggest that while language and design modifications together can increase subjective judgments of understanding and memory (metacognition) more than language modifications alone, those increases do not necessarily reflect actual cognitive improvements.

### 2.2.3 Discussion of Experiments 1A and 1B

Written health materials play a key role in many healthcare situations. They can provide patients with details that are necessary for making safe and effective decisions. However, the content of these materials is only useful if patients can understand and
remember it. Unfortunately, research has shown that written health materials often contain barriers to patient comprehension and memory, including complex language and poor design. The experiments reported here aimed to improve comprehension and memory by simplifying language and modifying the design of an informed consent form.

In Experiment 1A, a Standard form was modified to simplify language and improve design, resulting in an Enhanced form. Participants who read the Enhanced form demonstrated higher metacognitive judgments, as well as improved comprehension and memory, compared to those who read the Standard form. In Experiment 1B, these two forms were compared to an Enhanced-Language form, in which language was simplified but the design remained unchanged. As in Experiment 1A, the Enhanced-Both form yielded higher metacognitive judgments than either the Standard or Enhanced-Language form. Regarding overall comprehension and memory, a one-way ANOVA comparing the three conditions revealed a significant difference in performance, though post-hoc analyses failed to reach significance for any pair of means.

These results suggest that language and design changes together can affect both metacognition and actual cognition. Experiment 1B also suggests that language and design changes together have a greater impact on metacognitive judgments than language alone. However, this finding was not true for actual comprehension and
memory as there were no significant difference between the Enhanced-Language and the Enhanced-Both forms in actual cognition scores. This suggests that design modifications can influence metacognition without actually affecting comprehension and memory. This finding is particularly important for those creating and testing written health materials. While a subjective sense of understanding is important, it does not guarantee actual comprehension. These experiments suggest that when testing written health materials for patient understanding, it is necessary to measure both subjective and objective cognition.

One limitation of these experiments is the sample used. Sample sizes were relatively small (35 participants per condition) and comprised Duke undergraduates, an educated population that doesn’t necessarily represent the general population. Future research should establish whether these findings are supported in a larger, more general population. Another limitation of these experiments is that participants did not have the informed consent form in front of them when answering questions, so questions designed to test comprehension also necessarily tested memory. While both comprehension and memory are important, future research should investigate these cognitive processes more independently in order to establish the effects of language and design on each.
3. Experiments 2, 3, and 4

The purpose of Experiments 2, 3, and 4 was to investigate how fluency affects judgment and decision-making with negative materials. In all three experiments, participants read some fluent and disfluent negative materials and made a series of judgments about them. In Experiment 2, participants read fluent and disfluent insults and judged how offensive and hurtful they were. Fluency was manipulated using language (Experiment 2A) and font (Experiment 2B). Across both experiments, fluent insults were judged as worse. The materials in Experiment 2 (insults) were unique in that they were emotionally charged and intended to cause negative affect in the recipient. In Experiment 3, we attempted to generalize our findings using materials that were negative but were not intended to cause negative affect. Participants read fluent and disfluent names of prescription medications and surgical procedures and made a series of judgments. Contrary to Experiment 2, fluent materials were judged more positively and less negatively than disfluent ones. Experiment 4 was designed to help resolve these discrepant findings using fluent and disfluent disease names as the negative materials. Surprisingly, we found no effects of fluency in Experiment 4. We explore some possible explanations for the conflicting findings of Experiments 2, 3, and 4 throughout this chapter.
3.1 Experiment 2A

Experiment 2A employed a straightforward design to provide an initial examination of the effects of fluency on judgments of negative materials. The negative materials used were insulting tweets from Twitter. Participants judged the offensiveness and hurtfulness of a series of insults that were either fluent or disfluent. The Fluency Amplification Model predicts that when negative materials are more easily processed, they are subsequently judged as worse. In line with this model, we expected that fluent insults would be judged as more offensive and more hurtful than disfluent insults.

3.1.1 Method

3.1.1.1 Participants

Participants included 202 mTurk workers who earned $0.15 for their participation. Only native English speakers were included in analyses. This resulted in 158 participants included in analyses.

3.1.1.2 Materials, Design, and Procedure

Materials included ten insults, each with a fluent and disfluent version (twenty total). Insults were taken from a collection of mean tweets directed at celebrities. Insults that were over 20 words or contained curse words were not included. Celebrity names were removed and insults were reworded so they were directed at the reader (e.g. You are... instead of Celebrity Name is...). Original insults were considered fluent. A disfluent version of each insult was created by replacing every noun, adjective, and verb with the
longest entry in the thesaurus (www.merriam-webster.com) for that word. This resulted in disfluent insults such as “You are an unadulterated laughingstock, a featherbrain who is disoriented” (changed from the fluent version, “You are a total joke, a dummy who is lost”). More examples of fluent and disfluent insults are included in Appendix C.

Fluency was manipulated within-subjects; each participant saw five fluent and five disfluent insults. Two versions of the materials were created so that each insult was represented fluently to half of participants and disfluently to the other half. The order of insults was randomized.

Participants were asked to read each insult and judge how offensive and hurtful they thought it was. They did this for all ten insults.

3.1.1.3 Results and Discussion

A repeated measures analysis of variance (ANOVA) over judgments of fluent and disfluent insults yielded a main effect of fluency for both offensiveness and hurtfulness judgments (Offensiveness: $F(1, 157) = 36.57, p < .001, \eta^2 = .19$; Hurtfulness: $F(1, 157) = 35.52, p < .001, \eta^2 = .18$). Fluent insults were judged as more insulting and more hurtful than disfluent insults (Offensiveness: Fluent $M = 5.13, SD = 1.18$, Disfluent $M = 4.78, SD = 1.26$; Hurtfulness: Fluent $M = 4.92, SD = 1.40$, Disfluent $M = 4.52, SD = 1.47$) (see Figure 7).
These results supported our hypothesis and the FAM: Fluent negative materials were judged as worse than their disfluent counterparts. A simple explanation is that, as predicted by the FAM, fluency amplified the initial affective response to the insults. In short, fluency made a bad insult seem worse. Another possible explanation is that comprehension differed between fluent and disfluent insults. Because of the nature of the fluency manipulation, disfluent insults contained longer, more complex words than fluent insults. It is possible that these complex words reduced comprehension so participants did not understand the meaning of disfluent insults as clearly as they understood the fluent insults. An insult that is clearly understood could be perceived as
more offensive and hurtful than one whose meaning is obscured. This possibility is addressed in Experiment 2B.

### 3.2 Experiment 2B

The purpose of Experiment 2B was to eliminate possible differences in comprehension between the fluent and disfluent insults. We did this by using a fluency manipulation that did not alter language. Instead, insults were made either fluent or disfluent by using easy- or hard-to-read handwriting. Aside from the fluency manipulation, the design and procedures were the same as Experiment 2A.

#### 3.2.1 Method

**3.2.1.1 Participants**

Participants included 247 mTurk workers who earned $0.15 for participating. Only native English speakers were included in analyses. This resulted in 217 participants included in analyses.

**3.2.1.2 Materials, Design, and Procedure**

Materials were the same ten insults used in Experiment 2A (fluent versions). Each insult was handwritten clearly with the writer’s dominant hand (fluent version), and again in a dense cursive or with the writer’s non-dominant hand (disfluent version). All insults were written in black ink on white paper, which was then uploaded to the computer as an image (see examples in Appendix C). Several versions of each insult were pilot tested, and the most fluent and disfluent version of each insult was used in
the study. Fluent and disfluent insults were significantly different in their perceived ease of reading ($p < .001$).

Procedures were the same as in Experiment 2A. Participants read and judged ten insults, five fluent and five disfluent, in a randomized order. Judgments included offensiveness and hurtfulness.

3.2.1.3 Results and Discussion

A repeated measures ANOVA over judgments of fluent and disfluent insults yielded a main effect of fluency for both offensiveness and hurtfulness judgments (Offensiveness: $F(1, 216) = 27.54$, $p < .001$, $\eta^2 = .11$; Hurtfulness: $F(1, 216) = 23.77$, $p < .001$, $\eta^2 = .10$). As in Experiment 1A, fluent insults were judged as more offensive and more hurtful than disfluent insults (Offensiveness: Fluent $M = 4.78$, $SD = 1.30$, Disfluent $M = 4.48$, $SD = 1.25$; Hurtfulness: Fluent $M = 4.48$, $SD = 1.52$, Disfluent $M = 4.20$, $SD = 1.45$) (see Figure 8).
Figure 8: Judgments of offensiveness and hurtfulness for fluent and disfluent insults. Fluency was manipulated using handwriting. Judgments were made on a scale from 1 (not at all offensive/hurtful) to 7 (very offensive/hurtful). Error bars represent standard error of the mean. Data are from Experiment 2B.

This pattern of results replicates the findings of Experiment 2A. In both experiments, fluent negative materials were judged more negatively than disfluent negative materials. Experiment 2B demonstrated that this difference was not due to differences in comprehension of the insults’ language.

Together, Experiments 2A and 2B support our hypothesis that fluent negative materials would be judged as worse than disfluent ones. The FAM would explain these results in terms of an amplifying effect: The insults cause a negative affective response in the reader and fluency amplifies that response, making it more negative. An alternative explanation relies on findings about fluency and truth. When information is easier to process, it is more likely to be judged as true or credible (Schwarz & Newman, 2017;
Schwarz 2017). In this context, fluent insults could be perceived as truer, and thus more offensive and hurtful. In either case, Experiments 2A and 2B showed that fluency makes a bad thing seem worse.

One of the unique characteristics of the materials used in these experiments is their intent to cause an affective response. By their nature, insults are designed to hurt the recipient in an emotional way. Throughout the fluency literature, many materials used to test the effects of fluency on judgment do not share this characteristic. This introduces the question of whether these effects would generalize to negative materials that do not intend to cause an affective response. Is it possible that the emotional nature of insults interacted with fluency in a way that non-emotional materials would not? We address this question in Experiments 3A and 3B.

3.3 Experiment 3A

The purpose of Experiments 3A and 3B was to explore the effects of fluency on judgments of negative materials that were not intended to cause an affective response. Materials in these experiments were fictional names of prescription medications and surgical procedures. Unlike Experiment 2, some materials were positively valenced and others were negatively valenced; positive to replicate the literature’s current findings, and negative to investigate fluency’s effects on judgments of negative materials. Valence was manipulated by emphasizing either the target’s positive traits (ability to help) or negative traits (ability to cause side effects or complications). Fluency was manipulated
by making the names either Easy- or Hard-to-Pronounce (EP or HP). Questions eliciting judgments were either positively or negatively framed.

In Experiment 2 using negative and emotionally charged materials, fluent insults were judged as worse. According to the FAM, fluency amplified the negative affective response, making it seem more negative. The materials used in Experiments 3A and 3B were also negative but did not have the same emotional charge and were not intended to cause an affective response. If the FAM accurately predicts the effects of fluency on judgments of negative materials regardless of the materials’ affective intent, we would expect that the fluent materials in this experiment would be judged more negatively. However, if judgments of emotional and non-emotional materials interact differently with fluency, it is possible that the HFM could more accurately predict the effects of fluency on judgments of non-emotional materials. That is, fluent materials would yield higher positive judgments and lower negative judgments compared to disfluent materials. Given these two plausible outcomes, we did not know the direction in which fluency would affect judgments.

3.3.1 Method

3.3.1.1 Participants

Participants were 568 mTurk workers who earned $0.10 for participating. Only native English speakers were included in analyses. This resulted in 363 participants included in analyses.
3.3.1.2 Materials, Design, and Procedure

Materials included four targets (prescription medication names; two fluent [EP] and two disfluent [HP]) and 2-3 questions per condition. Targets were based on real medication names. At the recommendation of several physicians, real medications were antibody and seizure medications as these tend to be unfamiliar to the general population. Fluent medication names were based on the brand name and disfluent names were based on the generic name for the same medication. One letter was changed in each medication name so that participants could not use the target to find real information about the medication. Responses were given on a 7-point Likert response scale. See medication names and judgments in Appendix D.

We used a 2 x 2 x 2 mixed factorial design (valence x frame x fluency) (see Figure 9 for a design schematic). Valence was manipulated between subjects; participants were randomized to either the Cure condition or Side Effects condition. The Cure condition was positively valenced and participants answered questions about the medication’s likelihood to cure. The Side Effects (SE) condition was negatively valenced and participants answered questions about the medication’s likelihood to cause side effects. Framing was also manipulated between subjects; participants were randomized to either the Positive or Negative framing condition. Positively and negatively framed questions asked about the same concept but used different language (e.g. positive: How likely are you to live? vs. negative: How likely are you to die?). Fluency was manipulated within
Figure 9: Design schematic for Experiment 3A. Participants were randomized to answer questions about the likelihood that each medication would cure or cause side effects. Questions were positively or negatively framed. Medications (Med.) 1 and 2 were either fluent (easy-to-pronounce) or disfluent (hard-to-pronounce). Participants saw one of each fluency manipulation, order counterbalanced.

Participants read a medication name, then made several judgments about the medication. No additional information was given about each medication besides the name. After making judgments about the first medication, participants made the same judgments about a second medication.
3.3.1.3 Results and Discussion

A 2 (fluency: EP vs. HP; within) x 2 (framing: positive vs. negative; between) repeated measures ANOVA over judgments in the Cure and Side Effects conditions revealed a main effect of fluency that was significant across both Side Effects conditions ($F(1, 175) = 22.78, p < .001, \eta^2 = .12$) and approached significance across both Cure conditions ($F(1, 180) = 3.26, p = .073, \eta^2 = .02$). Fluent medications were judged as more likely to cure and less likely to cause side effects than disfluent medications. There were no significant interactions between fluency and framing. A series of follow-up repeated measures ANOVAs explored the effects of fluency in each condition. These analyses revealed a significant effect of fluency in all conditions (Cure. Positive frame: $F(1, 86) = 5.89, p = .017, \eta^2 = .064$; Side Effects. Positive frame: $F(1, 87) = 6.18, p = .015, \eta^2 = .07$; Side Effects. Negative frame: $F(1, 86) = 17.74, p < .001, \eta^2 = .17$ except for the Cure. Negative frame condition ($F(1, 92) = .034, p = .855, \eta^2 = .000$) (see Figures 10 and 11; also see Table 3).

Analyses also revealed a main effect of framing in both the Cure and Side Effects conditions (Cure: $F(1, 180) = 18.29, p < .001, \eta^2 = .09$; Side Effects: $F(1, 175) = 7.37, p = .007, \eta^2 = .04$) such that in positive frame conditions, medications were judged as more likely to cure and less likely to cause side effects.
Figure 10: Judgments of how likely medications are to cure when medication names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce). Judgments were made on a scale from 1 (not likely) to 7 (very likely). Questions were positively or negatively framed. Data are from Experiment 3A. Error bars represent standard error of the mean.

Figure 11: Judgments of how likely medications are to cause side effects when medication names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce). Judgments were made on a scale from 1 (not likely) to 7 (very likely). Questions were
positively or negatively framed. Data are from Experiment 3A. Error bars represent standard error of the mean.

Table 3: Means and standard deviations of judgments about the likelihood that a medication will cure or cause side effects. Judgments were made on a scale from 1 (not likely) to 7 (very likely). Medication names were either fluent or disfluent, and questions were framed either positively or negatively. Data are from Experiment 3A.

<table>
<thead>
<tr>
<th>Judgments</th>
<th>Fluency</th>
<th>Framing</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cure</td>
<td>Fluent</td>
<td>Positive</td>
<td>4.69</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>3.99</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Disfluent</td>
<td>Positive</td>
<td>4.48</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>3.97</td>
<td>1.15</td>
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<tr>
<td>Side effects</td>
<td>Fluent</td>
<td>Positive</td>
<td>3.03</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>3.37</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>Disfluent</td>
<td>Positive</td>
<td>3.38</td>
<td>1.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>3.82</td>
<td>1.03</td>
</tr>
</tbody>
</table>

These results demonstrated that fluent medication names were judged as more likely to cure and less likely to cause side effects than disfluent medications. This effect of fluency was seen in all conditions except the Cure.Negative frame condition. The effects of fluency on judgments of negative materials (Side Effects conditions) were contrary to those found in Experiments 2A and 2B in which fluent negative materials were judged as worse than their disfluent counterparts. Because of this reversal of effects, it was particularly important to replicate and generalize these findings.
3.4 **Experiment 3B**

The purpose of Experiment 3B was to replicate and generalize the findings from Experiment 3A.

3.4.1 **Method**

The methods were the same as Experiment 3A except for the following changes:

- **Context:** To generalize, we used a different medical context: Surgical procedures. Procedure names were developed using the root of target words that have been widely used in the fluency literature (Song & Schwarz, 2008; Bahnik & Vranka, 2017; Schwarz, Jalbert, & Newman, under review). We then added a typical procedure suffix to these roots such as –ostomy or –ectomy.

- **Negative material wording:** Rather than asking about *Side Effects*, Experiment 3B asked about *Complications*.

- **Target length:** In Experiment 3A, targets were based on real generic and brand medication names, resulting in differences in target length. In Experiment 3B, all targets were 12 letters long.

- **Question design:** In some of the judgments in Experiment 3A, the question wording combined with the scale wording resulted in a double negative at the lower end of the response scale (e.g. *If you take [medication name], how likely is it that you will NOT be cured? 1-Not at all likely to 7-Very likely*). To ensure this wording didn’t interfere with the effects of fluency, judgments in Experiment 3B
were worded as: Out of 100 people who get a [procedure name], how many will be cured? Participants made judgments on a scale from 0-100 people.

- Additional questions: Following the cure or complications judgments for a particular procedure, participants answered 6 additional questions about the procedure’s complexity (e.g. How long do you think it would take to recover from a [procedure name]?). The purpose of these questions was to explore participants’ perceptions of each procedure beyond the cure or complication judgments. All materials and judgments are included in Appendix D.

Participants were 460 mTurk workers; each earned $0.20 for participating. Only native English speakers were included in analyses, resulting in 253 participants. Based on the results of Experiment 3A, we expected to find a main effect of fluency (fluent procedure names would yield higher positive judgments and lower negative judgments compared to disfluent procedure names) and framing (positive framing would yield higher positive judgments and negative framing would yield higher negative judgments).

**3.4.2 Results and Discussion**

A 2 (fluency: EP vs. HP; within) x 2 (framing: positive vs. negative; between) repeated measures ANOVA over judgments in the Cure and Complications conditions revealed a main effect of fluency across both Complications conditions ($F(1, 127) = 9.91, p = .002, \eta^2 = .07$). Fluent procedures were judged as less likely to cause complications
than disfluent procedures. There was no main effect of fluency across both Cure conditions \( F(1, 122) = 2.46, p = .119, \eta^2 = .02 \). Unlike Experiment 3A, there were no main effects of framing across Cure conditions \( F(1, 122) = .207, p = .65, \eta^2 = .002 \) or Complications conditions \( F(1, 127) = .695, p = .406, \eta^2 = .005 \). However, there was a significant interaction between fluency and framing in the Cure conditions \( F(1, 122) = 7.29, p = .008, \eta^2 = .056 \) (see Figures 12 and 13; also see Table 4).

A series of follow-up repeated measures ANOVAs explored the effects of fluency in each condition. As in Experiment 3A, these analyses revealed a significant effect of fluency in all conditions (Cure. Positive frame: \( F(1, 58) = 8.32, p = .005, \eta^2 = .125 \); Complications. Positive frame: \( F(1, 63) = 6.082, p = .016, \eta^2 = .088 \); Complications. Negative frame: \( F(1, 62) = 4.813, p = .032, \eta^2 = .072 \)) except for the Cure. Negative frame condition \( F(1, 62) = .643, p = .426, \eta^2 = .01 \).
Figure 12: Judgments of how likely procedures are to cure when procedure names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce). Judgments were made in terms of how many people would be cured (0-100 people). Questions were positively or negatively framed. Data are from Experiment 3B. Error bars represent standard error of the mean.
Figure 13: Judgments of how likely procedures are to cause complications when procedure names are fluent (easy-to-pronounce) vs. disfluent (hard-to-pronounce). Judgments were made in terms of how many people would experience complications (0-100 people). Questions were positively or negatively framed. Data are from Experiment 3B. Error bars represent standard error of the mean.

Table 4: Means and standard deviations of judgments about the likelihood that a surgical procedure will cure or cause complications. Judgments were made on a scale from 1 (not likely) to 7 (very likely). Procedure names were either fluent or disfluent, and questions were framed either positively or negatively. Data are from Experiment 3B.

<table>
<thead>
<tr>
<th>Judgments</th>
<th>Fluency</th>
<th>Framing</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cure</td>
<td>Fluent</td>
<td>Positive</td>
<td>64.26</td>
<td>18.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>61.58</td>
<td>23.24</td>
</tr>
<tr>
<td></td>
<td>Disfluent</td>
<td>Positive</td>
<td>57.53</td>
<td>19.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>63.36</td>
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</tr>
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<td>Complications</td>
<td>Fluent</td>
<td>Positive</td>
<td>32.06</td>
<td>14.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>36.00</td>
<td>9.81</td>
</tr>
<tr>
<td></td>
<td>Disfluent</td>
<td>Positive</td>
<td>38.39</td>
<td>11.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>40.22</td>
<td>10.69</td>
</tr>
</tbody>
</table>
Responses to the six questions about procedure complexity were highly correlated (range of correlations for Cure conditions: $r(245) = .245 - .603$, $p < .001$ for all; Complications conditions: $r(255) = .204 - .641$, $p < .001$ for all) so participants’ six responses for each procedure were combined to create a cumulative complexity score (ranging from 0 - 42). Fluent procedures were judged as significantly less complex than disfluent procedures (Cure conditions: EP $M = 28.63$, $SD = 5.36$, HP $M = 29.93$, $SD = 5.62$, $p = .015$, $\eta^2 = .049$; Complications conditions: EP $M = 28.89$, $SD = 5.79$, HP $M = 30.42$, $SD = 5.32$, $p = .002$, $\eta^2 = .071$). This difference in perceived complexity could be explained in part by another common finding in the fluency literature: Fluent materials are often judged as more familiar (Whittlesea, 1993; Reber & Zupanek, 2002). It is possible that seemingly familiar procedures are perceived as “routine” and therefore less complex, less likely to cause complications, and more likely to cure. Future research would be necessary to determine whether familiarity and perceived complexity mediate the fluency effects observed here.

Overall, the results from Experiments 3A and 3B demonstrated that fluency had the same effect on both positive and negative materials: Fluent materials were judged more positively (more likely to cure, less likely to cause side effects or complications) than their disfluent counterparts. These results suggest that the effects of fluency on judgments of negative materials mirror those of positive materials, supporting the HFM. This pattern of results is contrary to the findings of Experiments 2A and 2B, in which
fluent materials were judged more negatively than disfluent materials. There are several possible explanations for these discrepant results.

First, while Experiments 3A and 3B used a pronounceability fluency manipulation, Experiments 2A and 2B used different fluency manipulations (language and handwriting). One could suggest that these different manipulations played a role in the different findings. However, as discussed earlier, a broad review of the literature suggests that fluency is a unified phenomenon (Alter & Oppenheimer, 2009). That is, regardless of how fluency is manipulated, the subjective experience of ease exerts consistent effects on judgments. This makes it unlikely that the discrepant results are due to differences in fluency manipulations.

Another possible explanation calls on the relationship between fluency and truth or credibility. As discussed earlier, fluent information is more likely to be judged as credible (Schwarz & Newman, 2017; Schwarz 2017). In the context of insults, true or credible insults would likely be judged more negatively due to their increased hurtfulness; however, in the context of medical information, it is likely that credible information would be judged more positively. Future research could explore the possible mediating effects of perceived truth and credibility.

Another difference between Experiments 2 and 3 is the materials’ affective content. In Experiment 2, the materials (insults) were emotionally charged and intended to cause an affective response in the reader. In contrast, the materials in Experiment 3
(medications and procedures) did not intend to cause an affective response. According to the FAM, when negative materials are fluent, fluency amplifies the negative affective response to make it more negative. While this model was supported in Experiment 2, it is unclear how the model would predict the effects of fluency in the case of negative, non-affective materials. More research is needed to determine whether judgments of affective and non-affective negative materials respond differently to fluency.

A final possible explanation for the differences in results between Experiments 2 and 3 is based on subtle differences in the materials’ valence. Targets in Experiment 2 (insults) were inherently negative. Each target was designed to evoke an immediate negative response. In Experiment 3, rather than using inherently negative materials, participants were asked to focus either on a positive (cure) or negative (side effects or complications) aspect of the target. However, the targets themselves had an inherently positive valence. Both medications and procedures exist to help and heal patients. Even when focusing on a negative aspect of these materials, the core of the materials is positively valenced. It is possible that this difference helps to account for the different results in Experiments 2 and 3. If so, we would expect that another experiment using inherently negative materials would replicate the findings of Experiments 2A and 2B. We considered this explanation to be the most plausible, and Experiment 4 was designed to test this idea.
3.5 Experiment 4A

Experiments 2 and 3, though designed to test the same phenomenon, demonstrated opposite effects of fluency on judgments of negative materials. Experiments 4A and 4B were designed to help identify the factors that contributed to the discrepant results in Experiments 2 and 3.

The purpose of Experiments 4A and 4B was to explore the effects of fluency on judgments of materials that were inherently negative and did not contain affective content. Like Experiment 3, these experiments were designed to generalize the findings of Experiment 2 by using materials that did not elicit the same affective response as materials in Experiment 2 (insults). In contrast to the materials used in Experiment 3, however, the materials used in these experiments were inherently negative (diseases) rather than asking participants to focus on a negative aspect of a positive material.

3.5.1 Method

3.5.1.1 Participants

Participants were 229 mTurk workers who earned $0.20 for participating. Only native English speakers were included in analyses. This resulted in 162 participants included in analyses.

3.5.1.2 Materials, Design, and Procedure

Materials included eight targets (disease names; four easy-to-pronounce and four hard-to-pronounce, written in either easy or hard handwriting) and two judgments per
target. Targets consisted of a 5-7 letter root (based on target words that have been widely used in the fluency literature) and ended in a disease-related suffix (-oma). Targets were selected based on pilot testing, which ensured that EP and HP targets were significantly different in pronounceability. Targets and judgments are included in Appendix E.

Responses were given on a 7-point Likert response scale.

Fluency was manipulated within subjects; we used a 2x2 fluency manipulation (pronounceability and handwriting) so that participants read and made judgments about four targets (one from each quadrant; see Figure 14). The order of targets was counterbalanced across participants.
Figure 14: Design schematic for Experiment 4A. Two fluency manipulations were used: Handwriting and pronounceability (pron). Each participant read and made judgments about one disease name from each quadrant in the figure.

Participants were asked to imagine they have just been diagnosed with a newly discovered type of cancer and very little is known about the disease. They saw a portion of their “doctor’s notes”, which read “Diagnosis: [target]” in easy-to-read handwriting (EH) or hard-to-read handwriting (HH). Participants then judged the likelihood of severe symptoms and likelihood of death from this disease. This process was repeated four times.

The results of Experiments 2 and 3 suggest opposite effects of fluency on judgments of negative materials. Like Experiment 2, Experiment 4A used inherently
negative materials (insults in Experiment 2, disease names in Experiment 4A). Like Experiment 3, the purpose of the targets used in Experiment 4A was not to elicit an affective response. This design, which incorporated elements from studies with discrepant results, does not facilitate a straightforward hypothesis based on the effects demonstrated thus far. If fluent materials were judged as more harmful as in Experiment 2, it would support the FAM and suggest that fluency makes inherently negative materials seem worse. If fluent materials were judged as less harmful as in Experiment 3, it would support the HFM and suggest that when materials are negative and do not have affective content, fluency makes them seem better. Given these two plausible outcomes, we expected that judgments would be significantly affected by fluency. However, we did not know the direction in which these effects would go.

### 3.5.2 Results and Discussion

Participants’ two judgments for each disease were averaged into an overall score indicating the target’s harmfulness. A repeated-measures ANOVA over judgments of harmfulness revealed no significant main effects of fluency, either for pronounceability or handwriting (EP.EH M = 4.83, SD = 1.07; EP.HH M = 4.79, SD = 1.23; HP.EH M = 4.83, SD = 1.16; HP.HH M = 4.78, SD = 1.12; Pronounceability: F(1, 161) = .012, p = .914, ηp² = .000; Handwriting: F(1, 161) = .367, p = .546, ηp² = .002). There were no significant interactions between the two fluency manipulations.
Contrary to our expectations, fluency did not demonstrate any significant effects on judgments. We identified several possible shortcomings in the design of this experiment that may help explain why the same fluency manipulations that significantly affected judgments in Experiments 2 and 3 did not do so here.

First, the scenario that participants were asked to imagine in Experiment 4A used a cancer diagnosis as the premise and participants made judgments about a fictitious type of cancer. It is possible that this scenario was too severe for fluency to exert an effect (i.e. cancer is perceived as deadly regardless of whether its name is fluent or disfluent).

Second, in regards to the handwriting manipulation, it is possible that participants glanced at the disfluent disease names but did not parse out what was actually written. In Experiment 2B, which also used a handwriting manipulation, insults were interesting and funny to read so it is likely that participants were motivated to make sense of the hard-to-read handwriting. In this experiment, however, the same motivation to make sense of the handwriting was not present and it is possible that participants did not actually read the names of the diseases. This would prevent participants from experiencing disfluency. Experiment 4B was designed to address these possible shortcomings.
3.6 Experiment 4B

Like Experiment 4A, the purpose of Experiment 4B was to explore the effects of fluency on judgments of materials that were inherently negative and did not contain affective content. However, several changes were made to address the possible shortcomings of Experiment 4A.

3.6.1 Method

3.6.1.1 Participants

Participants included 125 undergraduates from Duke University who were approached on campus and asked to complete a brief survey. Participants were not compensated. Participants were excluded if they gave the same response to every question in the survey, indicating lack of attention. They were also excluded if they did not correctly identify the disease name in the survey. Overall 15 surveys were excluded and 110 surveys were included in analyses.

3.6.1.2 Materials, Design, and Procedure

Materials included four targets (disease names; two fluent [easy-to-pronounce; EP] and two disfluent [hard-to-pronounce; HP]) and four questions. As in Experiment 4A, targets consisted of a root (based on target words that have been widely used in the fluency literature) and ended in a typical disease suffix (e.g. –osis, -idia). Targets were selected based on pilot testing, which ensured that EP and HP targets were significantly
different in pronunciability. Handwriting was not manipulated. Judgments were made on a 7-point Likert response scale. Targets and judgments are included in Appendix E.

Each participant read two scenarios, each of which included an introduction, a target, and four questions. In each scenario, participants were asked to imagine they have a disease (either a sexually transmitted infection [STI] or flu) that is spreading around campus. These classes of diseases were used rather than cancer (as in Experiment 4A) since they are less severe and can typically be cured or treated. Participants read the target (name of the disease) and answered the questions (one attention check and three judgments). For the attention check, participants were asked to write out the name of the disease in the scenario. This ensured that participants were paying attention to the disease names rather than just skipping over them, even when they were difficult to read. Judgments also differed from those in Experiment 4A; they reflected participants’ personal reactions to the disease (e.g. *How scared would you be if you had this STI?*) rather than the harmfulness of the disease itself.

Participants saw one of each scenario (STI and flu). They also read one fluent and one disfluent disease name. Order of scenarios and disease names was counterbalanced across participants (see Figure 15).
Figure 15: Schematic for Experiment 4B. Participants responded to questions in both the STI scenario and Flu scenario. Participants saw one fluent (easy to pronounce) and one disfluent (hard to pronounce) disease name. The order of scenarios and diseases was counterbalanced across participants.

3.6.2 Results and Discussion

A repeated-measures ANOVA revealed a significant main effect of disease such that STI diseases names were judged as worse than flu disease names, whether fluent or disfluent. Because of this, STI judgments and flu judgments were compared separately using between-subjects t-test analyses.

Analyses for STI judgments revealed a non-significant trend: Fluent STI’s were judged as worse than disfluent STI’s, though none of these differences reached significance (Scared: Fluent $M = 5.40, SD = 1.43$, Disfluent $M = 5.00, SD = 1.40$, $t(108) = 1.47$, $p = .15, d = .28$; Stressed: Fluent $M = 5.77, SD = 1.32$, Disfluent $M = 5.46, SD = 1.29$, $t(108) = 1.28$, $p = .21, d = .25$; Bad: Fluent $M = 4.60, SD = 1.38$, Disfluent $M = 4.33, SD = 1.31$, $t(108) = 1.05$, $p = .29, d = .20$) (see Figure 16).
Figure 16: Judgments of how scared participants would be, how stressed participants would be, and how bad participants think the disease is for the STI scenario. Disease names were fluent (easy-to-pronounce) or disfluent (hard-to-pronounce). Judgments were made on a scale from 1 (not at all) to 7 (very). Data are from Experiment 4B. Error bars represent standard error of the mean.

Analyses for flu judgments revealed the opposite (though also non-significant) trend: Disfluent flu names were judged as worse than fluent flu names. None of these differences reached significance at the $p = .05$ level (Scared: Fluent $M = 4.11$, $SD = 1.54$, Disfluent $M = 4.38$, $SD = 1.42$, $t(107) = .98$, $p = .33$, $d = .18$; Stressed: Fluent $M = 4.37$, $SD = 1.68$, Disfluent $M = 4.62$, $SD = 1.36$, $t(108) = .87$, $p = .39$, $d = .16$; Bad: Fluent $M = 4.11$, $SD = 1.29$, Disfluent $M = 4.55$, $SD = 1.20$, $t(107) = 1.84$, $p = .07$, $d = .35$) (see Figure 17).
Figure 17: Judgments of how scared participants would be, how stressed participants would be, and how bad participants think the disease is for the flu scenario. Disease names were fluent (easy-to-pronounce) or disfluent (hard-to-pronounce). Judgments were made on a scale from 1 (not at all) to 7 (very). Data are from Experiment 4B. Error bars represent standard error of the mean.

Experiment 4B was designed to explore the effects of fluency on judgments of materials that were inherently negative and did not contain affective content. Overall, we found no significant effects of fluency. There are several possible explanations for these findings.

First, it is possible that the lack of effect was due to the analyses using between-subjects rather than within-subjects methods. People are more sensitive to changes in subjective ease than to a stable level of ease (Song & Schwarz, 2008; Dechêne, Stahl, Hansen, & Wänke, 2009, 2010; Schwarz, Jalbert, & Newman, under review). Because of this, fluency effects are stronger when using a within-subjects rather than between-subjects design. By analyzing participants’ responses between-subjects, we failed to
capture the effects of the change in subjective ease between fluent and disfluent disease names. It is possible that a within-subjects design would have yielded stronger effects.

Along these same lines, many studies in the fluency literature ask participants to make judgments about numerous fluent and disfluent targets. It is not uncommon for participants to make judgments about 6-10 different targets (e.g., Song & Schwarz, 2008; Bahnik & Vranka, 2017). Making judgments about multiple targets rather than one or two emphasizes the change in subjective ease between fluent and disfluent targets. In this experiment, participants only made judgments about two targets. Furthermore, those judgments were compared between-subjects, which prevented any change in subjective ease from being reflected in the analyses. This is likely to have contributed to the lack of effect. Future research could capture the true nature of the effect of fluency by asking participants to make judgments about numerous fluent and disfluent targets.

3.7 Discussion of Experiments 2, 3, and 4

The purpose of the experiments described here was to explore how fluency affects judgments of negative materials with an emphasis on two models that predict opposite effects: HFM and FAM. Given the complexities of fluency, it was expected that neither model could cleanly predict fluency’s effects in this domain. Rather than definitively show the accuracy of one model over the other, our goal was to explore the circumstances under which one model can predict better than the other.
In Experiments 2A and 2B, fluent insults were judged as more offensive and more hurtful than disfluent ones. These results support the amplifying effects predicted by the FAM. Because of the emotional nature of insults, we wondered whether these results would generalize to negative materials that are not intended to cause an affective response or whether the affective nature of insults could have interacted with the effects of fluency.

This question was addressed in Experiments 3A and 3B, which asked participants to make judgments about fluent or disfluent medication and procedure names. These materials were presented as either having the potential to cure (positive materials conditions) or cause harmful side effects/complications (negative materials conditions), and lacked the affective intent that was inherent to insults. The results showed that fluent materials were judged more positively than their disfluent counterparts, regardless of whether the materials were positive or negative. This pattern of findings supports the HFM and contradicts the findings of Experiments 2A and 2B. It is possible that this reversal of effects is due to the differences in affective response to the materials: When materials cause an affective response, fluency amplifies that response; when materials do not cause an affective response, fluency leads to more positive judgments. It is also possible that the effect reversal was due in part to subtle differences in the materials' valence between Experiments 2 and 3. While targets in Experiment 2 were inherently negative, those in Experiment 3 were inherently positive but
participants were asked to focus on either positive or negative aspects of the target. If this difference in valence was responsible for the reversal of effects between Experiments 2 and 3, we would expect that using inherently negative materials that did not cause an affective response would replicate the findings of Experiments 2A and 2B. Experiments 4A and 4B were designed to test this.

Experiments 4A and 4B explored the effects of fluency on judgments of diseases. Materials were inherently negative and did not contain affective intent. Overall, we found no significant effects of fluency. Several possible explanations point to details in experiment design such as using between-subjects rather than within-subjects methods and asking participants to make too few judgments since fluency effects are most apparent when judgments are relative, not absolute. It is possible that changes to the experiment design would yield stronger effects.

On its surface, this exploratory investigation of the effects of fluency on judgments of negative materials suggests that: 1) When materials cause an affective response, fluency amplifies that response; and 2) When materials do not cause an affective response, the effects of fluency are mixed. However, this simplified explanation overlooks other possible factors at play, such as naïve theories. As mentioned previously, naïve theories bridge the gap between fluency and judgments by providing a context-specific interpretation of fluency (Schwarz, 2004). These interpretations could vary between participants, thus affecting the direction of fluency’s effects. Consider an
example where a doctor is using disfluent language to explain a concept to a patient. The patient could interpret this disfluent language as being unfamiliar, and therefore judge the information more negatively. Alternatively, the patient could interpret the disfluent language as an indication that the doctor is competent or has expertise, and therefore judge the information more positively. People are likely to rely on their most accessible theory without considering plausible alternatives, rendering the subjective meaning of fluency highly malleable and sensitive to context (Schwarz, 2010). This malleability, which was clearly illustrated by the mixed results of the experiments described here, makes it impossible to conclusively determine the direction of fluency’s effects on judgments of negative materials without also investigating which naïve theories might be at play. This is an important avenue for future research.

Future work should explore the nature of the naïve theories that influence judgments of fluent vs. disfluent negative materials. It should also address how individual differences and social context impact the naïve theories that are brought to bear in certain scenarios. Investigating these factors would further clarify our understanding of how fluency affects judgments of negative materials, particularly in a healthcare context.
4. Experiments 5, 6, and 7

The experiments described in Chapter 3 demonstrated that fluency is a nuanced phenomenon and that its effects on judgments are not simple or straightforward. Because of its complexity, it is important to study fluency systematically within a specific context to explore its effects. The purpose of Experiments 5, 6, and 7 was to investigate the nuances of fluency’s effects specifically in the context of research study risks. Experiments 5A and 5B explored how fluency affects judgments of riskiness for study risks. We also explored the interplay of fluency, communicators, and naïve theories about communicative intent. The purpose of Experiment 6 was to generalize our findings to judgments of risk likelihood. In Experiment 7, we examined whether the effects of fluency differ if positive information (benefits) is presented alongside the negative information (risks).

4.1 Experiment 5A

Experiments 5A and 5B were designed to provide an initial examination of how fluency affects judgments of study risks. Fluency was manipulated by using simple (fluent) or complex (disfluent) language to describe the risks. We explored the effects of fluency on judgments of riskiness and willingness to participate in a research study, whether those effects were consistent across different communicators, and whether participants’ naïve theories helped explain the relationship between fluency and judgments. We expected that judgments would differ between fluent and disfluent risks.
Since research has shown that the effects of fluency on judgments of negative materials can go in either direction, we were interested in determining the direction of the effect in this particular context.

A pilot study was conducted to identify naïve theories that participants might have regarding fluency and the intent of the risk communicator. Twenty mTurk Master workers earned $0.50 for their participation. Participants saw a list of fluent and disfluent risks and were told that each list was written by a different hospital. Participants were asked to identify reasons why one hospital used simple language and the other used complex language. Common themes in the open-ended responses were identified, and the most common themes were used as naïve theories in the following experiments.

4.1.1 Method

4.1.1.1 Participants

Participants included 122 mTurk workers who earned $0.40 for their participation. Participants were excluded from analyses if they failed to answer all questions in the survey. This resulted in 120 participants included in analyses.

4.1.1.2 Materials, Design, and Procedure

Materials included two lists of mild risks. Each list contained the same risks, but the fluency differed (one used simple language and the other used complex language). The risks came from a fictitious but realistic informed consent form for a prescription
drug clinical trial (Weinfurt et al., 2008). Risks in the form were originally written in simple language and were used in the fluent risk list. To create the disfluent list, we conducted an online search for the “medical term” for each fluent risk (e.g. “Swelling in face” became “Facial edema”). Participants were told that the two lists contained the same risks for the same research study, as written by two different hospitals.

Participants read the two lists of risks, then read a statement informing them that even though the two lists contain the same information, the way the information is written can make it feel different. Then participants made judgments about which list felt riskier and whether they would be more likely to participate in the supposed research study if the risks were written like List A or List B. For each judgment, participants could select List A, List B, or neither (e.g. “Neither one feels riskier than the other”). Finally, participants read several pairs of statements and selected which of the two statements they agreed with more. The pairs of statements were possible naïve theories that the participants might hold about what simple vs. complex descriptions of risks suggest about the communicator’s intent (e.g. “Hospitals that use complex language about risks are trying to be professional and precise” vs. “Hospitals that use complex language about risks are trying to make the information harder for patients to understand and hide things from patients”). Materials are included in Appendix F.
4.1.2 Results and discussion

In regards to riskiness, half of participants judged the disfluent list as riskier (50%). Of the remaining half, 31.7% judged the fluent list as riskier and 18.3% said neither felt riskier than the other (see Figure 18). For participation, a majority of participants said they would be more likely to participate in the research study with the fluent list (52.5%). The remaining participants were almost evenly split between those who would be more likely to participate in the research study with the disfluent list (25%) and those who indicated no preference (22.5%).

![Figure 18: Percent of participants who judged the fluent (black), disfluent (grey), and neither (white) list of risks as riskier and would participate in a research study with the associated list of risks. Data are for Experiment 5A.](image)

Regarding naïve theories, a majority of participants endorsed the idea that hospitals use simple language to make the information easier for patients to understand (80%) rather than to make risks seem safer than they really are (20%). For disfluent risks,
a majority of participants said they thought hospitals use complex language in order to be precise and professional (60.8%) rather than to hide things from patients (39.2%).

To summarize, a majority of participants judged the fluent risks as less risky than the disfluent risks, and said they were more likely to participate in the research study with the fluent risks. This result replicates the common finding in the fluency literature that fluent information is judged more positively and less negatively than disfluent information. While the literature has established this finding with positive and neutral materials, this experiment replicated those findings with negative materials. In Experiment 5B, we attempted to generalize these results.

### 4.2 Experiment 5B

Health information can come from a variety of sources, including medical institutions, doctors, and drug companies. Patients’ perceptions and trust can vary based on the communicator (Perry, Cox, & Cox, 2014). In Experiment 5B, we explored how fluency affected judgments when the risk communicator was either a doctor or drug company (rather than a hospital, as in Experiment 5A). We expected that, as in Experiment 5A, fluent risks would yield higher positive judgments and lower negative judgments compared to disfluent risks. Because patients’ trust can vary with different risk communicators, we also expected that naïve theories about communicative intent would differ significantly based on whether the risk communicator was a doctor or drug company.
4.2.1 Method

4.2.1.1 Participants

Participants included 142 mTurk workers who earned $0.40 for their participation. Participants were excluded from analyses if they failed to answer all questions in the survey. This resulted in 140 participants included in analyses.

4.2.1.2 Materials, Design, and Procedure

The materials and design were similar to Experiment 5A with the following exceptions:

- Participants were randomized to either the doctor or drug company condition. They were told that the two lists of risks were written by either two different doctors or two different drug companies.
- The four pairs of naïve theories from Experiment 5A were condensed into two pairs, fluent intent and disfluent intent.
- Participants were asked about naïve theories before making judgments.
- Judgments of risk and participation were made on 7-point Likert scales (materials are included in Appendix F).

4.2.2 Results and Discussion

A series of repeated-measures analyses of variance (ANOVAs) revealed that across both conditions (doctor and drug company), disfluent risks were judged as riskier than fluent risks (Doctor Risk A $M = 4.59$, $SD = 1.32$, Risk B $M = 5.35$, $SD = 1.24$, $F(1, 67) =$
16.03, $p < .001$, $\eta^2 = .19$; Drug Company Risk A $M = 4.78$, $SD = 1.30$, Risk B $M = 5.64$, $SD = 1.13$, $F(1, 71) = 25.51$, $p < .001$, $\eta^2 = .26$) (see Figure 19). In both conditions, participants also said they would be more likely to participate in the study with fluent risks rather than the study with disfluent risks (Doctor Participation A $M = 4.59$, $SD = 1.78$, Participation B $M = 3.32$, $SD = 1.64$, $F(1, 67) = 19.96$, $p < .001$, $\eta^2 = .23$; Drug Company Participation A $M = 4.28$, $SD = 1.86$, Participation B $M = 3.14$, $SD = 1.80$, $F(1, 71) = 32.73$, $p < .001$, $\eta^2 = .32$). Comparing judgments across conditions revealed that the communicator did not affect judgments of risk or participation.

**Figure 19: Judgments of riskiness and willingness to participate in a research study with the associated list of risks.** Risks were either fluent (simple language) or disfluent (complex language). Judgments were made on a scale from 1 (not at all) to 7 (very). Error bars represent standard error of the mean. Data are from Experiment 5B.

Regarding naïve theories, a majority of participants agreed on the perceived communicative intent of fluent risks; most participants in both conditions (85.7% in the
doctor condition and 80% in the drug company condition) endorsed the statement that doctors/drug companies use simple language to make information easy for patients to understand (rather than to make risks seem safer than they really are). However, participants’ perceptions about the communicative intent of disfluent risks varied across conditions. In the doctor condition, 73.5% of participants endorsed the statement that doctors use complex language in order to be precise. In the drug company condition, however, a majority of participants (56.9%) endorsed the opposite statement: Drug companies use complex language to hide things from patients. A chi-square analysis revealed that this difference between conditions was significant ($\chi^2(1, N = 140) = 13.32, p < .001$).

As in Experiment 5A, fluent risks were judged more positively and less negatively than disfluent risks. Additionally, judgments did not significantly differ based on whether the communicator was a doctor or drug company. While naïve theories about the communicative intent of fluent risks were similar across conditions, there was a significant difference between the doctor and drug company conditions for disfluent risks. While the majority of participants in the doctor condition believed complex language was used to be precise, more participants in the drug company condition believed complex language was meant to hide things from patients. It is interesting to note that while this perceived communicative intent varied between
conditions, this variation did not result in differences in judgments of risk or willingness to participate.

Overall, the results of Experiments 5A and 5B using negative materials support the literature’s findings for fluency and its effects on judgments of positive and neutral materials. In Experiment 6, we attempted to extend these findings to judgments beyond riskiness and willingness to participate.

4.3 Experiment 6

The purpose of Experiment 6 was to generalize our findings from Experiment 5 to judgments of risk likelihood. As in Experiment 5, we expected that fluent and disfluent risks would be judged as significantly different in risk likelihood and willingness to participate.

4.3.1 Method

4.3.1.1 Participants

Participants included 103 mTurk workers who earned $0.40 for their participation. Participants were excluded from analyses if they demonstrated lack of attention, either by failing to answer all questions or giving the exact same response to all questions. This resulted in 98 participants included in analyses.

4.3.1.2 Materials, Design, and Procedure

The materials and design were similar to Experiment 5B with the following exceptions:
• Participants judged the likelihood rather than riskiness of each risk list.

• Naïve theories addressed the meaning of simple vs. complex descriptions of risks in terms of risk likelihood.

• The order of judgments for each list (fluent and disfluent) was counterbalanced across participants (materials are included in Appendix G).

4.3.2 Results and Discussion

A series of repeated-measures ANOVAs revealed that across both conditions (doctor and drug company), fluent risks were judged as more likely than disfluent risks (Risk A $M = 4.52$, $SD = 1.42$, Risk B $M = 4.07$, $SD = 1.34$, $F(1, 96) = 4.99$, $p = .028$, $\eta^2_p = .049$). Across both conditions, participants also said they would be more likely to participate in the study with fluent risks rather than the study with disfluent risks, though this difference did not quite reach significance at the $p = .05$ level (Participation A $M = 4.03$, $SD = 1.70$, Participation B $M = 3.70$, $SD = 1.66$, $F(1, 98) = 1.84$, $p = .178$, $\eta^2_p = .019$).

Comparing judgments across conditions revealed that condition did not affect judgments of risk likelihood or participation, with one exception. There was a significant difference between conditions in willingness to participate in the supposed research study with disfluent risks; those in the doctor condition were more likely to participate than those in the drug company condition when risks were disfluent (Doctor $M = 4.10$, $SD = 1.70$; Drug Company $M = 3.77$, $SD = 1.91$; $t(96) = 2.52$, $p = .013$).
Regarding naïve theories, most participants in both conditions (70.6% in the doctor condition and 61.7% in the drug company condition) endorsed the statement that risks written in simple language seem more likely because people can relate to the risks. A majority of participants in both conditions (54.9% in the doctor condition and 68.1% in the drug company condition) also endorsed the statement that risks written in complex language seem less likely because people don’t understand the language so they discount or ignore these risks. These beliefs were reflected in the judgments of risk likelihood described above.

Overall, fluent risks were judged as more likely, and participants were more likely to participate in the study with fluent risks. At first glance, these results together seem counterintuitive; why would a participant be more willing to participate in a study with risks that are judged as more likely? However, revisiting the results of Experiment 5, we see that fluent risks are also judged as less risky. One can imagine a scenario in which a participant is more likely to accept a risk that is more likely but less risky (e.g. large chance of experiencing a headache) than a risk that is less likely but riskier (i.e. small chance of experiencing a blood clot).

Experiments 5 and 6 demonstrated that risk fluency affects judgments of riskiness, likelihood, and willingness to participate in a research study. In these experiments, the risks were presented alone. However, in real informed consent forms,
much more information is presented alongside the risks (e.g. the benefits of participating). Experiment 7 was designed to address this.

### 4.4 Experiment 7

The purpose of Experiment 7 was to explore how fluency affects judgments of risks and benefits when they are presented together. Based on the results of Experiments 5 and 6, we expected that participants would judge fluent and disfluent risks and benefits as significantly different in riskiness and likelihood (for risks), appeal (for benefits), and willingness to participate. Specifically, we expected that: Fluent risks would be judged as less risky and more likely; fluent benefits would be judged as more appealing; and participants would be more likely to participate in the study with fluent risks and benefits.

### 4.4.1 Method

#### 4.4.1.1 Participants

Participants included 108 mTurk Masters workers who earned $0.50 for their participation. All participants were included in analyses.

#### 4.4.1.2 Materials, Design, and Procedure

The materials and design were similar to the previous experiments with the following exceptions:

- The list of risks that participants read was shortened. Three hypothetical benefits of participating in the research study were added to the list. Half of participants
saw a list that had Risks on top and Benefits below, and the other half saw the opposite order.

• As in previous experiments, participants made several judgments about each list (fluent and disfluent). Participants judged the riskiness and likelihood of risks, the appeal of benefits, and the likelihood they would participate in a research study with the risks and benefits listed.

• In Experiments 5B and 6, participants were randomized to either the doctor or drug company condition. In Experiment 7, all participants were told that the Risks and Benefits were written by a doctor.

In Experiments 5A, 5B, and 6, participants were asked to endorse a series of naïve theories. Across these three experiments, participants showed general agreement regarding naïve theories. In Experiment 7, questions about naïve theories were not included (materials are included in Appendix H).

4.4.2 Results and Discussion

Judgments were compared using a series of repeated-measures ANOVAs, with fluency as a within-subjects factor and the order of risks and benefits as a between-subjects factor. For judgments about the risks, fluent risks were judged as significantly less risky than disfluent risks (fluent $M = 4.23, SD = 1.45$; disfluent $M = 5.30, SD = 1.42$; $F(1, 106) = 31.48, p < .001, \eta^2 = .23$) (see Figure 20). Contrary to what we found in Experiment 6, there were no significant differences in judged likelihood between fluent
and disfluent risks. For both of these judgments, the order of risks and benefits did not create any significant differences.

For judgments of the benefits’ appeal, there was a significant main effect of fluency: Fluent benefits were judged as more appealing than disfluent benefits (fluent $M = 4.72, SD = 1.58$; disfluent $M = 4.00, SD = 1.78$; $F(1, 106) = 17.57, p < .001, \eta^2 = .14$). As with risks, the order of risks and benefits did not create any significant differences.

Considering both risks and benefits together, participants said they were significantly more likely to participate in the study that used fluent language rather than disfluent language (fluent $M = 4.55, SD = 1.72$; disfluent $M = 3.51, SD = 1.80$; $F(1, 106) = 26.69, p < .001, \eta^2 = .20$). Analyses of this judgment also revealed a significant main effect of order: Participants who read the benefits first were significantly more likely to participate in the study than those who read the risks first (Risks first $M = 3.72, SD = 1.75$; Benefits first $M = 4.31, SD = 1.74$; $F(1, 106) = 4.87, p = .03, \eta^2 = .04$).
Figure 20: Judgments of riskiness (risks), likelihood (risks), appeal (benefits), and willingness to participate in a research study (both risks and benefits). Risks and benefits were either fluent (simple language) or disfluent (complex language). Judgments were made on a scale from 1 (not at all) to 7 (very). Error bars represent standard error of the mean. Data are from Experiment 7.

4.5 Discussion of Experiments 5, 6, and 7

These three experiments aimed to demonstrate the effects of fluency on judgments of negative materials, specifically risks for research studies. As previously mentioned, research regarding fluency’s effects on negative materials is sparse, and the research that has been conducted on this topic has yielded mixed results (e.g. Witvliet & Vrana, 2007; Albrecht & Carbon, 2014; Bahnik & Vranka, 2017). The results of the three experiments described in this chapter consistently suggest that fluent risks and benefits are judged more positively and less negatively than disfluent ones, mirroring the findings that have been established in the literature with positive and neutral materials.
However, though these findings were consistent, the body of research on fluency as a whole is far from conclusive. Obvious examples of inconsistency are the mixed results from the experiments in Chapter 3. The tangled nature of fluency theories is discussed further in the Conclusion chapter of this dissertation.
5. Conclusion

The overall aim of this dissertation was to examine how language, design, and fluency affect cognition with regards to written health materials. Chapter 2 explored how language and design affect comprehension and memory using an informed consent form for a research study. In Experiments 1A and 1B, participants read either a Standard form, a form with simplified language (Enhanced-Language), or a form with simplified language and improved design (Enhanced-Both). After reading, participants completed a series of comprehension, memory, and metacognition tasks. Those who read the Enhanced forms rated their own cognition as higher than those who read the Standard form, and also demonstrated better comprehension and memory. Additionally, those who read the Enhanced-Both form gave metacognitive judgments that were higher than those who read the Enhanced-Language form. These findings suggest that language and design make important contributions to cognitive processing of written health information.

In Chapter 3, we explored some different cognitive processes: Judgment and decision-making. The goal of this chapter was to investigate the effects of fluency on judgment and decision-making with negative materials. In Experiment 2, participants judged fluent and disfluent insults on offensiveness and hurtfulness. We used two different fluency manipulations: Language and handwriting. Across both manipulations, fluent insults were judged more negatively. These results demonstrated
support for the FAM since fluency seemed to amplify the negative nature of the insults. Experiment 3 tested the same phenomenon using positive and negative materials that had less affective intent than insults: Names of prescription medications and surgical procedures. Participants were randomized to either the positive condition (focused on cure) or negative condition (focused on side effects or complications). Participants were also randomized to a series of judgments that was either framed positively (e.g. How likely are you to live?) or negatively (e.g. How likely are you to die?). Overall, fluency had similar effects on judgments of positive and negative materials: Fluent materials were judged more positively and less negatively. These results conflict with the findings of Experiment 2 and support the HFM rather than the FAM. Experiment 4 was designed to resolve some methodological differences in Experiments 2 and 3 in order to help explain the discrepant results. In Experiment 4, participants made judgments about fluent and disfluent disease names. Fluency was manipulated using both pronounceability and handwriting (Experiment 4A) or only pronounceability (Experiment 4B), and participants made judgments about each disease. Overall, we found no significant effects of fluency. This lack of effect could have been due to our methodology, specifically our use of a between-subjects rather than within-subjects design and asking participants to judge too few targets.

The goal of Experiments 2, 3, and 4 was to explore how fluency affects judgments of negative materials, especially in terms of two models that predict opposite effects.
Across these three experiments, we found support for FAM, HFM, and no effect. These findings suggest that the relationship between fluency and negative materials is not simple or straightforward; rather, there are nuances and other forces (e.g. naïve theories) that influence this relationship.

In Chapter 4, we described a series of experiments that were designed to examine these nuances specifically in the context of research study risks. In each experiment, participants read a fluent and disfluent list of study risks. Fluency was manipulated using simple (fluent) or complex (disfluent) language. The risks were presented side by side and participants were informed that each list contained the same risks but they were worded differently. In Experiment 5, we explored how fluency affects judgments of riskiness for study risks and also willingness to participate. We also investigated whether the effects were consistent across different communicators (doctors and drug companies). Overall, fluent risks were judged more positively than disfluent risks, and judgments did not differ based on whether the communicator was a doctor or drug company. Participants were also more likely to participate in a research study with fluent risks. In Experiment 6, participants judged fluent and disfluent risks on likelihood and willingness to participate. Though fluent risks were judged as more likely than disfluent ones, participants were still more likely to participate in the research study with fluent risks. In Experiment 7, we explored whether the findings from Experiments 5 and 6 were consistent if positive information (benefits) was presented alongside the
negative information (risks). As in Experiment 5, fluent risks were judged as less risky than disfluent risks; however, judged likelihood did not differ. Fluent benefits were judged as more appealing than disfluent benefits, and participants were more likely to participate in a research study with fluent risks and benefits. This set of experiments suggests that within the context of research study risks, fluency exerts a similar effect on negative materials as it does on positive or neutral materials: Fluency yields more positive judgments.

The experiments described in Chapter 4 have significant practical implications. These experiments suggest that research patients’ judgment and decision-making can be affected by the language that is used in written health information. While much emphasis has been placed on using simple language in order to improve patient understanding, these experiments demonstrated that the effects of simple language go beyond comprehension of the information. Using simple language may improve patient comprehension, but it can also make risks seem less risky and more likely; it can make benefits seem more appealing; and it can make participants more willing to participate in a research study. When trying to ensure that potential research patients are truly informed, it is important to consider how the effects of fluency might influence important judgment and decision-making processes.

This body of research demonstrates that fluency is a complicated and nuanced phenomenon; fluency’s effects are likely to interact with other variables, including
context, emotion, materials, and naïve theories. The experiments described in this dissertation are a befitting illustration of these nuances and complexities: While the experiments in Chapter 4 yielded results that were consistent across experiments and also with much of the fluency literature regarding positive materials, the experiments described in Chapter 3 demonstrated support for FAM, (Experiment 2), HFM (Experiment 3), and neither theory (Experiment 4). Fluency’s effects on judgments do not fit cleanly into one model, and further study of fluency’s effects should carefully and systematically consider the nuances of this phenomenon.

The experiments described in this dissertation yield many opportunities for future research. Regarding the effects of improved language and design on comprehension and memory, future research could avoid the limitations of traditional readability measures by using a more comprehensive text analysis tool. For example, the Coh-Metrix readability measure was designed to assess text cohesion, or “characteristics of the explicit text that play some role in helping the reader mentally connect ideas in the text,” (Graesser, McNamara, & Louwerse, 2003). To date, no empirical research has used Coh-Metrix to evaluate the language of written health materials. This tool could facilitate more systematic changes to language in order to test their effects on cognition.

Another opportunity for future research is to explore the nuanced relationship between fluency and negative materials in other domains. The discrepant results of Experiments 2, 3, and 4 demonstrated that this relationship is not straightforward and
that the effects of fluency should be explored rigorously in specific domains. In Experiments 5, 6, and 7, we began to investigate the relationship between fluency and negative materials in the area of research study risks. There are many other domains, both within a healthcare context and outside it, where negative information is communicated through written materials. Each of these domains presents an opportunity for research regarding fluency and judgments of negative materials.

Finally, each experiment in this dissertation presented participants with a hypothetical situation and asked them to make judgments as if they were in that situation. This vignette methodology is common in psychology research and allows for controlled study of a phenomenon. However, it is possible that participants’ responses to a vignette differ from their responses to a stimulus in real life. Future research could explore the questions addressed in this dissertation using real life scenarios. For example, variations of Experiments 5, 6, and 7 could be conducted with real patients for research studies.

Within the context of healthcare, written materials can have significant effects on patient cognition. Principles like language, design, and fluency can affect how patients understand and remember information, and use that information to make important judgments and decisions. The experiments in this dissertation explored the effects of these principles on cognition and metacognition using various written materials. As we continue to increase our understanding of how these principles influence cognitive
processes, we can leverage that understanding to create written health materials that optimize patient cognition.
Appendix A: Materials (informed consent forms) for Experiments 1A and 1B

Standard informed consent form

DUKE UNIVERSITY HEALTH SYSTEM

Patient Consent Form for participation in a Research study of XXXXXXXX
Imaging of Radiofrequency Ablation Surgery
IRB # XXXXXXXXXXXXX

You are being asked to take part in this study because you have a tissue mass that will be treated with radiofrequency ablation surgery. Research studies include only people who choose to take part. Please read this consent form carefully and take your time making your decision. As your study doctor or study staff discusses this consent form with you, please ask him/her to explain any words or information that you do not clearly understand. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

The study is being done by the Departments of Radiology (Primary contact: Dr. Williams) and Biomedical Engineering (Primary contact: Dr. Williams), at Duke University Medical Center, Durham, NC 27708.

This study is being sponsored by a grant from the National Institutes of Health. Portions of Dr. Williams and his research team’s salaries are being paid by this grant.

Who will be my doctor in this study?

If you decide to participate, Dr. Williams will be your doctor for the study and will be in contact with your regular health care provider throughout the time that you are in the study and afterwards, if needed.

Why is this study being done?

The purpose of this study is to investigate a new ultrasonic method (using sound waves to take pictures of internal organs) for assessing the size of ablation lesions as they are created during surgery. An ablation lesion is a stiff region of dead tissue that forms in the body when a tissue mass (such as a tumor) is treated with radiofrequency ablation techniques.

How many people will take part in this study?

Approximately 50 people will take part in this study.

What is involved in the study?

If you agree to be in this study, you will be asked to sign this consent form. You will have the following tests and procedures to make sure that you are eligible:

- Physical exam and medical history
- Vital signs
- Blood tests
- Electrocardiogram (EKG), a tracing of the electrical activity of the heart
The study will involve acquiring ultrasound images of your ablation therapy treatment site throughout your procedure. To perform the ultrasound, a small amount of warm jelly will be placed on your side. A transducer, which is a hand-held box that is connected by a cable to the ultrasound machine, is then placed on the jelly. This sends sound waves into your body, which bounce off the tissues within your body and send back an image, which is displayed on a television screen. In this research study, the transducer will send in a series of sound waves that are expected to push on the ablation lesion and the tissue region surrounding it, and move them a very small amount (about the width of a hair). The stiff ablation lesion will move less than the surrounding healthy tissue. The motion will be detected by the ultrasound system. This study will be performed during your surgical procedure, and will not extend the duration of your treatment session. Both conventional ultrasound and the investigational method are painless, involve no exposure to x-rays, and are considered low risk.

How long will I be in this study?

This study will be performed entirely during your surgical procedure, and will not extend the duration of your treatment session. You may also be asked to take part in a similar study when you return for a follow-up assessment of your surgery. If you are asked to take part in this follow-up study, you will be provided an additional patient consent form outlining the procedures and risks involved in that study.

You can choose to stop participating at any time. However, if you choose to stop participating in the study, we encourage you to talk to your doctor first.

What are the risks of the study?

This new ultrasound technique involves minimal discomfort to you. The series of sound waves that will be used to push on your liver or kidney are similar to those that are commonly used for routine therapeutic ultrasound treatments. Therapeutic ultrasound is often used in physical therapy, and is used to generate heat in muscle tissue and joints to promote healing (like an internal heating pad). The remote possibility of tissue injury from the ultrasound technique in this examination is no different from that normally encountered in any diagnostic or therapeutic examination using ultrasound. These risks are minimized because the ultrasound waves will be applied in very short time bursts (less than 1 second), shorter than those normally used in therapeutic procedures (greater than 5 minutes).

As a result of your participation in this study, you are at risk for the following side effects. You should discuss these with the study doctor and your regular health care provider if you choose.
The ultrasound waves used in this study may cause some, all or none of the side effects listed below.

More likely

- Small temperature increases in tissue regions under investigation

Less likely

- Tissue damage due to moderate heat increases produced by ultrasound waves

There also may be other side effects that are unknown at this time. If you experience any side effects during or after this ultrasound procedure, inform the study doctor and you will be provided treatment.

Are there benefits to taking part in the study?

If you agree to take part in this study, there may not be direct medical benefit to you. We hope the information learned from this study will benefit other patients with your condition in the future.

Will my information be kept private?

Study records that identify you will be kept confidential as required by law. Federal Privacy Regulations provide safeguards for privacy, security, and authorized access. Except when required by law, you will not be identified by name, social security number, address, telephone number, or any other direct personal identifier in study records disclosed outside of Duke University Health System (DUHS). For records disclosed outside of DUHS, you will be assigned a unique code number. The key to the code will be kept in a locked file in Dr. Williams’ office.

As part of the study, Dr. Williams and his study team will report the results of your study-related images to the National Institutes of Health. In addition, your records may be reviewed in order to meet federal or state regulations. Reviewers may include representatives from the Food and Drug Administration, and the Duke University Health System Institutional Review Board. If your research record is reviewed by any of these groups, they may also need to review your entire medical record.

The images that are acquired today will not be included in your medical record. The study results (data and images) will be retained in your research record for at least six years or until after the study is completed, whichever is longer. At that time your name and other identifying information will be removed from the study results.

While the information and data resulting from this study may be presented at scientific meetings or published in a scientific journal, your identity will not be revealed.

What are the costs?

There will be no additional costs to you as a result of being in this study. However, routine medical care for your condition (care you would have received whether or not you were in this study) will be charged
to you or your insurance company. You may wish to contact your insurance company to discuss this further.

What about compensation?

You will not be compensated for your participation in this study. Taking part in this study is entirely voluntary, and you may choose not to be involved in the study.

What about research related injuries?

Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. Further information concerning this and your rights as a research subject can be obtained from the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111.

What about my rights to decline participation or withdraw from the study?

You may choose not to be in the study, or, if you agree to be in the study, you may withdraw from the study at any time. If you withdraw from the study, no new data about you will be collected for study purposes. You may withdraw your authorization for us to use your data that have already been collected (other than data needed to keep track of your withdrawal), but you must do this in writing.

Your decision not to participate or to withdraw from the study will not involve any penalty or loss of benefits to which you are entitled, and will not affect your access to health care at Duke. If you do decide to withdraw, we ask that you contact Dr. Williams in writing and let him know that you are withdrawing from the study. His mailing address is: P.O. Box 90281, Durham, NC 27708-0281. At that time we will ask your permission to continue using all information about you that has already been collected as part of the study prior to your withdrawal.

We will tell you about new information that may affect your health, welfare, or willingness to stay in this study.

Your doctor may decide to take you off this study if your condition gets worse, you have serious side effects, or your study doctor determines that it is no longer in your best interest to continue. The sponsor or regulatory agencies may stop this study at anytime without your consent. If this occurs, you will be notified and your study doctor will discuss other options with you.
DUKE UNIVERSITY HEALTH SYSTEM
Patient Consent Form for participation in a Research study of XXXXXXXX
Imaging of Radiofrequency Ablation Surgery
IRB # XXXXXXXXXXXXX

Whom do I call if I have questions or problems?
For questions about the study or a research-related injury, contact Dr. Williams at (919) 555-5555
during regular business hours and at (919) 777-7777 after hours and on weekends and holidays.

For questions about your rights as a research participant, contact the Duke University Health System
Institutional Review Board (IRB) Office at (919) 444-4444.

Statement of Consent
"The purpose of this study, procedures to be followed, risks and benefits have been explained to me. I
have been allowed to ask questions, and my questions have been answered to my satisfaction. I have
been told whom to contact if I have additional questions. I have read this consent form and agree to be in
this study, with the understanding that I may withdraw at any time. I have been told that I will be given a
signed copy of this consent form."

Signature of Subject ___________________________ Date ____________

Signature of Person Obtaining Consent ___________________________ Date ____________

Version Date: 6/07/2005 Page 5 of 5
Enhanced-Both informed consent form

Patient Consent Form

INTRODUCTION
Please Read Carefully

You are being asked to participate in a research study.
Before you make a decision,
-read this form carefully,
-make sure you fully understand the information in this form,
-and ask your study doctor to explain any information you do not understand.

We encourage you to talk with your family and friends before you decide to participate, and take your time making your decision.

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PURPOSE OF STUDY
Why is this study being done?

The purpose of this study is to investigate a new imaging method.

The new method
- is used during surgery
- is ultrasonic, which means it uses sound waves to take pictures of internal organs.

You are being asked to participate in this study because you have a tissue mass that will be treated with radiofrequency ablation surgery.

During your surgery
- the techniques used will create stiff regions of dead tissue called ablation lesions
- the new ultrasonic method will measure the size of ablation lesions

LENGTH OF STUDY
How long will I be in the study?

We perform the study during your surgery. It will not extend the length of your treatment session.

The study doctor may ask you to take part in a similar study when you return for a follow-up visit for your surgery. If we ask you to participate in the follow-up study, we will give you a different consent form about that study.

STUDY DOCTOR
Who will be my doctor in this study?

Dr. Williams will be your doctor during the study. He will be in contact with your regular doctor while you are in the study.

NUMBER OF PARTICIPANTS
How many people will participate in this study?

Approximately 50 people will participate in this study.
MEDICAL PROCEDURE
What procedures does the study involve?

If you agree to be in this study, we will complete the following to make sure you are eligible:
- Physical exam and review medical history
- Check vital signs
- Blood tests

If you are eligible, we will take ultrasound images of your treatment site during your surgery.

To perform the ultrasound:
1. We place a small amount of warm jelly on your side.
2. We place a transducer on the jelly. (A transducer is a hand-held box that is connected to the ultrasound machine.)
3. The transducer sends sound waves to your treatment site, which bounce off your tissue and send back an image,
4. The image is displayed on a television screen.
5. The waves are expected to push on the stiff ablation lesion (dead tissue) and the tissue around it, and move them a very small amount (about the width of a hair).
6. The dead tissue moves less than the healthy tissue around it, and the ultrasound system detects the motion.

If you choose not to participate in this study, you will receive the conventional ultrasound method. Both methods
- are painless
- do not expose you to x-rays
- and are considered low-risk.
RISKS
What are the risks of the study?

If you choose to participate in the study, the ultrasound waves may cause some, all, or none of the side effects listed below. You should discuss these with the study doctor, and your regular doctor if you choose.

More likely
- Tissue regions under investigation increase slightly in temperature

Less likely
- Tissue is damaged due to heat increases produced by ultrasound waves

The new ultrasound technique involves minimal discomfort to you. The sound waves that push on your tissue are similar to the ones used for routine therapeutic ultrasound treatments, like physical therapy. These therapeutic ultrasounds are used to:
- create heat in muscles and joints
- and promote healing (like an internal heating pad).

The risk of tissue injury in this study is no different from the risk in therapeutic ultrasound. The risks in this study are minimized because
- we apply the ultrasound waves in very short time bursts (less than 1 second),
- which is shorter than those normally used in therapeutic procedures (greater than 5 minutes).

There may be other side effects that are unknown at this time. If any side effects occur during or after this procedure, inform the study doctor and we will provide you with treatment.

BENEFITS
What are the benefits of participating in the study?

If you participate in the study, there may be no direct medical benefit to you. We hope the information learned from the study will benefit other patients with your condition in the future.

COSTS
Are there any costs?

There are no additional costs if you participate in the study. Routine medical care (care you would receive whether or not you were in the study) will be charged to you or your insurance company.

COMPENSATION
Will I be compensated?

You will not be compensated for participating in the study.
PATIENT RIGHTS
Do I have the right to decline participation or withdraw from the study?

You may choose not to be in the study, and if you agree to be in the study, you may withdraw at any time.

If you decide not to participate or to withdraw, you will not be penalized and your access to health care at Duke will not be affected.

If you decide to withdraw:
1. Please tell Dr. Williams in writing. His mailing address is: P.O. Box 999, Durham, NC.
2. We will not collect any new data about you for study purposes.
3. We will ask your permission to continue using your study information that has already been collected.

You may withdraw your permission for us to use this data (other than data needed to keep track of your withdrawal), but you must do this in writing.

We will tell you about new information that may affect your health, welfare, or willingness to stay in this study.
Your regular doctor may decide to take you off this study if:
- your condition gets worse
- you have serious side effects,
- or your study doctor determines that it is no longer in your best interest to continue.

The sponsor or regulatory agencies may stop this study at anytime without your consent. If this occurs, your study doctor will notify you and discuss other options.

PRIVACY
Will my information be kept private?

Study records that identify you will be kept confidential as required by law. Federal Privacy Regulations provide safeguards for privacy, security, and authorized access.

Except when required by law, we will not identify you by name, social security number, address, telephone number, or any other direct personal identifier in study records disclosed outside of Duke University Health System (DUHS). For records disclosed outside of DUHS, we will assign you a unique code number. We will keep the key to the code in a locked file in Dr. Williams’ office.

Who may see my study records?
1. Dr. Williams and his study team will report the results of your study-related images to the National Institutes of Health.
2. The Food and Drug Administration and the Duke University Health System Institutional Review Board may review your records in order to meet federal or state regulations.
   - If your research record is reviewed by any of these groups, they may need to review your entire medical record.
3. The results of this study may be presented at scientific meetings or published in a scientific journal, but your identity will not be revealed.

The images from the study will not be included in your medical record. We will retain the study results (data and images) in your research record for at least six years or until after the study is completed, whichever is longer. At that time, we will remove your name and other identifying information from the study results.
STATEMENT OF CONSENT

"The purpose of this study, medical procedure, risks, and benefits have been explained to me. I have been allowed to ask questions, and my questions have been answered to my satisfaction. I have been told whom to contact if I have additional questions. I have read this consent form and agree to be in this study, with the understanding that I may withdraw at any time. I have been told that I will be given a signed copy of this consent form."

Signature of Subject ___________________________ Date ____________

Signature of Person Obtaining Consent ______________ Date ____________

STUDY CONTACT

Whom do I call if I have questions or problems?

For questions about the study or a research-related injury, contact:
Dr. Williams
(919) 999-9999 (Regular business hours)
(919) 888-8888 (After hours, weekends, and holidays)

For questions about your rights as a research participant, contact:
Duke University Health System Institutional Review Board (IRB) Office
(919) 777-7777
Enhanced-Language informed consent form

DUKE UNIVERSITY HEALTH SYSTEM

Patient Consent Form for participation in a research study
Imaging of Radiofrequency Ablation Surgery
IRB # 55555555

Patient Consent Form

Introduction
Please Read Carefully

You are being asked to participate in this study because you are having surgery (“radiofrequency ablation”) to remove a tissue mass. Research studies include only people who choose to participate. Before you make a decision, read this form carefully and take your time making your decision. Make sure you fully understand the information in this form, and ask your study doctor to explain any information you do not understand. We encourage you to talk with your family and friends before you decide to participate. The purpose of the study, risks, inconveniences, discomforts, and other important information is included below.

The study is being done by the Departments of Radiology and Biomedical Engineering at Duke University Medical Center. The primary contact is Dr. Williams.

This study is being sponsored by a grant from the National Institutes of Health. The grant will pay portions of the research team’s salaries.

Study doctor
Who will be my doctor in the study?

Dr. Williams will be your doctor during the study. He will be in contact with your regular doctor while you are in the study.

Purpose of study
Why is this study being done?

The purpose of this study is to investigate a new imaging method that is ultrasonic (it uses sound waves to take pictures of internal organs). The new ultrasonic method is used to measure the size of ablation lesions during your surgery. “Ablation lesions” are stiff regions of dead tissue created by the techniques used during your surgery.

Number of participants
How many people will participate in the study?

Approximately 50 people will participate in this study.

Medical procedure
What are the study procedures?

Version Date: 6/07/2005 Page 1 of 6 Subject Initials
DUKE UNIVERSITY HEALTH SYSTEM

Patient Consent Form for participation in a research study
Imaging of Radiofrequency Ablation Surgery
IRB # 555555555

Before the study: First you will decide whether to be in the study. If you agree, you will be asked to sign this consent form. We will see if you are eligible, based on this information:

- Your medical history
- Physical exam
- Vital signs
- Blood tests
- Electrocardiogram (EKG), a test that checks for problems with the electrical activity of your heart

During the study: If you are eligible, we will take ultrasound images of the surgery area during your surgery. For the ultrasound: We place a small amount of warm jelly on your side. We place a transducer on the jelly (a transducer is a hand-held box that is connected to the ultrasound machine). The transducer sends sound waves to your treatment site, which bounce off your tissue and send back an image. The image is displayed on a television screen. The waves should push on your tissue, both the stiff ablation lesion (dead tissue) and the healthy tissue around it, and move the tissues slightly (about the width of a hair). The dead tissue moves less than the healthy tissue around it, and the ultrasound system detects the motion. If you choose not to participate in this study, you will receive the standard ultrasound method. Both the study procedure and the standard method are painless, do not expose you to x-rays, and are considered low-risk.

Length of study
How long will I be in the study?

The study takes place only during your surgery. It will not make your surgery last longer. The study doctor may ask you to participate in a similar study in the future. If we ask you to participate in another study, we will give you a new consent form for that study.

You may withdraw at any time. If you choose to withdraw, we encourage you to talk to your doctor first.

Risks
What are the side effects and other risks of the study?

The new ultrasound technique causes minimal discomfort. The waves that push on your tissue are like the ones used in physical therapy ultrasound treatments. They create heat in muscles and joints and promote healing (like an internal heating pad). The risk of tissue damage in the study is the same as for therapeutic treatments. The risks in the study are minimized because we apply the ultrasound waves in very short time bursts (less than 1 second). This is shorter than those normally used in therapeutic procedures (greater than 5 minutes).
DUKE UNIVERSITY HEALTH SYSTEM

Patient Consent Form for participation in a research study
Imaging of Radiofrequency Ablation Surgery
IRB # 5555555555

Possible side effects: If you participate in the study, you are at risk for some side effects. You should discuss the possible risks with the study doctor and your regular doctor if you choose.

The ultrasound waves may cause either, both, or none of these side effects:
More likely
  • Tissue increases slightly in temperature

Less likely
  • Tissue is damaged due to increases in temperature (produced by ultrasound waves)

Other risks: There may be other side effects that are unknown at this time. If any side effects occur during or after this procedure, tell the study doctor and we will treat you.

Benefits
What are the benefits of participating in the study?

If you participate in the study, there may be no direct medical benefit to you. We hope the study results will benefit other patients with your condition in the future.

Privacy
Will my information be kept private?

Study records that identify you will be kept confidential as required by law. Federal Privacy Regulations provide safeguards for privacy, security, and authorized access. Except when required by law, we will not identify you by name, social security number, address, telephone number, or any other direct personal identifier in study records disclosed outside of Duke University Health System (DUHS). For records disclosed outside of DUHS, you will have a unique code number without any of your personal information. We will keep the key to the code in a locked file in Dr. Williams' office.

Who may see my study records?

Dr. Williams and his study team will report your study results to the National Institutes of Health (NIH). The U.S. Food and Drug Administration (FDA) and the Duke University Health System Institutional Review Board (IRB) may review your records in order to meet federal or state regulations. If your research record is reviewed by any of these groups, they may need to review your entire medical record.

The images from the study will not be included in your general medical record. We will retain the study results (data and images) in your research record for at least six years or until after the study is completed, whichever is longer. Then we will remove your name and other identifying information from the study results.
The results of this study may be presented at scientific meetings or published in a scientific journal, but your identity will not be revealed.

Costs
Are there any costs?

There are no additional costs if you participate in the study. Routine medical care (what you would receive whether or not you were in the study) will be charged to you or your insurance company. You may want to talk to your insurance company about this.

Compensation
Will I be paid?

You will not be paid for participating in the study. Participation is voluntary, and you may choose not to participate.

Injuries
What about research-related injuries?

If you are injured because of this study, you may receive immediate care at Duke University Medical Center. However, this care may not be free and you may not be compensated. More information about your rights is available from the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111.

Patient rights
Do I have the right to decline participation or withdraw from the study?

You may choose not to be in the study. If you agree to do it, you may withdraw at any time. If you withdraw, we will not collect any new study data from you. You may withdraw your permission for us to use the data we have already collected, other than data needed to keep track of your withdrawal, but you must do this in writing.

If you decide not to participate or to withdraw, you will not be penalized and your access to health care at Duke will not be affected. If you decide to withdraw, please tell Dr. Williams in writing. His mailing address is: P.O. Box 999, Durham, NC. We will ask your permission to continue using your study data that has already been collected.

We will tell you about new information that may affect your health, welfare, or willingness to stay in the study.

Your regular doctor may decide to take you off the study if your condition gets worse, you have serious side effects, or the study doctor determines that it is not in your best interest to continue. The sponsor or
DUKE UNIVERSITY HEALTH SYSTEM

Patient Consent Form for participation in a research study
Imaging of Radiofrequency Ablation Surgery
IRB #: 5555555555

regulatory agencies may stop this study at anytime without your consent. If this occurs, your study
doctor will notify you and discuss other options.

Study contact
What if I have questions or problems?

For questions about the study or a research-related injury, contact: Dr. Williams 919-999-9999 (Regular
business hours), or 919-888-8888 (After hours, weekends, and holidays).

For questions about your rights as a research participant, contact: Duke University Health System

Statement of Consent

"The purpose of this study, medical procedure, risks, and benefits have been explained to me. I have
been allowed to ask questions, and my questions have been answered to my satisfaction. I have been
told whom to contact if I have additional questions. I have read this consent form and agree to be in this
study, with the understanding that I may withdraw at any time. I have been told that I will be given a
signed copy of this consent form."

______________________________  __________________________
Signature of Subject               Date

______________________________  __________________________
Signature of Person Obtaining Consent   Date

Version Date:6/07/2005               Page 5 of 6               Subject Initials
Appendix B: Questions for Experiments 1A and 1B

1. You had some time to read the form. Was it about
   (Enough time, too little, or too much)
2. About what % of the leaflet did you
   a. read completely?
   b. just skim?
   c. not read at all?
3. Overall, how easy/hard was it to understand the information in this form?
   (1 - Very hard – 5 - Very easy)
4. Overall, how helpful was this form?
   (1 - Not at all helpful – 5 - Very helpful)
5. How confident are you that you know enough to decide whether or not to participate in this trial?
   (1 - Very unconfident – 5 - Very confident)
6. Overall, how easy/hard would it be to remember the information in this form?
   (Very hard - 5 - Very easy)
7. If we asked you questions about information in the form, about what % do you think you would get correct?
8. The form is divided into several major topics. About how many topics are there?
   If you are not sure, make your best guess – a ballpark number.
9. What are the names of the major topics? If you are not sure, it is OK to guess. If you have no idea, enter “?”
10. What is the purpose of this clinical trial? Describe briefly (1-2 phrases maximum)
11. What is the new medical technique used in this clinical trial?
12. If you agreed to be in this clinical trial, what are the chances these things would happen?
   (0% - No chance, 1-24%, 25-49%, 50-74%, 75-99%, 100% - It is certain)
   a. I would get the procedure described.
   b. I would get a placebo procedure.
   c. I would not get either the procedure or a placebo.
13. How long would your participation in the clinical trial last?
    (a few hours, a few days, a few weeks, a few months, a few years)
14. Are any follow-up visit required?
    (yes, no)
15. (If Q14 answered yes) How many follow up visits are there?
16. Would you be paid for participating?
    (yes, no)
17. (If Q16 answered yes) How much would you be paid?
18. About how many risks were given in the form?
19. Please list as many risks as you can, in any order that comes to mind.
   If you are not sure, it’s OK to guess, but not wildly. If you have no idea, enter a question mark (?)

20. Now you will see a list of risks, one at a time. For each, decide whether or not it was in the form.
   If you think it was in the form, click Yes.
   If you think it was not in the form, click No.
   If you are not sure, make your best guess.
   You must click Yes or No for each item, even if you have to guess.
   (Each risk listed was preceded by the question “Was this risk in the form?” and followed by Yes or No response options.
    a. Tissue damage
    b. Severe discomfort
    c. Temperature increase in tissue
    d. Radiation poisoning

21. Now you will see another list of risks, one at a time. For each, indicate how serious it would be if you experienced the risk during this clinical trial.
   (Each risk listed was preceded by the question “How serious is this risk?” and followed by the following response options: Very serious, Serious, Moderate, Mild, Inconsequential)
    a. Tissue damage
    b. Temperature increase in tissue

22. Now you will see another list of risks, one at a time. For each, indicate how often the risk might happen in this clinical trial.
   (Each risk listed was preceded by the question “How often might this risk happen?” and followed by the following response options: Very often, Often, Sometimes, Rarely, Never)
    a. Temperature increase in tissue
    b. Tissue damage

23. About how many benefits were given in the form?

24. Please list as many of the benefits as you can, in any order that comes to mind. If you are not sure, it’s OK to guess, but not wildly. If you have no idea, enter a question mark (?)

25. Now you will see a list of benefits, one at a time. For each, decide whether or not it was in the form.
   If you think it was in the form, click Yes.
   If you think it was not in the form, click No.
   If you are not sure, make your best guess.
   You must click Yes or No for each item, even if you have to guess.
(Each benefit listed was preceded by the questions “Was this benefit in the form?” and followed by Yes or No response options.)

   a. Decreased pain
   b. Benefit future patients

26. If you signed the form, could you withdraw from the trial later?
   (yes, no)

27. Can you withdraw from the trial for the following reasons?
   (yes, no)
   a. Your doctor recommends that you withdraw
   b. Your medical condition worsens
   c. You live more than a 90-minute drive from the clinic
   d. You experience too much pain in the trial
   e. You can withdraw for any reason

28. If you signed the form and withdrew from the trial, would there be a penalty?
   (yes, no)

29. If you withdrew from the trial, would the following penalties occur?
   (yes, no)
   a. Charged for the trial costs up to the point that you withdraw
   b. Now allowed to participate in future trials
   c. Must return any compensation received
   d. No penalties would occur

30. In addition to the study team at Duke University Medical Center, can anybody else review your trial records?
   (yes, no)

31. Can the following people review your trial records?
   (yes, no)
   a. U.S. Food and Drug Administration
   b. Duke University Institutional Review Board
   c. Your regular physician
   d. Other patients who are interested in the trial
   e. Anyone else I approve

32. Can information from this trial be presented at scientific meetings or published in a scientific journal?
   (yes, no)

33. If information from this trial is presented at scientific meetings or published in a scientific journal, may the following information be included?
   (yes, no)
   a. My image results from the trial
   b. My other results from the trial
   c. My complete medical record
34. If you had the medical condition described in the form and given what you’ve learned today, how likely would you be to participate in this trial?
   (0% - No chance, 1-24%, 25-49%, 50-74%, 75-99%, 100% - It is certain)
Appendix C: Materials for Experiments 2A and 2B

Experiment 2A

Sample of insults:

Fluent language:

You represent everything I hate about myself.

You are the most boring, vanilla dude.

Disfluent language:

You characterize everything I abominate about myself.

You are the most monochromatic, characterless fellow.

Questions:

1. How offensive do you think this statement is?
   (1 – Not at all offensive – 7 – Very offensive)

2. How hurt do you think you would be if someone said this to you?
   (1 – Not at all hurt – 7 – Very hurt)

Experiment 2B

Sample of insults:

Easy-to-read Handwriting:

You are a total joke, a dummy who is lost

you are a dead eyed trash bag
that smells like low tide.

114
Hard-to-read Handwriting:

Questions:
1. How offensive do you think this statement is?
   (1 – Not at all offensive – 7 – Very offensive)

2. How hurt do you think you would be if someone said this to you?
   (1 – Not at all hurt – 7 – Very hurt)
Appendix D: Materials for Experiments 3A and 3B

Experiment 3A

Introduction
Imagine you have been diagnosed with an autoimmune disease. This means your body’s immune system is attacking its own healthy cells. Because of your disease, you often have

- disabling pain
- severe shortness of breath
- and seizures.

Worse yet, if you do not treat your disease, you will eventually die from it.

Fortunately, your doctor says that your disease can be treated with some prescription medications.

In the following sections, we are going to give you the name of two medications that could potentially relieve your symptoms and could even cure your disease.

However, the medications could cause severe side effects that interfere with your everyday life. These side effects could be harmful to your health.

Please answer the following questions about these medications. It is okay if you have not heard of them.

Do not look up the medications or try to read more about them.

Just use your gut feeling and give your best guess to answer the questions.

Medications
Imagine your doctor is considering a medication called _______________.

Easy-to-pronounce
Zevalon
Ontag

Hard-to-pronounce
Ibritumomag Fiuxetab
Danileukit Diftetox
Cure-Positive judgments
1. If you take Zevalon, how likely is it that your symptoms (like the disabling pain or seizures) will go away?
   (1 – Not at all likely – 7 – Extremely likely)

2. If you take Zevalon, how likely are you to be cured?
   (1 – Not at all likely – 7 – Extremely likely)
3. If you take Ibritumomag Fiuxetab, how likely are you to live?
   (1 – Not at all likely – 7 – Extremely likely)

Cure-Negative judgments
1. If you take Zevalon, how likely is it that your symptoms (like the disabling pain and seizures) will NOT go away?
   (1 – Not at all likely – 7 – Extremely likely)

2. If you take Zevalon, how likely is it that you will NOT be cured?
   (1 – Not at all likely – 7 – Extremely likely)

3. If you take Zevalon, how likely are you to die from your disease?
   (1 – Not at all likely – 7 – Extremely likely)

Side effects-Positive judgments
1. If you take Zevalon, how likely is it that you will NOT experience any side effects?
   (1 – Not at all likely – 7 – Extremely likely)

2. Generally, how safe do you think it is to take Zevalon?
   (1 – Not at all safe – 7 – Extremely safe)

Side effects-Negative judgments
1. If you take Zevalon, how likely is it that you will experience severe side effects?
   (1 – Not at all likely – 7 – Extremely likely)

2. Generally, how dangerous do you think it is to take Zevalon?
   (1 – Not at all dangerous – 7 – Extremely dangerous)
Experiment 3B

Introduction

Cure
Imagine you have just been diagnosed with a rare growth in your abdomen. The growth causes you disabling pain, chronic diarrhea, and vomiting. Worse yet, if you do not treat your growth, you will eventually die from it.

Fortunately, your doctor says there are some surgical procedures that can be performed to treat your growth. These procedures could potentially relieve your symptoms and could even get rid of your growth.

Next, we will give you the name of two procedures and ask you some questions about them.

It's ok if you haven't heard of them. Do not look up the procedures or try to read more about them. Just use your intuition and give your best guess to answer the questions.

Complications
Imagine you have just been diagnosed with a rare growth in your abdomen. The growth causes you disabling pain, chronic diarrhea, and vomiting. Worse yet, if you do not treat your growth, you will eventually die from it.

Fortunately, your doctor says there are some surgical procedures that can be performed to treat your growth. These procedures could cause complications that interfere with everyday life. These complications could be harmful to your health.

Next, we will give you the name of two procedures and ask you some questions about them.

It's ok if you haven't heard of them. Do not look up the procedures or try to read more about them. Just use your intuition and give your best guess to answer the questions.

Procedures

To treat your growth, your doctor suggests a procedure called a __________________.

Easy-to-pronounce
Forbinplasty
Magniaplasty

Hard-to-pronounce
Nxungzrotomy
Tzronhsotomy
Cure-Positive judgments

1. Out of 100 people who have a Forbinplasty performed, how many do you think will have relief from their symptoms? (0-100)

2. Out of 100 people who have a Forbinplasty performed, how many do you think will be cured of their growth? (0-100)

3. Out of 100 people who have a Forbinplasty performed, how many do you think will live? (0-100)

Cure-Negative judgments

1. Out of 100 people who have a Forbinplasty performed, how many do you think will NOT have relief from their symptoms? (0-100)

2. Out of 100 people who have a Forbinplasty performed, how many do you think will NOT be cured of their growth? (0-100)

3. Out of 100 people who have a Forbinplasty performed, how many do you think will die? (0-100)

Complication-Positive judgments

1. Out of 100 people who have a Forbinplasty performed, how many do you think will be free from any complications? (0-100)

2. Out of 100 people who have a Forbinplasty performed, how many do you think will live? (0-100)

3. Generally how safe do you think a Forbinplasty is? (0 – Not at all safe – 100 – Extremely safe)
Complication-Negative judgments

1. Out of 100 people who have a Forbinplasty performed, how many do you think will have complications?
   (0-100)

2. Out of 100 people who have a Forbinplasty performed, how many do you think will die?
   (0-100)

3. Generally how dangerous do you think a Forbinplasty is?
   (0-100)

Complexity judgments

1. Compared with other procedures that a surgeon typically performs, how much special training do you think a surgeon would need to perform a Forbinplasty?
   (1 – Less special training than average – 7 – More special training than average)

2. How much easier/harder would it be for a surgeon to perform a Forbinplasty than to take out your appendix?
   (1 – Much easier – 7 – Much harder)

3. Compared with other procedures that a surgeon typically performs, how invasive do you think a Forbinplasty is?
   (1 – Less invasive than average – 7 – More invasive than average)

4. Compared with other procedures that a surgeon typically performs, how innovative do you think a Forbinplasty is?
   (1 – Less innovative than average – 7 – More innovative than average)

5. Compared with other procedures that a surgeon typically performs, how long do you think it would take to perform a Forbinplasty?
   (1 – Less time than average – 7 – More time than average)

6. Compared with other procedures that a surgeon typically performs, how long do you think it would take to recover from a Forbinplasty?
   (1 – Less time than average – 7 – More time than average)
Appendix E: Materials for Experiments 4A and 4B

Experiment 4A

Introduction
Please imagine the following scenario:
You visit your doctor for some routine tests. The tests come back, and your doctor calls you in with some very bad news.

Your doctor diagnoses you with a newly discovered type of cancer. We know very little about this cancer, and we don't know if there are any treatment options available.

As your doctor is writing, you catch a glimpse of his notes about the name of your cancer. Below, you will see a portion of these notes. Please read the notes and answer the questions.

It’s ok if you haven’t heard of this cancer. Do not look it up or try to read more about it. Just use your gut feeling and give your best guess to answer the questions.

Sample of diseases

Easy-to-pronounce, Easy Handwriting

Your doctor’s notes say:

Diagnosis: Allotema

Easy-to-pronounce, Hard Handwriting

Your doctor’s notes say:

Diagnosis: Trisoma
Hard-to-pronounce, Easy Handwriting

Your doctor’s notes say:

Diagnosis: Atrzyb2lomq

Hard-to-pronounce, Hard Handwriting

Your doctor’s notes say:

Experiment 4B

Judgments
1. How likely do you think it is that you will experience severe symptoms from this cancer?
(1 – Not at all likely – 7 – Very likely)

2. How likely do you think it is that you will die from this cancer?
(1 – Not at all likely – 7 – Very likely)

Introduction

STI scenario
You recently had unprotected sex, and now you are experiencing some strange symptoms.
You visit the Student Health Center and your doctor tells you about Allostrea, a sexually transmitted infection (STI) that is spreading around campus.
You test positive for Allostrea.

Flu scenario
There is a new strain of flu that has made its way to the U.S. from Asian birds. It is called Nxurzyclidia.
You are experiencing some possible symptoms and visit the Student Health Center.
You test positive for Nxurzyclidia.
Questions and judgments

1. Please write the name of the STI (the underlined word above)._________________________

2. How scared do you think would you feel if you got this STI?

   1                        2   3   4   5   6   7
   Not scared               Very scared

3. How stressed do you think you would be if you got this STI?

   1                        2   3   4   5   6   7
   Not stressed             Very stressed

4. How bad do you think this STI is?

   1                        2   3   4   5   6   7
   Not bad                 Very bad

Disease names

Easy-to-pronounce
Allostrea
Magniosis

Hard-to-pronounce
Nxurzyiclidia
Xtlipinoscius
Appendix F: Materials for Experiments 5A and 5B

Experiment 5A

**Introduction:**
People often participate in medical research studies. In order to participate, people must read a form that tells them about the study. These forms include the possible risks that could happen if they participate.

Sometimes these risks are written in simple, straightforward language. Other times, they are written in complex language or medical terms.

You will see two lists of risks that were written by two different hospitals (Hospital A and Hospital B). The two lists contain the same risks for the same study. The lists contain the same information but use different language.

Please read and compare the two lists carefully, then answer the questions that follow.

**Risks:**

<table>
<thead>
<tr>
<th>Hospital A</th>
<th>Hospital B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>If you participate in this research study, you may experience:</strong></td>
<td><strong>If you participate in this research study, you may experience:</strong></td>
</tr>
<tr>
<td>Yellow skin</td>
<td>Jaundice</td>
</tr>
<tr>
<td>Fewer red blood cells</td>
<td>Reduced hemoglobin; anemia</td>
</tr>
<tr>
<td>Fever</td>
<td>Febrile response</td>
</tr>
<tr>
<td>Throwing up</td>
<td>Emesis</td>
</tr>
<tr>
<td>Headache</td>
<td>Cephalgia</td>
</tr>
<tr>
<td>Red cheeks or neck</td>
<td>Flushed appearance</td>
</tr>
<tr>
<td>Low blood pressure</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Heartburn</td>
<td>Pyrosis</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Frequent and liquid stools</td>
</tr>
<tr>
<td>Swelling in face</td>
<td>Facial edema</td>
</tr>
<tr>
<td>Rash and/or itching</td>
<td>Dermatitis and/or pruritis</td>
</tr>
<tr>
<td>Feeling like heart is beating too hard</td>
<td>Cardiovascular palpitations</td>
</tr>
<tr>
<td>Stomach pain</td>
<td>Abdominal discomfort</td>
</tr>
<tr>
<td>Feeling tired</td>
<td>Somnolence and fatigue</td>
</tr>
</tbody>
</table>

(Please read and compare for at least 30 seconds. Then you can advance when you're ready.)
Questions:
Even though Lists A and B contain the same information, the way the information is written can make it feel different.

1. Which list feels riskier to you, Hospital A or Hospital B?
(Hospital A, Hospital B, or Neither one feels riskier than the other)

2. Would you be more likely to participate in the research study if the risks were written like Hospital A or Hospital B?
(Hospital A, Hospital B, or I would be equally likely to participate in both)

Naive theories:

The following questions contain two statements.
Please select the statement that you agree with more.

1. Which statement do you agree with more?
   - Hospitals that use **simple** language about risks are trying to make the information easier for patients to understand.
   - Hospitals that use **simple** language about risks are trying to make them seem safer than they really are.

2. Which statement do you agree with more?
   - Hospitals that use **complex** language about risks are trying to be professional and precise.
   - Hospitals that use **complex** language about risks are trying to make the information harder for patients to understand and hide things from patients.

3. Which statement do you agree with more?
   - Hospitals that use **complex** language about risks are trying to make them seem safer so that patients will participate in the study.
   - Hospitals that use **complex** language about risks are trying to make them seem more dangerous to scare patients away from the study.

4. Which statement do you agree with more?
   - It is better for hospitals to use **simple** language because it is better for patients.
• It is better for hospitals to use complex language because it is what doctors are used to.

Study 5B

Introduction:
Same as Study 1A, but substituting “Doctor” or “Drug Company” for “Hospital”

Risks:
Same as Study 1A, but substituting “Doctor” or “Drug Company” for “Hospital”

Naive theories:
The following questions contain two statements.
Please select the statement that you agree with more.

1. Which statement do you agree with more?
   • Doctors that use simple language about risks are trying to make the information easier for patients to understand.
   • Doctors that use simple language about risks are trying to make them seem safer than they really are.

2. Which statement do you agree with more?
   • Doctors that use complex language about risks are trying to be professional and precise.
   • Doctors that use complex language about risks are trying to hide things from patients.

Questions:
Even though Doctor/Drug Company A and Doctor/Drug Company B wrote about the same risks, the way the risks are written can make them feel different.

1. Consider the risks written by Doctor/Drug Company A. How risky do they seem to you?
   (1 – Not at all risky – 7 – Very risky)

2. How likely would you be to participate in a medical research study if the risks were presented like they were by Doctor A?
   (1 – Not likely to participate – 7 – Very likely to participate)
Appendix G: Materials for Experiment 6

Introduction:
Same as Experiment 5B

Risks:
Same as Experiment 5B

Naive theories:

The following questions contain two statements. Please select the statement that you agree with more.

Which statement do you agree with more?

- Risks that are written in simple language seem more likely to happen. This is because people can relate to the risks or recall an experience they’ve had with that risk.
- Risks that are written in simple language seem less likely to happen. This is because the simple language makes them seem less scary overall, so people also assume they are less likely.

Which statement do you agree with more?

- Risks that are written in complex language seem more likely to happen. This is because the language is more precise and professional, like what a doctor would actually use if the risk was likely to happen.
- Risks that are written in complex language seem less likely to happen. This is because people often don’t understand the language so they discount or ignore these risks.

Questions:

1. Consider the risks written by Doctor/Drug Company A. How likely does it seem that people who participate in this study would experience these risks? (1 – Not likely at all – 7 – Very likely)

2. How likely would you be to participate in a medical research study if the risks were presented like they were by Drug Company A? (1 – Not likely at all – 7 – Very likely)
Appendix H: Materials for Experiment 7

Introduction:
Same as Study 5A, using “Doctor” instead of “Hospital”

Risks and benefits:
(Other version listed benefits first, followed by risks).

<table>
<thead>
<tr>
<th>Doctor A</th>
<th>Doctor B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risks:</strong></td>
<td><strong>Risks:</strong></td>
</tr>
<tr>
<td>If you participate in this study, you may experience:</td>
<td>If you participate in this study, you may experience:</td>
</tr>
<tr>
<td>Swelling in face, Diarrhea, Feeling like heart is beating too hard, Fewer red blood cells, Throwing up, Fever, Rash and/or itching, Feeling tired</td>
<td>Facial edema, Frequent and liquid stools, Cardiovascular palpitations, Reduced hemoglobin; anemia, Emesis, Febrile response, Dermatitis and/or pruritis, Somnolence and fatigue</td>
</tr>
<tr>
<td><strong>Benefits:</strong></td>
<td><strong>Benefits:</strong></td>
</tr>
<tr>
<td>You will also experience the following:</td>
<td>You will also experience the following:</td>
</tr>
<tr>
<td>- Payment for your time, - Get a new treatment before it is available to the public, - You could help researchers find answers to their research questions</td>
<td>- Financial remuneration, - Access to novel treatment prior to its public distribution, - Your participation could contribute to the greater body of knowledge surrounding the research questions</td>
</tr>
</tbody>
</table>

(Please read and compare for at least 1 minute. Then you can advance when you're ready.)

Questions:

1. Consider the risks written by Doctor A. How risky do they seem to you? (1 – Not at all risky – 7 – Very risky)
2. Consider the risks written by Doctor A. How likely does it seem that people who participate in this study would experience these risks? (1 – Not at all likely – 7 – Very likely)

3. Consider the benefits written by Doctor A. How appealing do they seem to you? (1 – Not at all appealing – 7 – Very appealing)

4. How likely would you be to participate in a medical research study if the risks and benefits were presented like they were by Doctor A? (1 – Not at all likely – 7 – Very likely)
References


Biography

Stephanie Santistevan-Swett grew up in Salt Lake City, Utah. She attended Brigham Young University from 2006-2009, and graduated with a bachelor’s degree in Business Management. From 2011-2012, she returned to school and received a master’s degree in Psychology from Palo Alto University. She began her graduate studies at Duke University in the Psychology and Neuroscience Department in 2013. She conducted research with Dr. Ruth Day and Dr. Peter Ubel while completing her PhD in Cognitive Psychology. Stephanie will graduate with her PhD in December 2018.