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Customizing Message Content to Facilitate Decisions about Participating in Genomics Research: A Reasoned Action Approach

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Abstract
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According to the reasoned action model (Fishbein & Ajzen, 2010), decisions to participate in genomics research--like any other behavior--are driven by a limited number of factors. In this dissertation, consequences of participating that readily came to mind for respondents were expected to have a larger impact on attitudes and intentions to participate in genomics research than were nonsalient consequences. Moreover, customized messages designed to target salient versus nonsalient beliefs were expected to have larger effects on attitude and intention. Based on media priming theory (e.g., Price & Tewksbury, 1997), plausible downstream effects on belief salience resulting from message exposure were also explored, as was the conditional effect of salience on belief change (Jaccard, 1981).

An open-ended belief elicitation in Study 1 revealed audience segments with different motivations for participating in a genetic biobank. Contributing to the greater good was especially salient for some respondents, while receiving personal test results was salient for others. In Study 2, an experimental design was used to test the conditional effects of segment-targeted messages on belief strength, attitudes and intentions toward participating in a fictional genomic research project. Both studies suggested that salient behavior-related beliefs had a larger influence on people's participation decisions. Results from Study 2 further indicated that salient beliefs might also be more difficult to change. Theoretical and practical implications for fostering informed consent in large-scale genomic research are discussed.

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ABSTRACT

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According to the doctrine of informed consent, research participants have a right to voluntarily decide whether to enroll in a study and to do so with an adequate understanding of what participation entails (Beauchamp & Childress, 2009). Mirroring these rights, investigators have a moral obligation to give people the facts that are most critical to their choices (Fischhoff, 2011). Yet, theory-based analytical tools for determining which information is likely to have the largest impact on participation decisions are underdeveloped. Lacking a basis to prioritize elements of disclosure for distinct audiences, the length and complexity of consent documents has increased over time. Ironically, these improvements may have hindered comprehension and people's access to the information they need to make informed choices.

According to the reasoned action model (Fishbein & Ajzen, 2010), decisions to participate in genomics research—like any other behavior—are driven by a limited number of factors. In this dissertation, consequences of participating that readily came to mind for respondents were expected to have a larger impact on attitudes and intentions to participate in genomics research than were nonsalient consequences. Moreover, customized messages designed to target salient versus nonsalient beliefs were expected to have larger effects on attitude and intention. Based on media priming theory (e.g., Price & Tewksbury, 1997), plausible downstream effects on belief salience resulting from message exposure were also explored, as was the conditional effect of salience on belief change (Jaccard, 1981).

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CHAPTER ONE: INTRODUCTION

The doctrine of informed consent entails that researchers and clinicians have a moral obligation to disclose information to potential research participants and patients. Where disclosure standards are concerned, an emphasis has been placed on determining how much information must be disclosed to foster effective decision making (Jessica Berg, Appelbaum, Lidz, & Parker, 2001). Indeed, it is commonly held that prospective research participants and patients are entitled to receive enough information to enable them to make voluntary and comprehending choices (Beauchamp & Childress, 2009; A. L. McGuire & Beskow, 2010). Some theorists have been particularly indiscriminate in establishing the scope of this obligation, claiming that anything short of complete disclosure violates the rights of those from whom consent is being sought (Kottow, 2004). Others have been more pragmatic, acknowledging that much of the information people could learn about a research project or clinical procedure is not necessary for attaining valid informed consent (J. Baron, 2006; Veatch, 2007; Wendler & Grady, 2008).

Interestingly, much less attention has been given to what disclosed information should *specifically* be about. Institutional codes of ethics and legal frameworks have defined general categories of information that disclosure procedures should address. However, as regulatory guidelines, these standards refer to general categories of information. In that sense, they provide only rough guides for determining what potential research participants and patients should understand about an intervention before valid consent can be granted or withheld. To meet these standards in practice, researchers and clinicians have erred on the side of providing increasingly detailed and specific information about proposed procedures (Manson & O'Neill, 2007). However, providing greater amounts of information does not necessarily translate into more

effective informed consent (Beauchamp & Childress, 2009; Fischhoff, 2011). A more fundamental and pragmatic question remains largely unaddressed: On what basis can a piece of information be classified as relevant or irrelevant to a decision?

Several recent articles (Boddington, 2010; Caulfield et al., 2008; Lunshof, Chadwick, Vorhaus, & Church, 2008; Ormand et al., 2008; A. L. McGuire & Beskow, 2010; A. L. McGuire, Caulfield & Cho, 2008; Tabor, Berkman, Hull, & Bamshad, 2011) have argued that progress in the field of human genomics presents a challenge to current ways of thinking about informed consent. These challenges are amplified by the increased availability of multiplex genetic tests and genome-wide sequencing techniques. At the most advanced level, these testing platforms are capable of simultaneously generating personalized data on an unfathomable number of genetic variants and thousands of health conditions (Bunnik, Schermer, & Janssens, 2011; Schloss, 2011). Moreover, contemporary genomics is characterized by rapid change and great uncertainty. Even in the short-term, it is not possible to fully foresee what can be learned about a person through an analysis of her DNA, who will have access to the data or how that information will be used. Practices that involve generating, storing and using personal genomic information simply do not map well onto the dominant consent model. Requirements to provide specific disclosure cannot be met because the specifics are largely unknown. The integration of these technologies into research protocols, clinical practice and consumer services strain conventional notions of how to facilitate informed consent and autonomous choice (Jonathan Berg, Khoury, & Evans, 2011; Ormand et al., 2010).

In this regard, it is important to recognize that there is a critical difference between (a) defining a universal set of information, which if understood, would be sufficient for anybody to make an informed choice in a given context, and (b) identifying

information that if *misunderstood* would guarantee that a person remains uninformed about a possible course of action. The dominant perspective in the informed consent literature has emphasized the former goal. Unfortunately, under the current norms the amount of information required for a sufficient disclosure increases with the complexity of the decision context. As an extension of this, choices that involve personal genome profiling do not fit well with the aims of specific consent. Rather than focus on the problem of determining which information would be sufficient for an adequate disclosure, it is useful to recognize that some facts may be more relevant to people's decisions than other kinds of information. A central premise of this dissertation is that inaccurate and mistaken beliefs are a barrier to informed consent, but only if people act on the basis of those beliefs. Accordingly, consent procedures should be oriented toward addressing the beliefs upon which an action or choice is based.

Understanding the cognitive basis of peoples' decisions to participate in research involving the production of personal genome profiles is important for selecting and prioritizing the content of consent materials. As has been noted by Beauchamp and Childress (2009), the bioethical principles underlying informed consent suggest that the disclosure process should address decision makers' informational needs. To the extent that these needs differ within a population, identifying sub-groups of similar individuals and delivering targeted disclosure materials may be an appropriate communication strategy. However, systematically determining those informational needs, how individualized they are in practice, and whether disclosure materials can be effectively customized remain open questions.

To address this crucial gap in the literature, I draw on the reasoned action model (Fishbein & Ajzen, 2010) and its implications for developing communication-based behavior change interventions. The cognitive underpinnings of this model align with the

normative perspective that disclosure procedures should be guided by decision makers' expectations, values and preferences. Conceptually, messages that strategically appeal to the unique behavior-related beliefs of a specific, well-defined audience are expected to have a greater influence on behavior than messages that are designed to address the general informational needs of a broad population (Hobbis & Sutton, 2005). Evidence supporting this basic theoretical proposition would provide empirical ground for favoring customized consent procedures, and would offer direction on how to create them. I also consider the implications of media priming theory (e.g., Cappella, Fishbein, Hornik, Ahern, & Sayeed, 2000) in relation to defining an audience's informational needs.

In Study 1, subjects from a random population-based sample were asked to list the perceived advantages and disadvantages of participating in a genetic biobank. Responses from this belief elicitation were then used to define distinct audience segments with different motivations for participating. Results from this study were used to inform the development of customized disclosure messages designed to meet the unique informational needs of these audience segments. In Study 2, subjects were randomly assigned to receive different versions of the disclosure materials. The aim was to test the impact of content matching on respondents' beliefs, attitudes and intentions to participate in a fictional genomic research study, called the *SEQOME Project*. The implications for adopting audience segmentation and message customization strategies to foster informed consent in large-scale genomics research are discussed.

CHAPTER TWO: PERSONAL GENOME PROFILING AND THE CHALLENGE OF INFORMED CONSENT

Recent technological advances have made it feasible to study the genomic causes of common health conditions and other traits on a massive scale. In contrast, efforts to understand the relationship between gene variation and health prior to the completion of the Human Genome Project in 2003 were restricted primarily to rare monogenetic conditions (i.e., Mendelian conditions). Yet, common complex diseases that have the greatest impact on public health are caused by interactions among multiple genes and environmental factors (Farkas & Holland, 2009). Accordingly, to better understand common diseases, like heart disease and cancer, it is necessary to look beyond single genes and their effects (i.e., *genetics*) to the impact of gene-by-gene and gene-by-environment interactions (i.e., *genomics*; see Guttmacher & Collins, 2002). Innovations in the field of human genomics have resulted in the development of new forms of genome-wide techniques that simultaneously compile data about millions of variants distributed across a person's entire genome (i.e., *personal genome profiling*; Bunnik et al., 2011).[1] From a single intervention, personal genome profiling generates information that may be relevant to multiple heritable phenotypes, like common multifactorial diseases and other observable traits. Integration of personal genome profiles into routine clinical, research and public health practice is a major part of the vision for the field of genomics (Green, Guyer, & National Human Genome Research Institute [NHGRI], 2011).

In this chapter, I contrast personal genome profiling with tests that focus on establishing a relationship between a single-gene and a single-condition. Further, I

[1] Although the vast majority (i.e., ~99.9%) of any given person's DNA sequence is identical to that of anyone else's, with roughly 3 billion base pairs in the human genome, the unique portion nonetheless constitutes several million points of possible variation (Guttmacher & Collins, 2002).

discuss how the characteristics of personal genome profiles complicate the informed consent process. Although many of these issues are equally relevant to genome profiling in clinical and consumer contexts, I will focus primarily on decisions to participate in research that involves the generation and analysis of personal genome profiles. Lastly, I argue that efforts to support informed consent would benefit from a descriptive understanding of the beliefs upon which people base their participation decisions.

Advancing Technology:

From Targeted Testing to Personal Genome Profiling

Personal genome profiling is possible because of innovations in the development of high-density microarrays and, more recently, high-throughput genome sequencing technologies. Applications of these technologies produce information that is far broader in scope than that associated with more traditional approaches to genetic testing. Briefly, sequencing is a process by which the exact nucleotide sequence (i.e., pairings of adenine, cytosine, guanine, and thymine) is determined for a given segment of an individual's DNA (Feero, Guttmacher, & Collins, 2010; Sequence analysis, 2003; National Institutes of Health [NIH], 2011). Sequence analyses may differ in method, as well as in how much of the genome is examined (Metzker, 2010; Su et al., 2011). For example, sequencing can produce a record of an individual's entire genome, a smaller portion of DNA—like a chromosome or single gene—or it can focus on select regions within and across genes (e.g., exons, or the functional portions of genes that encode for amino acids). Sequencing a segment of DNA identifies virtually all of the nucleotides within that segment and can be used to identify genomic variation when compared with a reference sequence (i.e., *genotyping*).

A microarray is also a technology used to study many points of variation at once, but it is less comprehensive in scope. As explained by Feero et al. (2010), thousands of

known gene segments are placed at specific locations on a glass slide, or gene chip. A prepared tissue sample containing sections of DNA or RNA is then deposited on the slide. Microarrays are built on the principle that nucleotide bases from the sample will bind to complementary bases in the probe sequences embedded on the chip (Trachtenberg et al., 2012). Specific sequences in the sample are then detected using a specialized measurement technique.

As with sequencing, microarrays can be used to study a single gene in depth or many genes at once (e.g., a multiplex testing) depending on what the specific array was designed to detect. A crucial point of difference between the two technologies is that microarray-based assays restrict genotyping to the probes that are embedded on the gene chip (Hurd & Nelson, 2009). These represent a relatively small fraction of the nucleotide sequence making up the region being examined. As a consequence, large gaps in the resulting genetic profile are introduced by design. DNA sequencing, on the other hand, generates far more complete nucleotide-level information about the analyzed region (Schlötterer, 2004). For example, a single high-density microarray with genome-wide coverage is capable of detecting up to a million nucleotide-level variants distributed at intervals across the entire genome.[2] In contrast, next-generation whole-genome sequencing (WGS) can be used to identify virtually all of the three billion base pairs of DNA in a person's genome (Stokes, 2011).

Continuous reductions in both cost and error rates are making it increasingly feasible to generate personal genome profiles using next-generation whole-genome sequencing technologies (Ball et al., 2012; Collins, 2010; Venter, 2010). For example, at

[2] In general, sequence variations can be classified into one of three broad categories: (1) single-base-pair changes, which occur when one nitrogen-containing base is substituted by another in the DNA nucleotide sequence (e.g. adenine for guanine, cytosine or thymine); (2) insertions of one or more nucleotide into the sequence or deletions from it; and (3) structural rearrangements in which the order of nucleotides is changed in some manner (Feero et al., 2010, p. 2003).

least one company now offers personal whole-genome sequencing services for as little as $7,500 per patient for clinical applications (Illumina, Inc., 2013) and to researchers for less than $4,000 per subject (Darcé, 2011). Due to this shift in the relative cost effectiveness of sequencing techniques, microarray technologies are gradually being replaced or relegated to more specialized purposes (Trachtenberg et al., 2012).

Generating and analyzing personal genome profiles for clinical and research purposes differs markedly from the way that genetic testing has been implemented in the past. As Biesecker et al. (2009) explain, researchers and clinicians have traditionally taken a "hypothesis-testing approach" to genetic testing, where a person is tested for a small number of genetic variants known to be associated with a single condition or trait. Jonathan Berg et al. (2011) refer to this approach as a "one-gene-at-a-time" analysis and Bunnik et al. (2011) call it "targeted testing." This hypothesis testing approach follows the logic underpinning most clinical diagnostics that "no test should be performed on a patient unless the ordering physician understands the test, knows how to interpret the result, and will change diagnosis or management based on the alternative results" (Biesecker et al., 2009, p. 1673). Likewise, for much of the past decade, genetic research protocols aimed at understanding the genetic basis of disease adopted a similar candidate gene approach. Studies were designed around a specific set of hypotheses relating a relatively short section of the genome to a single disease or other phenotype (e.g., observable physical traits, dispositions, etc.). Due to the type of assays used for genotyping, relatively little residual information was collected for any given subject.

In contrast, personal genome profiles generated from large-scale sequencing contain a potentially unlimited number of test results from a single tissue sample. In the case of personal, whole-genome sequencing, all the information from virtually every conceivable genetic test could be derived from a single assessment, and this information

can remain available for reinterpretation indefinitely (Ball et al., 2012; Mountain, 2011). In other words, personal genome profiling can proceed without any immediate clinical or research purpose in mind. Moreover, the interpretability of data contained in a personal genome profile will change over time as evidence from translational research studies continues to accrue (Kohane, Masys, & Altman, 2006). In this sense, personal genome profiles—especially those comprised of whole-genome sequencing data—are best viewed as general-purpose resources rather than tests (Biesecker, 2012).

A Challenge to Informed Consent

Personal genome profiles can be thought of as enormous, highly individualized datasets that are perpetually open to reanalysis. Informed consent procedures for clinical testing and research participation do not scale well to practices that are characterized by so much uncertainty (Jonathan Berg et al., 2011; Bunnik et al., 2011; Lunshof et al., 2008). Traditional standards of informed consent aim to ensure that participants enter into research voluntarily and that their decisions to enroll are based on enough information to constitute an adequate understanding of what participation entails; the same general requirements are held for patients deciding whether to undergo clinical procedures (Beauchamp & Childress, 2009; A. L. McGuire & Beskow, 2010; Wendler, Prasad, Wilfond, 2002).

Toward that end, domestic and international regulatory frameworks outline minimum disclosure requirements that cover several broad classes of information (Council for International Organizations of Medical Sciences & World Health Organization, 2002; Protection of Human Subjects, 2009). Many of the requirements defined for research and clinical contexts parallel each other. For example, some common elements in both domains include information about the nature and purpose of the proposed procedure; a description of any foreseeable risks of harm that might result

from it; a disclosure of likely benefits to self or others; a statement that involvement in the procedure is completely voluntary; and any alternative treatments or courses of action that might be taken by the subject (Jessica Berg et al., 2001; LeBlang, Rosoff, & White, 2004). In research contexts involving human subjects, some additional elements include language indicating that a participant may withdraw from the study at any time without penalty and the extent to which confidentiality of personally identifying information will be maintained. Recent recommendations pertaining specifically to consent for research involving whole genome sequencing call for an explanation of what whole genome sequencing is; how data will be analyzed, stored, and shared; how it might be used in the future; and what kinds of results or other data might be returned to participants (Presidential Commission for the Study of Bioethical Issues, 2012).

Regulatory obligations to disclose information in medical and research contexts are meant to achieve a higher-order bioethical imperative. The primary ethical justification most often given for the doctrine of informed consent rests upon the principle of self-determination, or respect for autonomy (Beauchamp & Childress, 2009; Jessica Berg et al., 2001; Faden & Beauchamp, 1986; Katz, 2002; LeBlang et al., 2004). According to Katz (2002), self-determination consists of choice and reflection—the freedom to act and to think about how to act, respectively. Echoing this perspective, J. Baron (2006) contends that showing respect for autonomy "implies that people should be able to make choices for themselves, after being fully informed" (p. 13). From this it follows that one of the primary objectives of informed-consent procedures is to enable potential subjects to accurately assess the risks and benefits of a study so they may evaluate whether participation is consistent with their values (Boddington, 2010; W. C. Thompson, 1996).

The challenge to informed consent posed by genomics research centers on the ability of regulatory practices and institutionalized guidelines to faithfully represent the moral interests that underpin those practices. To clarify, Faden and Beauchamp (1986; see also Beauchamp & Childress, 2009) observe that "informed consent" has two meanings. In the first sense, informed consent only occurs when a subject voluntarily authorizes his or her involvement in a proposed activity after thoughtful, reasoned, and informed deliberation. The informed consent process implied by this sense of the term can be thought of as a moral ideal closely aligned with autonomous choice. In the second sense, informed consent occurs whenever the rules that have been established to define a valid consent from an institutional, legal or regulatory perspective have been satisfied. In practice, informed consent can be achieved in one sense of the term and not the other. For example, an eligible research participant who quickly reviews and signs a consent document, but does not comprehend the material, might satisfy rule-based requirements of informed consent while failing to provide autonomous authorization. Systematic misalignments between the policies governing the regulatory practice and the moral ideal of informed consent are a cause for concern because they denote a dysfunctional process (Goldstein, 2010; Henderson, 2011; Katz, 2002).

Although there is substantial variation in genomic research protocols, such studies share several common features that challenge established norms of informed consent. Generally, genomic research involves the production of personal genome profiles based on existing or newly collected biological samples and several levels of data analysis. Thus, genomic research draws upon a massive volume of genetic data often in combination with phenotypic data (Caulfield et al., 2008; A. L. McGuire & Beskow, 2010). Moreover, data sharing is an established social norm among genome scientists (Human Genome Organization, 1996, 1997; The Wellcome Trust, 2003), such that it is

typically required to release sequence data into publicly accessible databases that will be used for a wide variety of research activities.

Several implications of these characteristics challenge standard informed-consent processes. First, because data produced for one project will likely be used in unspecified future research, it is not possible to fully disclose the study purpose at the time of initial consent (Caulfield et al., 2008). Further, A. L. McGuire and Beskow (2010) note that data originating from an analysis of DNA may by definition be considered identifiable private information, and thus research participants have a right to be protected against involuntary disclosure of that information. If this right is interpreted to include direct participant control over who will have access to personal genomic information, the conditions under which it is disclosed and how it is used, then individual autonomy rights would be violated unless specific re-consent were granted for each future use (see also Lunshof et al., 2008). Third, once the data contained in a personal genome profile is released to publicly accessible databases, it becomes difficult, if not impossible, to retrieve or destroy. As a result, a person's ability to unconditionally withdraw from research is fundamentally compromised (Caulfield et al., 2008; A. L. McGuire & Beskow, 2010). Lastly, the massive volume of genetic markers included in a personal genome profile in combination with the rapid pace at which knowledge is accrued make it impossible to predict what that information will reveal about any given research participant or her biological relatives (Sharp, 2011). Strictly speaking, it is not possible to fully anticipate the risks associated with participation.

The consent process is viewed as a means of ensuring that potential subjects have the information they need to make an informed decision about enrolling in research or undergoing treatment (Wendler et al., 2002). On this point, Manson and O'Neill (2007) have observed that the procedural standards of informed consent in research and clinical

practice have come to emphasize the specificity of information that is disclosed. That is, investigators and clinicians are expected to provide detailed and specific descriptions of a proposed intervention, its purpose, duration, risks of harm and benefit. If taken to the logical extreme, anything that is not explicitly explained to the consenting subject, by definition, falls outside the purview of the consent. In the case of large-scale genomics research, several additional categories of information have been suggested as being necessary elements of the consent process. These recommended elements include details about sampling and sequencing procedures; data security issues; the risk of uncovering clinically meaningful unanticipated results; and the possibility of re-identification (Caulfield et al., 2008; Tabor et al., 2011).

However, efforts to provide more complete information to potential research participants tend to increase the length of written consent documents, and the complexity of what is disclosed, while simultaneously impeding comprehension (Albala, Doyle, Appelbaum, 2010; Henderson, 2011; Mann, 1994; Tabor et al., 2012). This is problematic because disclosure is not only meant to ensure that information about a project is available, but that research volunteers are able to understand how that information applies to their decisions to participate (Fischhoff, 2011). By trying to touch on all aspects of a study that might be relevant to any given participant, "consent forms have become a repository for information that may not be central to the decision" (Henderson, 2011, p. 268).

Prioritizing Information for Disclosure

A common theme in the informed-consent and decision-making literatures is that disclosure should emphasize information that will be relevant to the choice at hand (Beauchamp & Childress, 2009; Feldman-Stewart et al., 2006; Fischhoff, 2005, 2011; Goldstein, 2010; Jepson, Hewison, Thompson, & Weller, 2005). Consistent with this,

the conceptual standards for determining whether a duty to inform has been satisfied tend to focus on what patients or research volunteers would need to know about the procedure and its consequences in order to make an informed decision (LeBlang et al., 2004; A. L. McGuire & Beskow, 2010). Two subtypes of this *materiality standard* have been outlined (Jessica Berg et al., 2001). In the *objective* sense, an investigator is obligated to disclose information that is expected to influence the decision for a prototypical, reasonably prudent person; in the *subjective* sense, the informational needs of this abstract decision-maker give way to those of actual patients and research volunteers. Beauchamp & Childress (2009) have argued that the subjective-materiality standard aligns best with the moral ideals underpinning the informed consent doctrine, and should be viewed as the preferred standard against which consent procedures are evaluated. However, they also recognize the practical difficulties involved in determining the informational needs of each patient or potential volunteer.

Elaborating on the materiality standard, Fischhoff (2011) recently outlined three criteria for determining whether a communication intervention is adequate to fulfill a duty to inform. Overall, he defined communication adequacy in terms of the ability of the information to enable effective decision making and action. The first criterion refers directly to the materiality standard. A disclosure should contain a significant fraction of the information that users need to make decisions. However, merely presenting the subjectively relevant facts is not enough. The audience also needs to be able to connect with the information provided (i.e., *accessibility*). For example, if users cannot find the information that matches their specific needs with reasonable effort, then the accessibility of that information is inadequate. The third characteristic is *comprehensibility*. The intended audience should readily understand disclosed

information. Thus, communicators must consider audience literacy, preferred delivery channels and the legibility of disclosure materials.

Information needs may be so varied within a population that no single communication can contain all the subjectively material facts without having an adverse affect on accessibility and comprehensibility. With this in mind, Fischhoff suggests that a *materiality analysis* can help prioritize information. The aim of such an analysis is to differentiate facts that are worth sharing with an audience from those that would have a limited impact on decisions. In some cases, partitioning a general audience into more homogenous subgroups may be necessary to adequately fulfill a duty to inform. Altering the content or style of a consent process with these subgroups in mind can help better meet the informational needs of all users.

With regard to decisions to participate in genomic research, a number of recent studies have examined the perceptions, expectations and decisions of potential and actual participants (Beskow, Friedman, Hardy, Lin, & Weinfurt, 2010; Facio et al., 2011; Gollust et al., 2012; Hallowell et al., 2010; Hoeyer, 2010; Kaufman, Murphy, Scott, & Hudson, 2008; Nobile, Vermeulen, Thys, Bergmann, & Borry, 2013; Paquin, Cappella, Price, 2010; Tabor et al., 2012; Treloar, Morley, Taylor, & Hall, 2007). An interesting finding from this body of research is that participation decisions do not appear to be motivated by a single, universal set of features. For example, Facio et al. (2011) asked a sample of 322 individuals enrolled in a large-scale sequencing study to report their reasons for wanting to participate. The two main motivations reported in that study were a conviction to altruism in promoting research (44% of participants) and a desire to learn more about factors that contribute to one's own health (56%). Further, the authors reported that respondents who gave altruistic reasons tended not to mention receiving personal health information as a motivation, and vice versa. Similarly, Beskow et al.

(2010) evaluated a simplified consent form that was designed as a disclosure template for biobanking. Respondents were given electronic access to additional information about the hypothetical study, and asked to identify specific sentences that they thought would matter most to them if they were deciding whether to take part. Although seven sentences per participant were selected on average, no single item was chosen by a majority of respondents. These findings suggest that peoples' decisions to participate are likely guided by different expectations regarding participation.

In order to better achieve the goals of informed consent, investigators must understand the factors that lead people to act the way they do. When these determinants differ from person to person, a one-size-fits-all approach to informed consent is less likely to hit its mark. In the next chapter, I will present a conceptual account of the belief-based origins of choice. Further, I will discuss its implications for the development of communication materials aimed at addressing the informational needs of people who are deciding whether to participate in large-scale genomics research. Whereas addressing immaterial beliefs may make for a better-informed person in a general sense, his choice may nonetheless be determined by a different subset of beliefs that remain inaccurate, unrealistic or false. As Valerius (2010) explains, a person who is mistaken about what can be achieved by following a plan of action has limited self-governance with respect to that action. Put simply, beliefs that are material to a decision but are inaccurate impede informed consent. Understanding how beliefs contribute to decisions to participate in genomics research can aid in the development of customized disclosure materials that better prevent people from choosing based on unrealistic or false expectations.

CHAPTER THREE:

A CONCEPTUAL MODEL OF CONTENT MATCHING AS A COMMUNICATION STRATEGY FOR INFORMED CONSENT

When attempting to foster informed consent, priority should be given to information that is likely to have the largest impact on people's decisions. If expressed as a communication strategy, this implies that disclosures and other educational materials should be customized to match the informational basis of the choice at hand. Such a strategy presupposes that it is possible to predict how message recipients select, interpret and integrate information to form judgments about a given course of action (e.g., participating in a research study that involves personal genome profiling). In this chapter, I will discuss a behavior theoretic approach to selecting message content for health intervention campaigns (Cappella et al., 2000; Fishbein & Cappella, 2006; Fishbein & Yzer, 2003). The purpose of doing so is to better understand what it suggests about message customization. Generally, *customization* refers to "the degree to which the messages that audiences receive reflect relevant individual characteristics" (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008, p. 456). In this dissertation, the relevant individual characteristics of interest will be defined in terms of beliefs that ultimately determine decisions to participate in large-scale genomics research.

The cognitive approach to conducting a materiality analysis discussed in this chapter draws on the reasoned action model (Fishbein & Ajzen, 2010) and media priming theory (e.g., Domke, Shah, & Wackman, 1998; Iyengar & Kinder, 1987; Price & Tewksbury, 1997). Whereas the reasoned action model (RAM) explains how people integrate information to generate attitudes and behavioral intentions, media priming theory (MPT) describes one mechanism by which information is selected to form the basis of these judgments. Below I will argue that *belief salience* is the lynchpin for

understanding how these models relate to one another. A central proposition derived from the RAM is that matching message content so that it addresses salient beliefs about a behavior helps achieve its intended effects. Media priming theory helps clarify how beliefs become salient as a function of contextual factors. Whereas the RAM and MPT describe the conditional effects of belief salience on the belief–intention relationship, this chapter also explores the implications of salience on belief change.

The Reasoned Action Model as a Framework for Selecting Message Content

From an applied perspective, the reasoned action model has important implications for designing and evaluating behavioral change interventions (Ajzen & Fishbein, 1980; Cappella et al., 2000; Fishbein & Ajzen, 2010; Fishbein & Cappella, 2006; Fishbein & Yzer, 2003; see also Fishbein, von Haeften, & Appleyard, 2001; Sayeed, Fishbein, Hornik, Cappella, & Ahern, 2005 for applied, public health examples). The RAM postulates that behaviors that are unconstrained by objective control factors are ultimately determined by beliefs. Although the reasoned action model does not say how to present information in order to change these beliefs, it can be used to strategically select message content (Ajzen & Fishbein, 1980; Ajzen & Manstead, 2007; Fishbein & Cappella, 2006). In other words, the model is a tool for identifying the primary beliefs that need to be addressed when recommending that people change or maintain a given behavior (Fishbein & Yzer, 2003).

Conceptual Overview of the Reasoned Action Model

The reasoned action model consolidates several behavioral theories that have been used to understand and predict a range of social and health behaviors. The framework is a direct extension of the theory of reasoned action (TRA; Fishbein & Ajzen, 1975), the theory of planned behavior (TPB; Ajzen, 1991), and the integrated model of

behavior change (IM; Fishbein, Triandis, et al., 2001; Fishbein, 2008); but also accommodates constructs and theoretical pathways described in the health belief model (HBM; Janz & Becker, 1984; Rosenstock, 1966), and social cognitive theory (SCT; Bandura, 1986, 1998). Central to the RAM is the idea that behavior "follows reasonably and often spontaneously from the information or beliefs that people possess about the behavior under consideration" (Fishbein & Ajzen, 2010, p. 20). While beliefs are the foundation of action, they influence behavior through a sequence of mediating and moderating variables. A major strength of the reasoned action framework is its formal expression of these causal relationships.

According to the RAM (see Figure 3.1), the most immediate determinant of behavior is the intention to engage in it. Behavioral intention is an indication of a person's readiness or willingness to act (Ajzen, 1991; Fishbein & Ajzen, 1975), and has been described, simply, as a decision to perform a given behavior (Fishbein, 2008). For conceptual clarity, intention is a subjective—though not necessarily conscious or deliberate—estimate of the likelihood that one will perform the behavior in question (Fishbein & Ajzen, 2010).[3] Generally, a person is more likely to act if one intends to do so, though the strength of the intention–behavior association can be moderated by several factors. These moderators include environmental constraints that would physically prevent intentions from being acted upon and underdeveloped skills that were not accurately considered when the intention was formed.

Direct antecedents of intention. According to the reasoned action model, intentions are derived from attitudes toward performing the behavior, perceived social pressure, and perceived behavioral control over it. Generally, these three constructs are

[3] This definition of behavioral intention aligns with J. Baron's (2004) characterization of decisions as judgments (i.e., a subjective probability) about what to do.

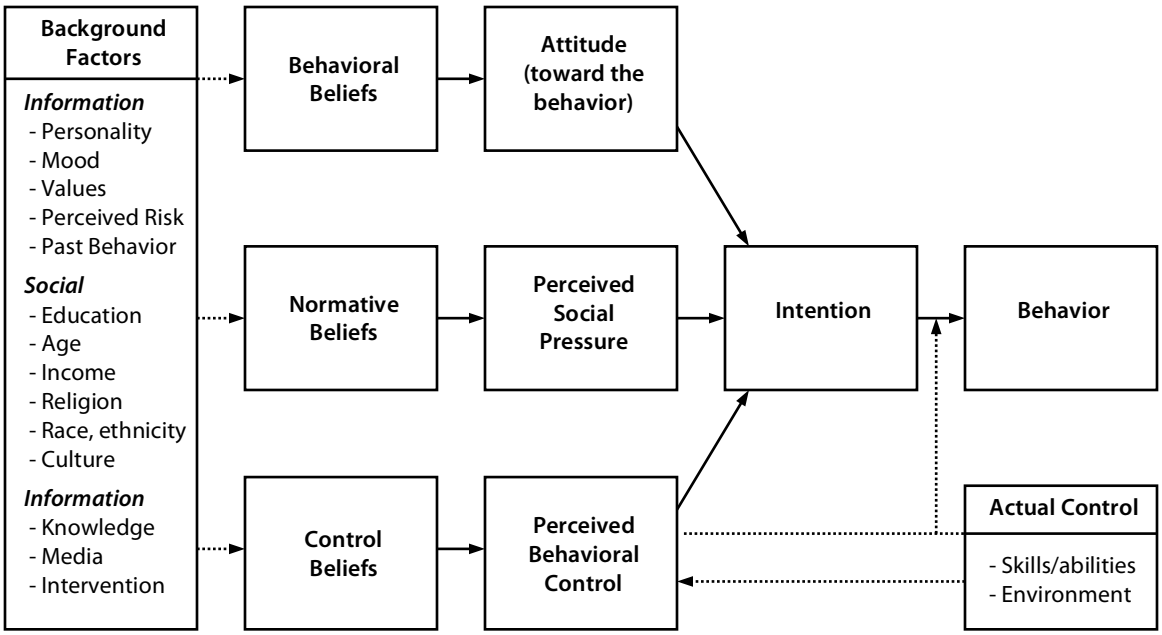

Figure 3.1. Path diagram of the reasoned action model. The dashed lines represent causal pathways that are anticipated by the theory, but are not formally part of the model. Adapted from *Predicting and changing behavior: The reasoned action approach,* by M. Fishbein and I. Ajzen, 2010, p. 22.

expected to have a combined, additive effect on intention and, by extension, behavior. The relative contribution of these direct antecedents to intention may vary by behavior, population or situation. Nonetheless, people with more favorable attitudes, more intense perceived social pressure, and greater perceived behavioral control on average have stronger intentions, and are more likely to perform a specified behavior (Fishbein, Hennessy, Yzer, & Douglas, 2003).

Attitude. Consistent with a definition offered by Eagly and Chaiken (1993), attitude in the reasoned action framework refers to "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p. 1). Attitudes have been characterized as relatively stable evaluative representations in memory and, alternatively, as judgments constructed when needed based on contextually available information (see Bohner & Dickel, 2010; Joel Cohen & Reed,

2006; Gawronski & Bodenhausen, 2006, for recent attempts to consolidate these theoretical perspectives). Despite these different characteristics, however, there is wide agreement that attitudes are fundamentally evaluative in nature and oriented toward specific objects (Albarracín, Johnson, Zanna, & Kumkale, 2005).

Perceived social pressure. The reasoned action model developed out of a research tradition particularly interested in issues surrounding the measurement of social attitudes and their relation to behavior (Ajzen & Fishbein, 2005; Lepper, 1994). Nonetheless, it has long been recognized that intentions and behavior are at least partially influenced by the norms that prevail in a social environment (e.g., Asch, 1951; Deutsch & Gerard, 1955; J. R. P. French & Raven, 1959). With this in mind, social influence is formally integrated with the RAM in the form of perceived social pressure. In short, perceived social pressure refers to an individual's perception that performing the behavior under consideration would be met with approval or disapproval, and is formed with reference to the supposed desires and actions of others (Fishbein & Ajzen, 2010). With this in mind, perceived social pressure in the RAM is best thought of as a multidimensional construct defined in terms of what the subject thinks important others would want them to do (i.e., *injunctive norms*) and how those others are believed to behave (i.e., *descriptive norms*; see Hagger & Chatzisarantis, 2005; Rivis & Sheeran, 2003).

Perceived behavioral control. In addition to attitude and perceived social pressure, the extent to which people believe they are capable of performing a given behavior and that the behavior is under their control is also expected to influence behavioral intentions and action. In short, people are less likely to form intentions to perform behaviors that they do not believe they can perform. Perceived behavioral control draws heavily on Bandura's (1977, 1994, 1998) concept of self-efficacy, which

focuses on a person's level of confidence that they can perform a behavior in a number of different situations. As it is currently defined in the RAM, perceived behavioral control emphasizes the subjective degree of control and ability one has over performing a given behavior (Ajzen, 2002; Fishbein & Ajzen, 2010).

Belief-based determinants of the direct antecedents of intention. According to the RAM, the direct antecedents of intention (i.e., attitudes, perceived social pressure and perceived behavioral control) derive from a system of beliefs about the behavior under consideration. The RAM draws qualitative distinctions between the beliefs that underlie each predictor. To clarify, an attitude toward a particular behavior is determined by *behavioral beliefs*, or the expected consequences of personally performing the behavior combined with evaluations of these outcomes. Perceived social pressure is influenced by *normative beliefs*, judgments about who would approve or disapprove of performing the behavior weighted by the motivation to comply with those social referents.[4] The *control beliefs* that underlie perceived behavioral control represent the potential barriers, resources and opportunities that a person considers relevant to performing the target behavior (Ajzen, 1991). The extent to which a person believes himself to have access to these control factors is weighted by their perceived power to facilitate or impede the behavior.

Belief integration from the expectancy-value perspective. Although the belief-based determinants underpinning each of these constructs are qualitatively distinct from each other, their respective components are combined following the same basic formula. For ease of exposition, the remainder of this discussion will focus on the

[4] This definition of "normative beliefs" relates specifically to injunctive norms. Fishbein and Ajzen (2010) have proposed that the belief-based determinants of descriptive normative pressure are a function of (a) how frequently a person believes each normative referent engages in the focal behavior, and (b) the extent to which that person identifies with those referents. To my knowledge, this definition has not yet been empirically vetted.

attitudinal pathway of the reasoned action model. It is important to note, however, that much of what follows has relevance for understanding the cognitive processes that underpin perceived social pressure and perceived behavioral control, as well.

Following Fishbein's (1963, 1967) expectancy-value model of attitude formation and change, an attitude toward any object can be described as an additive function of the evaluations associated with salient attributes of the object (e_i, $i = 1, \ldots, n$) weighted by the strength with which those attributes are believed to be characteristic of the object (b_i, $i = 1, \ldots, n$). Formally, the relationship between these beliefs about an object and one's attitude toward the object (i.e., in this case a behavior) can be expressed by the following equation:

$$A_B \propto \sum_{i=1}^{n} b_i e_i , \tag{3.1}$$

where A_B is one's attitude toward personally performing a behavior B, b_i is the strength of the belief that doing B will result in outcome i, e_i is the implicit evaluative response associated with i, and n is the number of outcomes that are spontaneously thought about when the idea of doing B is called to mind. An implication of this operational definition is that attitude should be directly proportional to the summed ratings of the positive and negative consequences that people expect from performing the behavior in question.

Salient beliefs in the RAM. A person may hold any number of beliefs about an object or behavior, such as participating in research that involves personal genome profiling. However, an important assumption of the RAM is that attitudes, perceived social pressure and perceived behavioral control are primarily determined by those

attributes, outcomes, social referents, and control factors that are immediately salient with respect to performing that behavior (Ajzen & Fishbein, 1980).

To clarify, Fishbein and Ajzen (2010) defined salient beliefs as "beliefs about an object that come readily to mind when a person has reason to retrieve them" (p. 98). Further, they equate the term *salience* with the more contemporary notion of cognitive accessibility.[5] The *accessibility* of a construct is its readiness to be used in information processing at a given point in time as a function of its contextual activation in memory or its retrieval from long-term memory into short-term memory (Eagly & Chaiken, 1993; Higgins, 1996; Higgins, King, & Mavin, 1982).[6] For example, when faced with the option to participate in a genomic research project, a person might automatically call to mind a number of beliefs about participating. These beliefs might include propositions like, "participating will contribute to science" or "if I participate, I will receive feedback about my genetic risk for disease." Clearly, there are an unlimited number of possible beliefs that people might hold about participating, but most of these will not come to mind (e.g., a trivial belief like, "If I participate, then I will have participated," etc.). According to the RAM, nonsalient beliefs are less likely to influence behavior.

Salience is an immutable component of the *primary beliefs* that ultimately drive behavior in the RAM (Fishbein & Ajzen, 1975, 2010). The expectancy-value

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[5] Operationally, the term *accessibility* may evoke response-time and other nonintrusive measurement techniques commonly used in the cognitive sciences. I will not be adopting such techniques in this dissertation. Rather, I will use traditional thought-listing techniques. To avoid raising false expectations regarding my method, I will use the term salience in this dissertation.

[6] In this definition, the term *construct* is used broadly to refer to the cognitive representation of any concept, idea, or object, as well as beliefs relating such representations to one another (see Fishbein & Ajzen, 2010, for a related definition of a *psychological object*). Also, the terms *activation* and *retrieval* refer to roughly comparable processes subscribed to in unitary-store and multi-store models of memory, respectively (see Jonides et al., 2008). The critical distinction is that multi-store models postulate that there are at least two architecturally distinct neural systems between which the content of memory is shuffled (e.g., the sort of architecture implied by the file-cabinet metaphor used by Wyer and Srull, 1989). Unitary-store models, on the other hand, reject the notion that there is literally more than one memory storage system and instead postulate that "short-term" memories are simply temporary activations of "long-term" representations (e.g., a view that aligns better with the symbolic associative network described by Higgins [1996]).

underpinnings of the RAM clearly entail an informational basis for the formation of attitudes, perceived social pressure and perceived behavioral control (Ajzen & Albarracín, 2007; Fishbein & Ajzen, 1975), and salience determines which information will be used or selected for that process. Following the causal sequence outlined by the RAM, beliefs that are salient when the decision is made to perform a behavior are expected to have a greater impact on its performance than beliefs that are not salient.

Summary. A primary implication of the RAM is that behavioral differences among people are ultimately derived from differences in the informational bases of those behaviors—not withstanding objective barriers that would prevent them from acting on their intentions. Fundamentally, the direct antecedents of intention (i.e., attitudes, perceived social pressure, and perceived behavioral control) are, in turn, determined by salient beliefs. Although direct measures of attitudes, norms and perceived behavioral control can efficiently describe the psychological mechanisms underlying action, truly understanding why people decide to perform a behavior requires a more careful analysis of the salient beliefs they hold about the behavior of interest.

Implications of the RAM for Decision Support and Consent Disclosure

From a communication perspective, the RAM has typically been discussed in the context of interventions that aim to either change or maintain behaviors that have been deemed desirable by some external criterion (e.g., evidence that the behavior tends to improve clinical outcomes or public health; a judgment that increased adoption of the behavior will generate revenue for a firm, etc.). In health-behavior contexts, the general goal of such interventions is to increase the likelihood that people will engage in behaviors known to lead to positive health outcomes (e.g., exercise) or discourage behaviors that are known to have an adverse impact on health (e.g., smoking). For decisions that involve these kinds of evidence-based choice options, as they have been

called (see O'Connor et al., 2007), the benefits are generally agreed to outweigh possible harms, or vice versa. Thus, when dealing with these sorts of behaviors, health communicators often adopt a persuasive stance aimed at promoting (or preventing) behavior in a directional way.

In contrast, efforts to facilitate informed consent or decision making typically treat behavior change, per se, as a secondary concern (Brewer, 2011). By definition, disclosure materials and decision aids are intended to foster decision making in choice contexts where no single best course of action can be determined without taking individual perspectives into account. This may be due to a substantial balance of beneficial and harmful consequences across alternatives, insufficient scientific evidence, uncertainty about outcomes, or variability in the subjective desirability of the activity and its attributes (O'Connor et al., 2009). Such choices have been described as "grey-zone," "close calls," "values-sensitive" or "preference-sensitive" (O'Connor et al., 2007; O'Connor et al., 2009). For decisions involving these kinds of behaviors, including decisions to participate in genomics research or to undergo genetic testing, interventionists typically adopt a nonpersuasive or educational stance. That is, no single choice is advocated for all decision makers. Adopting this perspective recognizes that the best choices for some people may be different from that of others, due to differences in goals and preferences (Fischhoff, 2005).[7] Ultimately, the primary aim is not to increase (or decrease) rates of uptake or maintenance, but instead to ensure that people's choices are consistent with their own, well-informed preferences and values. This may or may

[7] The term *nonpersuasive*, in this sense, refers only to the stance of the interventionist in recommending a specific choice or that a given course of action is followed. A nonpersuasive intervention does not make such recommendations uniformly for all decision makers. It is important to understand that the term nonpersuasive does not necessarily refer to the stance of the interventionist toward other people's beliefs or judgments about the potential consequences of the behavior, some of which may be factually inaccurate and thus a focus of intentional change.

not involve overt changes in behavior, even if it does involve changes in beliefs or other lower-level judgments (Molenaar et al., 2000).[8]

In sum, applying the RAM to educational interventions that aim to inform preference-sensitive decisions requires one to adopt a somewhat different perspective than when it is applied in persuasive interventions. In a persuasive intervention, developers set out to strategically address behaviorally relevant beliefs that meet specific criteria (e.g., a strong association with behavior, room for change, and amenability to change; see Hornik & Woolf, 1999). Intervention materials attempt to change only those beliefs that are likely to have the greatest impact on behavior in the intended direction. For example, a campaign aimed at getting smokers to quit (i.e., an evidence-based behavior shown to reduce a number of health risks) would likely stress the benefits of quitting while deemphasizing reasons not to quit. From a health perspective, reductions in smoking are generally accepted to be a good thing, and so persuasive interventions in this context are warranted.

In an educational intervention, on the other hand, developers might still attempt to change behaviorally relevant beliefs, but the purpose is to address those in such a way that they become more accurate according to some factual standard. Ultimately, improvements in the quality of preference-sensitive decisions and choices are achieved by improving the truth of the judgments upon which those decisions and choices are based. For example, participation in research involving personal genome profiling is meant to be entirely voluntary. A potential research volunteer is entitled to receive information that explains what participation entails, but the best choice depends on his or her personal values. In this context, encouraging or discouraging participation (i.e.,

[8] Regardless, actual or preferred choice has been used as a primary outcome in several studies intended to evaluate the effectiveness of decision support interventions (Kryworuchko, Stacey, Bennett, & Graham, 2008; Mullen et al., 2006).

change behavior) is not the communicator's primary aim. Rather, the goal is to foster understanding (i.e., change beliefs) with an emphasis on any aspects of the project that are most likely to factor into the decision. Although the aim of may be different, the persuasive and educational perspectives make similar assumptions about the mechanisms that underlie behavior.

The expectancy-value principle and content matching. An emphasis on addressing belief-based determinants of behavior is a common characteristic shared by both persuasive and educational interventions. In this sense, the implications of the RAM with regard to communication strategy are a clear extension of what Eagly and Chaiken (1993) have termed the *expectancy-value principle*—the notion that message content must address the primary beliefs that form the basis of whatever variable the message is meant to influence (see also Fishbein & Ajzen, 1981, as cited in Fishbein & Ajzen, 2010). Recall that an important tenet of the reasoned action model is that beliefs influence intentions through attitudes, perceived social pressure, and perceived behavioral control. According to the expectancy-value principle, changes in these direct antecedents of intention are only expected to the extent that change has occurred in the underlying sets of behavioral, normative and control beliefs, respectively (Fishbein & Ajzen, 2010). Interventions that change beliefs that are not related to one of these direct factors are expected to have a limited impact on intention, decisions or future behavior.

The strategic implications of the expectancy-value principle can be viewed as a special case of *content matching* (also referred to as *message adaptation*). Generally speaking, content matching is a communication strategy whereby messages are developed so as to address the specific needs or interests of a given audience (Noar, Harrington, & Aldrich, 2009; Rimer & Kreuter, 2006). Less broadly, content matching refers to the practice of designing messages so they correspond with key theoretical

determinants that underlie a variable of interest for a given audience (Hawkins et al., 2008). In principle, content could be matched to any characteristic of an audience whatsoever; however, to maximize effectiveness it behooves communicators to make such decisions on theoretic or pragmatic grounds (Rimal & Adkins, 2003). Because the direct antecedents of behavioral intention are formed through the integration of salient beliefs, it follows that the focus of a RAM-based message or campaign are those beliefs that are salient to the target audience (Fishbein & Ajzen, 1975; Eagly & Chaiken, 1993). In other words, the information contained in the message should address beliefs that the audience would likely spontaneously think about when their attention is focused on the behavior.

The goal of informed consent is to foster decisions and choices that are congruent with a decision maker's values and preferences. This audience-oriented perspective aligns disclosure with *message tailoring* and *targeting* (Kreuter & Wray, 2003; Noar et al., 2009). In health-communication contexts, tailoring has been defined as "an assessment-based approach to creating individualized communications, in which data from or about a specific individual and related to a given health outcome are used to determine the most appropriate information or strategies to meet that person's unique needs" (Rimer & Kreuter, 2006, p. S184). Tailoring can be compared with *targeting*, a message tactic that focuses on the characteristics and preferences of a broader audience segment as opposed to individual audience members (Noar et al., 2009). Rather than view targeting and tailoring as rigid categories, Hawkins et al. (2008) suggest that communication can vary in the degree to which it is tailored based on (a) the level of segmentation assumed when defining the intended audience and (b) the extent to which the content or delivery channel is customized for that audience.

Content matching relies on some level of *audience segmentation*, the division of a general audience into well-defined subgroups characterized by minimal within-group and maximal between-group differences on some set of variables (Hawkins et al., 2008; Noar et al., 2009; Smith, 1956). Crucially, identifying groups of people who are similar in important respects and customizing message content to them is a more efficient way to have a desired impact given limited resources compared to a generic, unsegmented strategy (Slater, 1995). Audiences can be segmented in a number of different ways. For instance, they could be segmented based on demographics, geography, lifestyle, attitudes, or personality variables. However, the most useful strategies for constructing meaningful messages are those that help researchers and practitioners understand the audience from the audience's perspective, including their values, beliefs, desires, needs and behavior (Hornik & Ramirez, 2006; Sharyn Sutton, Balch, & Lefebvre, 1995).

In theory, an audience could be segmented so that each subgroup consists of exactly one audience member, achieving a maximum degree of individuation. Thus, if mediated messages were placed along a continuum according to their degree of segmentation and customization (see Figure 3.2), tailoring would correspond to a range of that continuum characterized by great individuation on both of these dimensions. Less personal approaches to content matching (e.g., targeting) may be equally effective as tailoring. For example, highly personalized messages may be inefficient if the segmentation criteria and matched content are not causally related to message outcomes. Also, high degrees of customization may not be possible if available message channels are not capable of delivering distinct messages to the intended audience segments. In such cases, a less fine-grained approach to segmentation and customization could yield a more parsimonious message strategy.

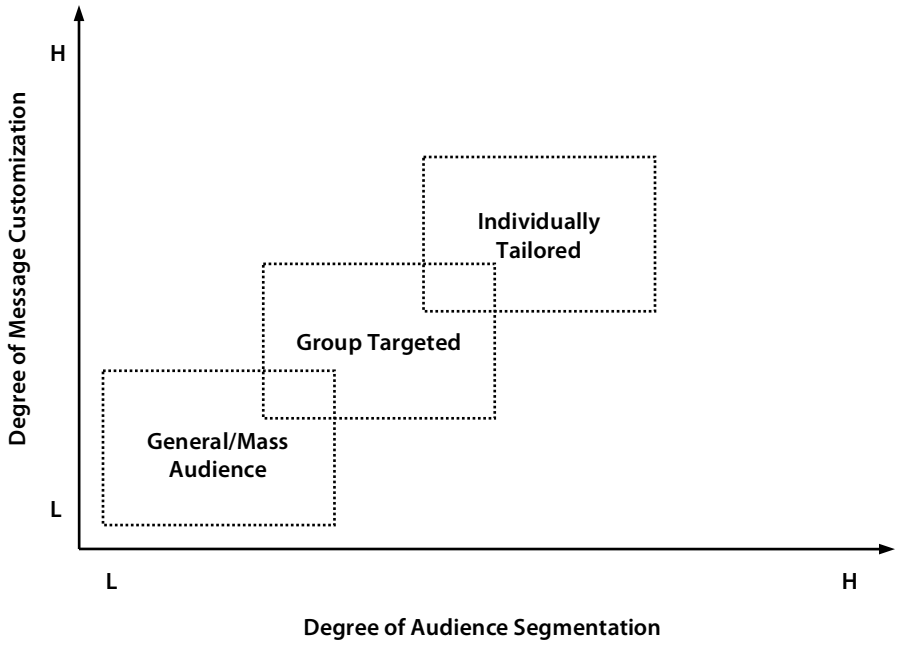

Figure 3.2. Message tailoring continuum. Adapted from "Understanding Tailoring in Communicating about Health," by R. P. Hawkins, M. Kreuter, K. Resnicow, M. Fishbein, and A. Dijkstra, 2008, *Health Education Research*, *23*, p. 455.

Salient beliefs as tools for segmentation and customization. The approach to content matching implied by the RAM suggests that addressing audience members' primary beliefs is a way to more effectively achieve communication goals. Methodologically, procedures for identifying the primary determinants of a behavior based on the RAM have been developed at both individual- and group-levels (Ajzen & Fishbein, 1980; Middlestadt, Bhattacharyya, Rosenbaum, Fishbein, & Shepherd, 1996). Both methods begin with a set of thought-listing exercises based on the premises that (a) there is a positive relation between the salience of a concept or proposition and the likelihood that it will be listed in a free-response procedure, and (b) in any information-processing task, individuals are generally limited in capacity to consolidate between five and nine pieces of information at a time (Trafimow, 2007; see also Fiske & Taylor, 1991;

Miller, 1956). The latter assumption establishes a limit on the number of beliefs that are likely to determine behavior and its underlying constructs.

Personally salient beliefs. When eliciting behavioral beliefs (i.e., those beliefs theoretically expected to contribute to the formation of direct or global attitudes), each respondent may be asked to list the advantages and disadvantages or things they expect to enjoy and dislike about performing a particular behavior. The set of outcomes that each person reports on these open-response questions represents his or her *personally salient beliefs*. Following this qualitative procedure, quantitative, subjective estimates of the strength with which each of the elicited beliefs are held (i.e., the subjective probability that the outcomes expressed in those beliefs will occur given that the behavior is performed) and the evaluative nature of those beliefs can be measured on closed-ended response scales. These quantitative scores can then be combined following the expectancy-value formula to construct personalized belief-based measures of attitude, or *personal belief indices*.[9] When this procedure is used, the number of beliefs elicited and the propositional content of these will likely differ from person to person as a reflection of the amount of between-subject variation in the sample. This variance in cognitive structure makes it difficult to generalize results about specific beliefs to the population from which the subjects are drawn. Accordingly, the personalized elicitation procedure has been further adapted to help determine which beliefs would be the most appropriate targets in strategic information campaigns geared toward a mass audience.

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[9] Alternative procedures for defining composite measures from personally salient beliefs are discussed by D. P. French and Hankins (2003). For the most part, these alternative procedures are meant to address operational issues that impact the statistical interpretability of the expectancy-value formulation, but do not necessarily reject the conceptual basis of the model. For example, it has been argued that multiplying evaluation scores by expectancy ratings may be unnecessary when computing a personal belief index because people are more likely to list outcomes they consider subjectively likely during the elicitation procedure (Cronen & Conville, 1975). As a result, expectancy ratings of personally salient beliefs tend to have little variance, and there is evidence that indices computed following a simpler, sum-of-evaluations formula have sufficient concurrent validity.

Modally salient beliefs. Given the pragmatic limitations of using indices constructed from personal beliefs for interventions, the *modally salient beliefs* of a population can instead be elicited as part of formative research (Middlestadt, 2012). Here, a small number of people from the group of interest are asked to complete thought-listing tasks that are identical to those discussed for the elicitation of personally salient beliefs. Rather than collect expectancy-value measures for all beliefs elicited by each participant, a content analysis of the resulting lists is conducted to classify outcomes according to theme and to determine which are cited most frequently across participants. Ajzen and Fishbein (1980) outline three decision rules that have been used to determine which beliefs should be classified as modally salient: (a) include the ten or twelve most frequently mentioned beliefs, (b) include all beliefs that exceed a pre-established frequency threshold (e.g., any belief mentioned by at least 10% or 20% of the sample), or (c) include as many beliefs as are necessary to account for a specified percent of all beliefs elicited (e.g., 75%). Once the modal set is defined, a fixed-item instrument can be drafted to measure the expectancy-value components of those beliefs, which are more likely to be salient within the population than an arbitrary set of outcomes derived, for example, from focus group discussions or from researchers' intuition (Fishbein & Middlestadt, 1995).

While this procedure overcomes some of the practical limitations associated with adapting the reasoned action approach to population-level behavior interventions, it does so at the expense of theoretical consistency at the individual level. For example, Stephen Sutton et al. (2003) observed, on average, only a 26% overlap between modal and personal belief sets. That means that roughly 3 out of every 4 items in the modal belief index represented beliefs that were *not* personally salient for any given research subject (see also Cook, Moore, & Steel, 2005). Given qualitative variation in personal-

belief sets among individuals within a population, a large margin of error may result from summarizing individual cognitions at a general-population level.

This is not exclusively a theoretical issue, but a practical one as well. Belief indices that include several nonsalient beliefs tend to be worse predictors of direct attitudes and behavior than belief indices composed exclusively of salient beliefs (see van der Pligt, de Vries, Manstead, & Harreveld, 2000, for a comprehensive review of the conditional effects of salience and accessibility on the belief–attitude relationship). For example, Chatzisarantis and Hagger (2005) conducted an experiment testing the hypothesis that participants exposed to a pro-attitudinal message targeting salient beliefs would report more positive post-exposure attitudes and intentions than participants exposed to a message that targeted exclusively nonsalient beliefs. The results provided evidence in support of the expectancy-value principle using belief-based determinants measured at a general-population level. Still, messages aimed at a general audience's modally salient beliefs will likely fail to address a large portion the personally-salient beliefs of many of its members (Cook et al., 2005; Stephen Sutton et al., 2003). In other words, generic communication materials are likely to be less adequate than tailored or targeted content because a smaller proportion of the information they provide is likely to influence user's choices (see Fischhoff, 2011).

Dividing a general audience into smaller audience segments may be one way to reduce this error. Subdividing a large heterogeneous audience into smaller homogenous segments facilitates the development of messages that are specifically targeted to address the needs of audience members within those groups (Albrecht & Bryant, 1996; Boslaugh, Kreuter, Nicholson, & Naleid, 2005; Lefebvre & Flora, 1988). From a reasoned action perspective, audience segments that hold different salient beliefs about a behavior are expected to engage in that behavior on the basis of different information. Accordingly, a

segmentation strategy that uses qualitative differences in salient beliefs as the main segmentation criteria would be conceptually aligned with the goals of customization. In turn, matching content to the modally salient beliefs of distinct audience segments would be expected to provide audience members with a greater proportion of the information they need to make effective choices.

Media Priming Theory and Dynamic Salience

The RAM expands upon the logic of the expectancy-value model to describe how information is combined in shaping the direct antecedents of behavioral intent. However, its treatment of the way information is selected for that integration process is more cursory. The model clearly postulates that people draw upon salient beliefs as the informational basis of their attitudes, perceived social pressure and perceived behavioral control, yet it is also evident that belief salience originates from multiple sources. Salient beliefs are subject to changes in strength and evaluation, but can also be replaced by new salient beliefs (Fishbein & Ajzen, 1975, 2010). For example, exposure to a message can temporarily make the beliefs addressed in that message salient (see Albarracín & Wyer, 2001; Thomas & Tuck, 1975, for evidence of post-manipulation changes in belief salience). Once they are made salient, message-based beliefs are more likely to be integrated into an overall judgment about the target behavior. Using a media priming strategy, an interventionist would select beliefs to address because the strength and evaluation components of those beliefs are presumably already aligned with the desired message outcome. In effect, beliefs that are nonsalient for a participant prior to message exposure can become salient and act as short-term determinants of attitudes, intentions and behavior. However, to the extent that message content can influence belief salience, the strategic implications of the RAM vis-à-vis content matching become somewhat unclear.

Disambiguating Salience

Traditionally, salience in the RAM has been treated as a relatively stable property of behavior-focused constructs or beliefs. The dominant account of belief salience and integration in the RAM can be summarized as follows (see Fishbein & Ajzen, 1975):

i) When an object or behavior is called to mind, a person automatically retrieves from memory a number of thoughts or beliefs that refer to characteristics, attributes, outcomes, or goals that are associated with that object.

ii) The probability that a specific belief will be retrieved or become activated in response to the stimulus object is determined by the strength of its learned association with that object in memory.

iii) Each belief (i.e., characteristic, attribute, outcome or goal) is also associated with an implicit evaluative reaction that is stored in memory.

iv) The evaluative reaction associated with a belief contributes to the overall attitude toward the stimulus object in direct proportion to the strength of the relationship between that object and the corresponding belief (viz., the product term in the expectancy-value model).

v) The effects of these belief-evaluation pairs combine across the set of salient beliefs in an additive manner (viz., the summation function in the expectancy-value model).

As described here, salience is derived from a learned association in memory. Symbolic exposure to an object or behavior prompts the activation, or retrieval, of constructs related to it in memory. Assuming that these learned associations remain somewhat

fixed or only change slowly over time, the salience of a construct in relation to another object can be viewed as a fairly stable characteristic of that construct.

In counterpoint to this view, contextual factors can also influence which beliefs are salient at any given moment (Ajzen & Sexton, 1999; Albarracín, 2002; Albarracín & Wyer, 2001; Kruglanski, 1989a; Tesser, Martin, & Medolia, 1995). Accordingly, the set of salient beliefs that constitute the determinants of behavior for any given person might vary in content depending on context. All else being equal, beliefs with salience that originates from learned associations in memory are more likely to come to mind spontaneously when thinking about the behavior; however, these beliefs can nonetheless be displaced by other beliefs due to changes in salience that originate from contextual features of the immediate environment (e.g., a message).

From a communication perspective, Albarracín and Wyer (2001; see also Albarracín, 2002) argued that the expectancy-value model describes the integration process that people engage in when forming attitudinal judgments. However, the model does not provide a full account of the origins of the information that gets integrated. When computing a subsequent attitude, message recipients may take into account (a) unmentioned beliefs that are spontaneously recalled, (b) information that was addressed in the message, or (c) both. To clarify, the audience might recall or infer outcomes of the behavior from memory that were not explicitly mentioned in a message (i.e., *knowledge-based information*).[10] The account of belief salience given in the RAM is aligned with the idea of knowledge-based information.

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[10] The concept that Albarracín (2002; Albarracín & Wyer, 2001) refers to as *knowledge-based information* is conceptually similar to *working knowledge* (Wood, 1982) and intra-attitudinal structure (Eagly & Chaiken, 1993). Working knowledge represents the attitude-relevant beliefs and prior experiences that are spontaneously activated when encountering the attitude object (Biek, Wood, & Chaiken, 1996; Wood, 1982). In relation to attitude strength, working knowledge is sometimes defined as a structural property of an attitude that focuses on the *number* of attitude-relevant beliefs and experiences that are available in memory (Fabriger, Petty, S. Smith, & Crites, 2006; Wood, Rhodes, & Biek, 1995). By virtue of having ready access to information that can be used to argue against it,

On the other hand, the audience might also consolidate new consequences described in the message into an overall attitudinal judgment. Thus, message processing may involve a construal process that draws on *message-based information*, or constructs that are contextually related to an object based on assertions made in a message. Further, information from both knowledge-based and message-based sources can be integrated into an overall judgment about the behavior. Conceivably, message-based information could become more salient than knowledge-based information.[11] As a result, judgments made following message exposure would likely be more influenced by message-based beliefs, at least in the short-term. Because of its emphasis on knowledge-based belief salience, this last implication is not explicitly anticipated by the RAM. To better understand the possible relationship between message exposure and belief salience, it is helpful to review media priming theory.

Conceptual Overview of Media Priming Theory

The basic media-priming hypothesis is that individuals who are exposed to messages referring to a given set of constructs will be more likely to draw upon those constructs when making subsequent judgments compared to individuals not exposed to that information. Broadly speaking, *priming* refers to the effect of a preceding stimulus or event on a person's reaction to some subsequent stimulus (Roskos-Ewoldsen, Roskos-Ewoldsen, & Dillman Carpentier, 2008). As a communication effect, *media priming*

Wood (1982) reasoned that people who have a well-elaborated belief structure are better able to defend against counterattitudinal information. They are also thought to be better able to critically evaluate the validity or strength of the assertions made in a message. Availability of knowledge-based information also has implications for the attitude–behavior relationship. Attitude–behavior correspondence depends in part on the extent to which the considerations that arise when an attitude is expressed are comparable to the considerations that arise when the behavior is enacted (Doll & Ajzen, 1992). That is, a strong association between an expressed attitude toward a behavior and action is more likely when the attitude-related information that is salient at the time the attitude judgment is made matches the salient information when the behavior is enacted. Attitudes that consistently draw upon the same knowledge base are likely to remain fairly stable.

[11] I should note that I am not using the term *knowledge* in a strict epistemological sense, which would entail that these beliefs are true or justified. Fishbein and Ajzen (2010) have clearly explained that the RAM makes no assumptions about the verity of the primary beliefs that determine behavior.

refers to "the effects of the content of media (e.g., extensive coverage of certain political stories, depictions of violence, the use of brief 'teasers' about an upcoming story on a newscast) on people's later behavior or judgments (e.g., evaluations of the president, aggressive behavior, attention to news stories related to the teaser)" (Roskos-Ewoldsen, Klinger, Roskos-Ewoldsen, 2007, p. 53; see also Domke et al., 1998; Iyengar & Kinder, 1987; Price & Tewksbury, 1997). Petty and Jarvis (1996; as cited in Petty, DeMarree, Briñol, Harcajo, & Strathman, 2008) noted that three basic steps are involved in the process that results in priming effects. First, a priming induction must activate, or make salient (at least temporarily), a construct from memory. Second, the activated construct biases the interpretation of a target object. Finally, the biased interpretation is used to guide judgments or impressions of the target, or behavior.

Most often, media priming effects are described as a kind of *assimilation*, where impressions of a target become biased toward the prime stimulus. Assimilation occurs when the primed construct becomes incorporated as part of the information upon which judgments about the target are based (DeCoster & Claypool, 2004). Thus, assimilative priming effects are closely related to the construal of message-based information described by Albarracín (2002; Albarracín & Wyer, 2001).

Priming theory suggests that concepts that would not otherwise spontaneously come to mind when deciding to follow a course of action can be made temporarily salient by increasing their prominence in the immediate environment or information context. Regarding communication-based interventions designed to influence behavior, it has been argued that assimilative priming can be employed strategically to guide the development of messages that will temporarily make certain concepts salient and alter behavior in the direction of campaign goals (Cappella et al., 2000; Fishbein & Cappella, 2006; Fishbein & Yzer, 2003). For example, a communication strategy aimed at

encouraging the adoption of a specific behavior may attempt to develop messages that emphasize potential outcomes that members of the target audience evaluate favorably, but that do not readily come to mind when thinking about the behavior. In essence, the goal of such an intervention is to temporarily increase the message-based salience of certain beliefs that have otherwise low knowledge-based salience. If the message strategy is successful, the influence of the primed beliefs on the criterion variables (e.g., attitudes, behavioral intentions, etc.) should be greater among subjects exposed to the priming message than among subjects who were not.

Empirical Tension between Content Matching and Assimilative Priming

Assimilative priming effects can enhance the anticipated strategic benefits of content matching; but under some circumstances, one would expect content matching and media priming to work against one another. The main point of contention is that content matching and media priming have divergent underlying assumptions regarding the stability of belief salience. Here it is important to recall that exposure to a message can influence (a) belief strength, (b) the evaluation of constructs predicated in that belief, (c) belief salience, or (d) any combination of these effects (Albarracín, 2002; Albarracín & Wyer, 2001). In content matching, the goal is to identify beliefs that are already salient and craft appeals to change belief strength and/or outcome evaluations. Media priming theory endorses a message strategy whereby salience is increased, but belief strength and outcome evaluations remain unchanged. As mentioned, if a priming strategy were used in an intervention, the goal might be to call to mind beliefs *already aligned* with the desired outcome in an effort to harness the predictive power of those beliefs. Clearly, assimilative priming effects could also work against campaign goals if the message inadvertently makes constructs that are *misaligned* with the intended message effect more salient. In further contrast to the media priming strategy,

addressing misaligned beliefs is strategically beneficial from the content matching perspective because those beliefs exhibit the greatest room for change (Hornik & Woolf, 1999).

Presenting content matching and media priming as two distinct message strategies deemphasizes the fact that mean changes in belief strength or outcome evaluations can occur in tandem with assimilative priming effects (Cappella et al., 2000; Fishbein & Cappella, 2006). In other words, these effects are not mutually exclusive in practice; message exposure can simultaneously affect changes in salience, belief strength, and evaluations. Consequently, message-driven changes in salience could undermine the relative empirical benefit of content matching. For example, suppose that an investigator is interested in testing the comparative efficacy of two versions of an informed consent procedure. One version is developed with the expectancy-value principle in mind, and addresses consequences that were found through an elicitation study to be modally salient to the target audience. The other version of the consent document was developed based on generic guidelines. These consent materials emphasize different sets of harmful consequences that could result from participating in the project. Suppose that both versions of the consent materials are equally efficacious at strengthening the respective beliefs that they target. Which version of the consent procedure is expected to result in more negative attitudes toward participating? The answer depends on the relative proportion of salient message-based beliefs following exposure.

According to the RAM, the generic version is less likely to address the audience's salient beliefs. As a result, the generic version would be expected to have less influence on attitudes from this perspective. However, based on MPT, exposure to the generic message could temporarily increase the salience of the consequences it mentioned. If

this were to happen, the relationship between message-based beliefs and attitude would be strengthened. Empirically, the content matching strategy adopted by the targeted version of the consent document may lose its "persuasive" advantage.[12] Post-exposure attitude would simply appear to be a function of message-based beliefs, regardless of how they match-up with pre-exposure, knowledge-based salient beliefs.

A study conducted by Albarracín and Wyer (2001) provides a good example of how a message-based shift in salience can impact attitude formation. In that study, belief-based measures of students' attitudes toward comprehensive exams were computed drawing on expectancy-value estimates of (a) four novel outcomes that were addressed in a message that a participants (N = 40) were asked to read (i.e., message-based beliefs), and (b) seven outcomes that had been spontaneously generated by participants in a pretest (i.e., knowledge-based beliefs). When correlated with a direct measure of attitude toward comprehensive exams, the index that drew upon message-based beliefs exhibited a stronger relationship (r = .57, p < .01) than the knowledge-based index (r = .25, *ns*). These results were compared with analogous data from an independent sample of participants (N = 21) who had not read the persuasive message. In this second sample the results were reversed; whereas the message-based belief index was not significantly associated with direct attitude (r = .18, *ns*), the knowledge-based index was strongly correlated with it (r = .47, p < .05). A reasonable explanation of this pattern of results is that the novel message-based beliefs became more salient immediately following message exposure than knowledge-based beliefs (see Domke, 2001; Domke, McCoy, & Torres, 1999; Yi, 1990).

[12] This assumes that the proportion of post-exposure salient beliefs with origins in the generic version increases to a point that is at least equivalent to the proportion of pre-exposure, knowledge-based salient beliefs addressed in the targeted version.

Based on the expectancy-value principle, a message that addresses knowledge-based beliefs is more likely to impact primary determinants of intention and behavior. However, if message exposure temporarily increases the proportion of salient beliefs with message-based origins, then the strategic advantage of matching content to knowledge-based salient beliefs could be over-powered.

The Role of Salience in Belief Change

Lastly, it is worth considering briefly how salience affects changes in belief strength in response to message content. Two characteristics of salient beliefs are especially relevant. First, salient beliefs tend to be held more strongly than nonsalient beliefs (Cronen & Conville, 1975; Fishbein & Ajzen, 1975; see also Newton, Ewing, Burney, and Hay, 2011). Second, belief salience has been found to be positively correlated with belief confidence (Kopp, 2010; Krosnick, Boninger, Ghuang, Berent & Carnot, 1993). Belief confidence is a sense that the belief or judgment is valid. Although this relationship is conventionally small, people tend to express greater certainty in judgments about salient behavioral consequences than they do nonsalient consequences.

According to a framework proposed and tested by Jaccard (1981), belief change in response to a message is a function of (a) the difference between the position advocated by the source and the position accepted by the recipient prior to message exposure (i.e., discrepancy), (b) the recipient's confidence that his or her original position is accurate (i.e., own confidence), and (c) the recipient's confidence that the message source is correct (i.e., source confidence). Belief salience can be viewed as a moderator of a message's impact on beliefs due to its associations with strength and confidence.

Jaccard's theoretical account extends W. J. McGuire's (1968) reception-yielding model of persuasion by specifying the psychological determinants of *yielding* as it relates

to belief change. Yielding here refers to message-congruent change in a primary belief resulting from exposure to a message (W. J. McGuire, 1968). Yielding is differentiated from *acceptance*, the extent to which a message recipient agrees with claims regarding a particular belief, regardless of message exposure (Fishbein & Ajzen, 1981; Wyer, 1974). When an audience already accepts the position taken by a message, discrepancy is low and so there is little opportunity for yielding. If the goal of the message is to change beliefs, large discrepancies are an advantage because they leave greater room for improvement (Dillard, 2011; Hornik & Woolf, 1999).

Yielding to a message is not only a function of discrepancy or prior acceptance (Kaplowitz & Fink, 1997). The results of Jaccard's experiment demonstrated that people tend to resist yielding when the message source is perceived to be less reliable than they are themselves. With a high degree of confidence in one's own position, little belief change occurs regardless of how great the discrepancy or how much confidence there is in the message source. On the other hand, the strength of the association between discrepancy and belief change increases as confidence in the source increases when own confidence is low. Generally, people who have a high degree of confidence in the accuracy of their original judgments tend to resist yielding to appeals that are incongruent with those judgments (Albarracín, Wallace, and Glasman, 2004; Jaccard, 1981). This is also consistent with Petty, Briñol and Tormala's (2002) self-validation hypothesis; that people rely more on their thoughts about a topic when they have confidence rather than doubt in those thoughts.

Because salience is positively associated with belief strength, knowing whether the beliefs addressed by a message are salient provides some clues about pre-exposure acceptance and, thus, discrepancy. A message that aims to strengthen a belief will have less room for improvement when the belief is salient, all else being equal. Conversely, a

message that aims to weaken a belief will have greater room for improvement when the belief is salient.

Likewise, the positive association between belief salience and confidence offers insights about resistance to belief change. Salient beliefs are likely to be held with greater confidence. When the goal of a message is to further strengthen, or affirm, a belief that the audience agrees is true, salient beliefs will be somewhat less resistant to change. However, because the appeal is congruent with the audience's original judgments, this reduction in resistance may be less consequential to yielding than prior acceptance. By virtue of having greater room to improve nonsalient beliefs, noticeable belief change resulting from an affirming appeal is more likely when it addresses a nonsalient belief. Conversely, when the goal of a message is to substantially weaken, or disconfirm, beliefs that the audience agrees with, salient beliefs will be more resistant to change than nonsalient beliefs. Although there is greater opportunity to change salient beliefs through a disconfirming appeal, salient beliefs are also held with greater confidence than nonsalient beliefs. As a result, it is more difficult to persuade people to disagree with a salient belief that they think is true than it is a nonsalient belief. In sum, salient beliefs are likely to be less amenable to change than nonsalient beliefs.

Conclusion

In this chapter, I have defined content matching as the alignment between message claims and the audience's salient beliefs about a message topic. Salient behavioral beliefs are important because they are expected to relate more strongly to attitudes and intentions than nonsalient beliefs. An implication of the RAM is that changes in belief strength in response to a message are more likely to cause changes in attitude and intention when the message topic is matched to the salient beliefs of the audience. Because the RAM views salience as a relatively fixed property of the beliefs

that people hold, differences in belief salience within a population can prove useful for audience segmentation and message customization. In Study 1, I examine the feasibility of taking a belief-based approach to audience segmentation. Here, the primary segmentation criteria were perceived advantages and disadvantages of taking a genetic test as part of a research study. Respondents in a large population-based sample who listed similar consequences of participating were grouped together and distinguished from other respondents who listed different consequences.

Dividing a general audience into smaller audience segments based on interindividual, qualitative differences in belief salience can help prioritize information for consent disclosure. The goal of that approach to segmentation is to identify information the audience needs to make effective choices. Salient behavioral beliefs are more strongly related to attitudes than nonsalient beliefs; further, attitude change partially mediates the impact of belief change on intention and behavior. Thus, salient beliefs have a larger impact on decisions, choices and actions than nonsalient beliefs. However, the RAM and MPT offer two alternative hypotheses regarding the effects of message exposure on the salience of behavioral beliefs. Specifically, the RAM emphasizes the knowledge-based origins of belief salience, treating salience as relatively stable over time. On the other hand, MPT emphasizes the immediate message-based origins of salience. From this perspective, short-term increases in salience are expected following exposure. Both processes may affect belief salience at any given point in time. Less clear, though, is whether message-based priming effects are likely to overpower the effects of salience with knowledge-based origins.

Figure 3.3 depicts the conditional direct and indirect effects implied by the conceptual models discussed in this chapter. These relationships can be stated as a set of general hypotheses. The studies presented in the next two chapters test specific

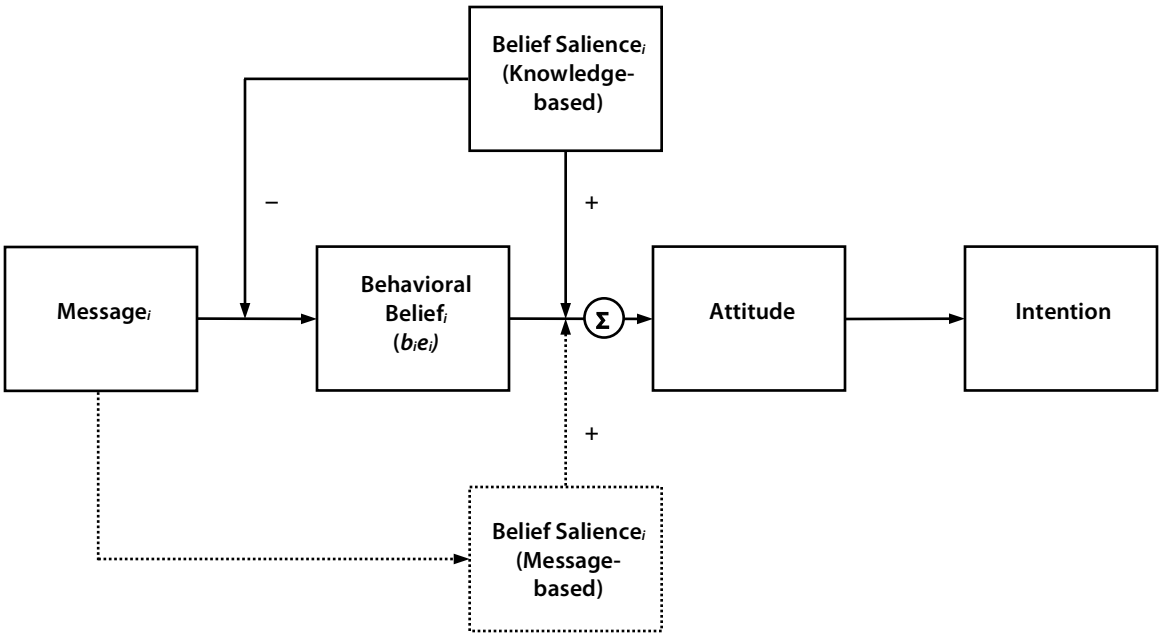

Figure 3.3. Conceptual model showing predicted conditional effects of belief salience on the attitudinal pathway of the reasoned action model. The dashed lines represent causal pathways implied by media priming theory. Sigma represents the summation of belief-evaluation products (i.e., b_ie_i) over several behavioral outcomes, *i*.

versions of these hypotheses as they related to peoples decisions to participate in large-scale genomics research projects.

First, belief salience will moderate the impact of message appeals on changes in behavioral belief strength. A message appeal directed at a given belief will lead to less change in belief strength when that belief is salient, compared to when it is nonsalient. Second, based on the RAM, belief salience will moderate the direct effect of corresponding behavioral beliefs (i.e., a belief-evaluation products, b_ie_i) on attitude. When a behavioral outcome is salient, the positive relationship between the behavioral belief and attitude will be stronger than when it is nonsalient. This hypothesis extends to a conditional indirect effect on intention. The moderating effect of belief salience on the relationship between a behavioral belief and attitude will impact intention through

attitude. Under conditions where behavioral outcomes are addressed in a message, a competing hypothesis is derived from MPT. When subjects receive a message that addresses a given behavioral outcome, the direct positive impact of the corresponding behavioral belief on attitude will be stronger than when subjects do not receive the message. A further condition of this MPT hypothesis is that the outcome addressed in the message is not already salient to the audience (i.e., knowledge-based salience). This hypothesis also implies a conditional indirect effect on intention through attitude. Lastly, the impact of a message on attitude and intention is a function of the hypothesized conditional effects of belief salience and mediating pathways.

CHAPTER FOUR: STUDY ONE

The purpose of Study 1 was twofold: (1) identify frequently held beliefs that are likely to be relevant to participating in a hypothetical genome-sequencing study, and (2) determine whether it is possible to define meaningful subgroups of potential research participants who differ in their primary motivations to participate. Toward this end, Study 1 was divided into two phases, which I will refer to as the *belief elicitation* and *audience segmentation*, respectively. Examining between group differences in belief strength, belief–attitude, and belief–intention associations, validated the audience-segmentation strategy.

Method

The data for this analysis were collected as part of the Genetics, Public Opinion, and Deliberation (gPOD) project at the University of Pennsylvania. The gPOD project was a three-phase study that consisted of a baseline survey of the general U.S. adult population, online discussion groups and an end-of-project survey designed to assess changes in public opinion over time. The analyses conducted in Study 1 drew exclusively from data collected during the baseline phase of the study.

Participants

Respondents of the gPOD baseline survey were a probability sample of noninstitutionalized adults aged 18 years or older living in the United States. Knowledge Networks (KN), a research firm that specializes in conducting nationally representative online surveys, collected the data. Knowledge Networks maintains a large subject pool of U.S. adults living in telephone-accessible households. Members of the KN subject pool were recruited using a list-assisted, random-digit-dialing method (RDD). To help ensure that the sample is not biased against households without a computer or internet connection, panel participants are provided with a Web TV appliance and monthly

internet service. For the gPOD baseline survey, a random probability sample of adults was drawn from households in the KN subject pool.

Eligible respondents who agreed to participate in the project (N = 3,754) completed an online questionnaire between October 29 and November 17, 2008. The overall cooperation rate for the baseline survey was approximately 77%. The belief elicitation and audience segmentation analyses that comprise Study 1 are based on a subsample of respondents (N = 1,099) drawn at random from among those who agreed to participate in the baseline survey.

Participants in the Study 1 subsample ranged in age from 18–89. Twenty-eight percent of participants in the sample were 18–34, 21% were 35–44, 31% were 45–59, and 20% were sixty years or older. Fifty-seven percent of the sample was female. The majority of the sample was non-Hispanic White Americans (69%), followed by non-Hispanic African Americans (20%), and Hispanics (7%).[13] A small proportion of the sample (4%) had less than a high school education, 24% had completed high school, 34% completed some college, 24% had earned a four-year degree, and 14% had completed a graduate or professional degree.

Procedure

Belief elicitation. The gPOD baseline survey included an open-ended question designed to elicit salient behavioral outcomes related to participating in a genetic research project. The research project was hypothetical and described as a population biobank. The question was modeled on the semi-structured, thought-listing exercise recommended by Fishbein and Ajzen (2010; see also Ajzen & Fishbein, 1980;

[13] An oversample of 544 African Americans was included among the respondents who completed the baseline survey. This oversample was designed to enhance the analytical power of comparisons between racial subgroups within the general population. The subsample for this analysis was drawn from the full group of baseline participants, without regard for the oversampling.

Middlestadt, 2012; Middlestadt et al., 1996). Each respondent was given space to list up to two advantages and two disadvantages of "volunteering to take a genetic test as part of a research study sometime in the next 12 months." A content analysis (Krippendorff, 2004; Neuendorf, 2002, 2009) of the reported consequences was then conducted to identify common themes.

A codebook for the analysis was developed using an iterative process. First, three independent coders classified responses from a random sample of participants ($n_{\text{codebook}} = 100$) into common themes. The coders were not given any background information about the target behavior or common themes reported in the relevant literature. The use of a blind-coding procedure was intended to minimize bias from the coders' prior knowledge of the subject matter being investigated (Neuendorf, 2009). Next, the three coders met to compare and discuss their respective classification schemes. These were then integrated to form an initial, standardized coding instrument. The initial codebook defined nineteen themes dedicated to advantages and fourteen dedicated to disadvantages.[14]

The reliability of the initial coding instrument was then tested on elicitation responses from a second random subsample of baseline participants ($n_{\text{reliability1}} = 100$). All three coders independently coded responses from this second sample, and a reliability check was conducted.

Responses from a final sample of gPOD baseline participants ($n = 1{,}000$) were then coded. All three coders analyzed responses from a random subsample of this final

[14] The gPOD baseline questionnaire was formatted so that the first two text-fields were designated as a place for the respondent to list "advantages" and the second two text-fields were designated for "disadvantages." Thus, advantages and disadvantages appeared in separate columns in the resulting data file. Except in some rare cases where the coders could reasonably judge that the respondent erroneously listed an advantage in the disadvantage text field (or vice versa), whether a response was an "advantage" or "disadvantage" could largely be taken at face value based on its column placement in the dataset. Also, two additional, nonthematic categories were included in the codebook. These were used to classify "don't know" responses, and responses that did not fit into any of the other predefined themes.

set of participants ($n_{\text{relibability2}}$ = 100), so that a final reliability test of the coding instrument could be conducted. Elicitation responses from the remaining participants (n = 900) were equally divided among the three coders. After coding was completed, the initial and final samples were combined into a single dataset (N = 1,099).[15]

Audience Segmentation. The second phase of Study 1 drew on the content-analyzed elicitation responses. Respondents were grouped into audience segments through a cluster analysis. The goal of the cluster analysis was to empirically identify two or more subpopulations whose members had similar motivations and informational needs with respect to participating in genetics research. If successful, the audience segments would be differentiated by having beliefs that are salient in one group but not the others. Thus, understanding which beliefs differentiate one audience segment from another can be useful for developing targeted messages.

Measures

The baseline gPOD survey included direct measures of intention, attitude, perceived social pressure, and perceived behavioral control with respect to participating in a genetic research study. Additionally, the survey measured several belief-strength items assumed to underlie the attitude construct. The belief items were selected based on a review of literature published between 1994 and 2007 that examined intentions to participate in genetics testing and research (see Paquin et al., 2010, for details).

Behavioral intention. Intention to participate in a genetics research study was measured with a single item (M = 3.24, SD = 1.23). The question was premised with a short paragraph that introduced the concept of "participating in research studies that involve genetic testing." Participants were then asked, "If it were no cost to you and your

[15] The combined sample size does not add up to 1,100. By conducting separate random draws without replacement to generate the initial and final subsamples, one participant was inadvertently included in both.

family and you were asked to take part in a research study, how likely is it that sometime in the next 12 months you would volunteer?" Responses were measured on a 5-point scale ranging from 1 (*very unlikely*) to 5 (*very likely*).

Direct attitude. Six semantic differential items were used to measure attitude toward taking a genetic test as part of a research study. All items were scored on 5-point scales ranging from 1 to 5. The common stem for these items was, "If there were no cost to you and your family, for you to volunteer to take a genetic test as part of a research study sometime in the next 12 months would be…." The semantic differential endpoints were *harmful–beneficial* (H-B), *foolish–wise* (F-W), *worthless–valuable* (W-V), *unsatisfying–satisfying* (U-S), *undesireable–desirable* (U-D), and *bad–good* (B-G). The internal consistency of the items was strong ($\alpha = .93$). For some analyses, the average of these six items was used as a composite attitude scale ($M = 3.66$, $SD = 0.87$).

Perceived social pressure. Two dimensions of social influence are relevant in applications of the reasoned action model (RAM). Injunctive norms ($M = 3.18$, $SD = 0.98$) were measured with a single item that asked, "If there were no cost to you and your family, would the people in your life whose opinions you value most think you should or should not volunteer to take a genetic test as part of a research study sometime in the next 12 months?" Responses were assessed on a 5-point scale ranging from 1 (*definitely should not*) to 5 (*definitely should*). The second dimension of perceived social pressure, descriptive norms ($M = 2.61$, $SD = 1.02$), was measured by asking respondents how much they agreed or disagreed with the following statement: "Most people like me have volunteered to take a genetic test as part of a research study." Responses were measured on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The bivariate association between injunctive and descriptive norms was too weak to justify

consolidating them into a single measure of perceived social pressure (r = .34, p < .001). Instead, the variables were treated as separate predictors.

Perceived behavioral control. Perceived behavioral control was measured with a single item (M = 1.66, SD = 1.01): "If there were no cost to you and your family and you were recruited to participate in a research study requiring a genetic test, how confident are you that you could follow through on completing the research?" Responses were measured on a 4-point scale ranging from 0 (*not at all confident*) to 3 (*extremely confident*)

Behavioral beliefs. Participant expectations about participating in a genetics research study were assessed with eight items. These items were premised with the phrase, "How much do you agree or disagree with the following statements: My participating in a genetics research study in the next 12 months will_____?" The items were scored on 5-point response scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The outcomes were (B_1) Help scientists develop treatments for disease, (B_2) Give me access to information about my genetic health risk, (B_3) Put the privacy of my genetic information at risk, (B_4) Make me a part of research that goes against my personal values, (B_5) Take away my control over how my DNA samples are used, (B_6) Make me worry about my health, (B_7) Make me feel proud, and (B_8) Make me hopeful about my future health.

Belief salience. As part of the content analysis, each elicitation response was assigned a numerical code corresponding to a codebook theme. In this way, the four open-ended response fields were translated into four, multinomial variables. These multinomial variables were then converted into thirty-three binary variables; one representing each of the thirty-three codebook themes. These variables indicated whether a respondent elicited a response matching a specific theme, and therefore

whether that theme was 0 (*nonsalient*) or 1 (*salient*) to the respondent. These themes are listed in the left-hand column of Table 4.1.

Data Analysis

Audience segmentation was conducted using the two-step cluster analysis procedure in SPSS 18.0. Two-step cluster analysis is an exploratory technique recommended for large data sets ($N > 200$). The procedure is capable of generating clusters on the basis of either continuous or categorical data and does not require that the number of clusters in the final solution be defined *a priori* (Norušis, 2012). The two-step clustering algorithm partitions objects into clusters so as to maximize *cohesion* and *separation*. Cohesion is the degree of similarity among objects within a given cluster. Separation is the amount of dissimilarity between clusters.

The reliability of the two-step clustering procedure is sensitive to the number of variables entered as clustering criteria (Maibach, Maxfield, Ladin & Slater, 1996). According to Formann (1984; as cited in Mooi & Sarstedt, 2011), the number of clustering variables, m, should not exceed the integer value expressed by the equation, $m = \left\lfloor \log(n) / \log(2) \right\rfloor$, where n is the number of objects to be clustered.[16] The analysis excluded participants with responses that did not correspond with any theme in the codebook (i.e., n =228, 21% of the final elicitation subsample). 871 respondents remained for clustering. Applying Formann's rule, using more than nine clustering variables would have reduced the reliability of the cluster solution. Thus, to facilitate audience segmentation based on belief salience, the thirty-three binomial salience variables were further compiled into nine *metathemes* (see the top row of Table 4.1). These indicated whether a respondent elicited at least one consequence matching a

[16] Formann (1984) refers to the minimum acceptable sample size, $n = 2^m$, given a known number of clustering variables, m. I transposed this equation to solve for the maximum acceptable m, given a known sample size.

Table 4.1

Inductively Developed Belief Elicitation Themes and Metathemes

	Metatheme								
Codebook theme	Greater Good	Personal Feedback	Practical Barriers	Family/ Friends	Anticipated Affect	Quality of Results	Privacy Concerns	Curiosity	Direct Benefit/ Cost
Altruism/help others (non family)	×								
Contribute to medicine	×								
Contribute to science	×								
Personal information about future health/genetic risk		×							
Personal information about current health		×							
Early diagnosis of diseases		×							
Prevent diseases		×							
Treat diseases		×							
Maintain current health		×							
Improve health		×							
Timing/time consuming			×						
Physical costs/barriers			×						
Inconvenient			×						
Help family/people who are close to you				×					
Learn about family members' genetic health risk				×					
Stressful for others				×					
Burden to others				×					
Worrisome/stressful for self					×				
Peace of mind					×				

(table continues on next page)

Table 4.1 (*continued*)

	Metatheme								
Codebook theme	Greater Good	Personal Feedback	Practical Barriers	Family/ Friends	Anticipated Affect	Quality of Results	Privacy Concerns	Curiosity	Direct Benefit/ Cost
Don't want to know						×			
Lack of response efficacy						×			
Unreliable results						×			
Uncertain predictor of future conditions						×			
Concerns about misuse of personal data							×		
Concerns about privacy/confidentiality							×		
Do not trust researchers/genetic science							×		
Knowledge								×	
Learn about personal genetic profile								×	
Interesting								×	
Incentives (nonmonetary)									×
Help self									×
Cost (monetary)									×
Payment (monetary)									×

Note. Cells marked '×' indicate which codebook themes (i.e., row) were components of each metatheme (i.e., column).

theme comprised by that metatheme. The binary metathemes were used as clustering variables. Thus, defining the nine metathemes was a pragmatic step taken to improve the likelihood of identifying meaningful audience segments.

Because cluster analysis is a heuristic technique, clusters are formed regardless of whether natural or meaningful subgroups are present in the population; thus, it was important to validate the cluster solution (Sharma, 1996). Reliability was established by using a different clustering procedure on the same data, and comparing the results (Mooi & Sarstedt, 2011). Because binary clustering variables were used, replicating the analysis using a *k*-means clustering approach was possible. The resulting clusters were then cross-tabulated with those defined by the two-step clustering procedure and measures of association computed (e.g., kappa, κ). The κ statistic is a measure of the observed agreement between coders—in this case clustering algorithms—over a set of categories that ranges from −1 to +1 (i.e., perfect disagreement and perfect agreement corrected for chance, respectively). Qualitative guidelines for interpreting κ values have been recommended by several authors, with different cut-off values endorsed (Hallgren, 2012). A systematic analysis of these cut-off values by Muñoz and Bangdiwala (1997) suggests that $\kappa \geq .75$ is an indication of near perfect agreement. With this threshold in mind, I adopted $\kappa = .75$ as the minimally acceptable value for designating a clustering solution as reliable.

The internal validity of the clustering solution was assessed using the silhouette coefficient, which is a measure of the clustering solution's overall goodness-of-fit based on cohesion and separation (Norušis, 2012). The silhouette coefficient ranges from −1 to +1, with values less than .20 indicating a poor quality solution, between .20 and .50 a fair solution, and greater than .50 a good solution (Mooi & Sarstedt, 2011).

The external validity of the clustering solution was evaluated using several criteria. First, a descriptive analysis of belief salience was conducted. Elicitation responses were ranked by frequency in the different audience segments (i.e., clusters of respondents). In turn, the relative frequency of a belief within a subpopulation indicated its salience for that segment (i.e., modal salience). Beliefs were classified as modally salient for each segment by applying three decision rules adapted from Ajzen and Fishbein (1980): (a) the ten most frequently mentioned beliefs, (b) any belief mentioned by at least 10% of the sample, or (c) as many beliefs as are necessary to cumulatively account for 75% of all beliefs elicited. The observed segments' modally salient beliefs were then compared to identify points of qualitative differentiation and commonality.

Second, it has long been hypothesized that salient beliefs will tend to be held more strongly than nonsalient beliefs (Cronen & Conville, 1975; Fishbein & Ajzen, 1975; see also Newton et al., 2011). Independent-samples *t* tests for equality of means were conducted to compare belief-strength ratings between audience segments (i.e., clusters).

Lastly, I tested the hypothesis that associations of differentiated behavioral beliefs with attitude and intention would be moderated by audience segment. A low-powered test of this hypothesis examined differences in correlation coefficients across segments. This was followed by a more sophisticated and conceptually appropriate moderation analysis. Specifically, a multiple-sample SEM analysis with maximum likelihood estimation (MLE) was implemented using the multi-group procedure in AMOS 16.0. The generic model for the analysis was based on the attitude-components measurement model of the RAM described in detail by Hennessy, Bleakley, and Fishbein (2012). The model was adapted for this study and is shown in Figure 4.1.
Briefly, the eight behavioral belief items were modeled as causal indicators of a composite belief index (i.e., formative measure). In the figure, this formative

measurement model presumes that the exogenous manifest variables (i.e., B_1 to B_8) collectively cause the underlying, belief-based attitude construct (i.e, the belief index). The double-headed arrows between the causal indicator items reflect unanalyzed correlations between items. The regression coefficients connecting the causal-belief items to the belief index are estimates of the influence that each of those beliefs has on the index. To define the scale of the index, the regression coefficient from B_8 (i.e., "make me hopeful about my future health") to the index was set to a value of 1. The disturbance of the belief index was set to 0, which makes the latent composite a linear combination of its causal indicators (i.e., a weighted manifest variable; Kline, 2011). Fixing the disturbance variance in this way was a strategy for dealing with under-identification in the formative measurement model. Items that referred to undesirable outcomes (i.e., B_3, B_4, B_5, and B_6) were multiplied by –1 to reverse their values.

The six semantic differential items were presumed to be manifest, effect indicators of respondents' underlying attitudes toward participating in genetics research. Accordingly, direct attitude was modeled as a standard latent variable (i.e., reflective measure).

Intention was measured with a single item, and was represented as a single-indicator measure. To avoid an identification problem, the residual of the manifest item was fixed to zero.

Single-indicator measures of perceived behavioral control, injunctive norms and descriptive norms were also included in the model, but are not depicted in Figure 4.1. These measures were included to control for the direct effects of perceived norm and perceived behavioral control on intention when estimating the indirect effects of belief strength items on intention via attitude. Consistent with the RAM, these measures were treated as exogenous variables with direct paths leading to intention. Covariances

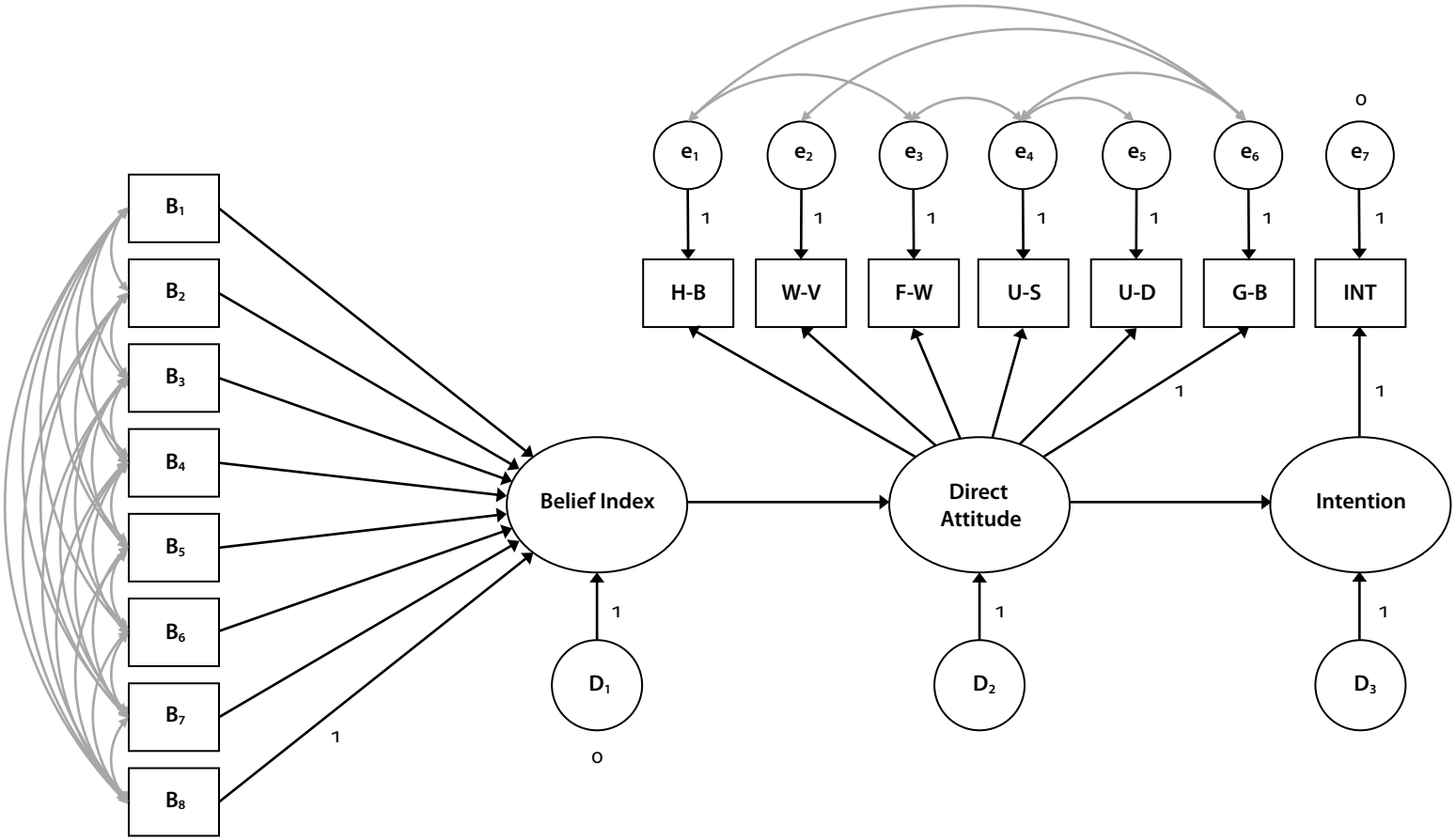

Figure 4.1. Measurement model for the attitude component of the reasoned action model as applied in this study. Adapted from "Measurement Models for Reasoned Action Theory," by M. Hennessy, A. Bleakley, and M. Fishbein, 2012, *The Annals of the American Academy of Political and Social Science*, *640*, p. 49

among these three variables and the disturbance term of the direct attitude scale were freely estimated.

Preliminary analysis revealed that in order to achieve good fit, the error terms between several of the semantic differential items needed to be correlated. In this context, this error-covariance structure is justified given the conceptual similarity of the response scales, and that these items were presented to respondents as a set.

In the multisample analysis presented here, the model was simultaneously fit to data drawn from two audience segments. This analysis focused on comparing parameter estimates for the direct and indirect effects of beliefs on the weighted-manifest belief index, attitude and intention. As explained in the results section, two beliefs were particularly relevant in assessing the external validity of the clustering solution: B_1 (i.e., "Help scientists develop treatments for disease") and B_2 (i.e., "Give me access to information about my genetic health risk"). Constraining parameters so they are equal in both samples is more parsimonious (e.g., has greater degrees of freedom) than a model in which these relationships are allowed to differ across groups. The central question examined in a multisample analysis is whether the overall fit of the model declines when equality constraints across samples are added to free parameters (Maruyama, 1998).

A variety of global fit indices will be reported, including indices of absolute fit, indices of relative fit, and indices of fit with a penalty for lack of parsimony. These include an overall chi-square test of model fit (which should be statistically nonsignificant at the .05 alpha-level), the root mean square of approximation (RMSEA; which should be less than .08 to declare satisfactory fit and .05 or less for good fit), the *p* value for the test of close fit ($p_{\text{close-fit}}$; which should be greater than .05), the comparative fit index (CFI; which should be greater than .95), the Tucker-Lewis index (TLI; which

should be greater than 0.95), and the standardized root means square residual (SRMR; which should be less than .05).

In the analysis presented here, the overall model for each group has the same form. That is, the parameter matrices, dimensions, and location of the fixed, free and constrained parameters are the same for each group (Bollen, 1989). Given this, models with more equality constraints are nested within models with fewer equality constraints. Accordingly, omnibus comparisons of model fit were made using the chi-square difference test, χ^2_D. Between-group comparisons of specific parameters and relationships between variables were assessed with pair-wise parameter difference tests.

Results

Belief Elicitation

Intercoder reliability of the initial codebook was calculated using ReCal3, a reliability calculator for nominal data coded by three or more coders (Freelon, 2010a, 2010b). The average, pair-wise percent agreement among the three coders was 84% for the first advantage and 86% for the second advantage listed by respondents (Krippendorff's α = .83 and .84, respectively). The first disadvantage had an average pair-wise percent agreement of 78%, while the second disadvantage was 88% (Krippendorff's α = .75 and .85, respectively). In each case, the intercoder reliability of the initial codebook met or exceeded the *a priori* acceptable minimum (i.e., Krippendorff's α = .75).

Satisfactory intercoder reliability was also achieved when coding the final sample. The average, pair-wise percent agreement among the three coders was 77% for the first advantage and 80% for the second advantage listed by respondents (Krippendorff's α = .75 and .77, respectively). The first disadvantage had an average pair-wise percent agreement of 86%, while the second disadvantage was 82% (Krippendorff's α = .84 and

.79, respectively). Codebook themes ranked by the number of times each belief was mentioned by participants in the elicitation study are presented in Table 4.2. The superscripts indicate which codebook themes would be considered modally salient beliefs for the general population based on the three different decision rules defined by Ajzen and Fishbein (1980).

Audience Segmentation

All nine metathemes were entered as clustering variables in an initial two-step cluster analysis. This analysis identified two distinct groups. The average silhouette for this clustering solution was .20, indicating that the degree of separation and cohesion exhibited by these clusters was poor. A replication of this analysis using a *k*-means clustering approach produced clusters that agreed substantially with the original two-step solution, $\kappa = .71$, $p < .001$. Nonetheless, this level of agreement fell short of the minimally acceptable reliability threshold (i.e., $\kappa \geq .75$).

A tentative examination of this solution revealed that two metathemes were particularly important for cluster formation: *personal feedback* and *greater good*. Compared to 77% of respondents in the first cluster who had elicited at least one belief that made up the personal feedback metatheme, only 14% did so in the second cluster. In contrast, only 18% of respondents in the first cluster had elicited at least one greater-good belief versus 73% of respondents in the second cluster.

As a follow-up, I performed a second two-step cluster analysis using only the personal-feedback and greater-good metathemes as clustering variables. This analysis produced a four-cluster solution, with an average silhouette of 1.0. In addition to very strong internal validity, a *k*-means replication analysis perfectly reproduced the four clusters generated by the two-step clustering procedure. An examination of the cluster

Table 4.2

Frequency of Belief-Elicitation Themes in a Random Subsample of gPOD Participants

Codebook theme	Rank	f	$\%_V$	$\%_N$
Timing/time consuming[abc]	1	198	7.9	18.0
Altruism/help others (non family)[abc]	2	169	6.8	15.4
Concerns about misuse of information/sample[abc]	3	161	6.4	14.6
Concerns about privacy/confidentiality[abc]	4	158	6.3	14.4
Contribute to science[abc]	5	157	6.3	14.3
Contribute to medicine[abc]	6	150	6.0	13.6
Personal information about future health/genetic risk[abc]	7	144	5.8	13.1
Don't want to know[abc]	8	136	5.4	12.4
Knowledge[abc]	9	130	5.2	11.8
Worrisome/stressful for self[abc]	10	128	5.1	11.6
Personal information about current health[ab]	11	127	5.1	11.6
Physical costs/barriers[a]	12	86	3.4	7.8
Inconvenient[a]	13	77	3.1	7.0
Lack of response efficacy[a]	15	67	2.7	6.1
Help family/people who are close to you	14	66	2.6	6.0
Family knowledge of genetic health risk	16	60	2.3	5.5
Personal information about genetics/genetic makeup	17	53	2.1	4.8
Treat diseases	18	51	2.0	4.6
Prevent diseases	19	50	2.0	4.5
Incentives (nonmonetary)	20	44	1.8	4.0
Help self	21	43	1.7	3.9
Unreliable results	22	41	1.6	3.7
Improve health	23	32	1.3	2.9
Interesting	24	28	1.1	2.5
Early diagnosis of diseases	25	25	1.0	2.3
Cost (monetary)	26	24	1.0	2.2
Payment (monetary)	27	22	0.9	2.0
Maintain current health	28	20	0.8	1.8
Lack of trust	29	15	0.6	1.4
Stressful for others	30	15	0.6	1.4
Peace of mind	31	10	0.4	0.9
Burden to others	32	9	0.4	0.8
Uncertain predictor of future conditions	33	5	0.2	0.5

Note. N = 1,099. V = 2,501 = Number of valid elicitation responses given by respondents. f = Frequency of the elicitation theme. $\%_V$ = Percentage of valid elicitation responses matching the theme. $\%_N$ = Percentage of respondents who elicited at least one belief matching the theme. Each participant could list up to four outcomes, which yielded a total of 4,396 coded responses.

[a] Modal salient belief based on "75% of valid elicitation responses" decision rule
[b] Modal salient belief based on "10% of respondents" decision rule
[c] Modal salient belief based on "Top 10 valid elicitation responses" decision rule

characteristics revealed that the first cluster (n = 317, 36%) was comprised entirely of respondents who elicited at least one greater-good belief and no personal-feedback beliefs. The second cluster (n = 282, 33%) included only respondents who elicited at least one personal-feedback belief but no greater-good beliefs. Respondents in the third cluster (n = 117, 20%) had elicited no beliefs that fit within these two metathemes. And the fourth cluster (n = 95, 11%) was made-up of respondents who elicited both greater-good and personal-feedback beliefs.

Participants in the first and second clusters differed with respect to the number of beliefs in the greater-good and personal-feedback metathemes that they listed. For the sake of convenience and clarity throughout the remainder of this dissertation, I will refer to these two groups as the *altruist* and *instrumentalist* audience segments, respectively. The emergence of differences based on these metathemes is consistent with findings reported by Facio et al. (2011). Corroboration with prior research in this way lends face validity to the clustering solution.

Validation of the audience-segmentation strategy. A more nuanced understanding of the characteristics of the clustering solution is possible. Toward that end, I examined between-segment differences in belief salience, belief strength, and associations of particular beliefs with attitudes and intentions.

Descriptive comparison of belief salience. As a qualitative check of the external validity of this clustering solution, I compared the modally-salient beliefs for these two groups. Table 4.3 shows the most frequent codebook themes by audience segment.

Not surprisingly, elicited beliefs that comport with themes consolidated into the greater-good and personal-feedback metathemes are among the most common in both groups. These beliefs also appear to differentiate the two audience segments from one

Table 4.3

Frequency of Belief-Elicitation Themes by Audience Segment

	Altruists (n = 317, v = 918)				Instrumentalists (n = 282, v = 840)			
Rank	Theme	f	$\%_v$	$\%_n$	Theme	f	$\%_v$	$\%_n$
1	Help others[abc]	143	15.6	45.1	Info about personal risk[abc]	99	11.8	35.1
2	Contribute to science[abc]	124	13.5	39.1	Info about current health[abc]	98	11.7	34.8
3	Contribute to medicine[abc]	114	12.4	36.0	Don't want to know[abc]	63	7.5	22.3
4	Time consuming[abc]	96	10.5	30.3	Worry[abc]	60	7.1	21.3
5	Privacy concerns[abc]	62	6.8	19.6	Misuse of data[abc]	49	5.9	17.4
6	Misuse of data[abc]	60	6.5	18.9	Privacy concerns[abc]	46	5.5	16.3
7	Physical barriers[abc]	48	5.2	15.1	Treat disease[abc]	44	5.2	15.6
8	Inconvenient[abc]	34	3.7	10.7	Prevent disease[abc]	42	5.0	14.9
9	Knowledge[abc]	32	3.5	10.1	Time consuming[abc]	39	4.6	13.8
10	Don't want to know[c]	27	2.9	8.5	Family health risk info[abc]	36	4.3	12.8
11	Worry	24	2.6	7.6	Response efficacy[ab]	30	3.6	10.6
12	Response efficacy	23	2.5	7.3	Improve health[a]	28	3.3	9.9

Note. N = 599. v = Number of valid elicitation responses given by respondents. f = Frequency of the elicitation response theme. $\%_v$ = Percent of valid elicitation responses that matched the theme. $\%_n$ = Percent of respondents who elicited at least one response matching the theme. Excluded in this analysis are responses in which the participant did not list anything in the space provided, indicated that nothing comes to mind, gave a response that did not correspond with any theme in the codebook, or repeated an outcome that fit into a single theme.

[a] Modal salient belief based on "75% of valid elicitation responses" decision rule
[b] Modal salient belief based on "10% or respondents" decision rule
[c] Modal salient belief based on "Top 10 valid elicitation responses" decision rule

another. The altruist segment reported with great frequency outcomes related to helping others, advancing medicine and contributing science. In contrast, many of the beliefs reported by participants in the instrumentalist segment presupposed that personal health information would be returned to them. People in this audience segment appeared to expect to receive direct health benefits for themselves or their friends and family through participating in genetics research.

The disadvantages that were salient for instrumentalists also reflect an underlying emphasis on receiving personal information. For example, 21% of respondents in the instrumentalist segment were concerned that they would learn something that they do not want to know, and 11% were concerned about receiving information that would not be actionable. In contrast, the motivation to contribute to society that is prevalent among the altruists may be offset by perceived disadvantages related to participation itself. For example, 15% of altruists mentioned physical barriers, like pain associated with having blood drawn, and 11% noted that participation would be inconvenient.

Comparison of the modally salient beliefs for the two audience segments revealed numerous points of differentiation; however, there was also evidence of commonality. Specifically, three beliefs were salient for both segments based on all three decision rules. In both segments, the time burden of participating, privacy concerns, and fears that data or DNA samples would be misused were salient disadvantages of participating in genetics research.

Between-segment differences of belief strength and belief–intention correlations. Many of the closed-ended belief-strength items (i.e., B_1–B_8) collected as part of the gPOD baseline survey correspond to modally-salient beliefs of the altruist and instrumentalist audience segments. Two beliefs were particularly notable. The closed-

ended item, "[My participation will…] Help scientists develop treatments for disease (B_1)," relates to the second most frequent codebook theme given by respondents in the altruist segment (i.e., "Contribute to science"). Likewise, the belief item, "Give me access to information about my genetic health risk (B_2)," corresponds closely with the most frequent codebook theme in the instrumentalist segment (i.e., "Info about personal risk"). A third item, "Make me worry about my health (B_6)," corresponds with a belief that was modally salient for instrumentalists, but fell short of meeting the salience criteria for altruists (i.e., "Worry").

In addition to beliefs that differentiate the two audience segments, three of the closed-ended items related to beliefs that were modally salient for both groups. "Put the privacy of my genetic information at risk (B_3)" relates to the theme, "Privacy concerns." The other items that corresponded with a belief that demonstrated common salience, "Make me a part of research that goes against my personal values (B_4)" and "Take away my control over how my DNA samples are used (B_5)," both loosely fit with the theme "Misuse of data."

Table 4.4 shows means and standard deviations of behavioral belief items by Audience Segment. Also listed is the room-for-improvement index (RFII) for each item. RFII is "a ratio that can be interpreted as analogous to the percentage of people yet to adopt the desired belief" (Dillard, 2011, p. 482).[17] Also reported are Pearson's correlation coefficients denoting the bivariate association of each belief item with intention to participate in genetics research.

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[17] Formally, Dillard defines RFII by the following equation:

$$RFII = \frac{UE - M}{UE - 1}, \tag{4.1}$$

where *UE* is the upper end of the response scale (i.e., the "true" or ideal score) and *M* is the item mean. In the case of negatively worded items, the RFII is flipped by subtracting from one.

Table 4.4

Mean Belief Strength, Correlation with Intention, and Room for Improvement of Belief Items by Audience Segment

	Altruists (n = 317)				Instrumentalists (n = 282)			
Belief item	*M*	*SD*	*r*	*RFII*	*M*	*SD*	*r*	*RFII*
My participating in a genetic research study in the next 12 months will…								
B_1…Help scientists develop treatments for disease.	4.22[a]	0.65	.40[b]	20%	4.04	0.72	.27	24%
B_2…Give me access to information about my genetic health risk.	3.88	0.79	.13	72%	4.10[a]	0.76	.32[b]	78%
B_3…Put the privacy of my genetic information at risk.	3.39	1.06	−.34	60%	3.48	1.05	−.39	62%
B_4…Make me a part of research that goes against my personal values.	2.21	1.11	−.39	30%	2.38	1.15	−.41	34%
B_5…Take away my control over how my DNA samples are used.	3.23	1.07	−.32	44%	3.28	1.06	−.26	43%
B_6…Make me worry about my health.	2.93	1.11	−.26	48%	3.42[a]	1.03	−.28	61%
B_7…Make me feel proud.	3.49[a]	0.97	.51	38%	3.18	0.92	.44	46%
B_8…Make me hopeful about my future health.	3.40	0.89	.32	40%	3.65[a]	0.83	.44	34%

Note. N = 599. RFII = room-for-improvement index. Correlation coefficients reported are measures of the association between each belief item with intention to participate in genetics research. All correlations are significantly different from zero at $p < .001$ except for that between B2 and intention in the GG audience segment ($r = .13$), which is significant at $p < .05$.

[a] Based on an independent samples t-test, the mean belief strength of this item for this audience segment is significantly greater than in the other segment, $p < .05$.

[b] Correlation coefficient is significantly greater in this audience segment than in the other, $p < .05$; based on a one-tailed test of the difference between two correlation coefficients found in two independent samples using Fisher's r to z transformation.

In assessing the external validity of the audience segmentation strategy, two sets of between-segment comparisons are particularly relevant. First, behavioral beliefs classified as modally salient in one audience segment but not the other are expected to be held more strongly by members of the segment for which the belief is modally salient (Cronen & Conville, 1975; Fishbein & Ajzen, 1975). In other words, altruists will agree more strongly with item B_1 (i.e., contribute to science) than will instrumentalists. Likewise, B_2 (i.e., received personal genetic information) and B_6 (i.e., worry) will be held more strongly by the instrumentalists. Between-segment differences in belief strength of outcomes that were salient for both audience segments are not expected (i.e., B_3–B_5).

Second, the absolute magnitude of associations between behavioral beliefs and intention were expected to be greater when the beliefs are salient than nonsalient. Thus, the B_1–intention correlation should be greater among the altruists. Likewise, B_2–intention and B_6–intention correlations should be greater among the instrumentalists than among the altruists.

In line with expectations, independent-samples *t* tests for equality of means provided evidence of conventionally small-to-medium differences in belief strength by Audience Segment. The belief that participating would help scientists develop treatments for disease (i.e., B_1) was significantly stronger in the altruist segment than in the instrumentalist segment, $t(591) = -3.25$, $p = .001$, $d = 0.26$. Similarly, the belief that participating in a genetic research study would provide personal information about genetic health risk (i.e., B_2) was held more strongly by instrumentalists than by altruists, $t(595) = 3.39$, $p < .001$, $d = 0.28$. Concerns that participating would lead to health-related worry (i.e., B_6) were also believed more strongly by respondents in the instrumentalist segment, $t(594) = 5.53$, $p < .001$, $d = 0.45$.

No between-segment differences were observed in the "commonality" beliefs (i.e., B_3–B_5); however, mean differences were observed in the remaining two belief items. Item B_7 (i.e., "make me feel proud") was significantly stronger for the altruists than the instrumentalists, $t(591.464) = -4.07$, $p < .001$, $d = 0.34$. In contrast, item B_8 (i.e., "make me hopeful about my future health") was believed more strongly by members of the instrumentalist segment, $t(593) = 3.43$, $p < .001$, $d = 0.28$. No specific hypotheses were posed with respect to these last two beliefs because neither corresponded to themes generated from the belief elicitation. It is worth noting that these beliefs appear to be affective in nature, and may not have been elicited even if they were salient due to the way the elicitation question was worded (Stephen Sutton et al., 2003).

Evidence in support of the hypothesized moderation effect of Audience Segment on the associations between belief items and intention was also found in two out of three cases. One-tailed tests of the difference between two independent correlation coefficients based on Fisher's r to z transformation were used for this analysis (Jacob Cohen, Cohen, West & Aiken, 2003; Preacher, 2002). These tests revealed that the correlation of B_1 with intention was significantly greater for the altruists than it was for instrumentalists, $z = 1.78$, $p = .037$. Also consistent with expectations, the correlation between B_2 and intention was significantly greater for instrumentalists, $z = 2.46$, $p = .007$. The correlation coefficients for the association between B_6 and intention by segment were not significantly different, $z = 0.31$, $p = .379$. In hindsight, this finding may not be particularly surprising, given that "worry" was the eleventh most-frequent theme elicited by participants in the altruist audience segment. By failing to meet the threshold of a modally salient belief according to the "top 10" rule by just one rank-position, the belief might have been marginally salient for members of the altruist segment.

Lastly, it is interesting to note that despite these differences in belief strength and belief–intention correlations, attitude toward participating was equally favorable for the altruists (M = 3.79, SD = 0.79) and the instrumentalists (M = 3.76, SD = 0.85), $t(595) = -0.49$, $p = .622$. Similarly, mean intention to participate in the altruist segment (M = 3.44, SD = 1.17) was statistically indistinguishable from the mean intention in the instrumentalist segment (M = 3.35, SD = 1.16), $t(596) = -1.01$, $p = .314$. The data presented to this point suggests that, on average, respondents in both segments have formed equally strong attitudes and intentions toward participating, but may have done so on the basis of different information.

Multisample SEM analysis. The external validity of the clustering solution was further evaluated by testing the hypothesis that the association of differentiated behavioral beliefs with the latent summed-product belief index, attitude and intention would be moderated by Audience Segment. Specifically, it was expected that the direct and indirect effects of B_1 (viz., contribute to science) on the belief index, attitude and intention would be stronger among altruists than among instrumentalists. Conversely, the direct and indirect effects of B_2 (viz., receive personal risk information) on the belief index, attitude and intention would be stronger in the instrumentalist segment than in the altruist segment.

The analysis reported here was restricted to respondents who had been classified as members of the altruist or instrumentalist audience segments (N = 599). Missing values on variables included in the model were imputed using the multiple imputation procedure in LISREL 8.8. Mardia's coefficient for multivariate kurtosis was 80.37 in the instrumentalist sample and 67.09 in the altruist sample, indicating a non-normal multivariate distribution of the data. Bias-corrected confidence intervals, standard errors and p-values were estimated using a bootstrapping approach with 2,000

replications. The Bollen-Stine bootstrapped *p* value for the chi-square tests of model fit were also reported ($p_{B\text{-}S}$; Bollen & Stine, 1992).

First, the fit of the hypothesized model was tested separately in the two samples to check that it was tenable for each group. For the altruists (n = 317), the hypothesized model showed excellent fit with the data, where $\chi^2(71) = 88.77$, $p_{B\text{-}S} = .268$, RMSEA = .03 [90% CI: .00, .05], $p_{\text{close fit}} = .990$, TLI = 0.99, CFI = .99, and SRMR = .03. The fit statistics also indicated adequate model-fit in the instrumentalist sample (n = 282), where $\chi^2(71) = 108.71$, $p_{B\text{-}S} = .098$, RMSEA = .04 [90% CI: .03, .06], $p_{\text{close fit}} = .736$, TLI = 0.97, CFI = .99, and SRMR = .03. In sum, the model was tenable for both samples.

Next, I conducted a multiple sample SEM. In the best fitting constrained model, all path coefficients connecting the measured belief items to the belief index, the path from the belief index to attitude, and the paths from attitude, injunctive norm, descriptive norm and perceived behavioral control to intention were constrained to be equal in both groups. The disturbances of the endogenous latent variables, measurement error terms, unobserved correlations among the belief items, and the coefficients relating observed indicators to the latent attitude scale were allowed to differ across groups. Fit indices for the constrained model were as follows: $\chi^2(154) = 222.86$, $p_{B\text{-}S} = .056$, RMSEA = .03 [90% CI: .02, .04], $p_{\text{close fit}} = 1.00$, TLI = 0.97, CFI = .99, and SRMR = .03.

In the unconstrained model, the coefficients relating B_1 and B_2 to the latent belief index were allowed to differ between the two audience segments. Based on the results from exploratory analyses of different model configurations, the direct path from descriptive norm to intention was also estimated separately for each sample. This characteristic of the statistical model is conceptually justified, given that the direct predictors of intention according to the RAM are not expected to have equal impact in all

populations. The unconstrained model also fit the data well, where $\chi^2(151) = 206.02$, $p_{B\text{-}S} = .114$, RMSEA = .03 [90% CI: .02, .04], $p_{\text{close fit}} = 1.00$, TLI = 0.98, CFI = .99, and SRMR = .03.[18] Fit indices for both the constrained and unconstrained models demonstrate adequate fit with the data.

Although the constrained model is more parsimonious than the unconstrained model, the imposition of equality constraints significantly reduced overall model fit, $\chi^2_D (3) = 16.844$, $p < .001$. In other words, when the estimates of the coefficients relating B_1 and B_2 to the belief index and descriptive norm to intention are allowed to differ by Audience Segment, the model fits the data significantly better despite a loss of parsimony.

Parameter estimates for the final (i.e., unconstrained) model are shown in Table 4.5. As expected, pair-wise parameter difference tests provided evidence that the direct effect of B_1 on the belief index was stronger among alturists than it was for instrumentalists, $z = 2.479$, $p = .013$. Also, the direct effect of B_2 on the belief index was significantly stronger for the instrumentalists than for the altruists, $z = 2.332$, $p = .020$. Comparison of the parameter estimates in the respective audience segments reveals that this moderation effect was particularly dramatic. Whereas B_1 was a significant causal indicator of the underlying belief index in the altruist audience segment, it was not significant in the instrumentalist segment. Likewise, B_2 was only a significant indicator of the belief index in the instrumentalist segment. The same pattern was also evident for the indirect effects of B_1 and B_2 on attitude and intention.

[18] I compared this unconstrained model with several others that had fewer equality constraints (e.g. setting all coefficients from the belief items to the index free; as well as setting the path coefficients from the belief index to latent attitude, and all direct paths to intention free). The overall fit of the model I adopted was statistically no different from any of these alternatives, but was the most parsimonious.

Table 4.5

Selected Maximum Likelihood Parameter Estimates from a Structural Model Predicting Attitude and Intention to Participate in a Genetic Research Study by Audience Segment

	Altruists (n = 317)			Instrumentalists (n = 282)		
Parameter	Unst.	*SE*	St.	Unst.	*SE*	St.
Direct effects						
B_1 → Belief index[a]	1.37***	0.57	.27	0.18	0.39	.04
B_2 → Belief index[a]	0.49	0.44	.12	1.51***	0.64	.34
B_3 → Belief index	0.47**	0.27	.16	0.47**	0.27	.15
B_4 → Belief index	0.58***	0.24	.20	0.58***	0.24	.20
B_5 → Belief index	−0.04	0.20	−.01	−0.04	0.20	−.01
B_6 → Belief index	0.59***	0.24	.20	0.59***	0.24	.18
B_7 → Belief index	1.33***	0.51	.40	1.33***	0.51	.36
B_8 → Belief index	1.00[c]	—	.28	1.00[c]	—	.25
Belief index → Direct attitude	0.18***	0.04	.74	0.18***	0.04	.73
$R^2_{Attitude}$	.54**			.54**		
Direct attitude → Intention	0.45***	0.07	.30	0.45***	0.07	.32
Descriptive norm → Intention[ab]	0.19***	0.06	.16	0.02	0.06	.02
Injunctive norm → Intention	0.15**	0.06	.13	0.15**	0.06	.13
Perceived behavioral control → Intention	0.41***	0.05	.33	0.41***	0.05	.35
$R^2_{Intention}$	.51**			.49**		
Indirect effects						
B_1 → Direct attitude[a]	0.24***	0.08	.20	0.03	0.06	.03
B_2 → Direct attitude[a]	0.09	0.06	.09	0.27***	0.07	.25
B_1 → Intention[a]	0.11***	0.04	.06	0.01	0.03	.01
B_2 → Intention[a]	0.04	0.03	.03	0.12***	0.04	.08

Note. N = 599. Unst. = Unstandardized parameter estimate; St. = Standardized parameter estimate; B_1 = Help scientists develop treatments for disease; B_2 = Give me access to information about my genetic health risk; B_3 = Put the privacy of my genetic information at risk; B_4 = Make me a part of research that goes against my personal values; B_5 = Take away my control over how my DNA samples are used; B_6 = Make me worry about my health; B_7 = Make me feel proud; B_8 = Make me hopeful about my future health; PBC = Perceived behavioral control. Bootstrap standard errors and p-values were calculated using the bias-corrected percentile method.

*p < .05, **p < .01, *** p < .001.

[a] Parameter freely estimated in each sample.
[b] The estimates for this parameter in each sample are significantly different, z = 2.47, p < .01.
[c] Unstandardized coefficient constrained to unity to set metric for latent index, no significance test possible.

In all, the results of the multisample analysis provide support for the external validity of the clustering solution. Specifically, the results provide evidence that expecting to "help scientists develop treatments for disease (B_1)" is a determinant of attitude and intention for altruists, but not for the instrumentalists. Similarly, expectations about receiving "information about my genetic health risk (B_2)" are associated with attitudes and intentions to participate in genetics research among instrumentalists, but not among altruists.

Alternative moderation analysis using OLS regression. To corroborate the results of the multisample SEM analysis, I also conducted tests for moderation using hierarchical OLS regression. Two separate analyses predicting attitude and intention were run. In both cases, the analysis proceeded in three steps. First, attitude (intention) was regressed on all eight behavioral beliefs. In the second step, a dummy variable denoting membership in one of the audience segments was added. The instrumentalist segment was the reference category. Lastly, two interaction terms were entered in the third step: $B_1 \times$ Audience Segment and $B_2 \times$ Audience Segment. The interaction terms were computed using mean-centered belief variables to avoid issues with multicollinearity (Jacob Cohen et al., 2003). All beliefs included in the model were also mean-centered. The analyses were conducted using the same imputed dataset from the multisample SEM (N = 599). For this analysis, attitude (M = 3.77, SD = .82) was computed by taking the average of the six manifest variables that had been used as effect indicators in the SEM analysis.

Collectively, the eight behavioral beliefs entered in the first step explained 47% of the variance in attitude, R^2 = .47, $F(8, 590) = 65.70$, $p < .001$, $f^2 = 0.890$. Addition of the audience segment variable in the second step did not significantly contribute to the amount of variance explained, $\Delta F\,(1, 589) = 1.26$, $p = .261$, *ns*. However, the two

interaction terms entered in the third step explained an additional 1% of the variance in attitude, $\Delta R^2 = .01$, $\Delta F(2, 587) = 4.15$, $p = .016$, $f^2 = 0.010$. Moreover, as predicted, the regression coefficients of both interaction terms were significantly different from 0. Adjusting for all other variables in the model, Audience Segment moderated the effect of B_1 on attitude, such that the association was stronger among members of the altruist segment, $b_{B1 \times \text{Audience Segment}} = 0.17$, $SE = 0.08$, $t(587) = 2.22$, $p = .027$, $f^2 = 0.013$. Audience Segment also moderated the effect of B_2 on attitude, such that the association was significantly weaker among members of the altruist segment, $b_{B2 \times \text{Audience Segment}} = -0.17$, $SE = 0.07$, $t(587) = -2.48$, $p = .014$, $f^2 = 0.013$. These results are fully consistent with those observed in the multisample SEM.

For the model predicting intention, the eight belief variables entered in the first step accounted for 36% of the variance, $R^2 = .36$, $F(8, 590) = 41.81$, $p < .001$, $f^2 = 0.570$. Addition of the Audience Segment variable in the second step did not explain any additional variance in intentions, $\Delta F(1, 589) = 0.71$, $p = .400$, *ns*. A marginally significant increase in explained variance resulted from adding the interaction terms in the third step, $R^2 = .01$, $F(2, 587) = 2.98$, $p = .052$. Bearing that in mind, being a member of the altruist audience segment did not significantly alter the association of B_2 with intention, $b_{B2 \times \text{Audience Segment}} = -0.18$, $SE = 0.11$, $t(587) = -1.654$, $p = .099$. The regression coefficient for the $B_1 \times$ Audience Segment interaction term was significant, $b_{B1 \times \text{Audience Segment}} = 0.27$, $SE = 0.12$, $t(587) = 2.25$, $p = .025$, $f^2 = 0.008$. Considering the limitations this analysis, I would emphasize that the pattern of results aligns with those observed from the multisample SEM.

Conclusion

Based on the results from Study 1, there is evidence of two distinct subpopulations of potential research participants: the altruists and instrumentalists.

Each of these audience segments has different motivations for participating in genetics research. Beliefs about contributing to science were determinants of attitude and intention, but only for respondents classified as members of the altruist segment. Beliefs about gaining access to information about personal genetic health risk were determinants of attitude and intention, but only for members of the instrumentalist segment. According to the conceptual model described in Chapter 3, changes in these beliefs should impact attitude and intention differently, depending on audience segment. In the next chapter, I present an experiment designed to examine the effects of message content that matches the uniquely salient beliefs of one audience segment versus the other. The messages used in that experiment were designed to influence beliefs about participating in a fictitious whole-genome sequencing research project, called the *SEQOME Project*. An important characteristic of the *SEQOME Project*—as it was presented to respondents—is that no individual sequence data or related health information would be returned to participants.

Specific Hypotheses

Effects of message exposure on belief strength. The first hypothesis refers to the conditional direct effects of messages targeted to address the altruists' and instrumentalists' uniquely salient beliefs. Table 4.6 lists the twelve behavioral beliefs that were differentially salient for the altruist and instrumentalist audience segments. Also presented are the desired position for each belief in the context of the *SEQOME Project* (i.e., true/strongly agree v. false/strongly disagree), the anticipated message position (i.e., affirm v. disconfirm), the overall evaluation of the outcome predicated in each belief item (i.e., advantage v. disadvantage), and the effect on attitude and intention that is expected assuming the belief is salient and yielding occurs. Study 1 demonstrated that altruists and instrumentalists agreed more strongly with beliefs that were uniquely

Table 4.6

Desired Position, Message Position, Outcome Evaluation, and Expected Effect of Yielding on Attitude and Intention for Salient Beliefs by Audience Segment

Belief item	Modal salience	Desired position	Message position	Outcome evaluation	Effect of yielding on attitude/ intention
My participating in a genetic research study in the next 12 months will…					
…Help others in the future.	ALT	T	A	+	M
…Help advance science.	ALT	T	A	+	M
…Contribute to medical research.	ALT	T	A	+	M
…Contribute to knowledge.	ALT	T	A	+	M
…Cause me to feel physical pain.	ALT	T	A	–	L
…Be an inconvenience to me.	ALT	T	A	–	L
…Give me information about my personal genetic health risk.	INST	F	D	+	L
…Teach me something new about my current health.	INST	F	D	+	L
…Give me information to help me make medical treatment decisions.	INST	F	D	+	L
…Provide me with information to help me prevent disease.	INST	F	D	+	L
…Make me feel worried about my health.	INST	F	D	–	M
…Tell me something about my genes that I do not want to know.	INST	F	D	–	M

Note. ALT = Modally salient for the altruist audience segment. INST = Modally salient for the instrumentalist audience segment. T = True/strongly agree. F = False/strongly disagree. A = Affirm the proposition expressed by the behavioral belief. D = Disconfirm the proposition expressed by the behavioral belief. + = Predicate is generally viewed as a positive outcome or advantage. – = Predicate is generally viewed as a negative outcome or disadvantage. M = Yielding with the message position will tend to contribute to a more favorable attitude and greater intention, assuming the belief is salient. L = Yielding with the message position will tend to contribute to a less favorable attitude and lower intention, assuming the belief is salient. No explicit assumptions are made about the behavioral beliefs that are concordantly salient for both segments: Time consuming, privacy concerns and misuse of data.

salient to members of their respective groups. Generalizing the results from Study 1, it is reasonable to assume that beliefs that were salient for the altruist segment (i.e., *greater-good beliefs*) will be aligned with the desired message position; beliefs that were salient for the instrumentalist segment (i.e., *personal-feedback beliefs*) are likely to be misaligned. Moreover, differences in belief strength by audience segment translate into foreseeable differences in discrepancy and, thus, room for improvement. Specifically, greater room for improvement is expected in both greater-good and personal-feedback beliefs among instrumentalists than among altruists.

The following pair of hypotheses refers to changes in belief strength due to message exposure. In the experiment presented in Chapter 5, message customization was captured by a manipulated factor, *Message Topic* (no-message control, altruist-targeted, instrumentalist-targeted). The altruist-targeted message aims to strengthen GG beliefs, and the instrumentalist-targeted message aims to weaken PF beliefs. The hypotheses follow from the conceptual discussion connecting salience to belief change (e.g., Jaccard, 1981). The observed group-level factor, *Audience Segment* (altruist, instrumentalist), can be viewed as a proxy of belief salience. Two complimentary hypotheses are outlined here. In H1a, greater-good (GG) beliefs are the dependent variables. In H1b, personal-feedback (PF) beliefs are the dependent variables.

H1a: There will be an Audience Segment × Message Topic interaction effect on GG belief strength. The altruist-targeted message will increase GG belief strength more among subjects in the instrumentalist segment than it will among those in the altruist segment. The expected pattern of GG belief strength by experimental condition is depicted in Figure 4.2.

H1b: There will be an Audience Segment × Message Topic interaction effect on PF belief strength. The instrumentalist-targeted message will decrease PF belief strength more among subjects in the altruist segment than it will among those in the instrumentalist segment. The expected pattern of PF beliefs strength by experimental condition is shown in Figure 4.3.

Moderator Effect of Belief Salience on the Association of Behavioral Beliefs with Attitude and Intention. According to the conceptual model outlined in Chapter 3, salient behavioral beliefs are more strongly related to attitudes and intentions than nonsalient beliefs. Operationally, belief strength × outcome evaluation terms (i.e., behavioral beliefs) will have a greater positive impact on attitude and intention when those measures refer to salient outcomes. However, the RAM and media priming theory (MPT) offer different accounts of salience. According to MPT, exposure to a message addressing otherwise nonsalient beliefs can make them temporarily salient. Thus, two competing hypotheses are offered.

$H2_{RAM}$: Audience Segment will moderate the direct positive association of behavioral beliefs with attitude. GG behavioral beliefs will be more strongly related to attitude among altruists than among instrumentalists. PF behavioral beliefs will be more strongly related to attitude among instrumentalists than among altruists. The conditional effect of Audience Segment will also indirectly impact intention through attitude.

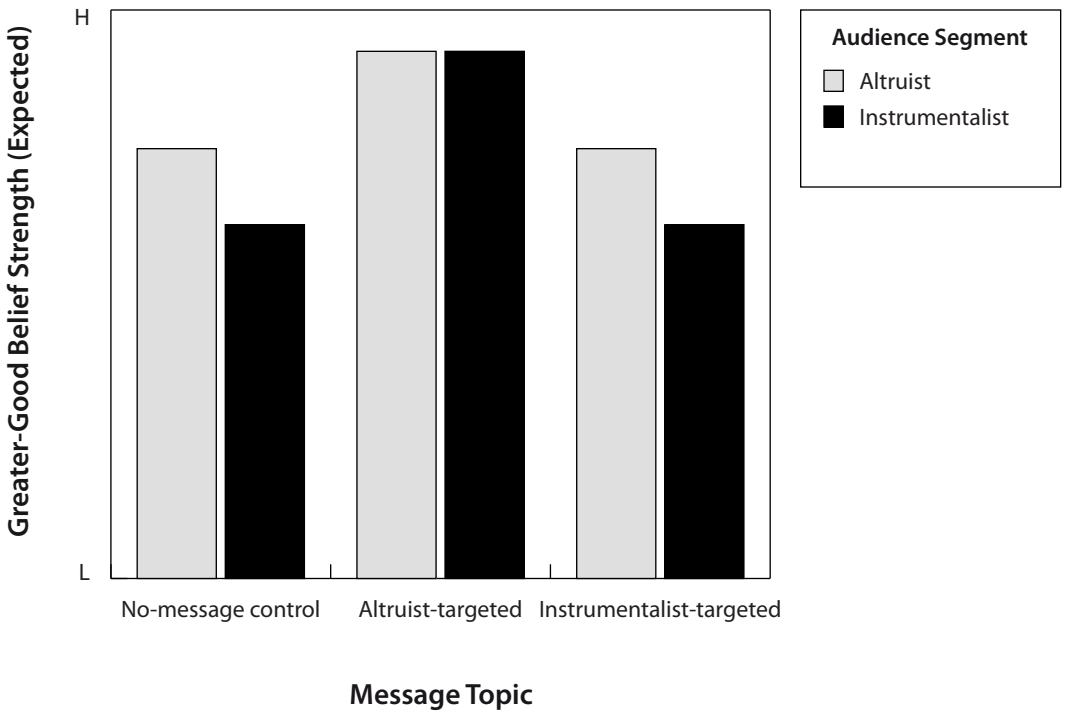

Figure 4.2. Expected pattern of greater-good belief strength by Message Topic and Audience Segment, as predicted in H1a.

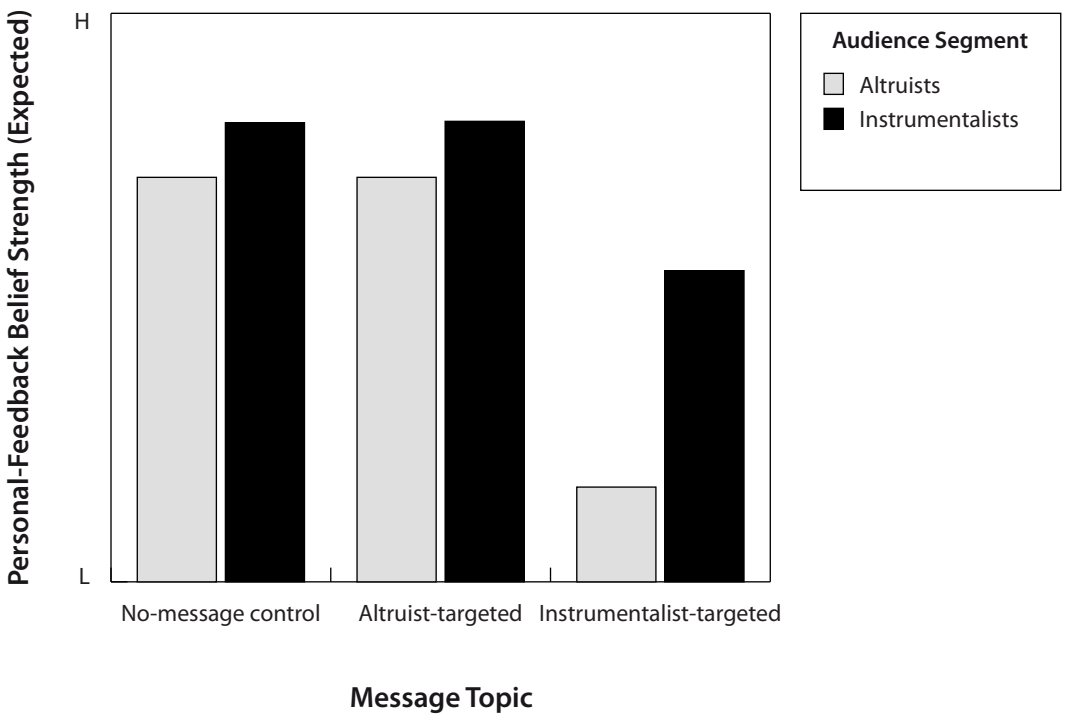

Figure 4.3. Expected pattern of personal-feedback belief strength by Message Topic and Audience Segment, as predicted in H1b.

$H2_{MPT}$: Audience Segment *and* Message Topic will moderate the direct positive association of behavioral beliefs with attitude. GG behavioral beliefs will be more strongly related to attitude among subjects exposed to the altruist-targeted message versus the instrumentalist-targeted message. PF behavioral beliefs will be more strongly related to attitude among those exposed to the instrumentalist-targeted message versus the instrumentalist-targeted message. The Audience Segment interaction effect will prevail when there is no message. The conditional effect of Message Topic will also indirectly impact intention through attitude.

Indirect effects of message exposure on attitude and intention. If the claims made in the instrumentalist-targeted message were fully accepted, they would generally entail a less favorable view of participating in the *SEQOME Project* than that originally held by respondents. According to the conceptual model outline in Chapter 3, the instrumentalist-targeted message indirectly affects attitude and intention through changes in PF belief strength. However, the strength of this indirect effect depends on the salience of those beliefs. Once again, the RAM and MPT offer competing accounts of belief salience. Following the RAM, PF beliefs are more likely to be salient among the instrumentalist audience segment. According to MPT, PF beliefs are more likely to be salient among recipients of the instrumentalist-targeted message.

$H3_{RAM}$: There will be an Audience Segment × Message Topic interaction on attitude and intention, such that members of the instrumentalist audience segment who receive the instrumentalist-targeted message

will have less favorable attitudes and weaker intentions compared to all other conditions.

$H3_{MPT}$: There will be a main effect of Message Topic on attitude and intention, such that the instrumentalist-targeted message will produce less favorable attitudes and weaker intentions compared to the altruist-targeted message or control.

Attitudinal ambivalence and decisional conflict. Lastly, I pose two research questions related to decisional conflict (Janis & Mann, 1977; O'Connor, 1993, 1995) and attitudinal ambivalence (Kaplan, 1972; M. M. Thompson, Zanna, & Griffin, 1995). Decisional conflict is a popular measure of decision quality (O'Connor et al., 2009; Stacey et al., 2011). Janis and Mann (1977) define decisional conflict as the intrapersonal tension to simultaneously accept and reject an action that is anticipated to yield some balance of positive and negative effects. In this sense, decisional conflict is conceptually similar to attitudinal ambivalence. When referring to actions, attitudinal ambivalence is the degree to which a behavior is evaluated positively and negatively at the same time. Decisional conflict and attitudinal ambivalence are, in part, a consequence of the inherent difficulty of some decision tasks, but may also be influenced by modifiable sociocognitive factors. For example, a person is likely to experience greater decisional conflict if he or she (a) feels uninformed about the alternatives, benefits and risks; (b) lacks clarity about relevant personal values; or (c) feels social pressure to choose a particular course of action. O'Connor (1995) has argued that reductions in decisional conflict improve the likelihood that effective decisions will be

made, where effectiveness is defined in terms of being informed, consistent with personal values and acted upon.

RQ1: Will there be differences in decisional conflict by Message Topic and Audience Segment?

RQ2: Will there be differences in attitudinal ambivalence by Message Topic and Audience Segment?

CHAPTER FIVE: STUDY TWO

Expanding on the results from the analyses presented in Chapter 4, Study 2 tested whether content matching facilitates the formation of message-congruent beliefs, attitudes and intentions. The main criterion variables in the study were attitudinal judgments and intentions toward participating in a hypothetical, whole-genome sequencing research project (i.e., *SEQOME Project*). Also examined were changes in belief strength, decisional conflict and attitudinal ambivalence as a function of message exposure and outcome salience.

Method

Design

The experiment was designed to be analyzed as a 3 (Message Topic: altruist-targeted, instrumentalist-targeted, no-message control) × 2 (Audience Segment: altruist, instrumentalist) between-subjects factorial design. Participants were randomly assigned to one of the message-topic conditions. Audience Segment was intended to be an observed factor. The segmentation analysis described in the last chapter established a rule for classifying respondents into segments. A critical assumption of this design was that similar segments would be identified in the Study 2 sample.

Participants

Survey Sampling International (SSI) administered sample selection and recruitment. SSI is a sampling firm that maintains a proprietary online subject pool. Participants were a general sample of U.S. adults aged 18 years or older drawn from the SSI online panel and invited by email to participate in the study. Stratified sampling was used to ensure national representativeness of the sample. Completing the survey entered respondents into a quarterly drawing for $12,500 funded by SSI. The drawing consisted of panelists from across the SSI subject pool (appx. N = 900,000), and was not limited to

participation in the current study. Beyond this incentive, participants did not receive any compensation for their participation.

SSI recruited a total of 2,521 respondents on September 5th–12th, 2012. Respondents followed a link to the study website and read the consent form.[19] In all, 2,350 consented to complete the study. Of these, 86 had missing values that should not have been possible given the way the survey was programmed. This loss of data was likely due to server overload during brief periods of excessive traffic to the online questionnaire. Because the extant data from these cases may have also been corrupted, they were excluded from all analyses presented here. A total of 817 respondents dropped out before completing the entire survey. Because the primary outcome variables in this study are reasoned action constructs (e.g., intentions, attitudes, and behavioral beliefs), all analyses presented here were restricted to respondents who completed all sections of the questionnaire designed to measure those constructs (N = 1,577). The demographic characteristics of this sample are presented in Table 5.1.

Procedure

Approval for the study was sought in accordance with the research ethics procedures of both the University of Pennsylvania and NHGRI. The protocol was approved by the Institutional Review Board at the University of Pennsylvania, and consequently designated exempt from additional internal review by the NIH Office of Human Subjects Research Protections (OHSRP).

[19] Unfortunately, it is not possible to calculate the response rate for the survey. The platform used by SSI is not driven through survey-direct invitations, so there is no record of the number of people who received an invitation to participate in this specific study. As was explained to me by an SSI account manager, "panelists are sent a daily e-mail inviting them to log into our online communities. From there they view a series of 10 question related to surveys we have in the field. Depending on their responses, they are then sent on to the survey for which they are most likely to qualify for" (C. Keeler, personal communication, September 17, 2012).

Table 5.1

Demographic Profile of Study 2 Participants

Variable			*N*	%
Sex				
Male			793	53.9
Female			678	46.1
Missing			106	—
Education				
Less than high school			36	2.5
High school graduate or GED			347	23.7
Some college, but did not finish			439	30.0
Two-year college degree/A.A. or A.S.			167	11.4
Four-year college degree/B.A. or B.A.			336	22.9
Masters, doctorate or professional degree			141	9.5
Missing			110	—
Ethnicity				
Hispanic, Latino or Spanish origin			148	10.2
Non-Hispanic			1,305	89.6
Don't know			4	0.3
Missing			120	—
Race				
White			1,115	76.5
Black or African American			203	13.9
American Indian or Alaska Native			16	1.1
Asian or Pacific Islander			66	4.5
Other			58	4.0
Missing			119	—
Household income				
Less than $25,000			372	25.6
$25,000 - $49,999			486	33.4
$50,000 - $74,999			319	22.0
$75,000 - $99,999			162	11.1
$100,000 or more			114	7.8
Missing			124	—
Age				
	M	43.23		
	SD	17.37		
	Mdn	41.00		
	Min	18		
	Max	86		
	Missing	101		

Note. $N = 1,577$. % = Percent based on valid responses, excludes missing.

All stimulus materials and questionnaire items were presented and completed online. The study was designed so that participants could complete the entire procedure in a single session, lasting approximately 25 minutes. Panelists who responded to the e-mail invitation to participate from SSI followed a link to the study website, which was hosted by the Annenberg School for Communication. The landing page consisted of a brief consent document providing a general description of the study and procedure (see Appendix A for the content and programming notes of the online questionnaire). Those who consented were considered enrolled in the study and given access to the rest of the questionnaire. Upon enrollment, all respondents were automatically assigned to one of three message-topic conditions (viz., *instrumentlist-targeted*, *altruist-targeted* and *no-message control*) using a random number generator coded into the online questionnaire.

On the first page of the questionnaire, participants were given general instructions for completing the survey. Next, they were presented with a brief paragraph introducing the target behavior of the experiment: participation in a hypothetical, whole-genome sequencing study called the *SEQOME Project*.

Following the introduction, respondents were presented with a dimensional-salience task, which is described in the Measures section. Next, respondents assigned to the instrumentalist- and altruist-targeted message conditions received additional information about participating in the *SEQOME Project*. This supplementary information was specifically designed to address the unique informational needs of the two main audience segments from Study 1: the *altruists* and *instrumentalists* (see Chapter 4). In total, 507 (32%) respondents were assigned to read the altruist-targeted message, 538 (34%) read the instrumentalist-targeted message, and 532 (34%) were assigned to the no-message control condition.

After that, participants were asked to complete the second part of the questionnaire. These measures included direct attitude and intention to participate *SEQOME Project*, expectancy-value ratings covering several beliefs, attitudinal ambivalence, decisional conflict, perceived knowledge about genome sequencing, message perceptions (i.e., perceived sufficiency, relevance and quality), and demographics.[20] Items for constructing perceived social pressure and perceived behavioral control scales were also included as theoretically relevant control variables.

Materials

Experimental intervention materials were designed to address segment-level, salient beliefs about participating in the *SEQOME Project*. The manipulated portions of the messages were comprised of six statements corresponding to beliefs found to be exclusively salient for either the altruists or the instrumentalists.

The message-topic manipulations were text-based and embedded within the survey (see Appendix B). Message content was modeled after informed consent documents and brochures developed for existing genomics research projects (Biesecker, 2010; Biesecker, et al., 2009; The 1000 Genomes Project Consortium, 2009, 2010; UK Biobank, 2010). For the sake of simplicity and brevity, the information was formatted as a bulleted list of statements.

Messages did not overtly endorse or dissuade participation. In other words, the messages did not directly suggest that participating in the *SEQOME Project* would be a good [or bad] thing to do. However, the messages did draw connections between participating in the *SEQOME Project* and specific consequences of doing so. Thus, it was expected that recipients would respond to the messages as if an attitudinal position had

[20] A skip pattern was coded into the questionnaire so that respondents assigned to the no-message control group did not receive the items designed to measure message relevance and quality.

been taken. From the theoretical perspective underlying this research, changes in attitude and intention toward participating in the *SEQOME Project* were expected to be a function of changes in belief strength, outcome evaluations, and, in some cases, outcome salience. This principle holds regardless of whether a message has been designed with persuasive intent (i.e., the message source aims to sway recipients' attitudes, intentions, or behavior in a certain direction). Coincidently, the messages used in this study affirmed beliefs that were accurate and disconfirmed beliefs that were inaccurate within the context of the *SEQOME Project*.

For example, contributing to science and receiving personal genetic risk information are both commonly salient outcomes related to genomic research participation. On average, people tend to believe that these outcomes will occur as a result of participating. However, the *SEQOME Project* was defined as a genomic research study in which individual results would not be returned to participants. Whereas the altruist-targeted message affirmed that participating in the *SEQOME Project* would contribute to science, the instrumentalist-targeted message disconfirmed that doing so would provide personal information about genetic health risk. Moreover, because both of these outcomes are seen as desirable, these messages have different implications for attitude and intention. Strengthening beliefs about contributing to science would foster more favorable attitudes toward participating and greater intentions. Weakening beliefs about receiving personal risk information would produce less favorable attitudes and lower intentions to participate.[21]

[21] Naturally, this characterization of the impact of belief change on attitude, intention and beliefs assumes that these concerns are salient.

Measures

Survey questions were divided into eight sections. Only the items used for analyses reported in this dissertation are described here in greater detail.

Belief salience. Belief salience was measured using a dimensional-salience task (Budd, 1986; Newton et al., 2011; van der Pligt & Eiser, 1984). Respondents were presented with a list of 20 potential consequences of participating in the *SEQOME Project* (e.g., "helping advance science").[22] They were then asked to select items from the list matching their five most important reasons for deciding whether to participate in the *SEQOME Project*. Prior research has shown that beliefs nominated in this way tend to have briefer response latencies—and thus greater accessibility and salience—than beliefs that are not nominated (van Harreveld, van der Pligt, de Vries, & Andreas, 2000). The dimensional salience approach was used as an alternative to the traditional, open-ended elicitation procedure (see Fishbein and Ajzen, 2010).

The behavioral outcomes that each participant selected were taken to represent his or her personally salient beliefs with regard to participating in the *SEQOME Project*. Behavioral outcomes ranked by frequency are presented in Table 5.2. Comparing the rank-order positions of these outcomes between Studies 1 and 2 reveals substantial differences.

Responses to the dimensional-salience task were meant to help categorize respondents into audience segments with characteristics similar to those identified in Study 1. The audience segments would then serve as a proxy measure of salience for beliefs addressed in the message topic manipulations. From an analytical perspective, it

[22] The content analysis described in Study 1 produced 33 themes. To reduce response burden, only the 20 most frequently elicited beliefs were represented in the list given as part of dimensional-salience task. In Study 1, fewer than 4% of respondents gave an elicitation response corresponding to each of the thirteen themes that were excluded (see Table 4.2).

Table 5.2

Frequency of Behavioral Outcomes Selected by Participants from the Dimensional-Salience Task

	Rank				
Behavioral outcome	Study 1	Study 2	f	$\%_V$	$\%_N$
Helping others in the future.[abc]	2	1	885	11.2	56.1
Contributing to medical research.[abc]	6	2	861	10.9	54.6
Helping advance science.[abc]	5	3	764	9.7	48.4
Contributing to knowledge.[abc]	9	4	721	9.1	45.7
Learning information to help me prevent disease.[abc]	19	5	509	6.5	32.3
Receiving information about my current health.[abc]	11	6	481	6.1	30.5
Receiving information about my personal genetic risk for disease.[abc]	7	7	475	6.0	30.1
Receiving information that may be helpful to my relatives.[abc]	15	8	435	5.5	27.6
Receiving information about my personal genetic code.[abc]	17	9	409	5.2	25.9
Learning information to help me make treatment decisions.[ac]	18	10	373	4.7	23.7
Learning more about my family history of disease.	16	11	368	4.7	23.3
Putting my privacy at risk.	4	12	227	2.9	14.4
Receiving compensation other than money.	20	13	217	2.8	13.8
Losing control over how my DNA samples are used.	3	14	217	2.8	13.8
Feeling physical pain.	12	15	192	2.4	12.2
Feeling worried.	10	16	175	2.2	11.1
Learning something that I cannot do anything about.	14	17	162	2.1	10.3
Having to make time in my busy schedule.	1	18	151	1.9	9.6
Learning something that I do not want to know.	8	19	145	1.8	9.2
Doing something that is inconvenient.	13	20	118	1.5	7.5

Note. N = 1,577. V = 7,885 = Total number of belief-item selections made during the dimensional salience task across all respondents. f = Frequency count of the number of times each belief item was selected. $\%_V$ = Percentage of the total number of selections matching the chosen item. $\%_N$ = Percentage of respondents who selected the item. Each participant was required to select five items from a list of twenty.

[a] Modal salient belief based on "75% of selections" decision rule
[b] Modal salient belief based on "25% of respondents" decision rule
[c] Modal salient belief based on "Top 10 valid elicitation responses" decision rule

was important that a large portion of the sample be classified as either altruists or instrumentalists. Using Study 1 as a reference, it was expected that 2/3 of all respondents would fit into one of these two groups. Also, the ratio of altruists to instrumentalists was expected to be balanced. Conceptually, it was crucial that a number of outcomes salient to the altruists would not be salient to the instrumentalists, and vice versa. Further, the uniquely salient beliefs of each audience segment were meant to correspond with the message manipulations. Beliefs addressed in the altruist-targeted message were to be uniquely salient to the altruists; beliefs addressed in the instrumentalist-targeted message were to be uniquely salient to the instrumentalists. Unfortunately, the proposed classification scheme failed to meet these qualifications when applied to the Study 2 sample. Appendix C contains a more detailed account of my efforts to implement and adapt the proposed audience-segmentation strategy. Ultimately, no satisfactory solution was found, and an alternative operationalization of belief salience was adopted.

A new approach: Relative greater-good salience. Instead of using audience segments as a proxy for belief salience, I developed an alternative measure. The aim of this measure was to capture relative differences in salience for outcomes addressed by the segment-targeted message manipulations. For this measure, I focused on two sets of outcomes from the dimensional-salience list. The first set was the four most frequently selected outcomes addressed in the altruist-targeted message (i.e., *greater-good outcomes*): (a) "Helping others in the future," (b) "Helping advance science," (c) "Contributing to medical research," and (d) "Contributing to knowledge." The second set was the four most frequently selected outcomes addressed in the instrumentalist-targeted message (i.e., *personal-feedback outcomes*): (a) "Receiving information about my personal genetic risk," (b) "Learning something new about my current health," (c)

"Receiving information to help me make medical treatment decisions," (d) "Learning information to help me prevent disease."

To compute *relative greater-good salience*, the number of greater-good (GG) and personal-feedback (PF) outcomes selected by each respondent was tallied. Next, for every respondent, the number of selected PF outcomes was subtracted from the number of GG outcomes. For example, a respondent who selected three GG outcomes from the list and two PF outcomes received a relative GG salience score of +1. Respondents who selected two GG outcomes and three PF outcomes received a score of −1. The resulting 9-point scale ranged from −4 to +4 (M = 0.88, SD = 1.74). Due to differences in the overall frequency that GG and PF outcomes were selected, the distribution of relative GG salience favored positive values (see Figure 5.1).

Respondents with positive relative-GG-salience values nominated more GG outcomes than PF outcomes.[23] In terms of content matching, portions of the instrumentalist-targeted message were expected to be a better match for respondents with lower relative GG salience; the altruist-targeted message was a better match for respondents with greater relative GG salience.

Dual salience. Relative GG salience only captured raw differences in the number of GG and PF outcomes nominated by a respondent. The measure ignores the overall number of outcomes from those two categories that were selected. For example, respondents who did not select any GG or PF outcomes received a relative GG salience score of 0; however, so did respondents who selected the same number of outcomes from both sets (i.e., 4:4, 3:3, 2:2, 1:1). In order to account for these differences in the *overall* salience of GG and PF outcomes, I also created a dual-salience index.

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[23] Referencing the audience segments identified in Study 1, relative GG salience can also be thought of as the degree to which a respondent is an altruist versus an instrumentalist.

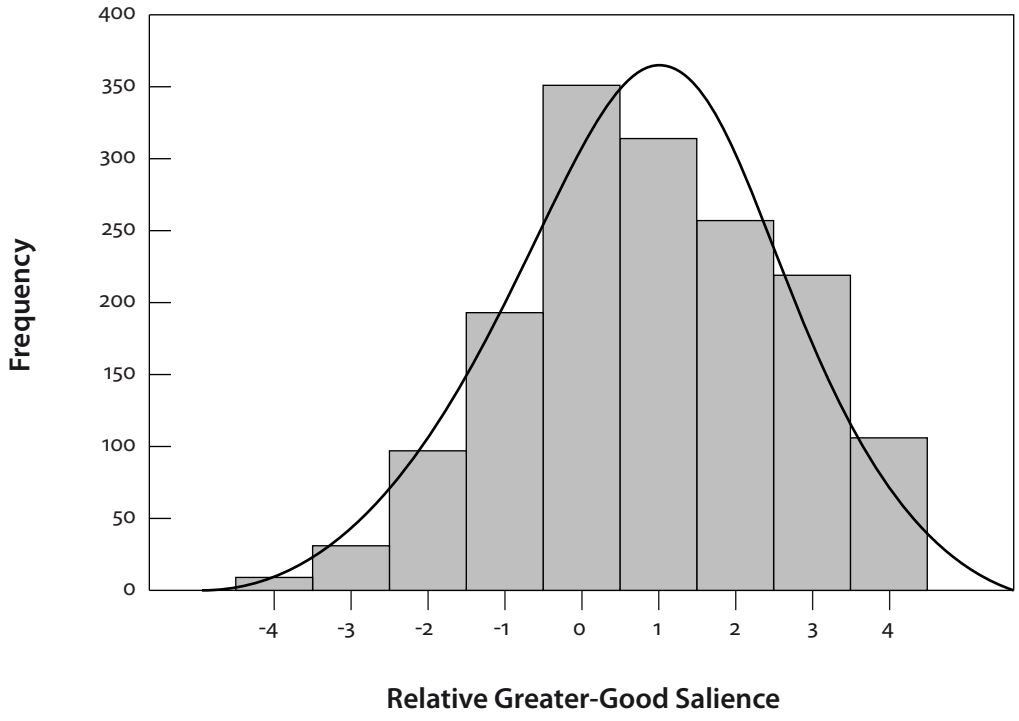

Figure 5.1. Frequency plot of relative greater-good salience scores.

Drawing an analogy with attitudinal ambivalence (M. M. Thompson et al., 1995), I constructed this index using the following equation:

$$\text{Dual salience} = \frac{\left(\sqrt{S_{GG}} + \sqrt{S_{PF}}\right)}{2} - \left|\left(\sqrt{S_{GG}} - \sqrt{S_{PF}}\right)\right|, \tag{5.1}$$

where S_{GG} is the number of GG outcomes selected and S_{PF} is the number of PF outcomes selected. The square root of these terms was used so that a unique score of 0 would be assigned to respondents who did not select any GG or PF outcomes (n = 57). The index ranged from −1 to +1.41 (M = 0.35, SD = 0.82). Negative values indicate that the

respondent selected at least one outcome from one of the two sets, but none from the other. As the number of outcomes from a single set increased, dual salience decreased toward –1. Positive dual-salience scores indicated that outcomes from both sets had been selected. Greater values were obtained when more outcomes from both sets were selected and when the proportion of outcomes selected from each set was more balanced (see Figure 5.2). Frequencies of dual-salience values are presented in Table 5.3.

Behavioral intention. Intention to participate in the *SEQOME Project*, was measured with three items using 7-point Likert-type scales: e.g., "If you were asked to take part, how likely is it that you would volunteer to participate in the *SEQOME*

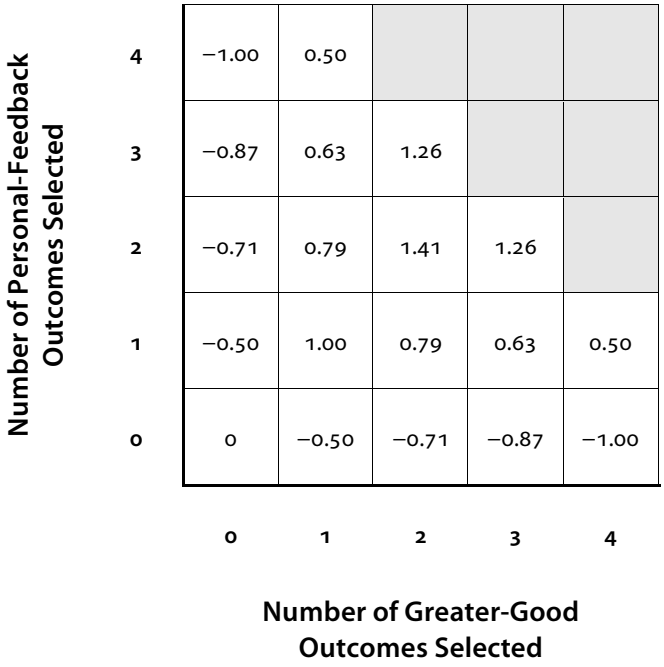

Figure 5.2. Dual-salience scores from different combinations of greater-good and personal-feedback outcomes. The empty grey cells represent combinations that were not possible in this study, given that respondents could not select more than five outcomes from the dimensional-salience list.

Table 5.3

Frequency Distribution of Dual-Salience Scores

Dual salience		f	%
Low	−1.00	115	7.3
	−0.87	114	7.2
	−0.71	151	9.6
	−0.50	111	7.0
	0.00	57	3.6
	0.50	136	8.6
	0.63	203	12.9
	0.79	280	17.8
	1.00	117	7.4
	1.26	116	7.4
High	1.41	177	11.2

Note. $N = 1{,}577$. % = Percent based on valid responses, excludes missing.

Project?" (1 [*extremely unlikely*], 7 [*extremely likely*]). The average of these items was used to construct an interval-level measure of intention (α = .97, *M* = 4.96, *SD* = 1.46). Greater scores on this composite scale represent a stronger intention to participate in the *SEQOME Project*.

Attitude. Attitude toward participating in the *SEQOME Project* was measured with five items that reflected instrumental and affective dimensions of attitude (see Fishbein & Ajzen, 2010). These items were presented as a set of 7-point semantic differentials (*Min* = 1, *Max* = 7): "For me to participate in the *SEQOME Project* would be (a) *bad–good*, (b) *harmful–beneficial*, (c) *disturbing–reassuring*, (d) *exciting–boring*, and (e) *valuable–worthless*." The adjectives anchoring the latter two items were displayed with reverse polarity, relative to the other attitude items. A confirmatory factor analysis of the main reasoned action model constructs revealed that the underlying attitude factor did not adequately explain the variance in these two items. After exploring alternative measurement models, I decided that a more reliable measure of attitude would be achieved by excluding these items. The reduction in content validity that resulted was acceptable, given that the retained items represent both conceptual dimensions of attitude. In the analyses presented here, the average of the three remaining items was used to represent attitudes toward participating in the *SEQOME Project*. Higher scores indicated more favorable attitudes (α = .88, *M* = 5.08, *SD* = 1.25).

Perceived social pressure. Perceived social pressure was measured with three items assessed on 7-point response scales. The most recent version of the reasoned action model considers perceived social pressure to be a two-dimensional construct. These dimensions consist of a respondent's perceptions of what important others think should be done (i.e., injunctive norms) and what important others do themselves with respect to a given behavior (i.e., descriptive norms). Because participation in whole-

genome sequencing research is an uncommon behavior, respondents were not expected to know any normative referents who have participated in such a study.[24] With this in mind, the items used to measure perceived social pressure focused exclusively on the injunctive-norm dimension: e.g., "Most people who are important to me think that I should participate in the *SEQOME Project*, if I am asked to take part in it," (1 [*completely false*] to 7 [*completely true*]). The average was used to create a composite scale ($\alpha = .94$, $M = 4.79$, $SD = 1.37$). Higher values on this scale indicated greater perceived social pressure to participate in the *SEQOME Project*.

Perceived behavioral control. Perceived behavioral control was measured using three items. One of these reflected the capacity dimension of that construct: "If I am asked to take part, I am confident that I am able to participate in the *SEQOME Project*" (1 [*completely false*], 7 [*completely true*]). The other two represented the autonomy dimension: e.g., "If I am asked to take part, participating in the *SEQOME Project* is completely up to me" (*strongly disagree* [1]–*strongly agree* [7]). Confirmatory factor analysis revealed that a single underlying factor was unable to explain a majority of the variance in two of these measures. To preserve the content validity of the overarching construct in subsequent analyses, I treated the capacity and autonomy dimensions as two separate factors. The first of these was represented by the single item used to measure the capacity dimension ($M = 5.25$, $SD = 1.45$). The other two items were averaged to form a single measure representing the autonomy dimension ($r = .57$, $M = 5.64$, $SD = 1.30$). Higher scores on these measures reflected a greater sense of control over participating in the *SEQOME Project*.

[24] Alternatively, asking respondents to report whether the people who are important to them *would* participate in genomics research if they had the chance might have been a way to measure descriptive norms in this context.

Behavioral beliefs. Thirty items were used to assess belief strength and evaluations of 15 behavioral outcomes. Descriptive statistics for these belief-strength (b_i) and outcome-evaluation (e_i) items are presented in Table 5.4. Also displayed are the characteristics of the belief-evaluation products ($b_i e_i$).

***Belief strength* (b_i).** Participants were asked to complete a block of 15 belief-strength items. These items were premised with the instructions, "We would also like to know how strongly you believe each of the following outcomes will happen if you participate in the *SEQOME Project*." For each behavioral outcome (e.g., "My participation in the *SEQOME Project*…will help advance science"), participants were asked to select the point on a 7-point response scale that best described their opinion, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Especially strong correlations among two sets of items suggested high internal consistency.[25] The first set referred to the four GG outcomes: (a) "Help others in the future," (b) "Help advance science," (c) "Contribute to medical research," and (d) "Contribute to knowledge." The inter-item reliability of these four items was strong (α = .94; see Table 5.5a for a correlation matrix). I combined them into a single measure by calculating the average score across all four items (i.e., *GG belief strength*; M = 5.94, SD = 1.16).

The second set referred to the four PF outcomes: (a) "Receive information my personal genetic risk," (b) "Learn something new about my current health," (c) "Receive information to help me make medical treatment decisions," (d) "Be given information to help me prevent disease." The correlation matrix for these items is presented below the diagonal in Table 5.5b. Noting conceptual similarity and strong inter-item reliability

[25] The magnitude of these correlations became problematic when I attempted to regress attitude on all 15 belief-strength items. Collinearity diagnostics from that analysis revealed that items in the GG and PF belief sets were too closely related to be included in the same model as independent variables.

Table 5.4

Summary of Means and Standard Deviations for Belief Strength, Outcome Evaluations, and Belief-Evaluation Products

	Belief Strength (b_i)		Outcome evaluation (e_i)		Belief-evaluation product ($b_i e_i$)	
Belief item	*M*	*SD*	*M*	*SD*	*M*	*SD*
1. Greater-good outcomes						
a. Help others in the future.[a]	5.93	1.27	2.16	1.25	1.98	1.13
b. Help advance science.[a]	5.91	1.26	2.04	1.24	1.89	1.16
c. Contribute to medical research.[a]	5.97	1.24	2.06	1.22	1.92	1.15
d. Contribute to knowledge.[a]	5.96	1.25	2.13	1.20	1.98	1.12
2. Personal-feedback outcomes						
a. Receive information about my personal genetic risk.[b]	5.17	1.74	1.60	1.40	1.34	1.21
b. Learn something new about my current health.[b]	5.29	1.71	1.86	1.29	1.56	1.18
c. Receive information to help me make medical treatment decisions.[b]	5.21	1.75	1.9	1.25	1.59	1.15
d. Be given information to help me prevent disease.[b]	5.18	1.76	2.08	1.23	1.67	1.14
3. Put the privacy of my genetic information at risk.	3.81	1.75	−0.61	1.70	−0.24	1.16
4. Be part of research that goes against my personal values.	3.21	1.83	−1.00	1.79	−0.26	1.05
5. Take up a lot of my time.	3.94	1.56	−0.17	1.47	−0.03	1.02
6. Feel worried about my health.[b]	3.61	1.73	−0.83	1.74	−0.28	1.11
7. Be told something about my genes that I do not want to know.[b]	4.07	1.77	0.40	1.63	0.35	1.15
8. Feel physical pain.[a]	3.42	1.67	−1.26	1.68	−0.44	1.02
9. Inconvenient.[a]	3.67	1.61	−0.45	1.44	−0.14	0.94

Note. N = 1,577. Belief strength items range from 1 to 7. Outcome evaluations range from −3 to +3. The belief-evaluation products were rescaled by dividing by 7, and range from −3 to +3.

[a] Belief addressed in the altruist-targeted message.
[b] Belief addressed in the instrumentalist-targeted message.

(α = .96), I averaged these measures into a single scale representing expectations about receiving personal feedback (i.e., *PF belief strength*; *M* = 5.21, *SD* = 1.63).

***Outcome evaluations* (e_i).** Participants were also asked to evaluate a parallel list of 15 outcomes. Each item was anchored by a phrase that directly corresponded to an outcome from one of the belief-strength measures (e.g., "Helping advance science is:"). Outcome evaluations were rated on 7-point response scales ranging from −3 (*extremely bad*) to +3 (*extremely good*). The evaluation items corresponding to the GG and PF outcomes had high internal consistency (see Tables 5.5a and 5.5b). The averages of these two sets were computed to create composite scales of *PF outcome evaluations* (*M* = 1.88, *SD* = 1.14, α = .91) and *GG outcome evaluations* (*M* = 2.10, *SD* = 1.11, α = .93).

***Belief-evaluation products* (b_ie_i).** Lastly, belief-evaluation products were created. These were computed by multiplying corresponding strength and evaluation items, then dividing each by a constant of 7.[26] Belief-evaluation products ranged from −3 to +3. To avoid using cumbersome variable labels, I will refer to specific belief-evaluation products as *behavioral beliefs*. The product of the GG strength and evaluation composites was calculated (*GG behavioral beliefs*: *M* = 1.94, *SD* = 1.06), as was that of the PF beliefs (*PF behavioral beliefs*: *M* = 1.54, *SD* = 1.07).

Attitudinal ambivalence. Consistent with Fishbein's expectancy-value model, numerical measures of ambivalence presuppose that attitudes can have positive and negative components. Simultaneously endorsing favorable and unfavorable positions toward some object is the hallmark of attitudinal ambivalence.

Two items developed by Kaplan (1972) were used to measure the positive (*P*) and negative (*N*) components of ambivalence toward participating in the *SEQOME Project*.

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[26] Dividing by a constant allowed for more precise reporting of regression results using fewer decimal places. The distributions of the product terms were not affected, only the unit size.

Table 5.5a

Intercorrelations among Greater-Good Belief Strength and Outcome Evaluation Items

Belief item	1a	1b	1c	1d
1a. Help others in the future.	—	.76	.79	.78
1b. Help advance science	.82	—	.82	.76
1c. Contribute to medical research.	.85	.82	—	.76
1d. Contribute to knowledge.	.78	.77	.80	—

Note. $N = 1{,}577$. Coefficients below the diagonal are among belief-strength items (b_i). Coefficients above the diagonal are for the outcome-evaluation items (e_i). All coefficients are significantly greater than zero, $p < .001$.

Table 5.5b

Intercorrelations among Personal-Feedback Belief Strength and Outcome Evaluation Items

Belief item	2a	2b	2c	2d
2a. Receive information about my personal genetic risk.	—	.75	.64	.64
2b. Learn something new about my current health.	.85	—	.73	.71
2c. Receive information to help me make medical treatment decisions.	.81	.86	—	.79
2d. Be given information to help me prevent disease.	.81	.85	.90	—

Note. $N = 1{,}577$. Coefficients below the diagonal are among belief-strength items (b_i). Coefficients above the diagonal are for the outcome-evaluation items (e_i). All coefficients are significantly greater than zero, $p < .001$.

Both items were assessed on 5-point unipolar response scales. The items had similarly worded stems: "Considering the positive (negative) qualities of participating in the *SEQOME Project* and ignoring its negative (positive) ones, please evaluate your participation on the following scale. For me to participate in the *SEQOME Project* is…" 0 (*not at all positive* [*negative*]), 1 (*a little positive* [*negative*]), 2 (*moderately positive* [*negative*]), 3 (*mainly positive* [*negative*]), or 4 (*completely positive* [*negative*]). These component scales were then transformed into a measure of ambivalence (*AMB*) using an equation derived from M. M. Thompson et al. (1995; see also Breckler, 1994; Zhao, 2005):

$$AMB = (P + N)/2 - |(P - N)|, \tag{5.2}$$

where P is the score on the positive component scale and N is the score on the negative component scale.

M. M. Thompson et al. (1995) assumed that the P and N terms of Equation 5.2 would be measured on 4-point scales ranging in value from 0 to 3. Given that assumption, ambivalence scores could vary from a minimum of −1.5 through +3.0 at increments of 0.5. Because I used 5-point response scales to measure P and N, the equation resulted in an ambivalence scale ranging from −2.0 to +4.0. Again, this scale varied at increments of .5; however, no combination of N and P yielded an ambivalence score of +3.5. Lacking a conceptual justification for this missing value, I recoded all scores of +4 so that they were instead +3.5. Further, I rescaled this variable by adding a constant of 2 and then multiplying by 2. Thus, the final measure of ambivalence (N = 1,569, M = 4.67, SD = 3.10) was distributed as a 12-point integer scale, ranging from 0 (*low ambivalence*) to 11 (*high ambivalence*).

Decisional conflict. Participants were also asked to complete the 16-item decisional conflict scale (DCS) developed by O'Connor (1993, 1995). The DCS measures the degree of uncertainty people experience in choosing to follow a course of action (see Table 5.6). The scale was adapted to refer to participating in the *SEQOME Project*.

Immediately prior to completing the DCS, respondents were presented with a forced-choice question, "If you were asked to take part in the *SEQOME Project* and you had be make a decision today, would you choose to participate" (0 [*no*], 1 [*yes*])? The majority of respondents (73%) indicated that they would participate under those circumstances. All items of the traditional DCS were assessed on 5-point Likert-type scales, ranging from 0 (*strongly disagree*) to 4 (*strongly agree*).

A confirmatory factor analysis of the DCS revealed that items from the uncertainty and support subscales did not load well. These items were removed. The fourth item in the effective decision subscale was also excluded because it detracted from overall model fit. Following O'Connor's scoring recommendations, I calculated a summary, decisional-conflict scale with the remaining 9 items (N = 1,526, M = 32.90 SD = 20.91). Each participant's responses were (a) summed across items, (b) divided by 9, (c) multiplied by 25, and (d) subtracted from 100. The resulting composite scale ranged from 0 (*no decisional conflict*) to 100 (*extremely high decisional conflict*).

Results

Preliminary Analysis

Inattentive responding. There is growing concern among survey methodologists that Internet-based data collection methods may be especially conducive to inattentive responding (Meade & Craig, 2012). The threat was a particular concern in this study because participating weighted the odds of winning a cash drawing. Panelists completing a greater number of studies were entered into the drawing a greater number

Table 5.6

Descriptive Statistics for Decisional Conflict Scale Items

Item	*M*	*SD*	*Skewness*	*Kurtosis*
Informed subscale				
1. When it comes to choosing to participate in the *SEQOME Project*, I know which options are available to me.[b]	2.57	1.13	−0.49	−0.47
2. I know the benefits of participating in the *SEQOME Project*.[b]	2.76	1.07	−0.83	0.20
3. I know the risks of participating in the *SEQOME Project*.[b]	2.34	1.18	−0.35	−0.71
Values clarity subscale				
1. I am clear about which benefits of particating in the *SEQOME Project* matter most to me.[b]	2.67	1.10	−0.65	−0.18
2. I am clear about which risks of participating in the *SEQOME Project* matter most to me.[b]	2.37	1.17	−0.31	−0.70
3. I am clear about which is more important to me, the benefits or the risks of participating in the *SEQOME Project*.[b]	2.67	1.08	−0.60	−0.16
Uncertainty subscale				
1. I am clear about the best choice for me.	2.75	1.07	−0.61	−0.26
2. I feel unsure about what to choose.[a]	1.80	1.27	−0.03	−1.07
3. This decision is hard for me to make.[a]	1.76	1.27	0.11	−1.03
Support subscale				
1. I have enough support from others to make a choice.	2.47	1.13	−0.35	−0.46
2. I feel pressure from others in making this decision.[a]	1.11	1.21	0.77	−0.48
3. I have enough advice to make a choice.	2.46	1.16	−0.39	−0.60
Effective decision subscale				
1. My decision shows what is most important to me.[b]	2.87	0.95	−0.54	−0.07
2. I expect to stick with my decision.[b]	2.96	0.91	−0.51	−0.30
3. I am satisfied with my decision.[b]	2.94	0.94	−0.56	−0.20
4. I feel I have made an informed choice.	2.67	1.06	−0.57	−0.14

Note. $N = 1{,}526$. All items were measured on 5-point Likert-type response scales, ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Except for the three items that were reverse-coded, higher scores are consistent with a lower degree of decisional conflict.

[a] = Item was reverse-coded.
[b] = Item was retained in the final measurement model and composite scale.

of times. As a result, participants unmotivated to faithfully represent their actual attitudes, beliefs, or opinions may have nonetheless been motivated to complete the questionnaire. Some respondents may have adopted a response strategy aimed at avoiding the cognitive burden of thoughtfully completing the survey while maintaining the appearance of having done so. Such a strategy poses a threat to protocol validity and has been labeled *satisficing* (Krosnick, 1991; Krosnick, Narayan, and Smith, 1996).

Prior to conducting my principal analyses, I screened the data for careless responding. Specifically, I identified cases with excessively long strings of the same response category over many consecutive items. A response pattern of this sort is known as *straight lining* (Kaminska, McCutcheon & Billiet, 2010) or *nondifferentiation* (Krosnick et al., 1996). To do so, I constructed a long-string index (Meade & Craig, 2012). For each respondent, I recorded the maximum number of consecutive items to which the same response category was selected (Meade & Craig, 2012). For instance, suppose a respondent selected "2" for twelve 7-point items in a row, but otherwise varied his or her response. The long-string value for that respondent would be 12. Long-string values were tallied separately for items measured on 7-point and 5-point scales. The greater of these two values represented the maximum number of consecutive items for which a participant gave an identical response.

Following the strategy developed by J. A. Johnson (2005), I plotted long-string values by frequency. Excessively long strings of the same response category were defined by applying a scree-like test to this graph (see Figure 5.3). The noticeable drop in frequency of long-string values greater than 12 marks the threshold for valid consecutive responses. Using this threshold as a cut-off point, 207 respondents (13%) had long-string values greater than 12, and were classified as *straight liners*. All subsequent analyses were conducted twice, once with the full sample and once with straight liners excluded.

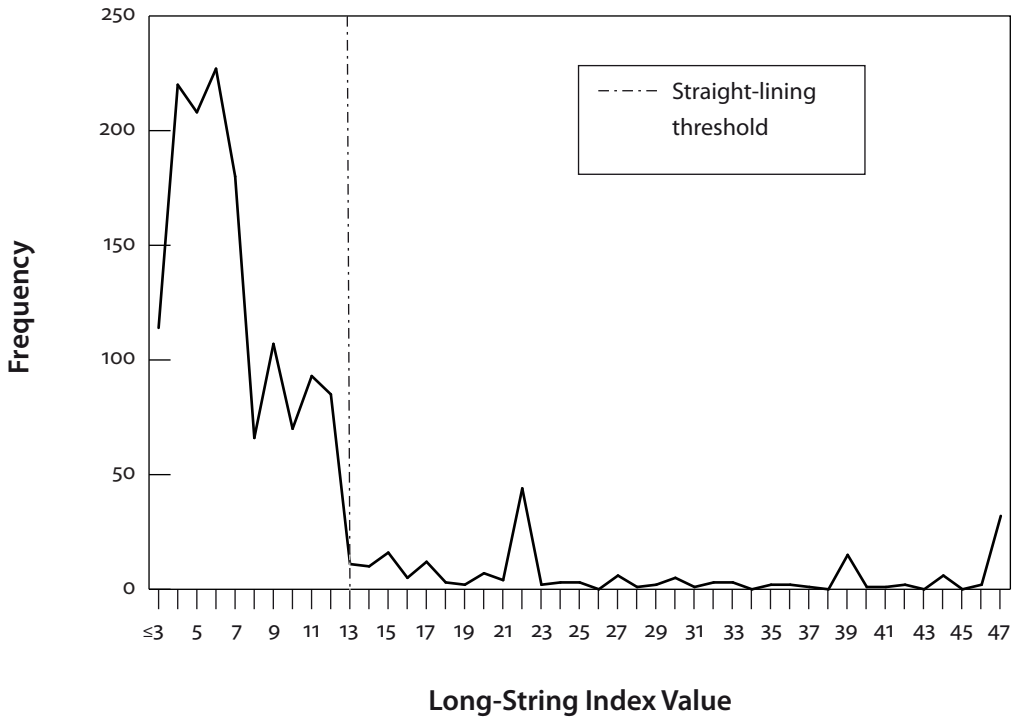

Figure 5.3. Frequency plot of long-string index values. Values to the left of the vertical dotted line were considered to be within a reasonable range of consecutive response. Respondents who selected the same response category on 13 or more items in a row were classified as straight liners.

Inferences derived from the two samples were not fundamentally different. In light of this, only analyses based on the full sample are reported.

Manipulation fidelity. I conducted a manipulation check to verify that respondents assigned to the message-topic conditions read the information that was provided to them. Each message included two claims targeting beliefs that turned out to be nonsalient in the overall sample. The instrumentalist-targeted message claimed that participating in the *SEQOME Project* would neither cause health-related worry, nor lead to being told something that the participant did not want to know. Thus, respondents who read the instrumentalist-targeted message could be expected to express weaker agreement with those beliefs. The altruist-targeted message claimed that participating in the *SEQOME Project* would cause minor physical pain, and be an inconvenience. Thus,

respondents who read the altruist-targeted condition could be expected to express stronger agreement with those beliefs.

As shown in Table 5.7, a MANOVA provided evidence in support of the predicted mean differences in belief strength by message-topic condition. The multivariate main effect of the message-topic manipulation was significant, Wilks's $\lambda = .94$, $F(8, 3142) = 11.88$, $p < .001$, $\eta^2 = .03$. Univariate effects of Message Topic on all four of the belief-strength items were also significant. In sum, these results support the fidelity of the message-topic manipulation.

Hypothesis Tests

Hypothesis 1: Effects of message exposure on belief strength.

H1a. In H1a, I predicted an Audience Segment × Message Topic interaction effect on GG belief strength. Rephrased in terms of relative GG salience, I hypothesized that the altruist-targeted message would increase GG belief strength more when relative GG salience was low (i.e., PF outcomes are comparatively more salient). The altruist-targeted message was designed to strengthen beliefs about participating in the *SEQOME Project* related to GG outcomes (e.g., advancing science and contributing to medicine). In contrast, the instrumentalist-targeted message remained silent on those outcomes. Thus, the instrumentalist-targeted message was not expected to have an impact on GG belief strength compared to the control condition.

A pair of regression analyses was conducted to test this hypothesis (see Table 5.8). In the first analysis, the message-topic control group was treated as the reference category. Dummy variables representing the altruist-targeted and instrumentalist-targeted message topic conditions were entered along with mean-centered, relative GG salience and dual salience (which was included as a control). Interaction terms were entered to test for moderating effects of relative GG salience by Message Topic. The

Table 5.7

Mean Belief Strength of Four Nonsalient Perceived Consequences of Participating in the SEQOME Project *by Message Topic*

		Message Topic					
		No-message control	Instrumentalist-targeted	Altruist-targeted			
Measure		*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*(2, 1574)	*p*	η^2
My participation in the *SEQOME Project* will…							
B_6	Make me feel worried about my health.	3.80 (1.68)	3.24[a] (1.77)	3.80 (1.67)	18.93	.001	.02
B_7	Tell me something about my genes that I do not want to know.	4.34 (1.63)	3.61[a] (1.89)	4.28 (1.69)	28.78	.001	.04
B_8	Cause me to feel physical pain.	3.35 (1.67)	3.30 (1.64)	3.62[a] (1.69)	5.33	.005	.01
B_9	Be an inconvenience to me.	3.54[a] (1.62)	3.65[ab] (1.57)	3.83[b] (1.62)	4.39	.013	.01

Note. $N = 1{,}577$. Means within rows that have no superscript in common are significantly different from each other based on results of Games-Howell tests, $p < .05$.

Table 5.8

Hierarchical Multiple Regression Analyses Predicting Greater-Good Belief Strength by Message Topic, Relative Greater-Good Salience, and Interaction Terms

	Model 1[a]				Model 2[b]			
Predictor	*B*	*SE*	β	95% CI	*B*	*SE*	β	95% CI
Constant	5.91***	0.05		[5.82, 6.01]	5.88***	0.05		[5.78, 5.97]
Message topic								
No-message control	—	—	—	—	0.03	0.07	.01	[−0.10, 0.17]
Instrumentalist-targeted	−0.03	0.07	−.01	[−0.17, 0.10]	—	—	—	—
Altruist-targeted	0.13†	0.07	.05	[−0.00, 0.28]	0.17*	0.07	.01	[0.03, 0.30]
Relative GG salience	0.19***	0.03	.28	[0.13, 0.24]	0.14***	0.03	.20	[0.08, 0.19]
Dual salience	0.25***	0.04	.18	[0.18, 0.33]	0.25***	0.04	.18	[0.18, 0.33]
No-message control × Relative GG salience	—	—	—	—	0.05	0.04	.04	[−0.03, 0.13]
Instrumentalist-targeted × Relative GG salience	−0.05	0.04	−.04	[−0.13, 0.03]	—	—	—	—
Altruist-targeted × Relative GG salience	−0.02	0.04	−.02	[−0.10, 0.06]	0.03	0.04	.03	[−0.05, 0.11]

Note. $N = 1{,}577$. CI = confidence interval. The dependent variable in both models is greater-good belief strength. The analyses were conducted as hierarchical multiple regressions. Estimates from the final models are presented here. When relevant, change statistics of individual steps are reported in the text. The two models differed only with respect to which message-topic dummy variable was treated as the reference category. Accordingly, both models were equivalent with respect to the amount of variance they explained, $R^2 = .07$, $F(6, 1570) = 19.79$, $p < .001$.

†$p < .06$. *$p < .05$. **$p < .01$. ***$p < .001$.

[a] = Reference category is the no-message control group.
[b] = Reference category is the instrumentalist-targeted message group.

model specified for the second analysis was identical, except that the instrumentalist-targeted message group was used as the reference category. The change statistics reported below refer to the unique contribution of a specific predictor, assuming a hierarchical regression model in which all other predictors had already been entered in the first step.

No additional variance in GG belief strength was explained with the addition of the interaction terms, $\Delta R^2 = .00$, $\Delta F(2, 1570) = 0.82$, $p = .439$. Crucially, the coefficient for the interaction term representing the effect of the altruist-targeted message by relative GG salience was not significantly different from zero, $\beta = -.02$, $p = .670$. In order to show support for Hypothesis 1a, this interaction effect would have had to have been both negative and significant. This result was corroborated in the second model that treated the instrumentalist-targeted message condition as the reference category. Contrary to H1a, relative GG salience did not moderate the effects of the altruist-targeted message on GG belief strength, $\beta = .03$, $p = .412$. Thus, H1a was not supported.

In all, relative GG salience was the only substantive predictor variable significantly associated with GG belief strength in both models. All else being equal, GG belief strength was higher at higher values of relative GG salience. In the model treating control as the reference category, the weighted average effect of relative GG salience across all levels of the other predictors was statistically significant, $\beta = .28$, $p < .001$. The estimate for this effect was nominally smaller when the instrumentalist-targeted message condition was used as the reference category, $\beta = .20$, $p < .001$. These findings are consistent with one of the conceptual assumptions underlying Hypothesis 1. Namely, that salient beliefs tend to be held more strongly than nonsalient beliefs. However, this observation alone is insufficient to be interpreted as support for H1a.

The two models differed with respect to the average effect the altruist-targeted message. When compared to the control group, only a marginally significant effect of the altruist-targeted message was observed, $\beta = .05$, $p = .058$. On the other hand, GG belief strength was significantly higher in the altruist-targeted message condition compared the instrumentalist-targeted condition, $\beta = .07$, $p = .016$. It is also worth noting that, on average, no significant differences in GG belief strength were observed between the no-message control and the instrumentalist-targeted conditions. At best, these findings lend partial support for the assumption that the altruist-targeted message would increase GG belief strength, on average. However, this increase in GG belief strength amounted to less than two-tenths of a point on a seven-point scale. Given the small size of this effect, it would be difficult to argue from a practical standpoint that the altruist-targeted message was successful.

H1b. In H1b, I predicted an Audience Segment × Message Topic interaction effect on PF belief strength. Replacing the audience-segment construct with relative GG salience, I hypothesized that the instrumentalist-targeted message would reduce PF belief strength more when relative GG salience was high (i.e., PF outcomes are comparatively *less* salient). Moreover, exposure to the altruist-targeted message was not expected to have an impact on PF belief strength compared to the no-message control condition.

Similar to the analyses used to test H1a, two regression models were devised to test H1b (see Table 5.9). Once again, the no-message control group was treated as the reference group in the first model. Dummy variables representing the altruist-targeted and instrumentalist-targeted message conditions, mean-centered relative GG salience and dual salience were entered. Interaction terms were entered to test for moderating effects of relative GG salience by Message Topic. The interaction of relative GG salience

Table 5.9

Hierarchical Multiple Regression Analyses Predicting Personal-Feedback Belief Strength by Message Topic, Relative Greater-Good Salience, and Interaction Terms

	Model 1[a]				Model 2[b]			
Predictor	*B*	*SE*	β	95% CI	*B*	*SE*	β	95% CI
Constant	5.68***	0.07		[5.56, 5.81]	5.62***	0.07		[5.49, 5.75]
Message topic								
No-message control	—	—	—	—	0.07	0.09	.02	[−0.12, 0.25]
Instrumentalist-targeted	−1.32***	0.09	−.38	[−1.50, −1.14]	−1.25***	0.09	−.36	[−1.43, −1.07]
Altruist-targeted	−0.07	0.09	−.02	[−0.25, 0.12]	—	—	—	—
Relative GG salience	0.05	0.04	.05	[−0.03, 0.12]	0.04	0.04	.05	[−0.03, 0.12]
Dual salience	0.26***	0.05	.13	[0.16, 0.35]	0.26***	0.05	.13	[0.16, 0.35]
No-message control × Relative GG salience	—	—	—	—	0.00	0.05	.00	[−0.10, 0.11]
Instrumentalist-targeted × Relative GG salience	−0.15**	0.05	−.09	[−0.25, −0.05]	−0.15**	0.05	−.09	[−0.25, −0.04]
Altruist-targeted × Relative GG salience	−0.00	0.05	−.00	[−0.11, 0.10]	—	—	—	—

Note. $N = 1{,}577$. CI = confidence interval. The dependent variable in both models is personal-feedback belief strength. The analyses were conducted as hierarchical multiple regressions. Estimates from the final models are presented here. When relevant, change statistics of individual steps are reported in the text. The two models differed only with respect to which message-topic dummy variable was treated as the reference category. Accordingly, both models were equivalent with respect to the amount of variance they explained, $R^2 = .16$, $F(6, 1570) = 50.84$, $p < .001$.

**$p < .01$. ***$p < .001$.

[a] = Reference category is the no-message control group.
[b] = Reference category is the altruist-targeted message group.

by the altruist-targeted message was not expected to be significant, but excluding it would have been a misspecification of the hypothesized model. The second model was identical, except that the altruist-targeted message condition was used as the reference category. Once again, change statistics reported here refer to unique variance contributed by a specific predictor after all other variables had been taken into account.

Interaction terms representing the moderated effect of Message Topic on PF belief strength by relative GG salience explained significantly more variance than the main effects alone, $\Delta R^2 = .01$, $\Delta F = 5.71$, $p = .006$. As hypothesized, the instrumentalist-targeted message reduced PF belief strength significantly more as relative GG salience increased, $\beta = -.09$, $p < .01$.

To further explore this interaction, simple regression coefficients, standard errors and *t* tests for the effect of the instrumentalist-targeted message on PF belief strength were estimated at three levels of relative GG salience: the mean and one-standard deviation above and below the mean. This simple-slopes analysis was conducted using an SPSS macro developed by A. F. Hayes (PROCESS; Hayes, 2012a, 2012b, in press). Estimated marginal means of PF belief strength by Message Topic at ±1 *SD* relative GG salience are presented in Figure 5.4.

At the mean relative GG salience, the instrumentalist-targeted message significantly reduced PF belief strength compared to the no-message control, $B = -1.32$, $SE = 0.09$, 95% CI [−1.50, −1.14], $t(1570) = -14.37$, $p < .001$. The impact of the instrumentalist-targeted message was less pronounced when relative GG salience was low. Recall that at −1 *SD* relative GG salience, PF outcomes were comparatively more salient than GG outcomes. At that level of relative GG salience, the instrumentalist-targeted message still significantly reduced PF belief strength, but to a lesser extent than at the mean, $B = -1.06$, $SE = 0.13$, 95% CI [−1.31, −0.80], $t(1570) = -8.11$, $p < .001$. The

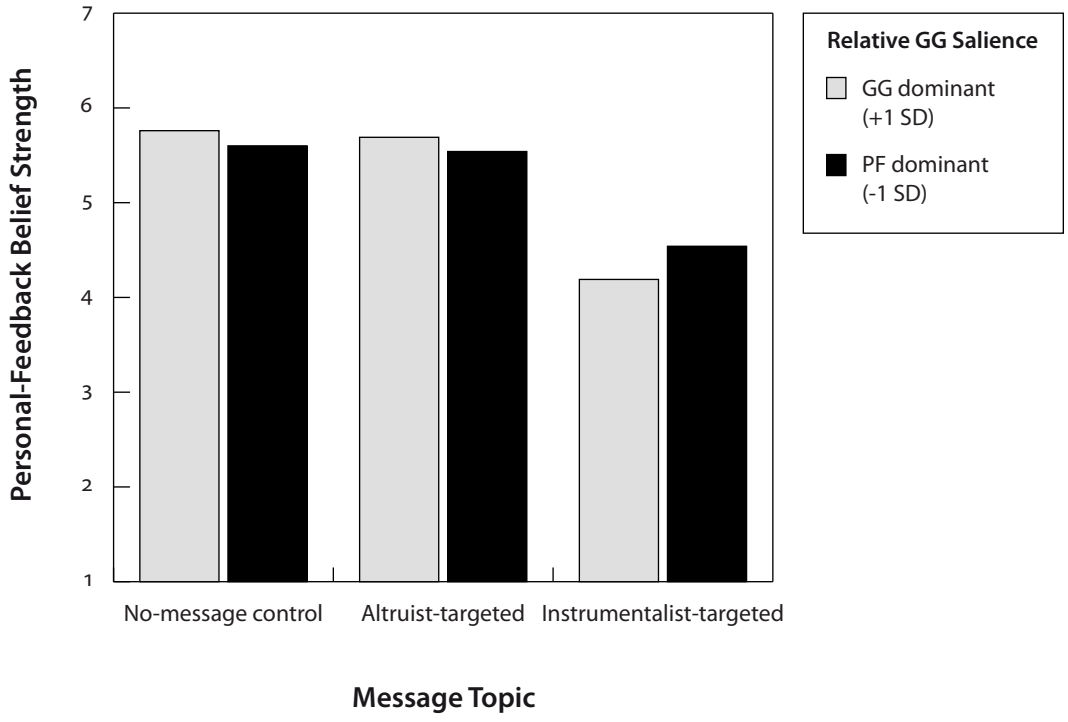

Figure 5.4. Mean estimates for personal-feedback belief strength as a function of Message Topic and relative greater-good salience.

instrumentalist-targeted message reduced PF belief strength more at +1 *SD* relative GG salience, $B = -1.57$, $SE = 0.13$, 95% CI [−1.83, −1.14], $t(1570) = -12.22$, $p < .001$.

A similar pattern of simple slopes was observed at these three levels of relative GG salience when the altruist-targeted message condition was the reference category. At −1 *SD* relative GG salience scale, the instrumentalist-targeted message was associated with a one-unit reduction in PF belief strength, $B = -1.00$, $SE = 0.13$, 95% CI [−1.25, −0.74], $t(1570) = -7.61$, $p < .001$. The estimated reduction in PF belief strength associated with the instrumentalist-targeted message at +1 *SD* relative GG salience was more pronounced, $B = -1.50$, $SE = 0.13$, 95% CI [−1.76, −1.25], $t(1570) = -11.43$, $p <$

.001. Combined, these results support H1b. The instrumentalist-targeted message reduced PF belief strength to a greater extent as relative GG salience increased. With increased salience of PF outcomes over GG outcomes, the instrumentalist-targeted message was *less* effective at reducing PF belief strength.

Hypothesis 2: Moderator effect of belief salience on associations of behavioral beliefs with attitude and intention. Two alternative predictions were made regarding the moderating effect of belief salience on the relationship of belief-evaluation products (viz., behavioral beliefs) with attitudes and intentions toward participating in the *SEQOME Project*. The first version of this hypothesis was derived from the reasoned action model ($H2_{RAM}$). In $H2_{RAM}$, I predicted that the direct positive influence of behavioral beliefs on attitude (and the indirect influence on intention) would be moderated by Audience Segment. In turn, this conditional direct effect was expected to influence intention through attitude. Rephrasing these predictions in terms of relative GG salience, (a) the positive relationship between GG behavioral beliefs and attitude will become stronger as relative GG salience increases, and (b) the positive relationship between PF behavioral beliefs and attitude will become stronger as relative GG salience decreases. Importantly, these conditional effects should also indirectly impact intention through attitude.

The competing hypothesis was based on media priming theory ($H2_{MPT}$). In $H2_{MPT}$, I predicted that the influence of behavioral beliefs with attitude—and indirectly intention—would be moderated by Audience Segment and Message Topic. Specifically, (a) the positive relationship between GG behavioral beliefs and attitude will be stronger following exposure to the altruist-targeted message (compared to the instrumentalist-targeted message), and (b) the positive relationship between PF behavioral beliefs and

attitude will be stronger following exposure to the instrumentalist-targeted message.[27] In the no-message control, the relationships of these behavioral beliefs to attitude will follow the pattern predicted by the reasoned action model. These conditional effects were also expected to indirectly impact intention through attitude.

To test these predictions with respect to attitudes toward participating in the *SEQOME Project*, I conducted a hierarchical regression analysis (see Table 5.10). Dummy variables representing the altruist- and instrumentalist-targeted message conditions were entered in the first step. Next, mean-centered GG and PF behavioral beliefs were entered along with the seven remaining behavioral-belief items. In the third step, mean-centered relative GG salience and dual salience were entered. Interaction terms of relative GG salience by GG and PF behavioral beliefs were entered in the fourth step. Two additional interaction terms were entered in the fifth step representing the conditional effects of the (a) GG behavioral beliefs by the altruist-targeted message, and (b) PF behavioral beliefs by the instrumentalist-targeted message. These last two interactions were included to test the predictions outlined in $H2_{MPT}$.

The regression analysis predicting attitude toward participating in the *SEQOME Project* was replicated using intention as the dependent variable. In two additional steps, attitude was entered as a predictor, followed by perceived social pressure and perceived behavioral control variables (see Table 5.11). Technically, this statistical model was insufficient to test the predictions made regarding intention in the competing versions of Hypothesis 2. According to the reasoned action model, behavioral beliefs and

[27] The conditional effect of altruist-targeted message exposure would be expected to positively increase the association of the greater-good belief-evaluation product with attitude and intention at all levels of relative GG salience. Likewise, the conditional effect of instrumentalist-targeted message exposure would yield positive increases to the association of the personal-feedback product with attitude and intention at all levels of relative GG salience. Thus, $H2_{MPT}$ does not propose three-way interactions of relative GG salience, Message Topic and behavioral beliefs, but rather, additive pairs of two-way interactions: (a) belief-evaluation products by relative GG salience and (b) belief-evaluation products by Message Topic.

Table 5.10

Hierarchical Multiple Regression Analysis Predicting Attitude Toward Participating in the SEQOME Project *from Message Topic, Behavioral Beliefs, Relative Greater-Good Salience, and Interaction Terms*

Predictor		ΔR^2	*B*	*SE*	β	95% CI
Constant			5.16***	0.05		[5.07, 5.25]
Step 1		.001				
Message topic[a]						
	Altruist-targeted		−0.08	0.06	−.03	[−0.20, 0.03]
	Instrumentalist-targeted		0.03	0.06	.01	[−0.09, 0.14]
Step 2		.439***				
B_1E_1	Greater-good behavioral beliefs		0.45***	0.04	.38	[0.38, 0.53]
B_2E_2	Personal-feedback behavioral beliefs		0.25***	0.04	.21	[0.17, 0.33]
B_3E_3	Put the privacy of my genetic information at risk		0.06†	0.03	.05	[−0.00, 0.12]
B_4E_4	Be part of research that goes against my personal values		0.11**	0.03	.09	[0.04, 0.17]
B_5E_5	Take up a lot of my time		0.08*	0.03	.06	[0.01, 0.14]
B_6E_6	Feel worried about my health		0.02	0.03	.01	[−0.04, 0.08]
B_7E_7	Learn something about my genes that I do not want to know		0.03	0.03	.03	[−0.20, 0.08]
B_8E_8	Feel physical pain		0.13***	0.03	.11	[0.07, 0.20]
B_9E_9	Inconvenient		−0.02	0.04	−.01	[−0.09, 0.05]
Step 3		.002†				
Relative GG salience			0.04*	0.02	.05	[0.01, 0.07]
Dual salience			0.08*	0.03	.05	[0.01, 0.14]
Step 4		.006***				
B_1E_1 × Relative GG salience			0.07***	0.02	.10	[0.04, 0.11]
B_2E_2 × Relative GG salience			−0.04*	0.02	−.06	[−007, −0.01]
Step 5		.001				
B_1E_1 × Altruist-targeted			0.08	0.05	.04	[−0.02, 0.17]
B_2E_2 × Instrumentalist-targeted			−0.03	0.05	−.01	[−0.13, 0.07]
	Total R^2	.443				
	Total *F*	74.58***				

Note. $N = 1{,}577$. CI = confidence interval. The B_iE_i predictors refer to belief-evaluation product terms. Regression coefficients and standard errors from the final model are presented here.

†$p < .06$. *$p < .05$. **$p < .01$. ***$p < .001$.

[a] Reference category is the no-message control group.

Table 5.11

Hierarchical Multiple Regression Analysis Predicting Intention to Participate in the SEQOME Project *from Message Topic, Behavioral Beliefs, Relative Greater-Good Salience, Interaction Terms, and Principal Reasoned Action Model Variables*

Predictor		ΔR^2	*B*	*SE*	β	95% CI
Constant			0.03	0.13		[−0.23, 0.29]
Step 1		.000				
Message topic[a]						
Altruist-targeted			−0.03	0.04	−.01	[−0.12, 0.06]
Instrumentalist-targeted			−0.03	0.05	−.01	[−0.12, 0.06]
Step 2		.414***				
B_1E_1	Greater-good behavioral beliefs		0.09**	0.03	.07	[0.03, 0.15]
B_2E_2	Personal-feedback behavioral beliefs		0.05	0.03	.04	[−0.01, 0.11]
B_3E_3	Put the privacy of my genetic information at risk		0.12***	0.02	.10	[0.07, 0.16]
B_4E_4	Be part of research that goes against my personal values		−0.05*	0.03	−.04	[−0.10, −0.00]
B_5E_5	Take up a lot of my time		0.00	0.03	.00	[−0.05, 0.05]
B_6E_6	Feel worried about my health		−0.04	0.02	−.03	[−0.08, 0.01]
B_7E_7	Learn something about my genes that I do not want to know		0.02	0.02	.02	[−0.02, 0.06]
B_8E_8	Feel physical pain		0.04	0.03	.03	[−0.01, 0.09]
B_9E_9	Inconvenient		0.01	0.03	.01	[−0.05, 0.06]
Step 3		.006***				
Relative GG salience			0.04*	0.02	.05	[0.01, 0.07]
Dual salience			0.08*	0.03	.05	[0.01, 0.14]
Step 4		.006***				
B_1E_1 × Relative GG salience			0.03*	0.01	.04	[0.01, 0.06]
B_2E_2 × Relative GG salience			−0.02	0.01	−.03	[−.05, 0.00]
Step 5		.003*				
B_1E_1 × Altruist-targeted			−0.06	0.04	−.03	[−0.13, 0.01]
B_2E_2 × Instrumentalist-targeted			−0.11*	0.04	−.05	[−0.19, −0.03]
Step 6						
Attitude			0.24***	0.02	.21	[0.20, 0.28]
Step 7						
Perceived social pressure			0.23***	0.02	.21	[0.19, 0.27]
Capacity[b]			0.47***	0.02	.46	[0.43, 0.50]
Autonomy[b]			0.04†	0.02	.03	[0.00, 0.07]
	Total R^2	.768				
	Total *F*	245.49***				

Note. $N = 1{,}577$. CI = confidence interval. The B_iE_i predictors refer to belief-evaluation product terms. Regression coefficients and standard errors from the final model are presented here.

†$p < .06$. *$p < .05$. **$p < .01$. ***$p < .001$.

[a] Reference category is the no-message control group.
[b] Dimension of perceived behavioral control.

the hypothesized interactions are expected to have an indirect effect on intention that is mediated through attitude. To test this mediated-moderation hypothesis, I combined the two regression models predicting attitude and intention into a single path analysis using the PROCESS macro for SPSS (Hayes, 2012b). The analysis followed the general structure of the causal-steps approach for testing mediation hypotheses (R. M. Baron & Kenny, 1986). Additionally, bias-corrected standard errors and 95% confidence intervals for the hypothesized conditional indirect effects were obtained. These were generated using the PROCESS bootstrapping procedure with 1000 replications (Preacher & Hayes, 2008).

Significant interaction effects were further explored by conducting simple slopes analyses at the mean and ±1 *SD* of the moderator. When relevant, the Johnson-Neyman technique (P. O. Johnson & Neyman, 1936; as cited in Preacher, Rucker, & Hayes, 2007) was also used to define the region of significance for conditional relationships. An added benefit of the Johnson-Neyman technique is that it produces estimated simple slopes at a wider range of moderator values, which facilitates plotting the interaction.

Hypothesized conditional effects on attitude. The relative-GG-salience interaction terms explained additional variance in attitudes toward participating in the *SEQOME Project*, $\Delta R^2 = .01$, $\Delta F(2, 1561) = 7.96$, $p < .001$. These interaction terms were designed to test whether relative GG salience moderated the effects of GG and PF behavioral beliefs. In line with $H2_{RAM}$, the association between GG behavioral beliefs and attitude became stronger as relative GG salience increased, $\beta = .10$, $p < .001$. Also as predicted, the association between PF behavioral beliefs with attitude became weaker as relative GG salience increased, $\beta = -.06$, $p = .020$.

Including the second pair of interaction terms in the fifth step did not explain any additional variance in attitude, $\Delta R^2 = .00$, $\Delta F(2, 1559) = 1.77$, $p = .171$. The regression

coefficients for these terms represented the moderating effect of Message Topic, based on a media priming account of attitude formation. In short, the competing hypothesis derived from media priming theory, $H2_{MPT}$, was not supported. Message Topic did not moderate the relationship of GG and PF beliefs on attitude toward participating in the *SEQOME Project*.

Follow-up analyses for the conditional effect of greater-good behavioral beliefs on attitude. Simple slopes for the moderating effect of relative GG salience on the association between GG behavioral beliefs and attitude are presented in Figure 5.5. The effect of GG behavioral beliefs on attitude at the mean relative GG salience was

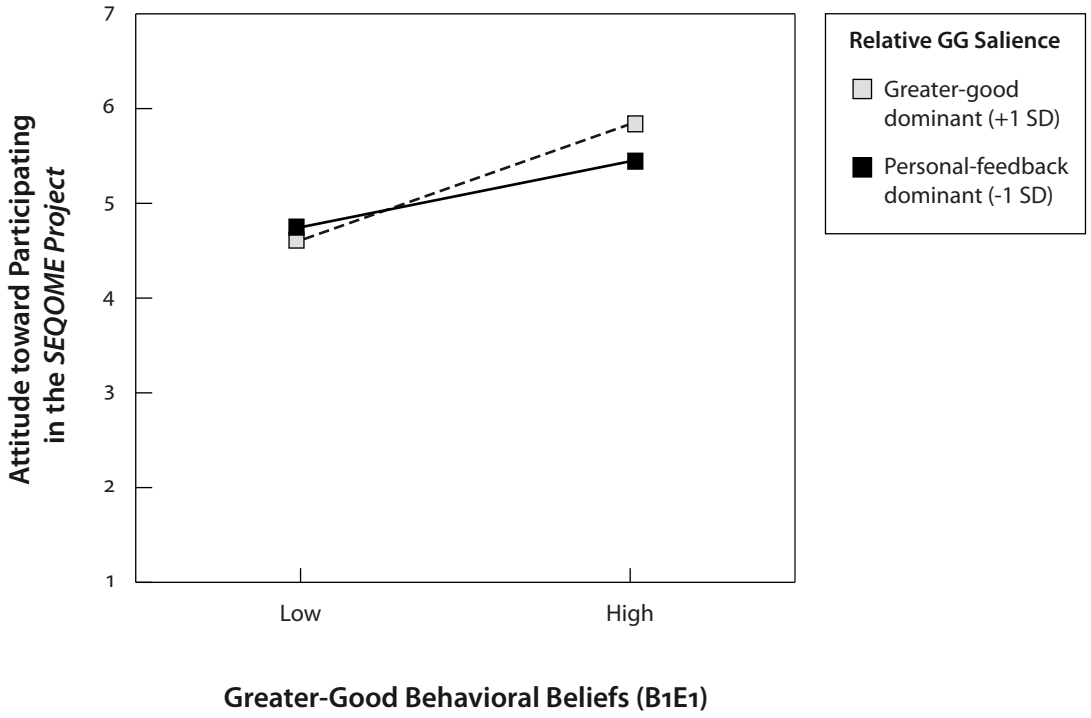

Figure 5.5. Simple slopes for the moderating effect of relative greater-good salience on the relation between greater-good behavioral beliefs and attitude toward participating in the *SEQOME Project*.

significant and positive, B = 0.45, SE = 0.04, 95% CI [0.38, 0.52], t(1559) = 12.46, p < .001.[28] At −1 *SD* relative GG salience, the association between GG behavioral beliefs and attitude was weaker, B = 0.33, SE = 0.05, 95% CI [0.23, 0.42], t(1559) = 6.84, p < .001. At +1 *SD* relative GG salience, the association of GG behavioral beliefs with attitude toward participating in the *SEQOME Project* was strongest, B = 0.58, SE = 0.05, 95% CI [0.49, 0.67], t(1559) = 12.21, p < .001. Further, the 95% confidence intervals for the slope estimates at one standard deviation relative GG salience below and above the mean do not overlap, indicating that those effects are significantly different from one another.

I also examined the Johnson-Neyman significance region for the conditional effect of GG behavioral beliefs on attitude by relative GG salience. For respondents with a speculative value of relative GG salience below −3.20, the association between GG behavioral beliefs and attitude was not significantly different from zero. In terms of the current sample, this means that GG behavioral beliefs had no discernable impact on attitudes toward participating in the *SEQOME Project* among respondents who selected four PF outcomes and no GG outcomes in the dimensional-salience task, B = 0.10, SE = 0.09, 95% CI [−0.08, 0.29], t(1559) = 1.08, p = .281.

Follow-up analyses for the conditional effect of personal-feedback behavioral beliefs on attitude. Simple slopes of the conditional direct effect of PF behavioral beliefs on attitude by relative GG salience are depicted in Figure 5.6. At the mean-level of relative GG salience, a one-unit increase in PF behavioral belief resulted in a 1/4-unit increase in attitude toward participating in the *SEQOME Project*, B = 0.25, SE = 0.04, 95% CI [0.17, 0.33], t(1559) = 6.16, p < .001.[29] The association was stronger at −1 *SD*

[28] The simple slope of the relationship between GG behavioral beliefs and attitude at the mean level of relative GG salience is not plotted in Figure 5.5. This slope was excluded to reduce clutter.
[29] The simple slope of the relationship between PF behavioral beliefs and attitude at the mean level of relative GG salience is not plotted in Figure 5.6. This slope was excluded to reduce clutter.

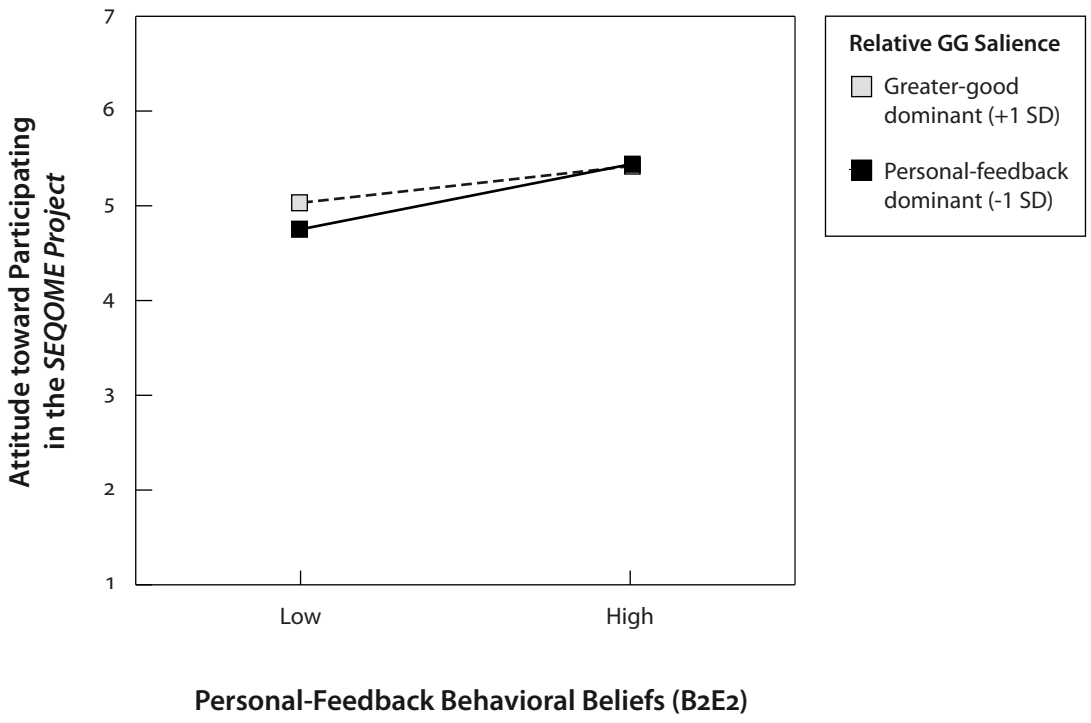

Figure 5.6. Simple slopes for the moderating effect of relative greater-good salience on the relation between personal-feedback behavioral beliefs and attitude toward participating in the *SEQOME Project*.

relative GG salience, B = 0.32, SE = 0.05, 95% CI [0.22, 0.42], $t(1559) = 6.25$, $p < .001$. At +1 *SD* relative GG salience, the association between PF behavioral beliefs and attitude was weakest, B = 0.18, SE = 0.05, 95% CI [0.08, 0.28], $t(1559) = 3.68$, $p < .001$. In short, the positive influence of PF behavioral beliefs on attitudes toward participating in the *SEQOME Project* increased with increased salience of PF outcomes (viz., relative to GG outcomes). This supports $H2_{RAM}$.

Moreover, the Johnson-Neyman significance region for this moderation effect revealed that PF behavioral beliefs were not significantly associated with attitudes when relative GG exceeded a speculative value of +3.95. In terms of the current sample, the simple slope for the relation between PF behavioral beliefs and attitude was not

significant for respondents who selected four GG outcomes and no PF outcomes, B = 0.13, SE = 0.07, 95% CI [−0.00, 0.25], $t(1559) = 1.92$, $p = .055$.

Hypothesized conditional indirect effects on intention. According to $H2_{RAM}$, the moderating effect of relative GG salience on the relationships between behavioral beliefs and intention to participate in the *SEQOME Project* were expected to be mediated through attitude. To test these predictions, a pair of mediation analyses was performed. In both of these, the outcome variable was intention to participate in the *SEQOME Project* and the proposed mediating variable was attitude toward doing so. The analyses focused on different initial causal variables. The initial causal variables were the interaction terms of GG behavioral beliefs by relative GG salience (i.e., B_1E_1 × Relative GG Salience) and PF behavioral beliefs by relative GG salience (i.e., B_2E_2 × Relative GG Salience). The generic statistical model used for these analyses is depicted in Figure 5.7.

Attitude partially mediated the conditional relationship of GG behavioral beliefs by relative GG salience on intention. The path coefficient for the indirect relationship of the B_1E_1 × Relative GG Salience term on intention through attitude was statistically significant, $\hat{a}_3\hat{b}_1 = 0.02$, SE = 0.01, 95% CI [0.01, 0.03]. The direct effect of this interaction on intention remained statistically significant when controlling for attitude, perceived social pressure and perceived behavioral control, $\hat{c}'_3 = 0.03$, SE = 0.01, 95% CI [0.01, 0.06], $t(1555) = 2.437$, $p = .015$; however, it was substantially smaller than the total estimated direct effect when those variables were not included, $\hat{c}_3 = 0.09$, SE = 0.02, 95% CI [0.05, 0.20], $t(1559) = 4.16$, $p < .001$.[30] Nonetheless, partial mediation is still consistent with the predictions outlined in $H2_{RAM}$.

[30] A portion of this conditional effect appears to have been mediated through the capacity dimension of perceived behavioral control. The estimated indirect effect of this interaction term through capacity was statistically

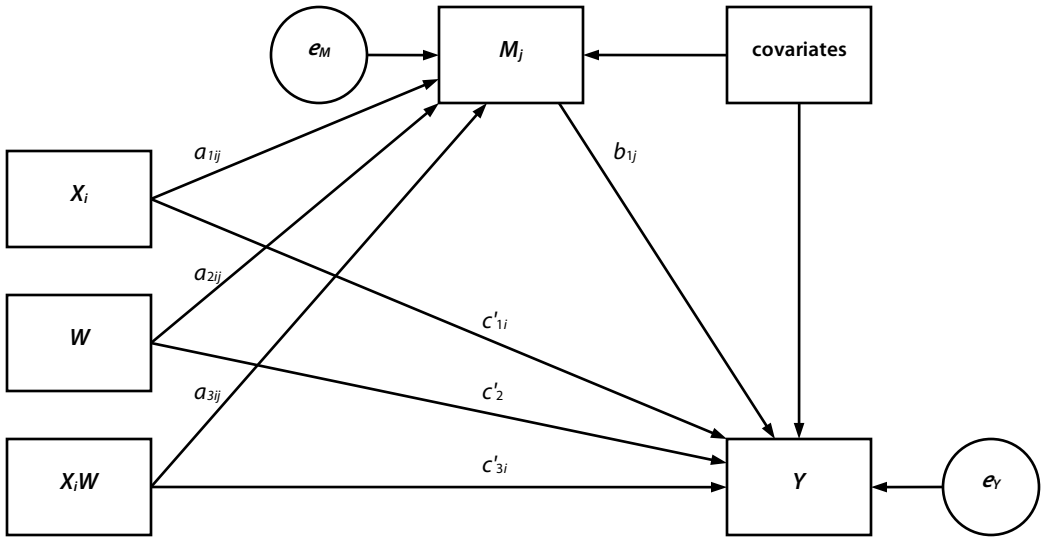

Figure 5.7. Statistical model for the conditional indirect effects of greater-good and personal-feedback behavioral beliefs on intention through attitude, as moderated by relative greater-good salience. X_1 = Greater-good behavioral beliefs; X_2 = Personal-feedback behavioral beliefs; W = Relative greater-good salience; M_1 = Attitude toward the *SEQOME Project*; Y = Intention to participate. Adapted from *SPSS PROCESS documentation*, by A. F. Hayes, 2012c, p. 24.

Figure 5.8 illustrates the conditional indirect effect of GG behavioral beliefs on intention to participate in the *SEQOME Project*, as mediated through attitude at different levels of relative GG salience. Referring to the path labels in Figure 5.7, I quantified this effect at different levels of relative GG salience, W, using an equation given by Hayes (2012c): $f(\theta_W) = (a_1 + a_3W)b_1$. The influence of GG behavioral beliefs on intention through attitude increased linearly as relative GG salience increased. Examination of the Johnson-Neyman significance region for this conditional indirect effect revealed GG behavioral beliefs did not significantly impact intention through attitude at values of relative GG salience lower than −3.22, $\hat{\theta}_{-3.22} = 0.04$, $SE = 0.02$, 95%

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significant, $\hat{a}_3\hat{b}_1 = 0.03$, SE = 0.01, 95% CI [0.01, 0.05]. Comparable indirect effects through perceived social pressure, $\hat{a}_3\hat{b}_1 = 0.009$, 95% CI [−0.001, 0.020], and the autonomy measure of perceived behavioral control, $\hat{a}_3\hat{b}_1 = -0.001$, 95% CI [−0.000, 0.004], were not significantly different from zero. It should be kept in mind that the regression models predicting capacity, and the other direct predictors of intention, do not include belief-based determinants of those constructs. Thus, the association of attitudinal behavioral beliefs with capacity may have resulted from model misspecification. The evidence of mediation through capacity produced in this analysis may be spurious.

CI [0.00, 0.08]. In other words, GG behavioral beliefs did not significantly influence intentions to participate in the *SEQOME Project* through attitude among respondents who selected four PF outcomes but no GG outcomes in the dimensional-salience task (i.e., relative GG salience of −4). This pattern echoes the results observed for the conditional direct effect of GG behavioral beliefs on attitude by relative GG salience, and further supports $H2_{RAM}$.

Also consistent with $H2_{RAM}$, the interaction of PF behavioral beliefs by relative GG salience (i.e., B_2E_2 × Relative GG Salience) indirectly affected intention to participate in the *SEQOME Project* through attitude, $\hat{a}_3\hat{b}_1 = -0.010$, $SE = 0.004$, 95% CI [−0.019,

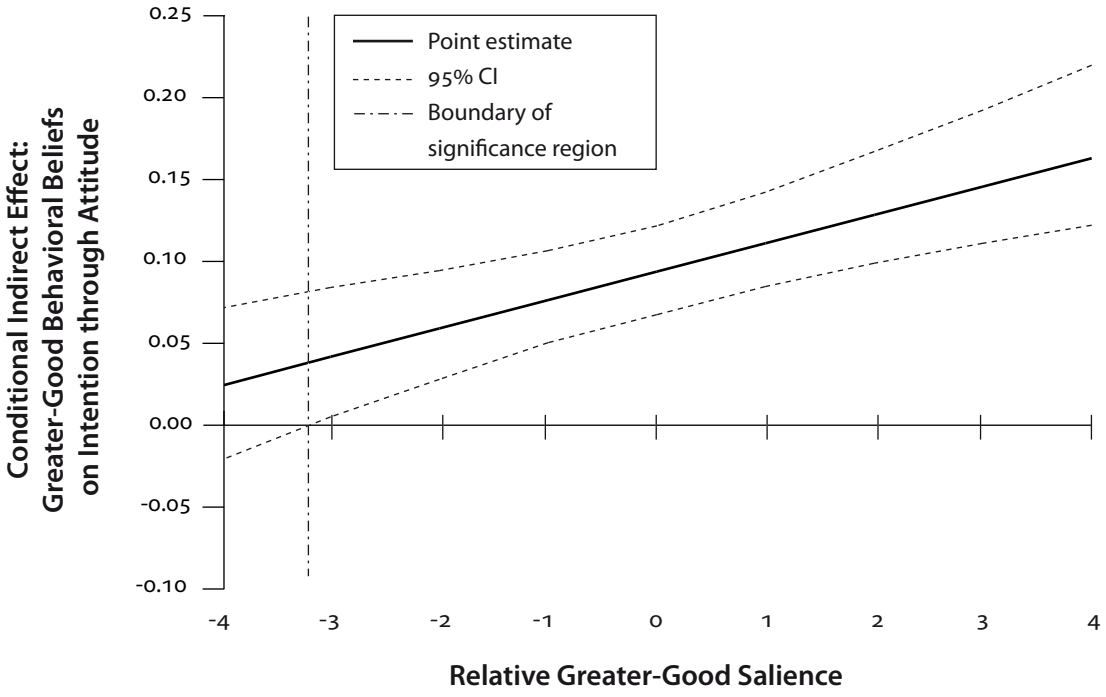

Figure 5.8. Bootstrap parameter estimates for the conditional indirect effect of greater-good behavioral beliefs on intention to participate in the *SEQOME Project* at different levels of relative greater-good salience, as mediated through attitude. Values to the right of the vertical dotted line are within the Johnson-Neyman significance region.

−0.002], p = .021.[31] Controlling for all other variables in the model, the average *direct* effect of this interaction on intention was not significant, $\hat{c}'_3$ = −0.02, *SE* = 0.01, t(1555) = −1.84, p = .065. Nor was there a significant direct effect of PF behavioral beliefs on intention, holding all else constant, $\hat{c}'_1$= 0.05, *SE* = 0.03, t(1555) = 1.59, p = .111. Combined, these results suggest that attitude fully mediated the effect of PF behavioral beliefs by relative GG salience on intention.[32]

As illustrated in Figure 5.9, the conditional indirect effect of PF behavioral beliefs on intention, as mediated through attitude, decreased linearly as relative GG salience increased. In other words, PF behavioral beliefs affected intentions to participate in the *SEQOME Project* more as PF outcomes became increasingly more salient than GG outcomes. The boundary of the Johnson-Neyman significance region for this conditional indirect effect revealed that PF behavioral beliefs did not significantly impact intention to participate in the *SEQOME Project* at values of relative GG salience greater than +3.94, $\hat{\theta}_{3.94}$ = 0.03, *SE* = 0.02, 95% CI [0.02, 0.00]. That is, PF behavioral beliefs were not a significant determinant of intention for respondents who selected four GG outcomes but no PF outcomes in the dimensional-salience task (i.e., relative GG salience of +4),

According to $H2_{MPT}$, hypothesized moderating effects of Message Topic on the association between behavioral beliefs and attitude would indirectly impact intention. Because no significant conditional direct effects of the GG and PF behavioral beliefs on attitude by Message Topic were found, corresponding conditional indirect effects on

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[31] An approximate *p* value was calculated by dividing the absolute value of the unstandardized path estimate by its standard error, −0.0097/0.0042. The resulting *z* statistic was then converted to a *p* value.

[32] The estimated indirect effects of the B_1E_1 × Relative GG Salience interaction on intention through the perceived social pressure and the two dimensions of perceived behavioral control were not significant. The path estimate for the effect through perceived social pressure was $\hat{a}_3\hat{b}_1$ = −0.00, SE = 0.01, 95% CI [−0.01, 0.01]. Through capacity, the estimated indirect effect was $\hat{a}_3\hat{b}_1$ = −0.01, SE = 0.01, 95% CI [−0.03, 0.02]. Through autonomy, the indirect effect was $\hat{a}_3\hat{b}_1$ = −0.00, SE = 0.0095% CI [−0.00 0.00].

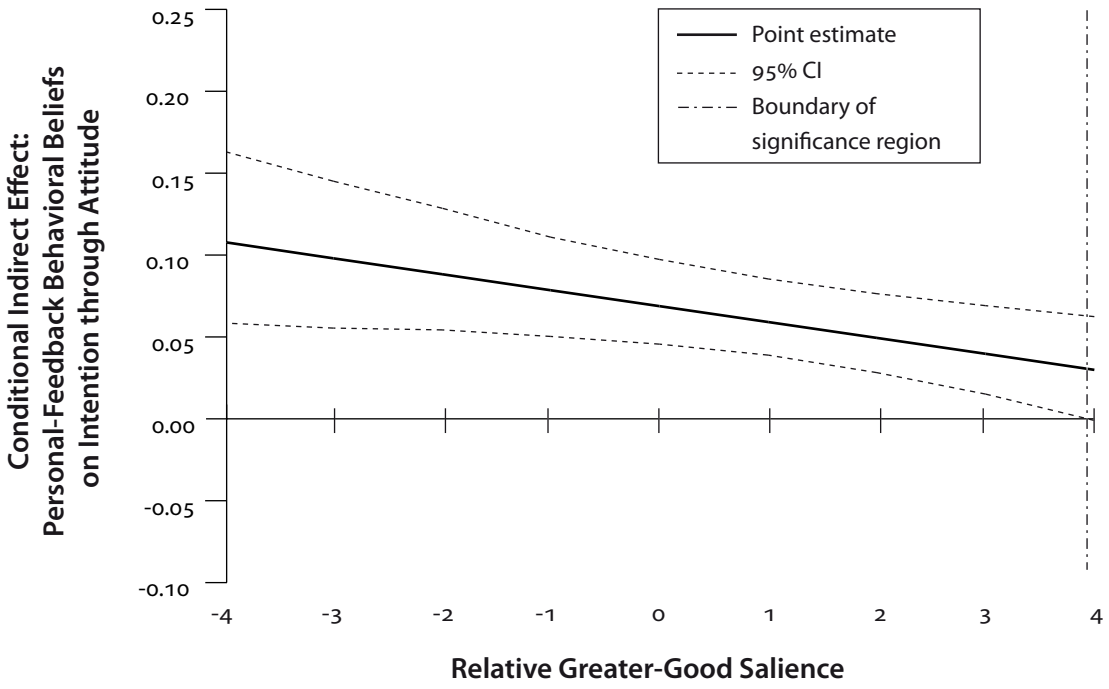

Figure 5.9. Bootstrap parameter estimates for the conditional indirect effect of personal-feedback behavioral beliefs on intention to participate in the *SEQOME Project* at different levels of relative greater-good salience, as mediated through attitude. Values to the left of the vertical dotted line are within the Johnson-Neyman significance region.

intention *through* attitude were not possible. Nonetheless, I conducted simple moderation analyses to explore whether there were conditional direct effects of GG and PF behavioral beliefs by Message Topic on intention that were not mediated through attitude.

As was shown in Table 5.11, two interaction terms representing the conditional effects of GG and PF behavioral beliefs by Message Topic significantly improved the prediction of intention, $\Delta R^2 = .003$, $\Delta F(1, 1559) = 3.91$, $p = .020$. This improvement in explained variance was derived exclusively from the interaction of the instrumentalist-targeted message with PF behavioral beliefs (i.e., $B_2E_2 \times$ instrumentalist-targeted), $B = -0.11$, $SE = 0.04$, 95% CI [−0.19, −0.03], $t(1555) = -2.80$, $p = .005$. Among respondents

assigned to the instrumentalist-targeted message condition, PF behavioral beliefs were a slightly *weaker* determinant of intentions to participate in the *SEQOME Project*. This effect was opposite of that predicted by $H2_{MPT}$. There is no evidence that a media priming effect increased the salience and influence of message-targeted beliefs on subsequent judgments about participating in the *SEQOME Project*.

Hypothesis 3: Effects of message exposure on attitude and intention. Two competing hypotheses were posited regarding the effects of message exposure on attitude and intention. Generally, belief salience was expected to moderate the effects of Message Topic on attitude and intention.

Drawing on media priming theory, in $H3_{MPT}$ I predicted a main effect of Message Topic on attitude and intention to participate in the *SEQOME Project*. This prediction was premised on the assumption that message exposure would impact intention indirectly through changes in behavioral beliefs and attitude. Moreover, $H3_{MPT}$ relied on the further assumption that the relationship of behavioral beliefs with attitude would be moderated by Message Topic. For example, exposure to a message addressing PF behavioral beliefs would strengthen the impact of PF behavioral beliefs on attitude. However, this underlying assumption was not met. Message Topic did not moderate the association between behavioral beliefs and attitudes. Nor did Message Topic moderate the association between behavioral beliefs and intentions.

Instead, I focus here on testing the competing hypothesis expressed in $H3_{RAM}$. With $H3_{RAM}$, I predicted that the influence of the instrumentalist-targeted message on attitude and intention would be mediated by PF behavioral beliefs and moderated by Audience Segment. Replacing the audience-segment construct with relative GG salience, the impact of the instrumentalist-targeted message on PF behavioral beliefs is expected to affect attitude and intention to a greater extent as relative GG salience decreases.

Because relative GG salience is expected to moderate two causal pathways, the conceptual model underlying $H3_{RAM}$ is an instance of moderated mediation as defined by R. M. Baron & Kenny (1986; see also Preacher et al., 2007).

A diagram of the statistical model used for this analysis is shown in Figure 5.10. The conditional indirect effect of the instrumentalist-targeted message on attitude was composed of two relationships: (a) the path from the instrumentalist-targeted message to PF behavioral beliefs, and (b) the path from PF behavioral beliefs to attitude. Both of these paths were expected to be moderated by relative GG salience. The statistical model predicting intention had the same basic structure, except that attitude, perceived social pressure and perceived behavioral control were included as control variables. Referring

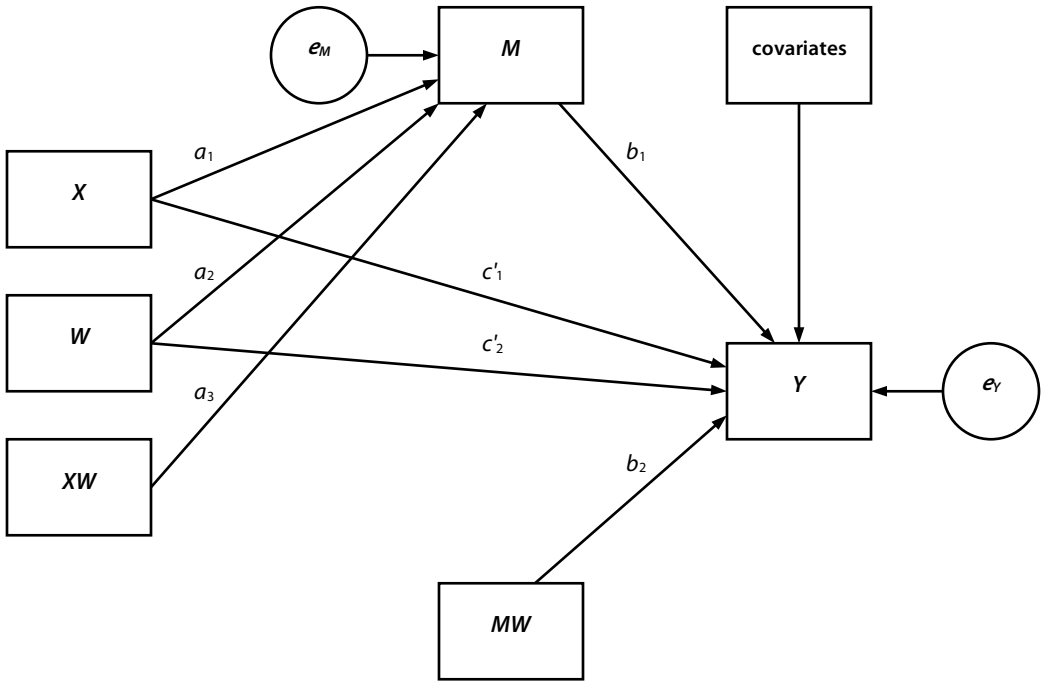

Figure 5.10. Statistical model for the conditional indirect effect of the instrumentalist-targeted message on attitude and intention through personal-feedback behavioral beliefs, as moderated by relative greater-good salience. *X* = Instrumentalist-targeted message; *W* = Relative greater-good salience; *M* = Personal-feedback behavioral beliefs; $Y_{Model\ 1}$ = Attitude toward participating in the *SEQOME Project*; $Y_{Model\ 2}$ = Intention to participate in the *SEQOME Project*. Adapted from *SPSS Process documentation*, by A. F. Hayes, 2012c, p. 74.

to the path labels given in Figure 5.10, these conditional indirect effects are quantified at different levels of relative GG salience, W, with the expression given by Muller, Judd, & Yzerbyt (2005): $f(\theta_W) = (a_1 + a_3W)(b_1 + b_2W)$.

Bias-corrected 95% confidence intervals and standard errors for hypothesized conditional indirect effects at different levels of relative GG salience were estimated using the PROCESS macro for SPSS with 1000 bootstrap replications. Due to some limited flexibility in the PROCESS macro, the no-message control and altruist-targeted message conditions were combined into a single reference category for these analyses.[33] I compared coefficients from this model with corresponding estimates of a better-specified model that included the second dummy variable and dual salience. The differences between the two models were negligible.

Conditional indirect effect of the instrumentalist-targeted message on attitude. Figure 5.11 illustrates the conditional indirect effect of the instrumentalist-targeted message on attitude toward participating in the *SEQOME Project* at different levels of relative GG salience. Plotting the conditional indirect effect by relative GG salience reveals a clear curvilinear relationship, which was not explicitly predicted in the stated hypothesis (i.e., $H3_{RAM}$).

The Johnson-Neyman significance region for this conditional indirect effect had two boundaries within the observed range of relative GG salience. The association between the instrumentalist-targeted message and attitude was not significantly different from zero for respondents with a speculative value of relative GG salience below

[33] One limitation of using the PROCESS macro to conduct this analysis was that only one initial variable could be entered at a time. Thus, only one of the two dummy variables representing the three message topic conditions could be included. Also, any additional variables defined as covariates in the model could only be selectively applied as predictors of the mediating or outcome variables as a block. As a result, neither the dummy-coded variable representing the altruist-targeted message condition nor the dual-salience variable could be modeled as predictors of personal-feedback behavioral beliefs without also controlling for all other variables that were included as predictors of attitude.

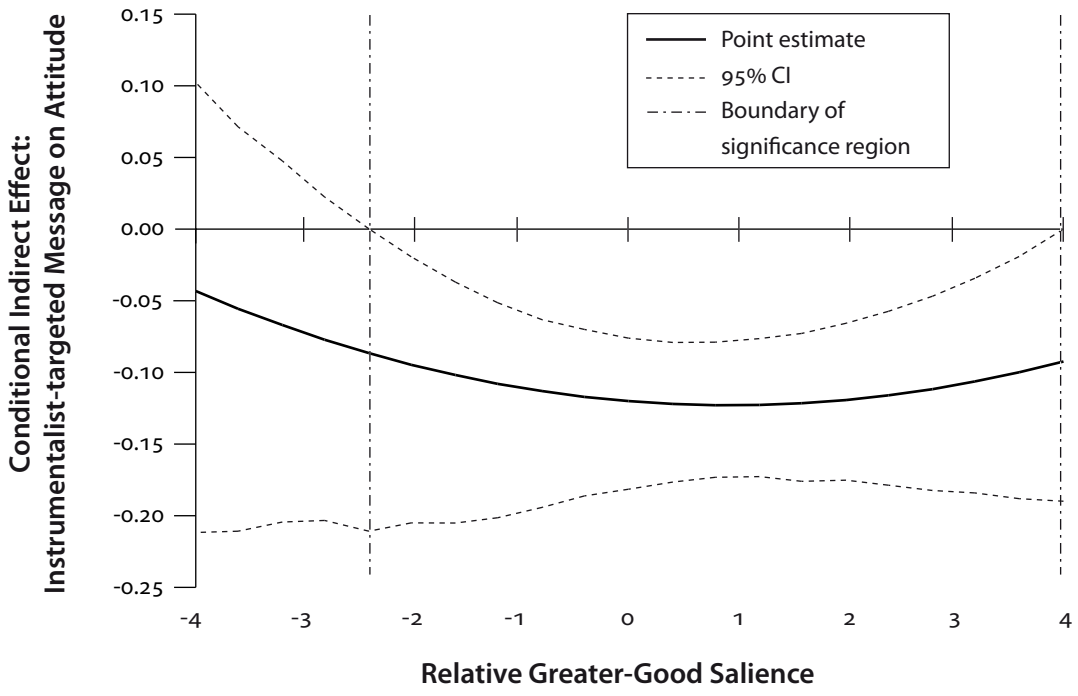

Figure 5.11. Bootstrap parameter estimates for the conditional indirect effect of the instrumentalist-targeted message on attitude toward participating in the *SEQOME Project* at different levels of relative greater-good salience, as mediated through personal-feedback behavioral beliefs. Values falling between the vertical dotted lines are within the Johnson-Neyman significance region.

−2.40, $\hat{\theta}_{-2.40} = -0.09$, *SE* = 0.05, 95% CI [−0.21, 0.00], $p = .050$. Accordingly, the instrumentalist-targeted message had no discernable impact on attitude toward participating in the *SEQOME Project* among respondents who selected four PF outcomes and no GG outcomes during the dimensional-salience task, $\hat{\theta}_{-4.00} = -0.04$, *SE* = 0.08, 95% CI [−0.21, 0.10], $p = .574$. Nor did the instrumentalist-targeted message influence attitude toward participation among respondents who selected four GG outcomes and no PF outcomes, $\hat{\theta}_{+4.00} = -0.09$, *SE* = 0.05, 95% CI [−0.19, 0.00], $p = .061$.

Compared to the no-message control and altruist-targeted message conditions, the instrumentalist-targeted message had the greatest impact on attitude for respondents with a relative GG salience value of +1.00, $\hat{\theta}_{+1.00} = -0.12$, *SE* = 0.03, 95% CI

[−0.17, −0.08], $p < .001$. Among respondents who nominated one additional GG outcome over the number of PF outcomes selected, the instrumentalist-targeted message led to a 1/10-unit decrease in attitude. Because this curvilinear effect was not explicitly anticipated, $H3_{RAM}$ was not supported. The evidence does not support the overall prediction that the instrumentalist-targeted message will yield less favorable attitudes and weaker intentions as relative GG salience decreases.

Conditional indirect effect of the instrumentalist-targeted message on intention. The conditional indirect effect of the instrumentalist-targeted message on intention to participate in the *SEQOME Project* at different levels of relative GG salience is presented in Figure 5.12. As with the model predicting attitude, conditional indirect

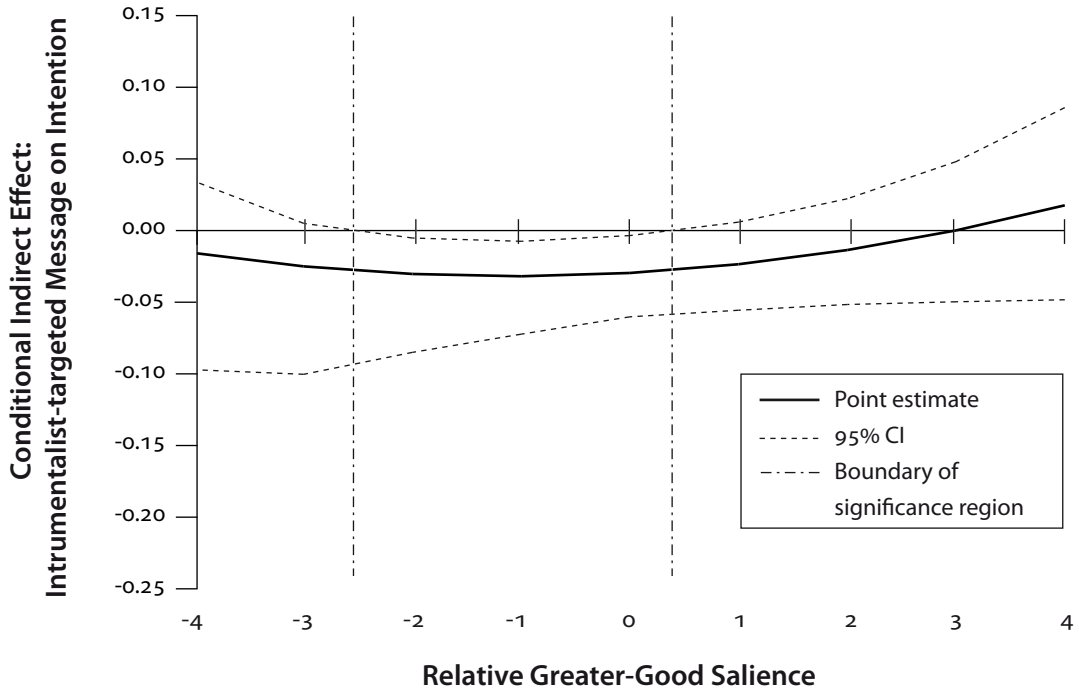

Figure 5.12. Bootstrap parameter estimates for the conditional indirect effect of the instrumentalist-targeted message on intention to participate in the *SEQOME Project* at different levels of relative greater-good salience, as mediated through personal-feedback behavioral beliefs and attitude. Values falling between the vertical dotted lines are within the Johnson-Neyman significance region.

effect of the instrumentalist-targeted on intention message by relative GG salience appeared to be curvilinear. Once again, this curvilinear association was not explicitly predicted in $H3_{RAM}$.

The Johnson-Neyman significance region for the conditional indirect effect on intention was narrower than that of the model predicting attitude, but also had two boundaries within the observed range of relative GG salience. The association between the instrumentalist-targeted message and intention was not significantly different from zero among respondents with relative GG salience below −2.67, $\hat{\theta}_{-2.67} = -0.03$, *SE* = 0.02, 95% CI [−0.09, 0.00], $p = .050$. The conditional indirect effect on intention was also not significantly different from zero when relative GG salience exceeded +0.53, $\hat{\theta}_{0.53} = -0.03$, *SE* = 0.02, 95% CI [−0.06, 0.00], $p = .050$. Among respondents who selected more GG outcomes than PF outcomes to any degree, the instrumentalist-targeted message did not have an observable impact on intention.

The instrumentalist-targeted message had the greatest impact on intention for respondents with a relative GG salience value of −2, $\hat{\theta}_{-2.00} = -0.03$, *SE* = 0.02, 95% CI [−0.07, −0.01], $p = .046$. In other words, among respondents who nominated two more PF outcomes than GG outcomes, the instrumentalist-targeted message led to an estimated three-hundredths of a unit decrease in intention. Thus, the instrumentalist-targeted message significantly lowered intentions to participate in the *SEQOME Project*, but only when PF outcomes were moderately more salient than GG outcomes. Due to the unanticipated curvilinearity of this conditional indirect effect, the findings with regard to intention do not support $H3_{RAM}$.

Research Questions

Lastly, I asked whether decisional conflict and attitudinal ambivalence would be influenced by Message Topic and/or relative GG salience. To explore these questions, I conducted two multiple regression analyses (see Table 5.12). In the first analysis, attitudinal ambivalence was the dependent variable. The predictors were two dummy variables representing the instrumentalist- and altruist-targeted message topics, relative GG salience, dual salience, and two terms to test for a Message Topic × Relative GG Salience interaction effect.[34] The predictor variables and structure of the second analysis was identical, but decisional conflict was the dependent variable.

Relative GG salience was the only significant predictor of attitudinal ambivalence, accounting for a less than 2% its variance, $\Delta R^2 = .02$, $\Delta F(1, 1562) = 27.22$, $p < .001$. As the relative GG salience increased attitudinal ambivalence decreased, $\beta = -.12$, $p = .007$.

In the model predicting decisional conflict, the Message Topic × Relative GG Salience step was not significant, $\Delta R^2 = .00$, $\Delta F(2, 1519) = 0.76$, $p = .466$. Controlling for all other variables, a main effect of Message Topic was observed, $\Delta R^2 = .01$, $\Delta F(2, 1519) = 8.08$, $p < .001$. Compared to the no-message control, the instrumentalist- and altruist-targeted messages were each associated with small reductions in decisional conflict. This effect was nominally more pronounced in the altruist-targeted condition, $\beta = -.13$, $p < .001$, than it was in the instrumentalist-targeted condition, $\beta = -.09$, $p = .008$; however, pairwise comparisons of the estimated marginal means for these two groups (30.07 and 32.66, respectively) revealed that this difference was not statistically significant, $p = .135$. Thus, respondents provided with additional information about the

[34] The model can also be thought of as an ANCOVA with a two-way interaction term specified between the fixed effect (i.e., Message Topic) and one of the covariates (i.e., relative GG salience).

Table 5.12

Hierarchical Multiple Regression Analyses Predicting Attitudinal Ambivalence and Decisional Conflict by Message Topic, Relative Greater-Good salience, and Interaction Terms

	Attitudinal ambivalence				Decisional conflict			
Predictor	*B*	*SE*	β	95% CI	*B*	*SE*	β	95% CI
Constant	5.17***	0.16		[4.86, 5.48]	38.51***	1.08		[36.39, 40.64]
Message topic[a]								
Instrumentalist-targeted	−0.32	0.21	−.05	[−0.74, 0.10]	−3.86**	1.44	−.09	[−6.69, −1.02]
Altruist-targeted	−0.35	0.21	−.05	[0.07, 0.60]	−5.75***	1.46	−.13	[−8.62, −2.89]
Relative GG salience	−0.21**	0.08	−.12	[−0.36, −0.06]	−2.08***	0.54	−.17	[−3.13, −1.03]
Dual salience	−0.17	0.10	−.04	[−0.36, 0.03]	−2.37***	0.68	−.09	[−3.69, −1.05]
Instrumentalist-targeted × Relative GG salience	−0.08	0.11	−.03	[−0.29, 0.14]	0.79	0.74	.04	[−0.65, 2.23]
Altruist-targeted × Relative GG salience	−0.03	0.11	−.01	[−0.24, 0.19]	0.00	0.75	.00	[−1.47, 1.47]
Total R^2	.02				.04			
Total *F*	5.49***				9.26***			
N	1,569				1,926			

Note. $N = 1{,}577$. CI = confidence interval. The analyses were conducted as hierarchical multiple regressions. Estimates from the final models are presented here. When relevant, change statistics of individual steps are reported in the text. The decisional conflict scale ranged from 0 to 100. Attitudinal ambivalence was measured on a 12-point scale, ranging from 0 to 11.

$^{\dagger}p < .06$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

[a] = Reference category is the no-message control group.

SEQOME Project—regardless of its specific content—experienced less decisional conflict. A main effect of relative GG salience on decisional conflict was also observed, $\Delta R^2 = .02$, $\Delta F(1, 1519) = 32.54$, $p < .001$. All else being equal, decisional conflict decreased as relative GG salience increased, $\beta = -.17$, $p < .001$. Overall, this model explained only about 4% of the variance in decisional conflict.

Conclusion

In Study 2, I examined the moderating effect of belief salience on causal pathways linking messages about participating in the *SEQOME Project* to beliefs, attitudes, and intentions to participate. Study 2 was designed to change beliefs about participating in a hypothetical whole genome sequencing research project (i.e., the *SEQOME Project*). The targeted beliefs were chosen because they had been identified as being especially important to one of two different audience segments. Each of these audience segments had been shown in Study 1 to have different motivations for participating in genetics research. In this case, these motivations were manifest as beliefs about participating that were uniquely salient to one of the identified segments, but not the other. According to the RAM, changes in the belief strength of these uniquely salient beliefs were expected to impact attitude and intention differently, depending on audience segment. By extension, this proposition implies that matching message content to the salient beliefs underlying peoples' decisions is a good strategy for fostering informed consent. A caveat derived from MPT was also explored. If messages generate temporary increases in belief salience, then matching content to audience segments would be less beneficial—at least in the short term. No evidence was found to support predictions derived from MPT regarding the effects of message-exposure on belief salience.

Results from Study 2 provide a nuanced view of the conditional effects of belief salience. For example, there was evidence that salience *reduced* the amount of belief change produced by a message; however, this was only found for the message targeting expectations about receiving personal feedback (i.e., the instrumentalist-targeted message). On the other hand, belief salience *increased* the impact of GG and PF behavioral beliefs on attitudes and intentions to participate. Taken together, the overall impact of the instrumentalist-targeted message on attitude and intention was greatest when GG and PF outcomes were both salient to some degree. This finding is interesting from an informed-consent strategy perspective. Salient beliefs were stronger determinants of attitudes and intentions to participate in the *SEQOME Project* than were nonsalient beliefs. Because salient beliefs have a greater impact on participation decisions, salient beliefs represent material information that should be given disclosure priority (Fischhoff, 2011). This is especially true when salient beliefs are factually incorrect. For example, most of the respondents in Study 2 expected to receive some form of personal genetic-risk or health information by participating in the *SEQOME Project*. This expectation was false, given that the *SEQOME Project* was defined as a study that would not return any research results. Lowering expectations about receiving personal feedback would be an important goal of disclosure, especially among respondents for whom those expectations were salient. At the same time, this study provided evidence that changing salient expectations or beliefs is more difficult than changing nonsalient beliefs. Thus, at least sometimes, the beliefs that need to be changed the most are also the least amenable to change.

CHAPTER SIX: DISCUSSION

In this dissertation, I examined public expectations about participating in research involving whole genome sequencing and broad sharing of personal genomic information. I tested several hypotheses related to content matching and message customization in an effort to clarify how the cognitive mechanisms underlying participation decisions might be leveraged to better meet disclosure obligations. Drawing on the reasoned action model (RAM; see Fishbein & Ajzen, 2010), I argued that efforts to support informed consent require a descriptive understanding of the beliefs upon which people base their decisions. The RAM postulates that most action is driven by a limited number of cognitive factors. Ultimately, behaviors that are under volitional control are determined by salient beliefs—those outcomes that readily come to mind when a person thinks about performing the behavior. From this it follows that effective informed consent procedures would prioritize information based on its correspondence to those salient beliefs. In other words, once salient beliefs about participating in a research project have been identified, a major goal of a consent disclosure is to ensure that the expectations expressed in those beliefs are accurate or true.

Moreover, I have suggested that identifying qualitative differences in the content of beliefs underlying people's decisions to participate in genomic research could prove valuable for delivering customized disclosure materials. In as much as the changeable, subjective factors influencing behavior differ from person to person, meeting the informational needs of a diverse population might require a targeted or tailored approach to informed consent. With this in mind, I explored the feasibility of taking a bottom-up approach to define meaningful audience segments. Using theory-based belief-elicitation procedures, the personally salient beliefs of a large sample of potential research participants were identified. In Study 1, I employed a data-driven approach to

define audience segments that differed with respect to their underlying motivations for participating. The input for this segmentation analysis drew on responses to an open-ended belief elicitation procedure. In Study 2, the open-ended procedure was replaced with a dimensional-salience task. Respondents were presented with a list of commonly mentioned outcomes and asked to select those that were most important to their participation decisions.

All respondents were also asked to complete a set of closed-ended belief strength and outcome evaluation items. Many of these items directly referred to outcomes frequently mentioned in the open-ended elicitation or selected in the list-based task. The amount of differentiation and communality between the identified audience segments was assessed using qualitative and quantitative criteria. Expanding on the expectancy-value principle,[35] messages targeted to address the *unique* behavioral beliefs of distinct audience segments were expected to influence behavior more than messages aimed at the general population (Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975, 2010; Hobbis & Sutton, 2005). The implications of media priming theory (MPT; e.g., Cappella et al., 2000) with respect to changes in belief salience resulting from message exposure and for defining an audience's informational needs based on prior observation were also examined.

In this final chapter, I review the major findings of this dissertation. I also discuss the implications of these findings for theory and practice in the domains of human genomics and health communication. The chapter concludes with a review of limitations and implications for future research and practice.

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[35] Eagly & Chaiken (1993) describe the expectancy-value principle as the notion that message content or arguments must address the primary beliefs that serve as the basis of whichever variable the message is meant to influence.

Summary of Findings

Study 1

Study 1 drew on a content analysis of responses to an open-ended belief elicitation procedure. A major advantage of the open-ended procedure is that it allowed respondents to spontaneously generate consequences they thought would result from participating in a genetic research study. The use of a free association task supported the aim of eliciting outcomes that were truly top-of-mind to respondents, and thus likely to represent the primary beliefs that influence behavior. Data derived from the elicitation was then used to divide a general-population sample into distinct audience segments. The aim of the segmentation was to classify respondents into groups, so as to maximize within group similarities regarding salient beliefs while also maximizing between group differences. Cluster analysis revealed four groups of participants. Two of these groups comprised approximately two-thirds of the overall sample, were roughly proportionate in size, and displayed qualitative differences in the perceived consequences of participating in a genetic research study that came readily to mind. Because the qualitative differences between these two groups were demonstrable, they became the focus of subsequent analyses.

The distinguishing characteristic of the first group (viz., altruists) was that its members listed outcomes related to helping others, contributing to science and to medicine with great frequency in the open-ended elicitation. Additional concerns that were uniquely salient for this group based on qualitative criteria were that participating would be inconvenient and might cause physical pain (e.g., because a blood sample would be drawn). People in the second group (viz., instrumentalists), on the other hand, were more likely to mention outcomes related to receiving information about their personal genetic risk, health status, and prevention or treatment of disease. This group

was also unique with respect to the frequency that concerns about feeling worried and that participating might lead to the discovery of something that they would rather not know. The groups also displayed some qualitative similarities. Substantial numbers of respondents in both groups expressed concerns about privacy, that their genetic information or biological samples might be misused by researchers, and that participating would be time consuming. All of the outcomes described here were classified as modally salient for one or both groups based on the decision rules defined by Ajzen and Fishbein (1980). The emergence of groups with qualitative differences in the prominence of concerns about contributing to the greater good and receiving research results is consistent with findings of prior research that examined people's motivations for participating in large-scale genome sequencing research (Facio et al., 2011).

To further verify that the altruist and instrumentalist segments had different underlying motivations to participate in a genetic research study, I tested whether the belief strength of outcomes that were uniquely salient to those groups were more strongly related to attitude and intention among its members. Two Likert-type belief-strength measures referred to the uniquely salient outcomes of the two segments. All respondents were asked to rate how strongly they agreed or disagreed that participating in a genetics research study would help scientists develop treatments for disease. This item matched one of the elicitation themes mentioned by a large number of people in the altruist segment but less so among the instrumentalists. All respondents were also asked to rate how strongly they agreed that participating would give them access to their own genetic health risk information. This item corresponded with a belief that was mentioned much more frequently by the instrumentalists than it was by the altruists.

According to the RAM, salient behavioral beliefs (i.e., belief strength × outcome evaluation product terms) are expected to have a greater impact on attitude and, indirectly, intention than nonsalient beliefs. Using audience segment as an operational proxy of salience, it was predicted that audience segment would moderate the association of behavioral beliefs with attitude and intentions. Specifically, expectations about helping scientists develop treatments for disease were uniquely salient for altruists, and were more strongly associated with attitude and intention among altruists than among instrumentalists. Likewise, beliefs that participating would provide personalized feedback about one's genetic risk were more strongly associated with attitude and intention among instrumentalists. The results of Study 1 were fully in line with the hypothesized conditional effect of belief salience on belief–attitude and belief–intention relationships in the context of participating in large-cohort genetic research. Further, Study 1 established that audience segments defined using a data-driven clustering procedure drawing on open-ended belief elicitation results could serve as useful proxies of belief salience. Ultimately, the results meet a descriptive precondition for matching message content to the informational needs of distinct audience segments.

Study 2

To further test how the impact of behavioral beliefs on attitude and intention is moderated by belief salience, an experimental approach was taken in Study 2. Although correlational evidence supporting the hypothesis that salient beliefs are more strongly related to attitudes and intentions than nonsalient beliefs was found in Study 1, such analyses are incapable of distinguishing beliefs that contribute to the formation of attitudes and intention from those that are merely associated but not causally antecedent to them (see Fishbein, 1967; Tourangeau & Rasinski, 1988). For this experiment, I developed two messages. One was designed to address beliefs that were uniquely salient

for people in the altruist segment. The other was designed to address beliefs that were uniquely salient for the instrumentalists. Participating in a hypothetical, whole genome sequencing study called the *SEQOME Project* was the target behavior in Study 2. A central aim of the analyses was to assess how exposure to the audience-segment targeted messages would affect changes in belief strength, attitude and intention. Critically, the study was designed to assess whether respondents who received content more closely matched to their salient beliefs would be more affected by the messages.

Hypothesis 1a and 1b derived from a single conceptual model for the effects of message exposure on belief strength (see Jaccard, 1981). Belief salience was expected to moderate the impact of message appeals on changes in belief strength. Message appeals targeting salient beliefs were predicted to result in less belief change than appeals targeting nonsalient beliefs. Taken together, the tests of H1a and H1b lend only partial support for the conceptual model.

No evidence was found for the specific interaction effect predicted in H1a. Salience of greater-good (GG) beliefs did not moderate the influence of the altruist-targeted message on GG belief strength. Nevertheless, there is reason to suspect that a ceiling effect may have been at play. For example, the intercept of the model predicting GG belief strength was 5.91 on a scale ranging from 1 to 7. In other words, the weighted average GG belief strength in the no-message control group was very close to the maximum value of that variable. This characteristic of the study sample left very little room for improvement. The altruist-targeted message was designed to increase GG belief strength. When the vast majority of people in a sample already strongly agree with a proposition, persuading them to agree even more strongly with it may not be possible. In effect, the opportunity to detect differences in GG belief strength was likely hindered. In this regard, the position taken by the message was constrained by the study context.

Investigators conducting human-subjects research are required to disclose the anticipated benefit of a study. Typically, the benefits of a research study apply to society at large or the progression of knowledge. In that sense, it would be unrealistic for a consent disclosure to explicitly disconfirm that a study will contribute to the greater good.

The conceptual model underpinning Hypothesis 1b established that belief salience would moderate the association between the instrumentalist-targeted message and personal-feedback (PF) belief strength. Whereas the altruist-targeted message was designed to affirm GG beliefs, the instrumentalist-targeted message explicitly denied that participating in the *SEQOME Project* would yield PF outcomes. Based on a moderation analysis, the interaction effect predicted in H1b was supported. The instrumentalist-targeted message reduced PF belief strength more as relative GG salience increased. This interaction effect was observed regardless of whether the no-message control or altruist-targeted message was used as the reference group. However, by explaining about 1% additional variance in PF belief strength, one might reasonably question the practical significance of this tiny effect, at least in this context.

Results from both studies supported the existence of a moderating influence of belief salience on the association of behavioral beliefs with attitudes and intentions to participate in genetic and genomic research. In Study 1, for example, expectations that participating would contribute to science were more strongly related to attitudes and intentions among respondents for whom that belief was salient versus nonsalient. In Study 2, two versions of this hypothesis were tested. The version based on an account of belief salience derived from the RAM suggested that behavioral beliefs (i.e., belief-evaluation products) would have a stronger positive impact on attitude and intention when those beliefs are salient. The competing version derived from MPT took into

consideration the possibility that message exposure could increase belief salience. Thus, the positive impact of behavioral beliefs on attitude and intention was expected to be more pronounced following exposure to a message addressing those beliefs.

The direct and indirect conditional effects predicted in the RAM-based version of Hypothesis 2 were supported while the competing predictions derived from the MPT account were not. As originally proposed, the audience segment variable was meant to capture this notion of salience. GG beliefs were supposed to be uniquely salient for altruists and PF beliefs were supposed to be uniquely salient for instrumentalists. However, because the audience segments identified in Study 1 did not generalize to the Study 2 sample, the relative GG salience operationalization was used instead. This operational change and its contributing factors had two obvious implications for the statistical power to detect hypothesized interaction effects (see Aguinis & Gottfredson, 2010; McClelland & Judd, 1993). First, compared to the open-ended belief elicitation procedure, the dimensional-salience task used in Study 2 appears to have been a less reliable means of eliciting top-of-mind consequences of participating in genomic research. Measurement error reduces statistical power to detect interaction effects. Second, relative GG salience was an interval-level variable with an approximately normal distribution. Regression coefficient estimates of product terms derived from two interval-level variables tend to have larger standard errors than product terms derived from one or more dichotomous variables, all else being equal. Inflated standard errors reduce the size of the *t* statistic, and thus also reduce power. Despite these drawbacks, relative GG salience was still better aligned with the methodological assumptions of Study 2 than were any of the alternative segmentation strategies explored in Appendix C.

In $H2_{RAM}$, I predicted that the association of GG and PF behavioral beliefs with attitude and intention would be moderated by belief salience, as measured prior to

message exposure. Consistent with $H2_{RAM}$, results from moderation analyses indicated that the positive association of PF behavioral beliefs with attitude and intention became stronger as relative GG salience decreased (i.e., PF beliefs were more salient). Likewise, the association of GG behavioral beliefs with attitude and intention became stronger as relative GG salience increased.

No evidence was obtained to support the predictions derived from media priming theory (i.e., $H2_{MPT}$). From the MPT perspective, message exposure was expected to influence belief salience, such that GG outcomes would become temporarily more salient following exposure to the altruist-targeted message and PF outcomes would be more salient in response to the instrumentalist-targeted message. Were such message-based increases in salience to occur, it was expected that stronger associations between message-targeted behavioral beliefs with attitude and intention would have been observed. In effect, GG behavioral beliefs would have a greater impact on attitude and intention for respondents assigned to the altruist-targeted message and PF behavioral beliefs would have a greater impact among respondents assigned to the instrumentalist-targeted message condition. For the most part, the interaction terms designed to test this hypothesis were not significant. The one exception was a regression coefficient for a direct conditional effect of PF behavioral beliefs on intention by instrumentalist-message topic. However, rather than strengthen the impact of PF beliefs on intention, the sign of this coefficient indicated that exposure to the instrumentalist-targeted message weakened this relationship.

When interpreting these results, it should be kept in mind that priming effects are a function of both the recency and intensity of the prime (Roscos-Ewoldsen et al., 2008; Kim, Mello, Lee, & Cappella, 2012). Whereas recency refers to the brevity of the time lag between the prime stimulus and assessment of the target object, intensity refers

to the frequency and duration of the prime. High-intensity, recent primes produce larger priming effects. In this study, respondents were exposed only once to the altruist- or instrumentalist-targeted message (i.e., low frequency). Thus, the intensity of these messages as prime stimuli may have been too low to produce discernible effects.

In the two versions of Hypothesis 3, the impact of the instrumentalist-targeted message on attitude and intention through PF behavioral beliefs was examined. An underlying assumption of both hypotheses was that the instrumentalist-targeted message would indirectly affect attitudes and intentions through changes in PF belief strength. According to the RAM-based version, I predicted an Audience Segment by Message Topic interaction effect, such that instrumentalists receiving the instrumentalist-targeted message were expected to have the least favorable attitudes and weakest intentions. From the MPT perspective, the weakest attitudes and intentions were expected among respondents who viewed the instrumentalist-targeted message regardless of audience segment. Neither hypothesis, as stated, was supported; however, the results are more consistent with the RAM-based hypothesis than the MPT-based hypothesis.

With increased salience of PF beliefs, PF behavioral beliefs were a stronger determinant of attitude and intention *but were also more difficult to change.* As a result, the instrumentalist-targeted message had the greatest impact on the attitudes and intentions of people for whom GG and PF beliefs were both salient to some degree. The failure of the data to support the stated hypothesis does not reflect an inconsistency with the underlying conceptual model, but rather a flaw in my logic deriving $H3_{RAM}$ from that model. Specifically, I did not place proper weight on the moderating effect of belief salience with respect to the association between the instrumentalist-targeted message and PF belief strength. Instead, I over-emphasized the weighted-average effect of that

message. On average, the instrumentalist-targeted message had a simple effect on PF belief strength, such that it significantly weakened PF beliefs. However, the effect of the instrumentalist-targeted message on the PF belief strength was also moderated by belief salience. Exposure to the instrumentalist-targeted message weakened PF beliefs to a greater extent as relative GG salience increased. Belief salience also moderated the impact of PF behavioral beliefs on attitude and intention, but in the opposite direction. When expectations about receiving individual research results or treatment recommendations were more salient, those beliefs had a greater impact on attitude and, indirectly, intention. Combined, the opposing moderating effects of PF belief salience on these two pathways clearly suggest that a curvilinear indirect effect of the instrumentalist-targeted message should have been expected.

Lastly, the effects of receiving additional information and belief salience on attitudinal ambivalence and decisional conflict were explored. Attitudinal ambivalence decreased slightly as relative GG salience increased. Receiving additional information about the *SEQOME Project* in the form of the altruist- or instrumentalist-targeted messages did not affect attitudinal ambivalence. A main effect of Message Topic on decisional conflict was observed, such that decisional conflict was reduced following exposure to the altruist- and instrumentalist-targeted messages. The match between message content and the audience's salient beliefs did not have an appreciable influence on decisional conflict beyond the main effect of receiving additional information about the project.

Theoretical and Practical Implications

The findings reported in this dissertation affirm a major theoretical proposition of the RAM that has received limited support in past research. Conceptually, salient behavioral beliefs are expected to be more strongly related to attitude and intention than

nonsalient behavioral beliefs (Hackman & Anderson, 1968; Kaplan & Fishbein, 1969; see also Towriss, 1984 as cited in Rutter & Bunce, 1989). A number of past studies have tested some variation of this hypothesis (Agnew, 1998; Eagly & Mladinic, 1989; Hackman & Anderson, 1968; Kaplan & Fishbein, 1969; O'Sullivan, McGee, & Keegan, 2008; Rutter & Bunce, 1989; Steadman, Rutter, & Field, 2002; Thomas & Tuck, 1975; van der Pligt et al., 2000). A common element of these studies is that they compared correlations between direct measures of attitude and two or more composite belief indices made up of beliefs representing specific levels of belief salience (e.g., personally salient indices, modally salient indices, or nonsalient indices). With the exception of Agnew (1998), no significant differences in the strength of these associations were observed. Overall, indirect measures of RAM constructs (e.g., attitudes, norms, perceived behavioral control) based on personally derived beliefs have criterion-oriented validity that is, at best, as good as that achieved by modal indices. Rather than examine the conditional effects of belief salience on the correlation between a belief composite and attitude, this dissertation found evidence that salience moderates the association of specific belief items with attitude and intention.

From a practical perspective, this moderating effect of belief salience may open up additional approaches for selecting message content. Reliable data respecting the beliefs that are salient for particular audience segments or specific individuals could be used to determine which beliefs are likely to have the greatest impact on their decisions and behavior (see Jaccard, 2012). This would be a departure from most typical applications of the RAM, which assume the causal weights of belief-based and other model predictors are homogenous for the target audience. In order to achieve this, it will be necessary to translate the belief elicitation procedure—which is typically treated as a

qualitative (and frequently overlooked) step of formative research leading to message development—into a critical and automated component of interventions.

The results of Study 2 also have implications for theories of belief change. The motivation behind testing for conditional effects of belief salience on yielding to message claims was based on a conceptual account of belief change that emphasizes the role of discrepancy and confidence in prior judgments as important causal variables (Jaccard, 1981). Empirical evidence from prior research demonstrating that belief salience was related to discrepancy and confidence served as the logical bridge connecting salience to belief change. Although the findings were partially in line with the hypotheses, the proposed causal pathway was not directly tested. Because confidence was not directly measured, the observed conditional effect of belief salience may not have had anything to do with confidence. Evoking a previously observed correlation between belief salience and confidence does not establish how or whether those constructs are actually related.

Although the size of the conditional effect of belief salience on the association between the instrumentalist-targeted message and PF belief strength was very small if judged by the conventional thresholds established by Jacob Cohen (1988), disregarding the effect on that basis alone would be a mistake. First, when considered in the context of moderator effects in the social sciences, the observed effect warrants further consideration. Moderator effects observed in social science studies typically account for less than 1% of the variance in the dependent variable (Aguinis, Beaty, Boik, & Pierce, 2005; Aiken & West, 1991; Champoux & Peters, 1987; Chaplin, 1991; M. G. Evans, 1985; McClelland & Judd, 1993). In light of this, Kenny (2011) has suggested that when testing for moderation effects, a more realistic standard for interpreting effect size estimates (viz. f^2) would be *small* = 0.005, *medium* = 0.010, and *large* = 0.025. Given those thresholds, the observed moderator effects in both studies may be considered medium-

sized—despite being very small in general terms. Given the difficulty of detecting moderator effects, M. G. Evans (1985) argued that an interaction explaining as little as 1% of the total variance should still be considered important, especially when its theoretical implications are understood. More importantly, the interaction of belief salience with the instrumentalist-targeted message contributed to an interesting moderated mediation effect on attitude and intention.

If considered in terms of content matching as a communication strategy, this moderated mediation effect presents an interesting conundrum. According to the expectancy-value principle, the salient beliefs underlying a behavior or decision are reasonable targets for communication interventions. If the communicator succeeds in changing those beliefs, then the message is more likely to influence action. However, the findings from Study 2 suggest that, at least under some circumstances, beliefs that are more salient may also be more difficult to change. For example, the instrumentalist-targeted message reduced PF belief strength to a lesser extent at lower levels of relative GG salience (i.e., a greater number of PF outcomes were nominated as salient than GG outcomes). The combined effect of these conditional effects of belief salience conflict with one another; it is more difficult to dispel misconceptions that actually drive behavior than it is to dispel misconceptions that are unrelated to it.

That said, I do not want to overstate the practical implications of the observed interaction effects of belief salience as they relate to developing audience-targeted informed consent procedures for large-scale genomic research. Although two discernible audience segments were identified in Study 1, the extent to which they differed from one another appears to have been somewhat overestimated. Based on the qualitative analysis of frequently mentioned belief elicitation themes in the altruist and instrumentalist segments, each group appeared to hold six uniquely salient beliefs while

only three beliefs were salient to both groups. The analysis of belief strength ratings of those outcomes in Study 2 revealed that many of the uniquely salient beliefs were redundant. For example, beliefs about contributing to science shared a great deal of variance with beliefs about advancing medicine, contributing to knowledge, and helping others. Likewise, beliefs about receiving information about personal genetic risk covaried to a considerable degree with beliefs about learning about current health, treatment and prevention. Although all of these outcomes were assigned separate themes in the content analysis, these qualitative distinctions did not carry over into the correlational analyses. In that sense, each segment differed on fewer behaviorally-relevant beliefs than initially supposed. Because attitudes and intentions are driven by the entire constellation of salient beliefs about participating, these differences may not be great enough to warrant adopting an audience-targeted consent disclosure strategy.

On the other hand, variation in the specific consequences comprising the GG and PF themes might instead suggest that still greater individualization in this domain is justified. The open-ended belief elicitation procedure appears to have been particularly useful for determining which beliefs were most important to the participation decisions of individual respondents. Acknowledging subtle differences in thematically-similar elicited consequences may be important for addressing prospective genomic research participants' specific needs and concerns about participating.

For example, people's expectations about being provided with personal genetic risk information tended to covary strongly with their beliefs about receiving information that would help them make medical treatment decisions. The correlation between these two belief-strength measures could indicate how people view genomic information. Personal genetic risk information might have been perceived as a kind of information that is useful for making medical treatment decisions. If that were the case, a plausible

explanation for the shared variance between these two measures might be that participants understood them to be slightly different ways of saying that genomic research participation will provide medically useful information. Alternatively, the correlation could mean that people have proportionate expectations about receiving personal genetic risk information as well as additional information that is useful for making treatment decisions. In that case, treating the two beliefs as though they were interchangeable would be unjustified. A closer analysis of belief elicitation responses (esp. those using the traditional, open-ended method) might provide insight on this issue. If respondents tend to report one or the other thematically similar outcome but not both, it is less likely that those outcomes are perceived to be distinct (Fishbein & Ajzen, 2010).

Regardless, the results have important implications for prioritizing the content of information featured in informed consent procedures. Instead of identifying distinct audience segments with different informational needs with respect to participating, the basic procedure that I've been discussing could still be useful for matching message content to the modally salient beliefs of the general population. The analyses in Study 1 and 2 that focus on the relationships of behavioral beliefs with attitude and intention revealed seven perceived consequences of participating in genetic and genomic research that have the greatest influence on participation decisions, generally: (i) Beliefs about contributing to the greater-good, (ii) expectations related to receiving individual research results or other feedback, (iii) concerns about privacy, (iv) uncertainty that researchers will use DNA samples in ways that are consistent with the subject's personal values, (v) concerns that participating will cause worry, (vi) beliefs related to feeling physical pain (e.g., from having blood drawn), and (vii) beliefs that research participation will be time consuming. The regulatory guidelines for informed consent already dictate that

researchers are required to address all of these beliefs in one form or another. As was explained in Chapter 2, the guidelines also require that several other categories of information be disclosed. Because information related to the seven consequences listed here are more likely to reflect the informational needs of potential research participants, strategies to prioritize facts related to those consequences should be explored. I want to emphasize that prioritizing does not imply excluding other forms of information. Rather, the goal is to improve the accessibility and comprehensibility of information that is most likely to be material to people's decisions (see Fischhoff, 2011).

For instance, on average, respondents to both of the surveys conducted for this dissertation expected to receive personal feedback related to their genetic health risk as part of participating in hypothetical genetic and genomic research studies. In Study 2, I also assessed expectations about receiving individual research results pertaining to current health, treatment and disease prevention. As with expectations about receiving genetic risk information, respondents also assumed that these kinds of information would be returned. This is consistent with a common finding reported in the literature. Many potential participants of genetic and genomic research studies expect to receive individual research results as a condition of enrollment (Kaufman et al., 2008; Meulenkamp et al., 2010; Murphy Bollinger, Scott, Dvoskin, & Kaufman, 2012; Murphy, Scott, Kaufman, Geller, LeRoy, & Hudson, 2008; Nobile et al., 2013; O'Daniel & Haga, 2011). For example, Kaufman et al. (2008) conducted a population-based survey of US adults to assess public support for a large cohort study proposed in 2004 by NHGRI. The study would aim to recruit a nationally representative sample of at least 500,000 people who would agree to provide DNA samples and extensive information about their health and environment over many years. Overall, the percentage of respondents who said they definitely or probably would participate increased from 55% to 65% when told

that individual results would be returned. This result corroborated self-reported importance of individual research results on participation decisions; 75% of respondents said they would be less likely to participate if individual research results were not made available to them.

In the background information of studies conducted for this dissertation, no indication that results would be returned was given. When considered in relation to the pervasiveness of these expectations in other samples and settings, it appears that many people presume that individual research results will be returned in exchange for participation in genetic and genomic research. Moreover, in this dissertation, expectations about receiving individual research results were associated with attitudes toward participating and intentions to participate. Again, this finding is consistent with those of Kaufman et al. (2008). Traditionally, individual research results from genetic and genomic research studies have not been returned to participants. In fact, it remains a subject of ongoing debate whether, how and to what extent individual research results should be returned to participants (A. L. McGuire & Lupski, 2010; Wolf, 2012). Because these beliefs are material to a large number of potential research participants, in as much as expectations about receiving individual research results are inaccurate, it is important that the informed consent process dispel those misconceptions.

Effectively doing so may require a more detailed account of what potential and actual research participants expect to receive. In this dissertation, salient consequences directly related to return of results were combined into fairly broad themes (i.e., genetic risk information, treatment-related information, etc.). Naturally, individual respondents may have had still more specific kinds of results in mind, falling into those general categories (e.g., genetic information about my risk for Alzheimer's disease but not for diabetes). They might also have implicit expectations about how that risk information

would be delivered to them, or about how much control they would have to seek out specific results while ignoring others. If those expectations can reasonably be met without impeding scientific progress, it may be worthwhile for genomics researcher to offer some form of feedback. However, as J. P. Evans and Rothschild (2012) point out, just because a majority of potential research subjects expect to receive a given benefit in exchange for their participation does not obligate researchers or the scientific enterprise to meet those expectations.

Limitations and Conclusion

As with any research, this study also had several limitations. First, the target behavior examined in Study 1 was not identical to the focal behavior in Study 2. Although this is a clear violation of the principle of correspondence (Fishbein & Ajzen, 2010), the general public does not appear at this time to draw category distinctions between various forms of targeted genetic research studies, large-cohort biobanks, and whole-genome sequencing research. To bolster this assumption, the relevance of the advantages and disadvantages elicited in the gPOD study were corroborated by research that examined the motivations behind participating in ClinSeq™, a whole-genome clinical sequencing study being conducted at the NIH (Biesecker et al., 2009). In particular, Facio et al. (2011) asked a subsample (N = 322) of the ClinSeq™ cohort to report their "reasons for wanting to participate in [ClinSeq™]?" Responses to this question were then submitted to a content analysis to identify common themes in much the same way that Fishbein & Ajzen (2010) recommend analyzing belief elicitation responses. Similarity in the themes generated in response to the gPOD elicitation items and those observed by Facio et al. (2011) were interpreted as evidence that the modally salient behavioral outcomes of "volunteering to take a genetic test as part of a research

study sometime in the next 12 months" would be largely the same as those related to participating in a whole-genome sequencing study.

A second limitation was the questionable validity of the dimensional salience task as a method of identifying personally salient beliefs in Study 2. The decision to use the dimensional salience task was based primarily on the assumption that it would be less demanding for respondents, and would thus lead to reductions in non-response bias. Another important consideration was that the dimensional salience task would remove the need to conduct a content analysis of a large number of open-ended elicitation responses. This second consideration also made the dimensional salience task more appealing from an applied perspective in that it could easily be integrated as part of an automated message tailoring system.

However, large discrepancies between the major themes elicited in Study 1 compared to the frequencies of outcomes nominated in Study 2 suggest that the dimensional salience task introduced response bias. Generally, the proportion of respondents who selected items related to greater-good themes and personal-feedback themes was generally much greater in Study 2 than it was in Study 1. These discrepancies may in part reflect differences in the populations from which the samples were drawn (e.g., which were primarily differentiated by time and specific behavioral context). The most likely explanation, though, rests with differences between the elicitation and dimensional salience tasks. Notably, the latter required that all respondents nominate exactly 5 items from a list of 20 options, while the former allowed between 1 and 4 responses drawn from the respondent's imagination. Rather than choose items because they were truly top-of-mind, respondents may have selected items from the dimensional salience task for other reasons (e.g., social desirability, the

perception that the outcome represented a good reason for participating, or order on the list).

A third limitation concerned the restricted variation among respondents with respect to the perceived consequences of participating in the hypothetical genomic research studies that readily came to mind. Although there were sufficient thematic differences within the Study 1 sample to identify distinct subgroups, these groups did not generalize to Study 2. Moreover, it appears that some of the qualitative differences identified in the content analysis did not reflect actual differences in perceived outcomes from the subjects' point-of-view. For example, receiving genetic risk information appears to have been a specific case of a broader category of outcomes, which also included receiving treatment advice and learning about current health. This dissertation is interested in content matching as a strategy for prioritizing information disclosed to foster informed decisions about participating in large-scale genomic research. Thus, striking a balance between the internal and external validity of the methods used was necessary. The theoretical framework guiding this research established that salient behavioral beliefs have a conceptually important status with respect to attitudes, intentions and behavior. My approach was to identify the knowledge-based salient beliefs that would likely influence decisions to participate, and then attempt to define subgroups of the population based on differences in those beliefs. Both studies drew on demographically representative population-based samples of U.S. adults. Nonetheless, the amount of observed variance in the population regarding salient beliefs, and the content of those beliefs, was not subject to my control.

Despite limited differences in belief salience, evidence to support many of the hypothesized conditional relationships was found. As has already been discussed, these effects tended to be quite small. Conceivably, had there been greater differences in

salience over a greater number of perceived consequences of participating in the hypothetical research projects, these effects might have been larger. In other words, restricted variance might have weakened the effects in this context. Descriptively, that does little to alter the practical implications of the findings as they relate to informed consent procedures in the domain of large-scale genomic research. Theoretically, though, it leaves open the possibility that in other behavioral contexts and populations where there is a great deal of variation in the salient beliefs that people hold, content matching and audience segmentation strategies like that explored here may prove more effective.

To yield medically useful information, data from personal genome profiles need to be coupled with clinical information about disease, and compared to genomic sequence data from many other people. Continued advancement of genomic medicine and related fields will depend on large numbers of willing research participants. In addition to agreeing to have their DNA sequenced and personal genome profiles generated, participants will also need to be willing to share detailed medical, socio-psychological and behavioral data (President's Commission, 2012). To help ensure that the benefits of genomic science are equitably distributed throughout society, it is important that the pool of willing participants is diverse and does not systematically exclude anyone; however, there is also an ethical responsibility to ensure that those who participate do so for reasons that are consistent with their own values and preferences. Efforts to select and prioritize the content of consent materials in order to facilitate decisions about participating in genomic research would benefit from a descriptive understanding of the cognitive bases of those decisions. Recognizing that different people may have different reasons for wanting to participate in large-scale genomic

research, this research was able to shed some light on the existence, nature, and impact of these differences.

APPENDIX A:

QUESTIONNAIRE AND PROGRAMMING NOTES

[PROGRAMMING NOTE: Include a 'CASEID' variable in the database that records a unique identification number for each subject, maybe ID# from SSI]

[INSERT A NO BACK PROMPT FOR EVERY SCREEN THROUGHOUT THE SURVEY] [DISPLAY]

You have been invited to participate in a research study.

The purpose of this research study is to examine public opinions on issues related to genetics research. You will be asked to read some information about a genomic research project and complete a survey online (approximately 25 minutes). This research is not designed to benefit you personally. Your participation is voluntary which means you can choose whether or not to participate. You may end your participation in the study at any time.

In some research studies, the investigators cannot tell you exactly what the study is about before you participate in the study. We will describe the tasks in the study in a general way, but we can't explain the real purpose of the study until after you complete these tasks. When you are done, we will explain why we are doing this study, what we are looking at, and any other information you should know about this study. You will also be able to ask any questions you might have about the study's purpose and the tasks you did. Though we may not be able to explain the real purpose of the study until after you complete the tasks, there are no additional risks to those that have been described in this consent form.

If you have any questions about your rights as a research subject, concerns or complaints pertaining to your participation in this study, you may contact the Office of Regulatory Affairs at the University of Pennsylvania by calling (215) 898-2614.

This research has been reviewed according to the IRB procedures of the University of Pennsylvania for research involving human subjects.

By clicking the "accept" button below you are certifying that you freely and voluntarily choose to participate in this research study.

[RADIO BUTTON, CAN SELECT ONLY ONE]

[PROMPT IF SKIPPED: "This question requires an answer. Please make a selection before continuing."]

SQ_1. I have read the consent form and agree to participate in this research project.

Accept **<1>** ○
Decline **<2>** ○

[DISPLAY IF SQ_1=2 OR REFUSED]

We accept your refusal to participate in this project. Thank you.

[TERMINATE IF SQ_1=2 OR REFUSED]
[CONTINUE IF SQ_1=1]

[RANDOMLY ASSIGN SUBJECTS INTO THREE GROUPS. RECORD ASSIGNMENT INTO VARIABLE 'XMEDTOP', WHERE
1=Altruist-targeted Message Topic
2=Instrumentalist-targeted Message Topic
3=No-Message Control]

[DISPLAY]

General instructions

Many questions in this survey make use of rating scales with seven places. Please read each statement carefully, and then select the point on the scale that best describes your opinion. Be sure to read each scale closely**.** It may seem that some questions have been repeated. Even so, please respond to every question.

This survey will take approximately 25 minutes to complete. Your responses to these questions will be kept confidential.

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

Background

In this study, we focus on participation in a research study that involves whole-genome sequencing. Whole-genome sequencing is a technology that allows us to analyze (or sequence) almost all of the genome from a single person. The human genome is the material in our cells that includes thousands of genes. Genes carry the instructions that your body needs to develop and function. Genome sequencing allows us to find gene alterations, which are also known as "gene variants." These gene variants may be important to your health or the health of your relatives.

One project, called the *SEQOME Project*, plans to collect DNA samples from several thousand adults living in the United States. The purpose is to improve the prevention, diagnosis and treatment of illness, and the promotion of health throughout society.

When answering the following questions, imagine that you have been asked to take part in the *SEQOME Project*, a whole-genome sequencing study. There are no right or wrong answers. We are interested in your personal opinions.

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

[PROGRAMMING NOTE: FORMAT ITEMS IN BOX AS SCROLLABLE LIST ON SINGLE SCREEN. MULTIPLE SELECTIONS (EXACTLY 5) CAN BE MADE. RANDOMIZE ORDER OF LIST ITEMS AND RECORD ORDER. RECORD NUMERICAL VALUE OF ITEMS SELECTED IN ORDER THAT THEY APPEAR IN LIST INTO FOLLOWING VARIABLES:
A_1_1
A_1_2
A_1_3
A_1_4
A_1_5]

[PROMPT IF GREATER THAN 5 ITEMS SELECTED: "You may only select 5 items from the list. If you would like to change a selection you have already made, please deselect an item before making a new selection."]

[PROMPT IF LESS THAN 5 ITEMS: "You have selected less than 5 items. Please select exactly 5 items from the list before continuing."]

<Section A. Dimensional Salience Task>

In the space below, there is a menu of advantages and disadvantages that many people think are relevant to participating in whole-genome sequencing studies, like the *SEQOME Project*. Please scroll through the list and select the 5 items that are most important to you for deciding whether to participate in the *SEQOME Project*. We would like you to select exactly 5 items from the list.

☐	**<1>** Contributing to knowledge.
☐	**<2>** Contributing to medical research.
☐	**<3>** Helping advance science.
☐	**<4>** Helping others in the future.
☐	**<5>** Receiving information about my current health.
☐	**<6>** Receiving information about my personal genetic risk for disease.
☐	**<7>** Receiving information about my personal genetic code.
☐	**<8>** Learning information to help me prevent disease.
☐	**<9>** Learning information to help me make treatment decisions.
☐	**<10>** Learning more about my family history of disease.
☐	**<11>** Receiving information that may be helpful to my relatives.
☐	**<12>** Receiving compensation other than money.

☐	**<13>** Doing something that is inconvenient.
☐	**<14>** Having to make time in my busy schedule.
☐	**<15>** Feeling physical pain.
☐	**<16>** Feeling worried.
☐	**<17>** Putting my privacy at risk.
☐	**<18>** Learning something that I cannot do anything about.
☐	**<19>** Learning something that I do not want to know.
☐	**<20>** Losing control over how my DNA samples are used.

<Message Topic Manipulation>

[DISPLAY IF XMEDTOP =1:
"ALTRUIST-TARGETED MESSAGE,
THEN CONTINUE TO SECTION X ON CLICK]

[DISPLAY IF XMEDTOP =2:
"INSTRUMENTALIST-TARGETED MESSAGE,
THEN CONTINUE TO SECTION X ON CLICK]

[IF XMEDTOP =3, CONTINUE DIRECTLY TO SECTION X]

< Section X. Information Quality>

**[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS;
IMMEDIATELY BEFORE 'SECTION B']
[Italicize '*SEQOME Project*']**

The next few questions will ask you to rate the quality of the background information about the *SEQOME Project* that was presented to you.

**[RANDOMIZE ORDER OF QUESTIONS X_1_1 THROUGH X_1_3]
[RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[SET ITEM STEM IN BOLD, '*SEQOME Project*' IN BOLD-ITALICS]
[PROMPT IF ANY X_1 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]**

[X_1_1] I learned enough about the *SEQOME Project* from the information that was presented.

strongly disagree	mainly disagree	somewhat disagree	neither agree nor disagree	somewhat agree	mainly agree	strongly agree
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

[X_1_2] How satisfied would you say you were with the background information about the *SEQOME Project*?

not at all satisfied	hardly satisfied	a little satisfied	moderately satisfied	mainly satisfied	considerably satisfied	completely satisfied
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

[X_1_3] How well do you feel you understood the background information about the *SEQOME Project* that was presented?

not at all understood	hardly understood	a little understood	moderately understood	mainly understood	considerably understood	completely understood
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

< Section B. Reasoned Action Model>
[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

For each of the following questions, please read each statement carefully, and then **select the point on the scale** that best matches your opinion. Be sure to read each scale closely and please respond to every question.

[GRID: RADIO BUTTONS, CAN SELECT ONLY ONE]
[RANDOMIZE AND RECORD ORDER]
[PROMPT IF ANY B_1 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

< Section B.1. Attitude>

For me to participate in the *SEQOME Project* would be:

		extremely <1>	very <2>	somewhat <3>	in-between <4>	somewhat <5>	very <6>	extremely <7>	
[B_1_1]	Bad	○	○	○	○	○	○	○	Good
[B_1_2]	Exciting	○	○	○	○	○	○	○	Boring
[B_1_3]	Disturbing	○	○	○	○	○	○	○	Reassuring
[B_1_4]	Harmful	○	○	○	○	○	○	○	Beneficial
[B_1_5]	Valuable	○	○	○	○	○	○	○	Worthless

[RANDOMIZE ORDER OF QUESTIONS B_2_1 THROUGH B_3_3 AND RECORD ORDER]
[RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY B_2 OR B_3 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

< Section B.2. Behavioral Intention>

[B_2_1] How likely is it that you would volunteer to participate in the *SEQOME Project* if you were asked to take part in it?

extremely unlikely <1>	very unlikely <2>	somewhat unlikely <3>	neither likely nor unlikely <4>	somewhat likely <5>	very likely <6>	extremely likely <7>
○	○	○	○	○	○	○

[B_2_2] I intend to participate in the *SEQOME Project* if I am asked to take part in it.

strongly disagree <1>	mainly disagree <2>	somewhat disagree <3>	neither agree nor disagree <4>	somewhat agree <5>	mainly agree <6>	strongly agree <7>
○	○	○	○	○	○	○

[B_2_3] If I am asked to take part, I plan to participate in the *SEQOME Project*.

strongly disagree	mainly disagree	somewhat disagree	neither agree nor disagree	somewhat agree	mainly agree	strongly agree
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

< Section B.3. Perceived Behavioral Control>

[B_3_1] If I am asked to take part, I am confident that I am able to participate in the *SEQOME Project*.

completely false	mainly false	partly false	neither true nor false	partly true	mainly true	completely true
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

[B_3_2] If I am asked to take part, participating in the *SEQOME Project* is completely up to me.

strongly disagree	mainly disagree	somewhat disagree	neither agree nor disagree	somewhat agree	mainly agree	strongly agree
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

[B_3_3] If I am asked to take part, participating in the *SEQOME Project* is under my control:

not at all under my control	hardly under my control	a little under my control	moderately under my control	mainly under my control	considerably under my control	completely under my control
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

< Section B.4. Perceived Social Pressure>

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

Other people in your life whose opinions you value may have opinions about whether or not you should participate in the *SEQOME Project*. For each of the following questions, please select the point on the scale that best describes *your* point of view.

[RANDOMIZE ORDER OF QUESTIONS B_4_1 THROUGH B_4_3 AND RECORD ORDER]
[RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY B_4 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

[B_4_1] Most people who are important to me would think that I should participate in the *SEQOME Project* if I am asked to take part in it.

completely false	mainly false	partly false	neither true nor false	partly true	mainly true	completely true
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

[B_4_2] Most people whose opinions I value would approve of me participating in the *SEQOME Project* if I am asked to take part in it.

extremely unlikely	very unlikely	somewhat unlikely	neither likely nor unlikely	somewhat likely	very likely	extremely likely
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

[B_4_3] Most people I respect and admire think I should participate in the *SEQOME Project* if I am asked to take part in it.

strongly disagree	mainly disagree	somewhat disagree	neither agree nor disagree	somewhat agree	mainly agree	strongly agree
<1>	**<2>**	**<3>**	**<4>**	**<5>**	**<6>**	**<7>**
○	○	○	○	○	○	○

< Section C. Behavioral Beliefs>

< Section C.1. Outcome Evaluations>

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

Below we have listed some outcomes that experts and people like you consider important when they think about participating in a whole-genome sequencing study, like the *SEQOME Project*.

For each item, please select the point on the scale that best describes your opinion. Once again, there are no right or wrong answers. We are interested in your personal point of view.

[RANDOMIZE ORDER OF QUESTIONS C_1_1 THROUGH C_1_15 AND RECORD ORDER]
[GRID: RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY C_1 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]
[PROGRAMMING NOTE: May want to break-up grids with many questions throughout survey so that there are 5-6 questions per screen? Or at least so that the response scale (i.e., extremely bad – extremely good, etc.) is repeated every 5-6 questions]

		extremely bad <1>	very bad <2>	somewhat bad <3>	neither good nor bad <4>	somewhat good <5>	very good <6>	extremely good <7>
[C_1_1]	Helping others in the future is:	○	○	○	○	○	○	○
[C_1_2]	Helping advance science is:	○	○	○	○	○	○	○
[C_1_3]	Contributing to medical research is:	○	○	○	○	○	○	○
[C_1_4]	Feeling physical pain is:	○	○	○	○	○	○	○
[C_1_5]	For something to be an inconvenience to me is:	○	○	○	○	○	○	○
[C_1_6]	Contributing to knowledge is:	○	○	○	○	○	○	○
[C_1_7]	Receiving information about my personal genetic health risk is:	○	○	○	○	○	○	○
[C_1_8]	Learning something new about my current health is:	○	○	○	○	○	○	○
[C_1_9]	To be told something about my genes that I **do not** want to know is:	○	○	○	○	○	○	○
[C_1_10]	Feeling worried about my health is:	○	○	○	○	○	○	○

		extremely bad <1>	very bad <2>	somewhat bad <3>	neither good nor bad <4>	somewhat good <5>	very good <6>	extremely good <7>
[C_1_11]	Receiving information to help me make medical treatment decisions is:	○	○	○	○	○	○	○
[C_1_12]	Being given information to help me prevent disease is:	○	○	○	○	○	○	○
[C_1_13]	For something to take up a lot of my time is:	○	○	○	○	○	○	○
[C_1_14]	Putting the privacy of my genetic information at risk is:	○	○	○	○	○	○	○
[C_1_15]	Being a part of research that goes against my personal values is:	○	○	○	○	○	○	○

< Section C.2. Belief Strength>

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

We would also like to know how strongly you believe each of the following outcomes will happen if you participate in the *SEQOME Project*. For each item, please select the point on the scale that best describes your opinion.

[RANDOMIZE ORDER OF QUESTIONS C_2_1 THROUGH C_2_15 AND RECORD ORDER]
[GRID: RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY C_2 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

My participation in the *SEQOME Project* will…

		strongly disagree <1>	mainly disagree <2>	somewhat disagree <3>	neither agree nor disagree <4>	somewhat agree <5>	mainly agree <6>	strongly agree <7>
[C_2_1]	Help others in the future.	○	○	○	○	○	○	○
[C_2_2]	Help advance science.	○	○	○	○	○	○	○
[C_2_3]	Contribute to medical research.	○	○	○	○	○	○	○
[C_2_4]	Cause me to feel physical pain.	○	○	○	○	○	○	○
[C_2_5]	Be an inconvenience to me.	○	○	○	○	○	○	○
[C_2_6]	Contribute to knowledge.	○	○	○	○	○	○	○
[C_2_7]	Give me information about my personal genetic health risk.	○	○	○	○	○	○	○

		strongly disagree <1>	mainly disagree <2>	somewhat disagree <3>	neither agree nor disagree <4>	somewhat agree <5>	mainly agree <6>	strongly agree <7>
[C_2_8]	Teach me something new about my current health.	○	○	○	○	○	○	○
[C_2_9]	Tell me something about my genes that I do not want to know.	○	○	○	○	○	○	○
[C_2_10]	Make me feel worried about my health.	○	○	○	○	○	○	○
[C_2_11]	Give me information to help me make medical treatment decisions.	○	○	○	○	○	○	○
[C_2_12]	Provide me with information to help me prevent disease.	○	○	○	○	○	○	○
[C_2_13]	Take up a lot of my time.	○	○	○	○	○	○	○
[C_2_14]	Put the privacy of my genetic information at risk.	○	○	○	○	○	○	○
[C_2_15]	Make me a part of research that goes against my personal values.	○	○	○	○	○	○	○

< Section C.3. Attitudinal Ambivalence>

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

[RANDOMIZE ORDER OF QUESTIONS C_3_1 & C_3_2 AND RECORD ORDER]
[RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY B_3 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

[C_3_1] Considering only the positive qualities of participating in the *SEQOME Project* and ignoring its negative ones, please evaluate your participation on the following scale. For me to participate in the *SEQOME Project* is…

not at all positive	a little positive	moderately positive	mainly positive	completely positive
<1>	**<2>**	**<3>**	**<4>**	**<5>**
○	○	○	○	○

[C_3_2] Considering only the negative qualities of participating in the *SEQOME Project* and ignoring its positive ones, please evaluate your participation on the following scale. For me to participate in the *SEQOME Project* is…

not at all negative	a little negative	moderately negative	mainly negative	completely negative
<1>	**<2>**	**<3>**	**<4>**	**<5>**
○	○	○	○	○

< Section D. Decisional Conflict Scale>

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]
[RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF SKIPPED: "This question requires an answer. Please make a selection before continuing."]

[D_1_1] If you were asked to take part in the *SEQOME Project* and you had to make a decision today, would you choose to participate?

- ○ **<1>** Yes.
- ○ **<2>** No.
- ○ **<3>** Don't know.

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

Now, thinking about the choice you just made, please look at the following comments some people make when deciding to participate in a whole-genome sequencing study, like the *SEQOME Project*. Please show how strongly you agree or disagree with these comments by **filling the circle** that best shows how you feel about the decision you just made.

[RANDOMIZE ORDER OF QUESTIONS D_2_1 THROUGH D_2_16 AND RECORD ORDER]
[GRID: RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY D_2 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

		strongly disagree <1>	somewhat disagree <2>	neither agree nor disagree <3>	somewhat agree <4>	strongly agree <5>
[D_2_1]	When it comes to choosing to participate in the *SEQOME Project*, I know which options are available to me.	○	○	○	○	○
[D_2_2]	I know the benefits of participating in the *SEQOME Project*.	○	○	○	○	○
[D_2_3]	I know the risks of participating in the *SEQOME Project*.	○	○	○	○	○
[D_2_4]	I am clear about which benefits of participating in the *SEQOME Project* matter most to me.	○	○	○	○	○
[D_2_5]	I am clear about which risks of participating in the *SEQOME Project* matter most to me.	○	○	○	○	○
[D_2_6]	I am clear about which is more important to me, the benefits or the risks of participating in the *SEQOME Project*.	○	○	○	○	○
[D_2_7]	I am clear about the best choice for me.	○	○	○	○	○
[D_2_8]	I feel unsure about what to choose.	○	○	○	○	○
[D_2_9]	This decision is hard for me to make.	○	○	○	○	○
[D_2_10]	I have enough support from others to make a choice.	○	○	○	○	○
[D_2_11]	I feel pressure from others in making this decision.	○	○	○	○	○
[D_2_12]	I have enough advice to make a choice.	○	○	○	○	○
[D_2_13]	I feel I have made an informed choice.	○	○	○	○	○
[D_2_14]	My decision shows what is most important to me.	○	○	○	○	○
[D_2_15]	I expect to stick with my decision.	○	○	○	○	○
[D_2_16]	I am satisfied with my decision.	○	○	○	○	○

< Section Y. Genome Sequencing Knowledge >
[DISPLAY ON SEPARATE SCREEN;
IMMEDIATELY AFTER D_2 ITEMS]

The following questions ask about your current understanding of genetics.

[RANDOMIZE ORDER OF QUESTIONS Y_1_1 THROUGH Y_1_6 AND RECORD ORDER]
[GRID: RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY Y_1 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

		strongly disagree <1>	somewhat disagree <2>	neither agree nor disagree <3>	somewhat agree <4>	strongly agree <5>
[Y_1_1]	I am confident in my ability to understand information about genetics.	○	○	○	○	○
[Y_1_2]	It would be easy for me to get information about genetics if I wanted to.	○	○	○	○	○
[Y_1_3]	I would be able to understand information about how genes can affect my health.	○	○	○	○	○
[Y_1_4]	I have a good idea about how genetics may influence risk for disease generally.	○	○	○	○	○
[Y_1_5]	I have a good idea about how my own genetic make-up might affect my risk for disease.	○	○	○	○	○
[Y_1_6]	I would be able to explain to others how genes affect health.	○	○	○	○	○

< Section E. Message Quality>
< Section E.1. Personal Relevance>
< Section E.2. Message Strength>

[IF XMEDTOP =3, SKIP SECTION E AND GO DIRECTLY TO SECTION F]

[DISPLAY IF XMEDTOP =1 OR XMEDTOP =2]

Earlier in this questionnaire, we showed you a fact sheet about participating in a whole-genome sequencing study titled, "Top 5 things you should know about participating in the *SEQOME Project*." We would like to know what you think about that fact sheet.

For each of the following items, please select the point on the scale that best describes your opinion. Once again, there are no right or wrong answers. We are interested in your personal point of view.

[RANDOMIZE ORDER OF QUESTIONS E_1_1 THROUGH E_2_9 AND RECORD ORDER]
[GRID: RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]
[PROMPT IF ANY E_1 OR E_2 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

		strongly disagree <1>	somewhat disagree <2>	neither agree nor disagree <3>	somewhat agree <4>	strongly agree <5>
[E_1_1]	The fact sheet speaks directly to my opinions about participating in the *SEQOME Project*.	○	○	○	○	○
[E_1_2]	The fact sheet was directed to me personally.	○	○	○	○	○
[E_1_3]	The fact sheet took who I am into account.	○	○	○	○	○
[E_2_1]	The fact sheet provided an argument about participating in the *SEQOME Project* that is believable.	○	○	○	○	○
[E_2_2]	The fact sheet provided an argument about participating in the *SEQOME Project* that is convincing.	○	○	○	○	○
[E_2_3]	The fact sheet provided an argument about participating in the *SEQOME Project* that is important to me.	○	○	○	○	○
[E_2_4]	The fact sheet helped me feel confident about deciding whether or not to participate in the *SEQOME Project*.	○	○	○	○	○

		strongly disagree <1>	somewhat disagree <2>	neither agree nor disagree <3>	somewhat agree <4>	strongly agree <5>
[E_2_5]	The fact sheet would help my friends decide whether or not to participate in the *SEQOME Project*.	○	○	○	○	○
[E_2_6]	The fact sheet put thoughts in my mind about wanting to participate in the *SEQOME Project*.	○	○	○	○	○
[E_2_7]	The fact sheet put thoughts in my mind about **not** wanting to participate in the *SEQOME Project*.	○	○	○	○	○
[E_2_8]	Overall, how much do you agree or disagree with the argument provided in the fact sheet?	○	○	○	○	○
[E_2_9]	The reasons the fact sheet gave for participating in the *SEQOME Project* are weak.	○	○	○	○	○

< Section F. Demographics>

[DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

Now we would like to ask some general questions about you.

[PROMPT IF ANY F_1 ITEMS ARE SKIPPED: "Please respond to every question before continuing."]

[TEXT BOX: ALLOW NUMERICAL INPUT ONLY. RECORD VALUE ENTERED]

[F_1_1] What is your age in years?

<Enter Number>

[RADIO BUTTONS, CAN SELECT ONLY ONE OPTION PER QUESTION]

[F_1_2] Are you Male or Female?

- ○ **<1>** Male.
- ○ **<2>** Female.

[F_1_3] What is the highest level of education that you have completed?

- ○ **<1>** Less than high school.
- ○ **<2>** High school graduate or GED.
- ○ **<3>** Some college, but did not finish.
- ○ **<4>** Two-year college degree / A.A. or A.S.
- ○ **<5>** Four-year college degree / B.A. or B.S.
- ○ **<6>** Masters, doctorate or professional degree.

[F_1_4] Are you of Hispanic, Latino, or Spanish origin?

- ○ **<1>** Yes.
- ○ **<2>** No.
- ○ **<3>** Don't know.

[F_1_5] Which of the following would you say is your race? Please select the one option that best describes you.

- ○ **<1>** White.
- ○ **<2>** Black or African American.
- ○ **<3>** American Indian or Alaska Native.
- ○ **<4>** Asian or Pacific Islander.
- ○ **<5>** Other.

[F_1_6] Which of the following is the best estimate of your total household income from all sources, before taxes, in 2011?

- ○ **<1>** Less than $25,000.
- ○ **<2>** $25,000 - $49,999.
- ○ **<3>** $50,000 - $74,999.
- ○ **<4>** $75,000 - $99,999.
- ○ **<5>** $100,000 or more.

<Debriefing>

[IF XMEDTOP =1: DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

This concludes our study. Thank you for participating!

We'd like to explain our purpose in conducting this study. We are interested in understanding how attitudes and behavior are affected by being exposed to new information about a topic.

You were assigned to one of several conditions. Some participants received information about the *SEQOME Project* that was different from the information you received. In particular, you viewed a fact sheet that was customized to better reflect aspects of participating in the *SEQOME Project* that relate to possible benefits to society. Other participants received a fact sheet that was designed to better address beliefs related to personal benefits of participating. Yet another group of participants were not given a fact sheet at all.

Please note that the *SEQOME Project* is not a real research project. Similarly, all information you viewed today was created solely for use in this study. This was done to help achieve the aims of the study. We would like to emphasize that our descriptions of the *SEQOME Project* may not represent genomic research in general.

This research is being conducted by **Ryan S. Paquin, M.A.** and **Joseph N. Cappella, Ph.D.** at the Annenberg School for Communication, University of Pennsylvania. If you have any questions about the research study itself, please contact Mr. Paquin at rpaquin@asc.upenn.edu.

If you would like to learn more about genetics and genomic research, the National Human Genome Research Institute has many public resources available through its website: http://www.genome.gov/Education/FactSheets/

[END OF SURVEY IF XMEDTOP = 1]

[IF XMEDTOP =2: DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

This concludes our study. Thank you for participating!

We'd like to explain our purpose in conducting this study. We are interested in understanding how attitudes and behavior are affected by being exposed to new information about a topic.

You were assigned to one of several conditions. Some participants received information about the *SEQOME Project* that was different from the information you received. In particular, some participants viewed a fact sheet that was customized to better reflect aspects of participating in the *SEQOME Project* that relate to possible benefits to society. You received a fact sheet that was designed to better address beliefs related to personal benefits of participating. Yet another group of participants were not given a fact sheet at all.

Please note that the *SEQOME Project* is not a real research project. Similarly, all information you viewed today was created solely for use in this study. This was done to help achieve the aims of the study. We would like to emphasize that our descriptions of the *SEQOME Project* may not represent genomic research in general.

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[END OF SURVEY IF XMEDTOP = 2]

[IF XMEDTOP =3: DISPLAY ON SEPARATE SCREEN FROM PREVIOUS]

This concludes our study. Thank you for participating!

We'd like to explain our purpose in conducting this study. We are interested in understanding how attitudes and behavior are affected by being exposed to new information about a topic.

You were assigned to one of several conditions. Some participants received information about the *SEQOME Project* that was different from the information you received. In particular, some participants viewed a fact sheet that was customized to better reflect aspects of participating in the *SEQOME Project* that relate to possible benefits to society. Other participants received a fact sheet that was designed to better address beliefs related to personal benefits of participating. You were part of yet another group of participants that was not given a fact sheet at all.

Please note that the *SEQOME Project* is not a real research project. Similarly, all information you viewed today was created solely for use in this study. This was done to help achieve the aims of the study. We would like to emphasize that our descriptions of the *SEQOME Project* may not represent genomic research in general.

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If you would like to learn more about genetics and genomic research, the National Human Genome Research Institute has many public resources available through its website: http://www.genome.gov/Education/FactSheets/

[END OF SURVEY IF XMEDTOP = 3]

APPENDIX B:

MESSAGE TOPIC MANIPULATION

<Altruist-targeted Message>

We would like you to be aware of the following information concerning the *SEQOME Project*. Please read the following fact sheet carefully.

Top 5 Things You Should Know about Participating in the *SEQOME Project*

- **Some parts of participating in the *SEQOME Project* will be inconvenient.** In order to participate, you will need to come in for an initial visit at a regional assessment center. During this visit, you will be asked to answer questions about your health and have some routine clinical tests done. You may also be re-contacted over the course of many years to provide additional information.
- **Everyone who agrees to participate in the *SEQOME Project* must have a sample of blood drawn for long term storage and analysis.** People usually feel minor discomfort, pain and bruising where the needle enters for blood drawing.
- **Your participation in the *SEQOME Project* will contribute to medical research.** By analyzing survey answers and DNA samples collected from participants, researchers may be able to work out why some people develop particular diseases while others do not. This should help us find new ways to prevent early death and disability from many different diseases.
- **The information and samples you provide by participating will be used in many future studies to help advance science. Also, by participating you will help contribute to knowledge.** The genetic material and data we collect from participants of the *SEQOME Project* will be put in scientific databases that are available to researchers around the world.
- **Your participation should help future generations by giving them a much better chance of living their lives free of diseases that disable and kill.** Even though, like donating blood, the *SEQOME Project* is not intended to directly help those who take part.

<**Instrumentalist-targeted Message**>

We would like you to be aware of the following information concerning the *SEQOME Project*. Please read the following fact sheet carefully.

Top 5 Things You Should Know about Participating in the *SEQOME Project*

- **You should not expect to receive any information about your current health status as part of your participation in the *SEQOME Project*.** The *SEQOME Project* is a research study, not medical care. We only intend to share information if it has urgent importance to your health. However, you should know that this type of result will be found very rarely, and most people in this study will not have a result like this.
- **You will not be given any feedback concerning your personal genetic health risk as part of your participation in the *SEQOME Project*.** It will take a long time for the data from this project to be used to produce health-related information that we will know how to interpret accurately. The results of your genome sequencing *will not* be given to you or your doctors.
- **By taking part in the *SEQOME Project*, you will not be provided with information to help you make medical treatment decisions. Also, you will not be given information to help you prevent disease as part of your participation in this project.** The genetic tests that will be done for this study are not a part of routine health care.
- **Taking part in the *SEQOME Project* is not expected to cause you to feel worried about your health.** Part of the decision not to return genetic sequencing results to participants of the *SEQOME Project* is to help minimize the risk of emotional and psychological harm.
- **It is very unlikely that you will learn something about your genes that you do not want to know as a result of taking part in the *SEQOME Project*.** This is because your sequencing results will not be returned to you.

APPENDIX C:

EVALUATION OF THE AUDIENCE-SEGMENTATION STRATEGY

As proposed, the experiment was designed as a 3 (Message Topic: instrumentalist-targeted message, altruist-targeted message, and no-message control) × 2 (Audience Segment: altruists vs. instrumentalists) between-subjects factorial design. Audience Segment was to be an observed variable operationalized using the classification scheme defined in Study 1. Seven items from the dimensional-salience list were especially important components of this rule. The first three correspond to greater-good (GG) elicitation themes used as clustering variables in Study 1: (a) "Helping others in the future," (b) "Contributing to medical research," and (c) "Helping advance science." The other four are examples of personal-feedback (PF) elicitation themes: (a) "Receiving information about my current health," (b) "Receiving information about my personal genetic risk for disease," (c) "Learning information to help me prevent disease," and (d) "Learning information to help me make treatment decisions." The proposed segmentation strategy was as follows:

(i) If a respondent selects at least one GG theme and no PF themes, classify him as a member of the *altruist* audience segment.

(ii) If a respondent selects at least one PF theme and no GG theme, classify her as a member of the *instrumentalist* audience segment.

(iii) Respondents who do not select any GG or PF themes are to be classified as members of the *neither* segment.

(iv) Classify respondents who select at least one item corresponding to a GG theme and at least one that corresponds to a PF theme as members of the *mixed* segment.[36]

The proposed double-factorial design assumed that the rule for classifying respondents into audience segments established in Study 1 would generalize to Study 2. Audience Segment was meant to be a categorical proxy of belief salience. Sorting observations into discrete and theoretically meaningful categories would increase the likelihood of detecting hypothesized interaction effects (McClelland & Judd, 1993). Moreover, it was important to maximize the number of respondents classified as altruists and instrumentalists. Also important was achieving a balanced ratio of subjects in these two groups. In applications of the generalized linear model (GLM)—including moderated multiple regression—statistical power to detect interaction effects with categorical moderating variables deteriorates as (a) total sample size decreases, and (b) the number of subjects in each subgroup of the moderator becomes more dissimilar (Aguinis & Gottfredson, 2010; Keppel & Wickens, 2004). Thus, statistical power is partially dependent upon segment size and proportionality.

Based on an *a priori* power analysis, it was estimated that a combined total of 880 altruists and instrumentalists would be required to detect the small-to-medium effects (e.g., $f^2 = .014$) expected in this study without exceeding a Type II error-rate of .20 (i.e., power = .80). Unfortunately, this basic condition was not met. Generalizing from the results of Study 1, it was expected that approximately two-thirds of the respondents would be classified as members of either the altruist or instrumentalist audience segment. Applying the proposed segmentation strategy to the Study 2 sample, only 530 respondents (34%) were classified into these two segments. Moreover, in Study 2,

[36] The last two segments were not examined in any depth in this dissertation.

altruists outnumbered instrumentalists by a ratio somewhat greater than 3:2. In Study 1, the ratio of altruists to instrumentalists was very close to 1:1. Following the proposed segmentation scheme, 21% (n = 332) were classified as altruists, 13% (n = 198) as instrumentalists, 4% (n = 70) were sorted into the neither segment, and 62% (n = 977) were in the mixed segment. These segments were expected to comprise 36%, 33%, 20% and 11% of the full sample, respectively. The proposed segmentation strategy produced groups that were too few in number and dissimilar in size to achieve sufficient power to test my hypotheses.

In light of these results, I explored several alternative segmentation strategies. In addition to partitioning the full sample into adequately apportioned groups, a good strategy would yield audience segments with two additional characteristics: (c) maximize the number of modally salient beliefs in each segment that match beliefs addressed in the corresponding message-topic condition (i.e., altruists : altruist-targeted :: instrumentalists : instrumentalist-targeted), and (d) maximize differences among the modally salient beliefs of altruists versus instrumentalists. I explored several alternative strategies aimed at defining larger segments that would meet these criteria. Table C.1 summarizes the classification rules I explored and provides an overview of how well each strategy met the given aims. Taking into consideration all four criteria for judging segmentation effectiveness, Strategy 9 appeared to be the best alternative. However, with only 613 respondents classified as altruists and instrumentalists, this strategy still fell short of the target sample size.

To assess differences among salient beliefs of audience segments identified using Strategy 9, I examined three characteristics.[37] First, there should be differences between segments in which outcomes are classified as modally salient, using the rules established

[37] The same characteristics were used in Study 1 to validate the original clustering solution.

Table C.1

Summary of Classification Rules Used in an Exploratory Audience Segmentation Analysis

			Criteria			
Strategy	Segments	Rule	a	b	c	d
1[a]	Altruists	$GG_A \geq 1$ & $PF_A = 0$	–	/	–	/
	Instrumentalists	$GG_A = 0$ & $PF_A \geq 1$				
	Neither	$GG_A = 0$ & $PF_A = 0$				
	Mixed	$GG_A \geq 1$ & $PF_A \geq 1$				
2	Altruists	($GG_A \geq 1$ & $PF_A = 0$) or ($GG_A > 1$ & $PF_A = 1$)	+	/	–	–
	Instrumentalists	($GG_A = 0$ & $PF_A \geq 1$) or ($GG_A = 1$ & $PF_A > 1$)				
	Neither	$GG_A = 0$ & $PF_A = 0$				
	Mixed	$GG_A > 1$ & $PF_A > 1$				
	One each	$GG_A = 1$ & $PF_A = 1$				
3	Altruists	($GG_A \geq 1$ & $PF_A = 0$)	/	+	–	/
	Instrumentalists	($GG_A = 0$ & $PF_A \geq 1$) or ($GG_A = 1$ & $PF_A > 1$)				
	Neither	$GG_A = 0$ & $PF_A = 0$				
	Mixed	$GG_A > 1$ & $PF_A \geq 1$				
	One each	$GG_A = 1$ & $PF_A = 1$				
4	Altruists	$GG_B \geq 1$ & $PF_B = 0$	–	–	+	+
	Instrumentalists	$GG_B = 0$ & $PF_B \geq 1$				
	Neither	$GG_B = 0$ & $PF_B = 0$				
	Mixed	$GG_B > 0$ & $PF_B > 0$				
5	Altruists	($GG_B \geq 1$ & $PF_B = 0$) or ($GG_B > 1$ & $PF_B = 1$)	+	–	+	–
	Instrumentalists	($GG_B = 0$ & $PF_B \geq 1$) or ($GG_B = 1$ & $PF_B > 1$)				
	Neither	$GG_B = 0$ & $PF_B = 0$				
	Mixed	$GG_B > 1$ & $PF_B > 1$				
	One each	$GG_B = 1$ & $PF_B = 1$				
6	Altruists	$GG_B \geq 1$ & $PF_B = 0$	–	+	+	/
	Instrumentalists	($GG_B = 0$ & $PF_B \geq 1$) or ($GG_B = 1$ & $PF_B > 1$)				
	Neither	$GG_B = 0$ & $PF_B = 0$				
	Mixed	$GG_B > 1$ & $PF_B \geq 1$				
	One each	$GG_B = 1$ & $PF_B = 1$				

(table continues on next page)

Table C.1 (*continued*)

			Criteria			
Strategy	Segments	Rule	a	b	c	d
7	Altruists	$GG_C \geq 1$ & $PF_A = 0$	–	–	/	+
	Instrumentalists	$GG_C = 0$ & $PF_A \geq 1$				
	Neither	$GG_C = 0$ & $PF_A = 0$				
	Mixed	$GG_C > 0$ & $PF_A > 0$				
8	Altruists	($GG_C \geq 1$ & $PF_A = 0$) or ($GG_C > 1$ & $PF_A = 1$)	+	–	/	-
	Instrumentalists	($GG_C = 0$ & $PF_A \geq 1$) or ($GG_C = 1$ & $PF_A > 1$)				
	Neither	$GG_C = 0$ & $PF_A = 0$				
	Mixed	$GG_C > 1$ & $PF_A > 1$				
	One each	$GG_C = 1$ & $PF_A = 1$				
9	Altruists	$GG_C \geq 1$ & $PF_A = 0$	/	+	/	/
	Instrumentalists	($GG_C = 0$ & $PF_A \geq 1$) or ($GG_C = 1$ & $PF_A > 1$)				
	Neither	$GG_C = 0$ & $PF_A = 0$				
	Mixed	$GG_C > 1$ & $PF_A \geq 1$				
	One each	$GG_C = 1$ & $PF_A = 1$				

Note. a = Maximize the number of respondents classified as altruists or instrumentalists; b= Achieve a more balanced ratio of altruists to instrumentalists; c = Maximize number of modally salient beliefs in each segment that match those addressed in the corresponding message-topic condition; d = Maximize the differentiation between the modally salient beliefs of respondents classified as altruists compared to instrumentalists; + = Strategy does well on the criterion; / = Strategy is acceptable on the criteria; – = Strategy does poorly on the criterion; GG_A = Number of selections from the dimensional-salience task corresponding to three items in the greater-good metatheme as defined in Study 1: "Helping others in the future," "Contributing to medical research," or "Helping advance science;" PF_A = Number of selections from the dimensional-salience task related to four items in the personal-feedback metatheme as defined in Study 1: "Receiving information about my current health," "Receiving information about my personal genetic risk for disease," "Learning information to help me prevent disease," or "Learning information to help me make treatment decisions;" GG_B = Number of selections matching six beliefs addressed in the altruist-targeted message from Study 2 (i.e., All three items from the set GG_A, plus "Contribute to knowledge," "Feeling physical pain," and "Doing something that is inconvenient;" PF_B = Selections matching the six beliefs in the instrumentalist-targeted message (i.e., The four items from the PF_A set, plus "Learning something that I do not want to know," or "Feeling worried." GG_C = Selections that match the four most salient items from set GG_B (i.e., "Helping others in the future," "Contributing to medical research," "Helping advance science, or "Contribute to knowledge.")

[a] Originally proposed strategy.

by Ajzen and Fishbein (1980). Specifically, at least some of the beliefs addressed in the altruist-targeted message should be uniquely salient for respondents classified as altruists, and beliefs addressed by theinstrumentalist-targeted message should be uniquely salient for instrumentalists. Second, there should be differences in how strongly these beliefs are held by members of the respective segments (Cronen & Conville, 1975; Fishbein & Ajzen, 1975). The belief strength of outcomes that are uniquely salient to altruists should be greater among altruists than instrumentalists, and *vice versa*. Third, and most important, the magnitude of associations between uniquely salient behavioral beliefs and intention should differ by audience segment. Correlation coefficients relating the altruist segment's uniquely salient behavioral beliefs to intention should be greater among altruists; correlations between instrumentalist salient beliefs and intention should be greater among instrumentalists. Failure to fulfill these characteristics calls into question the usefulness of the observed audience segments as proxies for belief salience.

Strategy 9 aimed to increase differentiation between eight items that were addressed by either the altruist- or instrumentalist-targeted messages. Descriptive comparisons of belief items nominated as salient by the altruist and instrumentalist segments are presented in Table C.2. As planned, members of the altruist segment did not select any items corresponding to expectations to receive information (i) "about personal genetic risk for disease," (ii) "about current health," (iii) "to help prevent disease," or (iv) "to help make treatment decisions." This occurred by definition, as a direct result of the classification rule used to define the altruist segment. These same four beliefs were the most frequently selected items among instrumentalists, indicating qualitative differentiation. The four most frequently selected items among altruists corresponded with expectations about (i) "helping others in the future," (ii) "contributing

Table C.2

Frequency of Behavioral Outcomes Selected by participants from the Dimensional-Salience Task by Strategy 9 Audience Segment

	Altruists (n = 345)		Instrumentalists (n = 268)		
Belief item	f	%	f	%	χ^2
Altruist-targeted message beliefs					
Help others in the future.	258	74.8[ab]	34	11.6	255.64***
Contribute to medical research.	227	65.8[ab]	55	18.7[ab]	142.76***
Help advance science.	229	66.4[ab]	33	11.2	199.60***
Contribute to knowledge.	227	65.8[ab]	26	8.8	215.28***
Feel physical pain.	52	15.1	44	15.0	0.00
Do something that is inconvenient.	31	9.0	27	9.2	0.01
Instrumentalist-targeted message beliefs					
Receive information about my personal genetic risk for disease.	0	—	154	52.4[ab]	238.10***
Receive information about my current health.	0	—	117	58.2[ab]	273.98***
Learn information to help me prevent disease.	0	—	161	54.8[ab]	252.56***
Learn information to help me make treatment decisions.	0	—	142	48.3[ab]	214.24***
Feel worried.	46	13.3	45	15.3	0.51
Learn something that I do not want to know.	42	12.2	39	13.3	0.17
Nonmessage beliefs					
Receive information about my personal genetic code.	98	28.4[ab]	114	38.8[ab]	7.70
Receive information that may be helpful to my relatives.	139	40.3[ab]	102	34.7[ab]	2.12
Learn more about my family history of disease.	82	23.8[ab]	92	31.3[ab]	4.54
Put my privacy at risk.	68	19.7[b]	60	20.4[ab]	0.05
Receive compensation other than money.	65	18.8[b]	46	15.6[a]	1.13
Lose control over how my DNA samples are used.	72	20.9[ab]	56	19.0[ab]	0.33
Learn something that I cannot do anything about.	41	11.9	39	13.3	0.28
Have to make time in my busy schedule.	48	13.9	30	10.2	2.04

Note. N = 639. f = Frequency count of the number of times each belief item was selected. % = Percentage of respondents who selected the item. Each participant was required to select five items from a list of twenty.
*** $p < .001$ (Bonferroni-adjusted).

[a] Modal salient belief for audience segment based on "75% of selected items" decision rule.
[b] Modal salient belief for audience segment based on "Top 10 valid elicitation responses" decision rule.

to medical research," (iii) "advancing science," and (iv) "contributing to knowledge." With the exception of "contribute to medical research," these items were not selected frequently enough by instrumentalists to meet the "75%" and "top 10" decision rules (Ajzen & Fishbein, 1980). Qualitatively, three of the beliefs addressed in the altruist-targeted message were differentially salient for the altruist segment, and four of the beliefs addressed in the instrumentalist-targeted message were differentially salient for the instrumentalists.

Chi-square tests of independence were also used to determine whether different proportions of altruists and instrumentalists nominated each belief as salient. To protect against inflated experiment-wise Type I error, a more conservative Bonferroni-adjusted critical value for detecting significant differences was used. By this criterion, all eight beliefs were differentially salient for altruists and instrumentalists. All other outcomes were nominated with statistically equivalent frequency by altruists and instrumentalists.

Table C.3 shows between-segment means and standard deviations of belief strength items related to outcomes listed in the dimensional-salience task. Also presented are zero-order correlations of these behavioral beliefs (i.e., belief-evaluation products) with intention to participate in the *SEQOME Project*. Because the altruist-targeted and instrumentalist-targeted messages were expected to influence these statistics, the analysis was restricted to the no-message control group. There were between-segment differences in belief strength for the four outcomes nominated most frequently by altruists. Altruists believed significantly more strongly than instrumentalists that participating would contribute to science, medical research, knowledge, and help others. Instrumentalists had nominally stronger beliefs about receiving genetic risk information and information about current health, though these differences were not significant. Beliefs about receiving information to help with medical

Table C.3

Mean Belief Strength and Correlation with Intention of Belief Items by Strategy 9 Audience Segment

Belief item	Altruists (n = 113) *M* (*SD*)	*r*	Instrumentalists (n = 93) *M* (*SD*)	*r*
My participation in the *SEQOME Project* will…				
Alturist-targeted message beliefs				
…Help others in the future	6.02 (1.10)[a]	.50	5.43 (1.36)	.34
…Help advance science.	6.12 (1.03)[a]	.53	5.39 (1.41)	.47
…Contribute to medical research.	6.18 (1.07)[a]	.62[c]	5.42 (1.42)	.43
…Contribute to knowledge.	6.03 (1.15)[a]	.57[c]	5.48 (1.33)	.37
…Cause me to feel physical pain.	3.27 (1.66)	.34	3.60 (1.56)	.20[b]
…Be an inconvenience to me.	3.31 (1.59)	.36[c]	3.70 (1.44)	.11[b]
Instrumentalist-targeted message beliefs				
…Give me information about my personal genetic health risk.	5.43 (1.39)	.36	5.67 (1.16)	.36
…Teach me something new about my current health.	5.57 (1.34)	.45	5.65 (1.24)	.39
…give me information to help me make medical treatment decisions.	5.47 (1.30)	.53	5.48 (1.40)	.37
…Provide me with information to help me prevent disease.	5.45 (1.30)	.56[c]	5.46 (1.35)	.28
…Tell me something about my genes that I do not want to know.	4.12 (1.61)	.29	4.33 (1.59)	.24
…Make me feel worried about my health.	3.70 (1.65)	.16[b]	3.92 (1.72)	.13[b]
Other beliefs				
…Take up a lot of my time.	3.70 (1.59)	.40	3.91 (1.38)	.22
…Put the privacy of my genetic information at risk	3.81 (1.67)	.14[b]	4.18 (1.58)	.25
…Make me a part of research that goes against my personal values.	3.05 (1.88)	.28	3.78[a] (1.59)	.19[b]

Note. Means and standard deviations relate to the belief strength items corresponding to each outcome. Correlation coefficients reported are measures of the association between each behavioral belief (i.e., belief-evaluation products) with intention to participate in the *SEQOME Project*.

[a] Based on an independent samples *t*-test, the mean belief strength of this item for this audience segment is significantly greater than in the other segment, $p < .05$.

[b] Correlation coefficient within this audience segment is *not* significantly different from zero at $p < .05$.

[c] Correlation coefficient is significantly greater in this audience segment than the other, $p < .05$; based on a one-tailed test of the difference between two correlation coefficients in two independent samples, using Fisher's *r* to *z* transformation.

treatment decisions and disease prevention were almost identical in both audience segments.

Significant differences between correlation coefficients found in the altruist and instrumentalist segments were found, based on one-tailed tests using Fisher's *r* to *z* transformation. Beliefs about contributing to medical research and knowledge were more strongly associated with intentions to participate among altruists than among instrumentalists. The correlation coefficient for the belief that participating would be inconvenient was also greater in the altruist segment. The correlation coefficients for the other beliefs addressed in the altruist-targeted message are also nominally greater in the altruist segment, but not significantly so. In all, beliefs that were expected to be more salient to the altruists appear to have been so. However, correlation coefficients for most of the beliefs that were supposed to be more salient to the instrumentalists were nominally *smaller* in the instrumentalist segment. In fact, the correlation coefficient for the belief about learning information to prevent disease was significantly smaller among instrumentalists. In other words, the qualitative evidence that instrumentalist-targeted beliefs were more salient to instrumentalists was not corroborated by tests for differences in mean belief strength and belief–intention correlations. When considered in combination with the low number of respondents classified as altruists and instrumentalists, even the best-case audience segmentation strategy (i.e., Strategy 9) was inadequate for the purposes of Study 2.

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