The Motivational Utility of Knowledge:

Conceptual Change and Comprehension Through the Lens of Fundamental Human Needs

by

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ABSTRACT

Past research on knowledge has differentiated between dimensions of knowledge, for example amount or coherence. This dissertation introduces a novel dimension of knowledge, the Motivational Utility of Knowledge (MUK), that is based on hierarchies of human needs (e.g., physical safety, status/esteem, actualization, reproduction). The effects of MUK are tested in a set of four studies on the topic of houselessness. All four studies used the same dataset. Adults in the United States (N = 190) were recruited from an online survey platform and paid for participation. They were first asked about their conceptions of houselessness. Next, they read a set of four texts arguing different views of houselessness, and administered a comprehension test, an emotion while reading test, and asked if the text conflicted with their beliefs. They were then reassessed on their conceptions and administered the MUK scale. Finally, they were given a demographics questionnaire, including questions about their personal experience with houselessness, and were administered a general prior knowledge test and a vocabulary knowledge test. Study 1 examined MUK as a construct and assessed the factor structure of the scale. The analyses showed that the subscales of MUK loaded onto a single factor – overall value of houselessness knowledge. Study 2 situated MUK within the domain of conceptual change. The results demonstrated that participants' conceptions of houselessness were related to MUK, and that their propensity to engage in conceptual change depended on MUK. Study 3 situated MUK within the domain of text comprehension research and demonstrated that the text-belief consistency effect is enhanced when participants have high MUK. Finally, Study 4 examined MUK as a mediator between conceptions and comprehension and examined the role of MUK in predicting negative emotions. Overall,

the findings suggest that MUK plays a role in conceptual change and text comprehension such that participants with high MUK are less likely to revise their knowledge and have worse comprehension when the text conflicts with their beliefs. In addition, MUK may predict emotions while reading about controversial topics, as participants with high MUK were more likely to report negative emotions while reading.

To my wife, Krista, for her love and support in getting me to the finish line.

I love you most.

And to my family, for shaping me into the person I am today.

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CHAPTER 1

INTRODUCTION

Our knowledge affects our perception, action, and cognition. Prior knowledge has strong effects on perception (de Lange, Heilbron, & Kok, 2018), memory (Shing & Brod, 2016), social cognition (Bless & Greifeneder, 2017), among many other psychological phenomena (Bitterman et al., 2023). However, knowledge is not a monolith. There is a long history of differentiating between types of knowledge. For example, some researchers categorize knowledge as either explicit or implicit (Batterink et al., 2015; Dienes & Perner, 1999). While others assess the extent to which knowledge varies along dimensions such as amount or coherence (McCarthy & McNamara, 2021). This dissertation introduces a novel dimension of knowledge, the Motivational Utility of Knowledge (MUK) and tests the effects of MUK in a set of four studies situated within the research on knowledge, misconceptions, and comprehension.

The Motivational Utility of Knowledge (MUK) is based on the classic work by Maslow (1943) and recent research by Kenrick and colleagues (2010) that categorizes human motives as based on a hierarchy of innate predispositions (i.e., physiological needs, social needs, parenting needs, self-actualization needs). MUK is the extent to which individuals value their knowledge because it either (a) provides opportunities to fulfill a fundamental motive or (b) removes threats to fulfilling a fundamental motive. For example, knowledge about the history of Japanese art may be of high value to a professor of art history, as that knowledge enhances their ability to earn money for housing and food, and gain affiliation and status in their community. However, similar knowledge

would be of less value to a software engineer as it may not provide a direct fulfillment of their physiological and social needs.

Knowledge

Knowledge has been defined many times; for example, Alexander and colleagues (1991) defined knowledge as, “an individual’s personal stock of information, skills, experiences, beliefs, and memories”. Kendeou and O’Brien (2014) defined knowledge as, “the theoretical or practical understanding of information and the representation of that understanding in memory”. Greene et al.’s (2018) defined knowledge as, “all that is stored and accessible in long-term memory”. Most recently, McCarthy and McNamara (2021) defined knowledge as, “all of the information in one’s memory”. This final, albeit general, definition will be the working definition for this dissertation.

The literature on knowledge is rich and extensive and includes research from multiple branches of psychology and learning sciences. Bitterman and colleagues (2023) identified more than 25 different theoretical backgrounds used in the study of knowledge, which they categorized into 5 “communities” of topics: Education, Learning Environments, Cognitive Processes, Nonacademic Settings and Language. Within and between these communities, knowledge has been categorized in several ways. For instance, some researchers have categorized knowledge in terms of content domains (e.g., mathematics, language, etc.). Other researchers have categorized different types of knowledge as declarative and procedural (Ulman, 2004) or, in a similar vein, as explicit and implicit knowledge (Batterink et al., 2015; Berry & Broadbent, 1998).

This diversity of research on prior knowledge renders the selection of any one schema or construct of knowledge, or indeed any novel contributions, unfortunately

limited in scope to the literature background from whence it came. Importantly for this dissertation, the characterization of knowledge within research focused on either conceptual change or comprehension share similar backgrounds and assumptions. For example, both lines of research agree that knowledge has a network structure, that knowledge can vary in quality or coherence, and that knowledge influences future learning (Bitterman et al., 2023). As such, this dissertation is situated within the research on knowledge that arises from the field of text comprehension.

Multidimensional Knowledge in Text Comprehension

McCarthy and McNamara (2021) proposed the Multidimensional Knowledge in Comprehension (MDK-C) framework for prior knowledge, postulating that there are four primary dimensions of prior knowledge in text comprehension: amount, accuracy, specificity, and coherence. It is worth underscoring that knowledge within this framework is conceptualized in terms of its relationship to the learning task (the text being read). Thus, amount is defined as the number of concepts a reader knows that are relevant to the target text. In connectionist terms, this refers to the number of nodes in the knowledge network that are related to the learning task. In measurement, prior knowledge assessments typically measure the relative amount of knowledge on a topic (i.e., a score of 100% on a multiple-choice test is not thought to represent three times as much knowledge as a score of 33%).

Accuracy is defined as the extent to which a reader's knowledge is correct or incorrect. Learners can have both inaccurate information nodes, and inaccurate links between nodes. However, knowledge accuracy is more complex than a binary correct/incorrect. For instance, Vosniadou and Brewer (1992; 1994) documented how

children have the knowledge that the world is round, but when asked to draw the world, would draw a flat circle with the sky above. This knowledge is characterized as naïve and contains both accurate and inaccurate nodes.

Specificity is defined as the degree to which the reader's knowledge is related to the text. General world knowledge is a strong predictor of reading comprehension both for children (Best et al., 2008) and adults (Talwar et al., 2018). However, specific domain or content knowledge can afford readers better comprehension (McNamara et al, 2011). This aspect of differences between domains or topics is a common way to categorize knowledge, even outside of comprehension contexts (Chiesi, Spilich, & Voss, 1979).

Finally, coherence refers to the degree to which the readers' knowledge is well-connected. Coherence is not simply having "more" knowledge, but rather, that the knowledge is well organized and interconnected. This dimension is based on studies that have shown differences in students' organization of keywords predicts their recall (Langer, 1980), or that knowledge items that require inferencing are stronger predictors of comprehension than items that do not require inferencing (McCarthy et al., 2018).

McCarthy and McNamara (2021) called for more research into these dimensions of knowledge, as well as identifying new dimensions to add to the framework. One potential dimension of knowledge that may influence text comprehension is its *value* or personal importance. While there has been little direct research on knowledge value in the literature on learning, several recent studies have found effects that imply a difference in knowledge value or importance. Maier and Richter (2014) have documented that readers better comprehend texts that espouse beliefs consistent with their beliefs compared to texts that espouse beliefs that are inconsistent with their beliefs. This finding

demonstrates that the value of knowledge, not just the amount or quality of the knowledge, influences comprehension. Furthermore, Gill and colleagues (2022) demonstrated differences in personal relevance predicted conceptual change. Their study was focused on group level differences between pre-service and in-service teachers, finding that in-service teachers were less likely to revise knowledge. They attributed this finding to differences in the personal relevance of knowledge. One question left unanswered from both of these studies is *how* to characterize differences in beliefs or value. While both conceptual change and comprehension research has identified the importance of personal values or beliefs, there has been little research on the individual differences that predict knowledge value.

Motivational Utility of Knowledge

Within the research on conceptual change and comprehension, there have been few efforts to characterize how knowledge might vary in terms of personal value or importance. The personal importance or value of knowledge has been a focus of study in philosophy. Pritchard (2009) reviewed the history of knowledge value and the "value problem" of knowledge. The value problem of knowledge is the question of what differentiates knowledge from belief and was first stated in Plato's *Meno.* In philosophy, answers to this question primarily revolve around justification, evidence, and for Plato, whether knowledge is tethered to reality (Pritchard, 2009). However, for psychologists, the question of knowledge value is not necessarily related to the objective truth of knowledge. Rather, the question of interest is how do individuals differ in their assessments of knowledge value?

Fundamental motives (or fundamental needs) provide a framework to measure differences in the value of knowledge. Human beings have innate dispositions to ensure physical safety, affiliate with other humans, reproduce, and self-actualize (Maslow, 1943; Kenrick et al., 2010). MUK is defined as the extent to which individuals value their knowledge or conceptions because it either (a) provides opportunities to fulfill a fundamental need or (b) removes threats to fulfilling a fundamental need.

Maslow (1943) theorized that humans have a hierarchy of needs. The needs are organized in a pyramid, with self-actualization at the top, followed by esteem, belongingness, safety and security, and physiological needs. In Maslow's theory, humans' basic needs (i.e., physiological) must be fulfilled before they can "move up" to the next level of needs. Importantly, individuals can vary in whether a need is fulfilled based on the current situation. For instance, fasting, the practice of refraining from food for a set period of time, is a global religious practice. Individuals fulfill their physiological needs with less-than-normal food in order to fulfill their need to self-actualize. As stated earlier, knowledge can be conceptualized as more valuable if it provides an opportunity, or removes a threat, to fulfilling a fundamental need. For example, knowledge about the nearest water fountain provides an opportunity to fulfill a fundamental physiological need. Applications of Maslow's hierarchy have been primarily studied in the context of organizational psychology and consumer purchasing decisions. For example, Sicilia and colleagues (2016) studied how the need for belongingness affected brand loyalty. To our knowledge, there has been no attempt to categorize knowledge in terms of Maslow's hierarchy.

More recently, Kenrick et al (2010) posited seven fundamental motives as an alternative or recharacterization of Maslow (1943) hierarchy of human needs. According to Kenrick and colleagues, humans have evolved innate dispositions to 1) satisfy immediate physiological needs, 2) self-protect, 3) affiliate with other humans, 4) gain status or esteem, 5) acquire mates. 6) retain mates, and 7) successfully parent. These needs are roughly equivalent to Maslow's needs, with immediate physiological needs and self-protection at the bottom of the pyramid followed by social needs (e.g., affiliation, belongingness). However, while Maslow perceived as self-actualization as the fulfillment of human potential, Kenrick and colleagues argue that successful reproduction (i.e., mating and parenting) is the fulfillment of human potential (see Kenrick et al., 2010 for a full comparison).

Within the framework of the seven fundamental motivations, human behavior is linked to attempts to either alleviate threats to fulfilling these motives or take advantage of opportunities to fulfill these motivations. For example, humans can be motivated to excel at basketball because excellence in sports fulfills several motivations. A star basketball player earns enough money to satisfy physiological needs (1), gains esteem within their social community (4), has opportunity to acquire and retain mates (5 and 6), and enough money to successfully parent (7). To our knowledge, there has been no attempt to categorize knowledge in terms of Kenrick's hierarchy.

Humans' attempts to alleviate threats and exploit opportunities can extend beyond employment and can include acquisition and retention of knowledge. Knowledge, and therefore, misconceptions, can be measured as the extent to which the knowledge helps humans satisfy the fundamental motives. For example, knowledge about cooking helps to

ensure that humans remain fed and healthy, indicating a high motivational utility. However, knowledge about Mrs. O'Leary's cow has low motivational utility, as it affords no opportunities for survival, affiliation, mating, nor parenting.

The motivational utility of knowledge may even change over time. For example, knowledge and misconceptions about masking during the COVID-19 pandemic evolved to meet specific motives. In the early months of the pandemic, most humans experienced a high motivation to ensure physical safety, and therefore were motivated to acquire and maintain knowledge and behaviors about masking. However, over time, knowledge about masking became associated with social and political affiliation (Young et al., 2022). Holding certain knowledge about masks became an opportunity to affiliate and gain status with social and political groups. Thus, the motivational utility of masking knowledge changed as it no longer fulfilled the motivational goal of physical safety, and instead the knowledge was useful in affiliation and status seeking behavior.

Houselessness

Four studies were conducted to test the novel construct of Motivational Utility of Knowledge within the topic of houselessness. The terms "Houseless" and "Unhoused" are treated as synonymous with "Homeless". "Houseless" and "Unhoused" are used because of recent work by researchers (e.g., Gupta & Jaswal, 2020; Winetrobe et al., 2017) and advocates (e.g., Robbins, 2022; Slayton, 2021) promoting the use of those terms. Houselessness was selected as the topic of interest for several reasons. First, misconceptions about poverty and houselessness are prevalent among adults in the United States. Tsai and colleagues (2019) found that 64% of adults in the United States believe that unhoused people are dangerous, 73% believe that unhoused people are more

likely to commit crimes, and 66% believed that unhoused people could not be trusted. Second, misconceptions about houselessness are frequently espoused in the media (i.e., film, and television) and traditional news sources. A longitudinal study by Gent and Loehwing (2022) identified two dominant story types in American films about houselessness. Either the unhoused character managed to overcome adversity through individual choices and gumption, which propagates the misconception of houselessness as a primarily individual issue (e.g., *The Pursuit of Happyness)*. Or the unhoused character is rescued by a (white) housed savior (e.g., *The Blind Side)*. A similar study by Pruitt, McKinsey, and Barile (2020) found that news coverage of houselessness in Hawai'i relied on stereotypes and stigmatizing characteristics. Finally, misconceptions about unhoused people have detrimental effects. Speak and Tipple (2006) found that interventions for reducing houselessness are often based on negative misconceptions (i.e., unhoused people are lazy and abuse substances), and that as a result, many interventions have no lasting effect.

Four conceptions of the unhoused and houselessness will be examined. The first is the misconception of unhoused people being more threatening or violent compared to housed people. As noted earlier, Tsai and colleagues (2019) found that 64% of adults in the United States believed that unhoused people are dangerous, and 73% believe that unhoused people are more likely to commit crimes than housed people. The second conception is that unhoused people are "other" or "out-group". A landmark study by Olufemi (2002) found that unhoused people are often referred to using derogatory and exclusionary language which is associated with the perception that unhoused people are out-group. The third is the misconception of houselessness being primarily a result of

individual choices. As noted above, previous research into misconceptions around houselessness has shown that, while houselessness is a societal issue, the misconception that houselessness is a result of personal choices is prevalent among adults in the United States and is a repeated theme in media about the unhoused. The fourth is the conception houselessness is primarily due to societal or community failures. Specifically, the availability of affordable housing. This is a true conception, the primary cause of houselessness is a lack of affordable housing. For instance, the National Coalition for the Homeless reported that the primary cause of houselessness is a lack of affordable housing, and that approximately half of all unhoused people hold jobs but cannot afford housing (National Coalition for the Homeless). The U.S. Department of Housing and Urban Development states that affordable housing is essential to fostering healthy communities and reducing houselessness (HUD, 2023).

In the following studies, the relationship of MUK to the four conceptions of unhoused people and houselessness (threatening, out-group, personal choices, societal failure) is tested. In addition, the set of studies contextualize MUK within the research on conceptual change and comprehension and examine the moderating and mediating effects of MUK within known relationships between knowledge, conceptions, and comprehension.

CHAPTER 2

STUDY 1: PRELIMINARY ANALYSES OF THE MOTIVATIONAL UTILITY OF KNOWLEDGE

Data were collected on the novel construct: Motivational Utility of Knowledge (MUK), in the context of houselessness. In addition, participants were assessed on their conceptions of houselessness, their general world knowledge, their comprehension of texts related to houselessness, and their personal experience with houselessness. In the following chapters, the same dataset is used in a set of four studies. The first study is exploratory, wherein descriptive statistics, including means, variance, and correlations were examined to assess MUK as a construct, and examine the relationships between MUK and personal experience with houselessness.

The factor structure of MUK was tested to inform the use of MUK in the following studies. One potential confound was due to wording effects of the different subscales. Specifically, the items representing Maslow's needs pyramid and the items representing Kenrick's fundamental motives were adapted from two different, published scales (Neel et al., 2016; Taomrina & Gao, 2013), introducing the possibility that wording of the items would cause variance between the MUK subscales. In addition, past research has indicated that unhoused people are viewed as more physically violent than housed people (Donley, 2008; Speak & Tipple, 2006; Turner, Funge, & Gabbard, 2018), and that unhoused people are perceived to have social stigmas such as criminal history or poor work ethic (Cronley, 2010; Phelan et al., 1997). Therefore, the factor structure was assessed to identify whether the MUK scale was unidimensional (i.e., an overall "Value of Houseless Knowledge") or multidimensional - either split along theoretical

backgrounds (Maslow, Kenrick) or relationship to houselessness (physical safety, social status, etc).

The measure of MUK was created by adapting prior measures of fundamental motivations and needs. As noted above, MUK encompasses only *fundamental motivations* as characterized by Maslow (1943) and Kenrick and colleagues (2010). Table 1 shows the 10 subscales that were developed, the previous measure they were adapted from, along with the theoretical model that the previous studies were based on.

Table 1.
Items and Constructs Tested in the Scale for the Motivational Utility of Knowledge.

Construct	Number of items	Items adapted from	Theoretical model
Physical Safety	6	Neel et al., 2016	Kenrick et al., 2010
Affiliation	6	Neel et al., 2016	Kenrick et al., 2010
Status	6	Neel et al., 2016	Kenrick et al., 2010
Mate Seeking	6	Neel et al., 2016	Kenrick et al., 2010
Mate Retention	6	Neel et al., 2016	Kenrick et al., 2010
Parenting	6	Neel et al., 2016	Kenrick et al., 2010
Physiological	6	Taormina & Gao, 2013	Maslow, 1943
Safety-Security	4	Taormina & Gao, 2013	Maslow, 1943
Belongingness	6	Taormina & Gao, 2013	Maslow, 1943
Self-esteem	4	Taormina & Gao, 2013	Maslow, 1943
Self-actualization	6	Taormina & Gao, 2013	Maslow, 1943

Method

Participants

Participants (N = 252) from the United States were recruited using the Testable Minds recruiting platform and paid $4 for participation in the study. Participants who failed to respond to more than 75% of the questions, scored below-chance on multiple choice tests, or responded with duplicate or nonsense answers (e.g., responding, “nice” to knowledge questions) were removed, leaving a final n = 190. Participants were required

to be currently living in the United States. The average age of the participants was 40.2 years old, and the majority were female (n = 117). The participants were asked to self-report ethnicity, 19 reported Asian, 26 reported Black or African American, 132 reported Caucasian, 9 reported Hispanic, and 4 reported Biracial. Of the 192 participants, 8 reported they did not speak English as their native language, however all 8 reported that they had spoken English for 7 or more years, and thus were included in the analyses. Finally, participants were asked their highest level of education, 37 reported high school, 55 reported an associate degree or some college, 72 reported a bachelor's degree, and 26 reported a post-graduate degree. See Appendix B for the demographic questions.

Measures

The texts and comprehension questions for the studies were piloted with undergraduate students to assess the validity and reliability of the questions (see Appendix A).

Texts

A set of four texts was used in the study. The texts were drawn from newspaper articles and edited lightly by the researcher for clarity. Each text presented a different view of unhoused people and the causes of houselessness. The texts were presented to students with no title or author information, and order was randomized for each participant to control for the effects of text order. Table 2 shows the title, length, and Flesch-Kincaid grade level of each text.

Table 2.
Titles, Lengths, and Flesch-Kincaid Grade Level of Texts.

Title	Length in Words	FKGL
Houselessness Epidemic	356	12
Individual Responsibility of the Unhoused	300	12
Housing Shortage	353	12
Houselessness in the USA	519	12

Reading Comprehension Questions

Reading comprehension for each text was measured with eight multiple-choice comprehension questions (see Appendix C). Responses were scored such that a correct answer was given a 1, and an incorrect answer was given a 0. From these scores, the proportion of correct responses was derived for each text. The internal reliability of the comprehension questions ranged from $\alpha = 0.51$ to $\alpha = 0.57$, the internal reliability was poor for the questions on the "Reliability" text with $\alpha = 0.42$. The internal reliability of the comprehension questions was lower compared to the internal reliability in the Pilot Study (α for the comprehension tests ranged from 0.61 to 0.70, see Appendix A). In addition, the comprehension questions in the Pilot study were moderately correlated with general prior knowledge and vocabulary knowledge (see Appendix A), indicating that comprehension test score was reflective of general reading skill.

Conceptions of the Unhoused and Houselessness

Participants' conceptions of houselessness were assessed with 16, 5-point (Strongly disagree – Strongly agree), Likert-scale items. The items assessed conceptions on four constructs: a) unhoused people are threatening, b) unhoused people are out-group, c) houselessness is caused by personal choices, and d) houselessness is caused by societal failures. Participants were administered the Conceptions assessment twice, before and after reading the texts. The items in the assessment were presented in a random order to each participant. The reliability of the sub scales in the pretest and posttest ranged from $\alpha = 0.58$ to $\alpha = 0.82$. While the reliability of some of the individual subscales was relatively

low, the reliability of all of the pretest items was $\alpha = 0.86$ and the reliability of all of the items in the posttest was $\alpha = 0.87$[1]. See Appendix D for the full measure.

Emotions while Reading

Participants were assessed on the strength of 18 emotions (3 surprise, 6 positive, 9 negative) they experienced while reading. The test consisted of 18, 5-point (Not at all – Very Strong) Likert-scale items previously used in reading comprehension and misconception research (Trevors, 2022; see Appendix E). The test was administered after each text, a total of 4 times.

Belief Conflict

Participants' belief conflict while reading was assessed with a single item previously used in research on knowledge, comprehension, and misconceptions (see Trevors, 2022). After each text, participants were asked if the information presented in the text conflicts with their personal views, the views of their community, both or neither (see Appendix E).

Motivational Utility of Knowledge

Participants' Motivational Utility of Knowledge (MUK) was measured using 62, 5-point (Strongly disagree – Strongly agree), Likert-scale items (see Appendix F). The test measured 11 fundamental motives from Kenrick and colleagues (2010), and Maslow (1943). The items were researcher-created based on two previous studies measuring fundamental motives (Neel et al., 2016; Taormina & Gao, 2013). The internal reliability of the subscales was good, ranging from $\alpha = 0.72$ to $\alpha = 0.92$.

[1] When calculating reliability for the combined pre and posttest conception measures, the subscale for societal failures was reverse coded.

General Prior Knowledge

Students' prior science knowledge of science, literature, and history was assessed using a 30-item measure of prior knowledge (see Appendix G). The items were general domain knowledge that were not related to the misconception statements. The test has been used previously in studies on comprehension and learning. (McNamara, O'Reilly, Best, & Ozuru, 2006; O'Reilly, Best, & McNamara, 2004; O'Reilly & McNamara, 2007;). The internal reliability in this study was acceptable ($\alpha = 0.65$).

Vocabulary

Students' individual differences in vocabulary were assessed because vocabulary knowledge accounts for unique variance in reading comprehension skill (e.g., Braze et al., 2007). The vocabulary test from the Gates–MacGinitie Reading Test (GMVT; MacGinitie & MacGinitie, 1989) because it is a standardized test that has been used previously in studies on reading and learning (e.g., McCarthy et al., 2018). The test consists of 45 multiple-choice questions in which a word is presented in the context of a sentence and students must select the word or phrase most synonymous with the target word. The internal reliability in this study was good ($\alpha = 0.89$).

Personal Experiences

Participants were asked to report their experience with houselessness based on a 4-level, 7-item scale drawn from the U.S. Department of Housing and Urban Development (HUD). Appendix H shows the HUD levels, and the number of participants who reported that they themselves, a family member, or close friend had experienced the category of houselessness. Level 0 indicated no experience, and level 4 indicated experience with extreme or long-term houselessness. In addition, participants were given

the option to share any personal experiences they had with unhoused people or houselessness in an open-response text box. Each level was scored with a point value corresponding to the level (e.g., participants who responded "Yes" to the level 1 question = 1 point) to create a continuous "Personal Experience" score.

Procedure

Participants were told the study involved reading and learning from multiple texts. After consenting to participate, participants were given the houselessness conceptions pretest. Following the pretest, participants read the four texts in a random order. After each of the four texts, they were administered comprehension questions, the emotions during reading scale, and the belief conflict question. Following the reading tasks, participants were given the houselessness conceptions posttest, followed by the MUK scale, and the general prior knowledge and vocabulary tests. Finally, participants were asked the demographic questions and about their personal experience with houselessness. The average time to complete was 51 minutes (SD = 12.5 minutes).

Preliminary Analyses

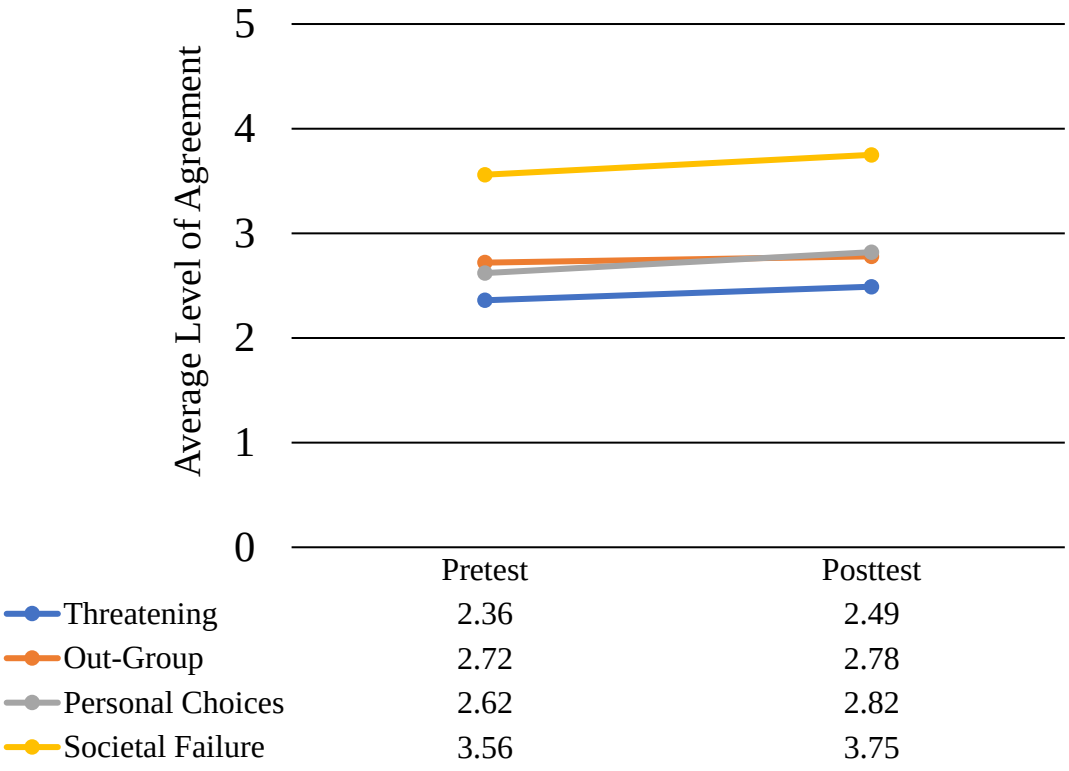
The distributions, skew, and kurtosis of all the measures were examined to assess the extent to which they were normally distributed (see Appendix I for the distributions). Vocabulary had a significant negative skew (skew = -1.37) indicating the participants had generally high vocabulary. Comprehension of the Epidemic text was peaked (kurtosis = 1.24), suggesting that the comprehension questions for that text were not as discriminatory compared to the other texts (i.e., participants tended to receive more similar scores). No other measures had a skew or kurtosis greater than 1.

Houselessness Conceptions

Conceptions of houselessness were measured with 16, 5-point Likert-scale items (e.g., “Most unhoused people are violent”) with 1 indicating strongly disagree, and 5 indicating strongly agree. The means and correlations of the houselessness conceptions pretest and posttest were assessed to identify the pattern of conceptual change during reading. Figure 1 presents the means of the conception measures between sessions. All of the constructs were correlated across the pretest and posttest (i.e., the pretest score and posttest score for that construct were strongly correlated). Three of the constructs were strongly correlated with each other in the pretest, posttest, and between the pretest and posttest. This indicates that some participants tended to hold three conceptions of unhoused people: they are violent; they are out-group; and they are personally responsible for being unhoused. In contrast, both the pretest and posttest measure of houselessness as a societal failure were negatively correlated with the other three constructs, indicating that participants who indicated that houselessness was a result of societal failure tended to disagree with characterizations of unhoused people as violent, out-group, or personally responsible. See Table 3 for the correlation matrix.

Figure 1.

Graph of the Average Conceptions of Houselessness (Threatening, Outgroup, Personal Choice, Societal Failure) by Test.



Note. 5 = Strongly agree, 4 = Agree, 3 = Neither agree nor disagree, 2 = Disagree, 1 = Strongly disagree.

Table 3.

Means and Correlations of the Proportion Scores for Pretest and Posttest Conceptions of Houselessness.

Measure	1.	2.	3.	4.	5.	6.	7.	8.
1. Pretest - Threatening								
2. Pretest - Out-group	**0.46**							
3. Pretest - Personal	**0.56**	**0.51**						
4. Pretest - Society	**-0.34**	-0.16	**-0.29**					
5. Posttest - Threatening	**0.80**	**0.36**	**0.56**	**-0.25**				
6. Posttest - Out-group	**0.41**	**0.78**	**0.55**	**-0.21**	**0.45**			
7. Posttest - Personal	**0.52**	**0.42**	**0.84**	**-0.31**	**0.58**	**0.53**		
8. Posttest - Society	**-0.36**	**-0.26**	**-0.49**	**0.50**	**-0.37**	**-0.32**	**-0.54**	
9. Personal Experience	-0.10	**-0.17**	-0.08	0.04	-0.05	**-0.19**	-0.04	-0.01

Motivational Utility of Knowledge

Participants' MUK was measured with 11 subscales containing a total of 62, 5-point Likert-scale items (e.g., "Does your knowledge about houselessness keep you safe from dangerous people?") with 1 indicating strongly disagree, and 5 indicating strongly agree. Table 4 presents the means and correlations of the MUK subscales. All of the subscales were strongly correlated with each other, suggesting that individuals tended to either view their knowledge of houselessness as fulfilling multiple fundamental motives (e.g., knowledge of houselessness keeps them safe, provides them with affiliation, improves their parenting, etc.) or that their knowledge of houselessness fulfilled no fundamental motives.

Knowledge and Comprehension

The vocabulary and general prior knowledge questions were examined to characterize the academic skill of the participants and the validity of the comprehension measures. Table 5 shows the means and correlations of the vocabulary, prior knowledge, and comprehension questions. Consistent with past research on comprehension, both the prior knowledge subscales and vocabulary tests were correlated with the comprehension questions.

Table 4.

Means and Correlations of the Proportion Scores for Motivational Utility of Knowledge.

Measure	Mean (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Physical Safety	2.51 (0.96)											
2. Affiliation	2.54 (0.66)	**0.56**										
3. Status	2.21 (0.87)	**0.69**	**0.77**									
4. Mate seeking	1.87 (0.82)	**0.54**	**0.71**	**0.79**								
5. Mate retention	2.37 (0.61)	**0.59**	**0.77**	**0.83**	**0.82**							
6. Parenting	2.56 (0.73)	**0.56**	**0.76**	**0.64**	**0.62**	**0.73**						
7. Physiological needs	2.76 (0.47)	**0.48**	**0.64**	**0.66**	**0.61**	**0.62**	**0.60**					
8. Safety-security	2.55 (0.89)	**0.73**	**0.63**	**0.68**	**0.60**	**0.64**	**0.63**	**0.52**				
9. Belongingness	2.55 (0.7)	**0.59**	**0.83**	**0.77**	**0.70**	**0.79**	**0.81**	**0.66**	**0.66**			
10. Self-esteem	2.92 (0.75)	**0.53**	**0.62**	**0.61**	**0.45**	**0.60**	**0.67**	**0.58**	**0.57**	**0.69**		
11. Self-actualization	2.65 (0.96)	**0.64**	**0.79**	**0.78**	**0.66**	**0.76**	**0.78**	**0.69**	**0.71**	**0.82**	**0.77**	
12. Personal Experience	3.19 (5.40)	0.06	0.07	0.02	-0.02	-0.04	0.07	0.01	0.09	0.07	0.11	0.05

Note. Bolded correlations are significant.

Table 5.

Means and Correlations of the Proportion Scores for Prior Knowledge, Vocabulary, and Comprehension Measures.

Measure	Mean (SD)	1.	2.	3.	4.	5.	6.	7.	8.
1. Prior Knowledge - Science	0.64 (0.14)								
2. Prior Knowledge - History	0.62 (0.18)	**0.40**							
3. Prior Knowledge - Literature	0.65 (0.19)	**0.19**	**0.42**						
4. Vocabulary	0.84 (0.15)	**0.33**	**0.47**	**0.34**					
5. Comprehension - Responsibility	0.67 (0.16)	0.15	**0.23**	0.12	**0.39**				
6. Comprehension - Shortage	0.72 (0.16)	0.14	0.15	**0.23**	**0.27**	**0.24**			
7. Comprehension - USA	0.67 (0.19)	**0.25**	**0.32**	**0.32**	**0.44**	**0.32**	**0.35**		
8. Comprehension - Epidemic	0.64 (0.17)	0.14	0.11	0.03	**0.27**	**0.26**	**0.21**	**0.22**	
9. Personal Experience	3.19 (5.40)	-0.01	0.03	0.01	0.04	-0.07	**-0.21**	**-0.03**	-0.04

Note. Bolded correlations are significant

Differences in Conceptions and MUK as a Function of Personal Experience

One potential source of variation between participants' conceptions of houselessness and MUK was participants' personal experience with houselessness. As a preliminary analysis, the correlations between personal experiences and conceptions, and personal experiences and MUK were examined (see Table 6). The correlations were nonsignificant, with only two weak correlations between personal experience and pretest and posttest conception of unhoused people as outgroup. These results indicate that overall differences in MUK and conceptions of houselessness were not strongly related to individuals' personal experience, ruling out personal experience as a potential confound.

Table 6.
Correlations between Personal Experiences and Conceptions, and Personal Experiences and MUK.

Independent Variable	Correlation with Personal Experience
MUK – Physical-Safety	0.06
MUK – Affiliation	0.07
MUK – Status	0.02
MUK – Mate Seeking	-0.02
MUK – Mate Retention	-0.04
MUK – Parenting	0.07
MUK – Physiological	0.01
MUK – Safety-Security	0.09
MUK – Belongingness	0.07
MUK – Self-Esteem	0.11
MUK – Actualization	0.05
Pretest Conceptions – Threatening	-0.10
Pretest Conceptions – Outgroup	**-0.17**
Pretest Conceptions – Personal Choice	-0.08
Pretest Conceptions – Societal Failure	0.04
Posttest Conceptions – Threatening	-0.05
Posttest Conceptions – Outgroup	**-0.19**
Posttest Conceptions – Personal Choice	-0.04
Posttest Conceptions – Societal Failure	-0.01

Note. **Bolded** correlations were significant at $p < 0.05$

Exploratory Factor Analysis of the MUK Subscales

One potential confound was due to wording effects of the different subscales. Specifically, the items representing Maslow's needs pyramid and the items representing Kenrick's fundamental motives were adapted from two different, published scales (Neel et al., 2016; Taomrina & Gao, 2013), introducing the possibility that wording of the items would cause variance between the MUK subscales. In addition, past research on houselessness has repeatedly found that conceptions of unhoused people reflect fear of physical harm (e.g., Tsai et al., 2019) and social stigmas (e.g., Olufemi 2002). Therefore, it was possible that participants' value of houselessness knowledge may reflect more than one underlying construct (i.e., value for physical safety, value for social status) rather than a unidimensional construct (i.e., overall value of houselessness knowledge)

An exploratory factor analysis (EFA) conducted with the subscales of MUK. Figure 2 shows the scree plot of the eigenvalues. Based on the eigenvalue scree plot, a 1-factor solution was deemed appropriate. Table 7 shows the factor loadings for the EFA (RMSEA = 0.14, TLI = 0.89).

Figure 2.
Scree Plot for the Exploratory Factor Analysis of the Subscales of Motivational Utility of Knowledge

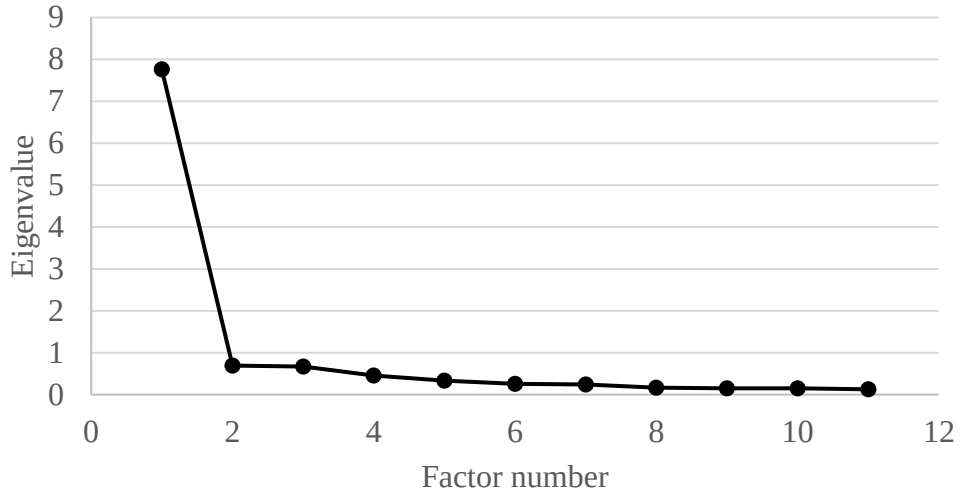


Table 7.
Factor Loadings for the Exploratory Factor Analysis of the Subscales of Motivational Utility of Knowledge

Subscale	Factor Loading
Physical Safety	0.71
Affiliation	0.87
Status	0.88
Mate Seeking	0.79
Mate Retention	0.88
Parenting	0.83
Physiological	0.73
Safety Security	0.77
Belongingness	0.90
Self-Esteem	0.74
Actualization	0.91

Study 1 Discussion

Study 1 was conducted to examine MUK as a construct and test its relationship to personal experiences with houselessness. Participants were adults in the United States recruited from an online survey platform. The participants were asked questions about their conceptions of houselessness, then read four texts offering alternative views of houselessness and were assessed on their comprehension, emotions while reading, and perceived belief conflict after each text. Participants' conceptions of houselessness were reassessed, followed by administration of the MUK scale. Finally, participants were administered a demographics survey, a general prior knowledge test, and a vocabulary knowledge test.

The means, distributions, and correlations of the survey measures were assessed for reliability, normality, and relationships between variables. Specifically, this study sought to rule out potential confounds for future studies and assess the MUK scale. Overall, MUK was not correlated with participants' personal experience with houselessness. This finding indicates that personal experience with houselessness is not directly related to the value that individuals place on their knowledge of houselessness. In addition, only the conception of unhoused people as outgroup was related to participants' personal experience with houselessness. These two findings collectively suggest that personal experience with houselessness is not a confounding factor in further analyses. Finally, an exploratory factor analysis indicated that the subscales of MUK all represented the same latent construct – an overall value of houselessness knowledge. Thus, in subsequent analyses, the subscales are combined into a single score.

The current study was intended as an exploratory study to examine the novel construct, MUK. In the following studies, MUK was operationalized to answer research questions in the domains of conceptual change and text comprehension. Study 2 examined MUK within the literature of conceptual change research. Study 3 examined MUK within the literature of comprehension research. Finally, Study 4 examined MUK as a mediator of the relationship between conceptions, emotions, and comprehension.

CHAPTER 3

STUDY 2: CONCEPTUAL CHANGE

Misconceptions

Misconceptions are knowledge which conflict with established or scientific facts (Vosniadu, 2020). Misconceptions can have large scale implications; for example, misconceptions regarding climate change have led to ineffective governmental policies with immense financial and human costs (Sterman, 2008). Therefore, it is essential to understand how misconceptions differ relative to other concepts in knowledge and identify best practices to revise them.

Research on misconceptions has ancient roots. Aristotle proposed the concept of *Tabula Rasa* in the 4th century B.C.E. (Britannica). The concept was formulated in modern philosophy by John Locke in the 17th century C.E. who proposed that a child's mind is a clean slate upon which experience and education can write knowledge (Britannica). Locke's clean slate was challenged in the 20th century by Piaget's research demonstrating that children think about the world in different ways from adults (Smith, diSessa, & Roschelle, 1994). Building on Piaget's research, psychologists in the 1970s discovered that students held beliefs which were in conflict with established concepts and theories in science that were being taught in their classrooms (Vosniadou, 2020). Students do not come to education as clean slates; rather, they hold explanatory concepts that are durable, resistant to change, and in direct conflict with scientific fact (Smith, diSessa, & Roschelle, 1994).

In the 1990s and early 2000s, misconceptions, the phenomenon of individuals' knowledge which conflict with scientific facts, were found to occur in numerous domains, including among teachers' educational beliefs (Gregoire, 2003), history textbooks (Ferretti, MacArthur, & Okolo, 2005), financial policies (Schatz, 1996), and healthcare practices (Cohen, 1994). Several theories have been proposed to explain phenomenon and guide the development of interventions to enhance conceptual change.

Theories on the Structure of Misconceptions

One early explanation was that misconceptions are simply knowledge that is intuitive or experiential (McCloskey, Washburn, & Felch, 1983). For example, a number of studies found that intuitive knowledge about physics contradicted Newton's laws (McCloskey et al., 1983; McCloskey, 1983). Within this interpretation, conceptual change is simply a matter of effective instruction on the correct concept. However, misconceptions have been repeatedly found to be stable and resistant to instruction (Hake, 1998; Chi, 2009; Watanabe & McNamara, 2020). Furthermore, early interventions demonstrated that students' individual differences in reasoning ability were related to the likelihood they would revise their misconceptions (Lawson & Weser, 1990) and training strategies such as analogical reasoning may be necessary to induce conceptual change (Brown & Clement, 1989). Thus, while some simple misconceptions may arise from intuition, it cannot be that *all* misconceptions are intuitive beliefs that can be "erased" or "rewritten" with factually correct instruction.

Thus, as research on misconceptions continued, two theories were proposed to model the structure of misconceptions in knowledge. The first was the Knowledge in

Pieces (or fragmented) theory (diSessa, 1988; Smith, diSessa & Roschelle, 1994). Within this theory, misconceptions are fragmented pieces of knowledge, known as phenomenological primitives (p-prims). P-prims are simple abstractions from everyday experiences. For instance, a child who throws a ball can generate the (mis)conception that force is something that can be passed between objects, instead of the correct concept that force is an interaction between objects. P-prims are thought to be isolated (i.e., not coherent with other knowledge), fluid (or naïve), and unstable. In comparison to mature concepts which are more organized, coherent, and stable in knowledge (diSessa, 2018).

The alternative to Knowledge in Pieces is the Framework (or coherent) theory. While p-prims are thought to be relatively incoherent, the view of Vosniadou and colleagues is that intuitive knowledge is *coherent*. Knowledge and concepts are not independent of frameworks. Knowledge gleaned from everyday experiences is integrated with other, related knowledge – both intuitive and taught. The integrated pieces of knowledge form a coherent framework with explanatory power. Frameworks are alternative conceptions that are characterized as misconceptions when they are in direct conflict with scientific facts. For example, Vosniadou (1994) interviewed a child who had been taught the Earth is round. That knowledge was integrated with the child's everyday experience that the world is flat. The framework had explanatory power in that the child was asked to draw the Earth and drew a circle, but the child also reported that it was possible to walk off the edge of the Earth. There have been attempts to harmonize the Knowledge in Pieces and Framework theories by identifying the different "conceptual

grain size" at which the theories may be more appropriate (diSessa, 2008), however as of this writing the two theories are still at odds.

One criticism of both the Knowledge in Pieces and Framework theories is that they are domain-specific. The theories are applied to distinct domains of thought (physics in most foundational studies, see diSessa 1988; Vosniadou, 1994) and describe the processes of learning and conceptual change within those domains. There is debate whether domain-specific constraints are innate as opposed to acquired, which would limit the explanatory power of either theory (Chi, 2005). Thus domain-general approaches to misconceptions were proposed. A domain-general explanation that arose from research on concepts and categories is that misconceptions are ontological category errors (Chi, 2005; Chi & Roscoe, 2002; Chi, Slotta & de Leeuw, 1994). Chi (2005) defines ontological categories as, "the basic categories of realities or the kinds of existent in the world, such as concrete objects, events, and abstractions". Different ontological categories are distinguishable from each other by the plausible attributes of that category (Chi & Roscoe, 2002; Chi, 2005). Consider these two sentences:

A dog can be colored green.

A dog can be poured out.

While dogs can *plausibly* be colored green, a dog cannot be plausibly "poured out". Therefore, coloring is an ontological attribute of dogs. A misconception is when one's conception does not match reality at the ontological level (Chi, 2005). In the example above, the conception that there are green colored dogs is plausible, but does not match reality, and is therefore a misconception.

While domain-general approaches to misconceptions may have more explanatory power, domain-specific theories need not be rejected. For instance, Keil (1994) reviewed concept and domain research in the context of new cross-cultural and developmental studies and concluded that it is very likely that both domain-general and domain-specific mechanisms and constraints apply in learning. Furthermore, these divergent views on the nature of misconceptions arose from different lineages in psychology (educational, cognitive) and may yet be unified. One proposal from Goldwater and Schalk (2016) is to orient the discussion of misconceptions on *relational* categories rather than feature (i.e., ontological) categories. Relational categories are defined in terms of how they interrelate and are learned in specific contexts compared to the abstract features of ontological categorization. Unifying multiple approaches to misconceptions is a worthy goal, yet it is beyond the scope of this dissertation. As such, this dissertation is situated within the research on the Framework theory.

This study is guided primarily by the assumptions within the Framework theory. Namely, concepts are embedded within frameworks and are coherent with other knowledge; they are alternative conceptions that have explanatory power; and they are in conflict with the scientific facts. While the ontological categorization model of misconceptions was considered, the Framework theory was selected for two reasons. First, the assumption that concepts are embedded in frameworks that arise from experience has explanatory power for the domain selected (houselessness). Second, the Framework theory was foundational for the research on conceptual change that is reviewed and operationalized (see "Refutational Texts" below).

Categories of Misconceptions

In addition to describing how misconceptions are structured in knowledge, researchers also began to examine another behavioral phenomenon: put simply, some misconceptions are more difficult to change than others. The observed differences between misconceptions across topics and domains produced several models that classify misconceptions into hierarchies.

A domain-general approach to categorically ordering misconceptions was proposed by Chi (2008) based on her work on misconceptions as ontological categories. Within her model, knowledge can be *inaccurate*, meaning that there is an incorrect value, but the property is plausible (i.e., dogs are the same size as salmon) or *incommensurate*, meaning that the knowledge is incorrect and not plausible (i.e., dogs lay eggs like salmon). These two categories are further divided based on the four levels of knowledge representations typically used in cognitive science research: propositions (false beliefs), mental models (flawed mental models), categories (category mistakes), and schemas (missing schema). Chi's model has theoretical strengths, specifically in the clear link to research in other areas of knowledge and memory. However, two other models were considered in an effort to remain consistent with research on the Framework theory of misconceptions.

Vosniadou (1994) argued that there is a distinction between specific theories and frameworks. Specific theories are conceptions that describe a single property or behavior and are generated through observation or constrained information. For example, the observation that cold objects heat up when coming into contact with hot objects can lead

to a specific theory that "hotness is a transferable property of physical objects" which is in fact a misconception. Frameworks are coherent sets of concepts, which include specific theories and correct concepts, and are used to generate mental representations and predictions about the world (Vosniadou, 1994). Vosniadou's ideas were grounded in physics education, and as such, other domain-specific and domain general classification models were proposed.

Gregoire (2003) proposed another domain-specific model, the Cognitive-affective Model of Conceptual Change (CAMCC). Her 3-tiered categorization is structured around the behavioral responses to information which conflicts with existing misconceptions. When conflicting information is presented, individuals can either appraise the information as self-implicating or not. Self-implicating information is that which involves one's core beliefs about oneself (Schlenker, 1982). If the information is not self-implicating, it is *inconsequential*, processed heuristically, and assimilated (superficial conceptual change) into knowledge. If the information is self-implicating, the information is classified as either *challenging* or *threatening*. The difference between challenging and threatening information depends on the individuals' motivation (e.g., self-efficacy) and skill (e.g., time, knowledge, strategy). A sufficiently motivated and skilled individual appraises the information as challenging, systematically processes it, and accommodates (true conceptual change) the information into knowledge. A less motivated or skilled individual appraises the information as *threatening* and assimilates the information.

The CAMCC was empirically tested on teachers' attitudes towards math education (Gill et al., 2022). Researchers found that refutational messages that were

perceived as challenging (i.e., self-implicating but not perceived as threats) enhanced conceptual change compared to messages that were perceived as inconsequential. Further research operationalizing Gregoire's model has identified both new domains in which it is applicable, and emotional responses that are associated with appraisals of self-implicating information. Studies on diverse topics including dieting (Trevors et al., 2016), vaccinations (Nyhan & Reifler, 2015), and even violent video games (Nauroth et al., 2014) have reported that self-implicating information produces a negative emotional response and inhibits conceptual change.

A key question raised by the research on the structure of misconceptions and categories of misconceptions regards the extent to which properties of knowledge cause individuals to deem challenges to knowledge as self-implicating. MUK may provide a paradigm by which knowledge and misconceptions can be measured as more or less self-implicating (i.e., inconsequential, challenging, or threatening).

Research Question 1: Does MUK provide a way to differentiate between conceptions that are self-implicating?

Past research on houselessness has found that conceptions of unhoused people as threatening, out-group, and personally responsible for their situation are prevalent among adults (Tsai et al., 2019). In addition, individuals who hold misconceptions about unhoused people are more likely to report unhoused people are out-group (Olufemi, 2002). That is, individuals' misconceptions about unhoused people are correlated with their perception of social status and social identity. Based on this past research, it was hypothesized that MUK would be positively correlated with conceptions of unhoused

people as threatening, out-group, and personally responsible. That is, individuals who perceive their social status and identity as threatened by unhoused people would hold stronger negative conceptions of houseless people, and as such, would also perceive that their knowledge of the topic affords opportunities or removes threats to fundamental needs.

Conceptual Change

Since the beginning of modern misconception research, researchers have attempted to model the cognitive processes behind conceptual change. The goals of this line of research has been twofold: (a) to identify individual differences in humans' propensity to engage in conceptual change, and (b) to design interventions to enhance conceptual change. This dissertation is consistent with the work by Vosniadou defining conceptual change as the restructuring of existing knowledge or knowledge structures (Vosniadou & Brewer 1987; Vosniadou, 2009).

One of the early theories of conceptual change was based on the Piagetian principles of accommodation and assimilation. Posner and Strike (1992) proposed that conceptual change occurs when an individual encounters a situation in which their conception is non-functional. This leads to dissatisfaction with the current conception, and either modifies their conception (weak change) or abandons the current conception and adopts a new conception (strong change). The work by Posner and Strike was further developed to examine the information processing aspects of conceptual change.

In line with the diverse theories on misconceptions, there are also diverse theories on how conceptual change occurs. Chi, Slotta, and Leeuw (1994) focused on the

ontological categorization, and mis-categorization, of entities. Their model proposes that conceptual change requires learners to undergo an ontological category shift. For instance, a learner who categorizes light as an entity must be taught that light is a process. In comparison, work by Vosniadou and Ionnides (1998) suggests that ontological change is only one of the possible paths for conceptual change. In addition to ontological change, students must also revise elements of their naïve concepts to match the scientific reality.

Refutation Texts

In recent years, conceptual change has been repeatedly studied in the context of refutation texts (Zengliowski et al., 2021). Refutation texts are considered the gold standard in text-based conceptual change research (Tippet, 2010). A refutation text is a text either written or adapted specifically to refute a misconception or set of misconceptions in a topic area (Sinatra & Broughton, 2011). Refutation texts are defined by three characteristics: (a) they contain a definition of a common misconception, (b) there are explicit statements addressing the inaccuracies in these beliefs, and (c) these statements are followed by explanations and evidence of the correct view of the concept (Guzzetti et al., 1997). The Knowledge Revision Components Framework (KReC: Kendeou & O'Brien, 2014) describes the cognitive processes underlying the refutation texts. The combined statements of the misconception and correct concept *co-activate* the correct and incorrect concepts in memory. Once both concepts are activated, the explanations and evidence of the correct concept continue to activate the correct concept, but not the incorrect concept. The continual activation increases the likelihood that the correct concept will become integrated in memory.

Refutation texts have been broadly studied since the 1990s. Studies on refutational texts have most commonly been situated in the domain of "hard" scientific learning and knowledge, for instance, physics or chemistry (Zengliowski et al., 2021). Multiple studies have demonstrated the effectiveness of refutation texts in enhancing revision of misconceptions about Newton's Laws or heat transfer in physics (Baser & Geban, 2007; Guzzetti et al., 1997; Kendeou, Muis, & Fulton, 2011). Recently, researchers have begun using refutation texts in domains such as history (Donovan, Zhan, & Rapp, 2018), social sciences (Lassonde, Kendeou, & O'Brien, 2016), and political beliefs (Nussbaum, Cordova, & Rehmat, 2017). These new topics have enriched the literature on refutation texts by extending the research to new domains, as well as testing "warm" factors such as emotions, epistemic beliefs, or identity conflict (Zengilowski et al., 2021).

Within the literature on refutation texts, there are divergent findings on their effectiveness. Some studies have demonstrated that refutation texts are effective interventions to revise misconceptions. (Ariasi & Mason, 2011; Sinatra & Broughton, 2011). However, others have found them to be ineffective in correcting misconceptions compared to non-refutation texts (Mikkila-Erdmann et al., 2008; Watanabe & McNamara, 2020). Finally, there have even been studies that report, "backfire effects" (Kessler, Braasch, & Kardash, 2021). A backfire effect is when individuals are more likely to endorse a misconception after an intervention aimed at correcting the misconception. One explanation for the divergent findings is that the effect of refutation texts depends on the individual differences in learners' affective states or personal values.

Individual Differences in Conceptual Change

Early research on conceptual change focused on cognitive abilities (e.g., reasoning ability, metalearning, etc.) as potential factors to explain differences in misconception revision. For example, studies on conceptual change in biology found that reasoning ability was related to the likelihood that participants would revise their misconceptions (Lawson & Weser, 1990). An early intervention based on similar findings was conducted by Brown and Clement (1989) who trained students in analogical reasoning as an intervention to enhance conceptual change. White and Gunstone (1989) promoted metalearning, the conscious control over one's learning, as the key to conceptual change.

Approaches such as these studies were labeled as "cold conceptual change" by Pintrich and colleagues (1993) because these types of studies focused on rational, cognitive factors while excluding affective and motivational factors. Pintrich was an early researcher in the field who examined how these "warm" factors influenced conceptual change. Most of his work was focused on students' achievement goals (see Linnenbrink & Pintrich, 2002; Pintrich, et al., 1993). He identified that students who adopted mastery goals (i.e., they are motivated to learn and understand ideas) were more likely to revise misconceptions compared to students who adopted performance goals (i.e., motivated to demonstrate one's ability in relation to others). He also articulated a vision of conceptual change research that included research into factors such as epistemological beliefs, self-efficacy, intention to change conceptions, and aspects of the learners' personal and affective characteristics (Linnenbrink & Pintrich, 2002). On the last point specifically,

Pintrich urged researchers to consider individual differences in interest, values, and importance that affect conceptual change. As we will examine below, while epistemological beliefs, self-efficacy, and intention to change conceptions have been studied in the literature, there are few studies that consider individual differences in values and importance and how they relate to conceptual change.

Pintrich's first three proposed areas of study have been well researched over the past 20 years. Multiple studies have investigated the role of epistemic beliefs (e.g., Andre & Windschitl, 2003; Mason, Gava, & Boldrin, 2008; Franco et al., 2012; Murphy & Alexander, 2016); self-efficacy (e.g., Cordova et al., 2014; Kang et al., 2005; Lee, Cawthon, & Dawson, 2013; Leuchter et al., 2020); and learning intention (Hallden, Scheja, & Haglund, 2009; Sinatra & Pintrich, 2003; Sinatra, & Taasoobshirazi, 2011; Treagust & Duit, 2008) on conceptual change. In comparison, there is less empirical research focused on the role of personal values or importance in conceptual change. There are several studies on learners' task-value (e.g., Jones, et al., 2015; Muis et al., 2018) that measure participants' self-reported and/or situational *interest* in the topic. However, only in recent years have researchers begun to examine how personal *values* or personal *importance* may influence conceptual change. A study by Gill and colleagues (2022) found a relationship between teachers' beliefs about teaching and their propensity to revise misconceptions. Trevors (2022) used a purposeful sampling technique to recruit participants that were likely to hold misconceptions about immigration, crime, and vaccination safety, and found that participants reported negative emotions overall, which negatively predicted conceptual change.

While there have been recent advances in examining how personal values affect conceptual change, few studies have attempted to investigate the *nature* of different values. For example, studies by Trevors (2016, 2022) simply queried participants on whether they felt the information in the task conflicted with belief. By introducing MUK into this line of research, we can examine whether participants' perception of identity conflict stems from their fundamental motives, which can lead to improved interventions to refute misconceptions.

Research Question 2: To what extent does MUK influence conceptual change?

Based on the past research on the role of personal value and importance in conceptual change, it was hypothesized that participants' conceptual change between the pretest and posttest would depend on their MUK such that the difference in conceptions between participants with high MUK and participants with low MUK would be enhanced in the posttest after reading the four texts on houselessness.

Study 2 Results

Research Question 1

Our first research question was how to assess and differences between self-implicating and inconsequential misconceptions. Conceptions of houselessness were measured, along with individuals' MUK. It was hypothesized that if individuals perceived their conceptions of houselessness as self-implicating (i.e., involving a core belief about oneself), there would be a correlation between MUK and participants' conceptions of unhoused people as threatening, outgroup, and personally responsible.

Table 8 shows the correlation matrix between conceptions of houselessness and MUK subscales.

Table 8.
Correlations between Motivational Utility and Pretest Conceptions of Houselessness.

MUK Subscale	Pretest Conception of Houselessness			
	Threatening	**Outgroup**	**Personal Choice**	**Societal Failure**
1. Physical Safety	**0.51**	**0.33**	**0.32**	**-0.15**
2. Affiliation	**0.22**	0.05	0.10	-0.05
3. Status	**0.35**	**0.27**	**0.21**	-0.14
4. Mate seeking	**0.30**	0.10	0.15	-0.18
5. Mate retention	**0.28**	**0.18**	**0.18**	-0.08
6. Parenting	**0.22**	0.13	**0.18**	-0.10
7. Physiological needs	**0.18**	0.13	0.13	-0.07
8. Safety-security	**0.31**	0.14	**0.20**	0.01
9. Belongingness	**0.27**	**0.18**	**0.19**	-0.01
10. Self-esteem	0.13	0.14	0.14	-0.05
11. Self-actualization	**0.21**	0.01	0.14	-0.02

Note. **Bolded** correlations are significant at $p < 0.01$

The pattern of results was consistent with our hypotheses, participants who thought unhoused people were threatening, out-group, and personally responsible were more likely to report that their knowledge of unhoused people was valuable. Notably, the correlations between MUK subscales and conceptions of houselessness as societal failure were in the opposite direction or null, indicating that there were differences in perceived value based on the specific conception.

Research Question 2

Our second research question was on the effects of MUK on conceptual change. It was hypothesized that participants' conceptual change between the pretest and posttest would depend on their MUK such that the difference in conceptions between participants with high MUK and participants with low MUK would be enhanced in the posttest.

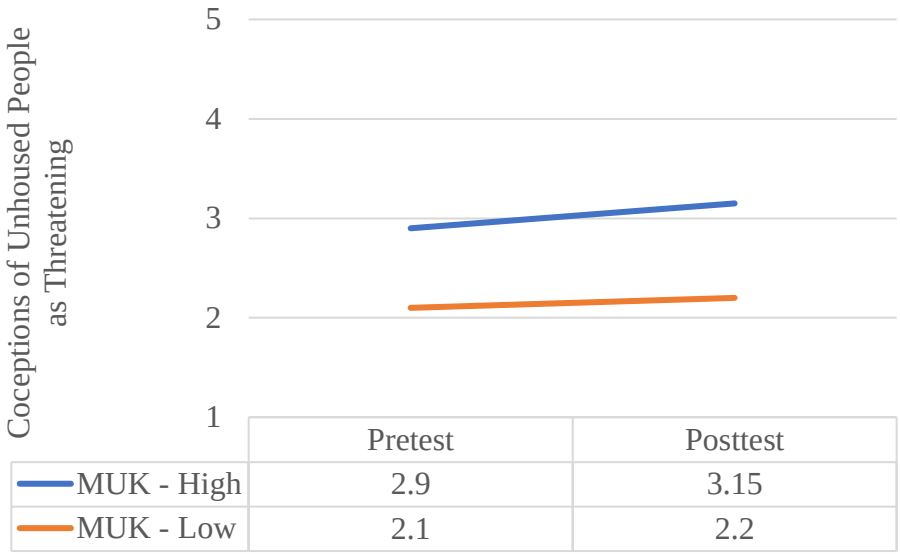
Four linear mixed effects (LME) models were conducted predicting conceptions of houselessness (threatening, outgroup, personal choice, societal failure) by test (pretest, posttest), general academic knowledge score, MUK, personal experience, and the interactions of test by vocabulary, test by MUK, and test by personal experience. ID was entered as the random variable.

In the model predicting conceptions of unhoused people as threatening, there were main effects of academic knowledge such that more knowledgeable participants were less likely to agree with statements characterizing unhoused people as threatening. In addition, there was a main effect of MUK such that participants with high MUK were more likely to agree with statements characterizing unhoused people as threatening. There was a significant interaction between Test and MUK such that the difference in conceptions between participants with high and low MUK was enhanced in the posttest. There was also a significant interaction between Test and Personal Experience such that the difference in conceptions between participants with high and low personal experience was attenuated in the posttest. Table 9 contains the full model, and Figure 3 shows the interaction between MUK and test.

Table 9.
LME Model Predicting Conceptions of Unhoused People as Threatening by Test (pre, post), Vocabulary, MUK, and the Interactions of Test by Vocabulary and Test by MUK.

Predictor	**Estimate**	**SE**	**t**	**p**
Test (Posttest)	0.19	0.103	-1.85	0.07
General Academic Knowledge	-1.06	0.401	-2.64	**<0.01**
MUK	0.31	0.077	4.06	**<0.01**
Personal Experience	-0.03	0.014	-1.94	0.06
Test * General Academic Knowledge	0.02	0.107	1.94	0.06
Test * MUK	0.06	0.206	2.78	**<0.01**
Test * Personal Experience	0.01	0.003	2.92	**<0.01**

Figure 3.
Estimated Marginal Means of Conceptions of Unhoused People as Threatening as a Function of Test and MUK, holding General Academic Knowledge Constant.



Note. For the conceptions scale 5 = Strongly Agree, 1 = Strongly Disagree. The line "MUK – High" is the EMM of conceptions at the 75th percentile of MUK. The line "MUK – Low" is the EMM of conceptions at the 25th percentile of MUK.

In the model predicting conceptions of unhoused people as outgroup, there was a main effect of test such that participants were more likely to agree that unhoused people are outgroup in the posttest compared to the pretest. There were main effects of academic knowledge such that more knowledgeable participants were less likely to agree with statements characterizing unhoused people as outgroup. In addition, there was a main effect of personal experience such that participants with high personal experience were less likely to agree with statements characterizing unhoused people as outgroup. There was a significant interaction between test and academic knowledge such that the difference in conceptions between high and low knowledge participants was attenuated in the posttest. There was a significant interaction between test and MUK such that the difference between participants with high and low MUK was enhanced in the posttest.

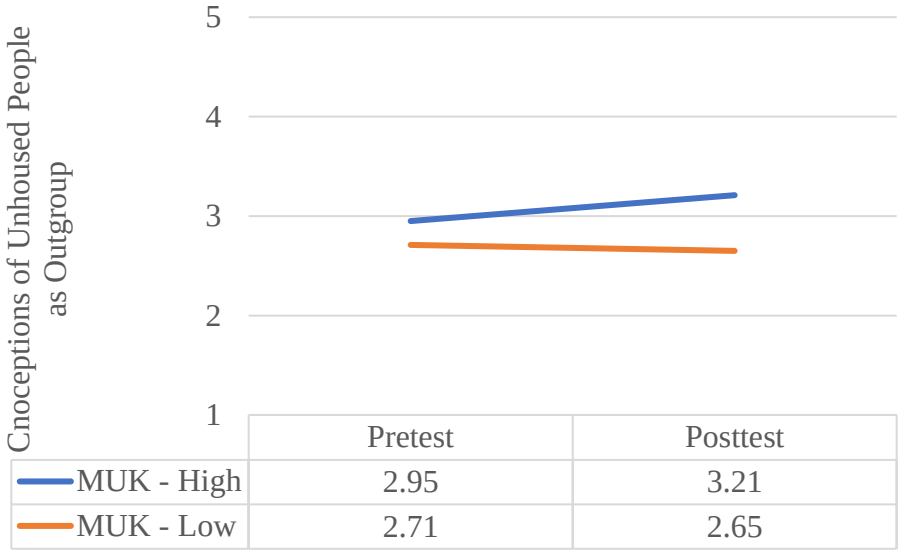
Table 10 contains the full model and Figure 4 shows the interaction between MUK and test.

Table 10.
LME Model Predicting Conceptions of Unhoused People as Out-group by Test (pre, post), Vocabulary, MUK, and the Interactions of Test by Vocabulary and Test by MUK.

Predictor	**Estimate**	**SE**	**t**	**p**
Test (Posttest)	0.95	0.11	-8.64	<**0.01**
General Academic Knowledge	-1.59	0.42	-3.75	<**0.01**
MUK	0.10	0.08	1.21	0.22
Personal Experience	-0.04	0.02	-2.88	<**0.01**
Test * General Academic Knowledge	0.96	0.11	8.41	<**0.01**
Test * MUK	0.12	0.02	5.41	<**0.01**
Test * Personal Experience	-0.01	0.01	-0.55	0.58

Figure 4.

Estimated Marginal Means of Conceptions of Unhoused People as Out-group as a Function of Test and MUK, holding General Academic Knowledge Constant.



Note. For the conceptions scale 5 = Strongly Agree, 1 = Strongly Disagree. The line "MUK – High" is the EMM of conceptions at the 75th percentile of MUK. The line "MUK – Low" is the EMM of conceptions at the 25th percentile of MUK.

In the model predicting conceptions of houselessness as a result of personal choices, there was a main effect of test such that participants were more likely to agree with statements characterizing houselessness as a result of personal choices in the posttest compared to the pretest. There was a main effect of academic knowledge such that participants with higher vocabulary were less likely to agree with statements characterizing houselessness as a result of personal choices. In addition, there was a main effect of MUK such that participants with high MUK were more likely to agree with statements characterizing houselessness as a result of personal choices. There was a significant interaction between academic knowledge and test such that the difference between high and low knowledge participants was enhanced on the posttest. There was a significant interaction between MUK and test such that the difference between

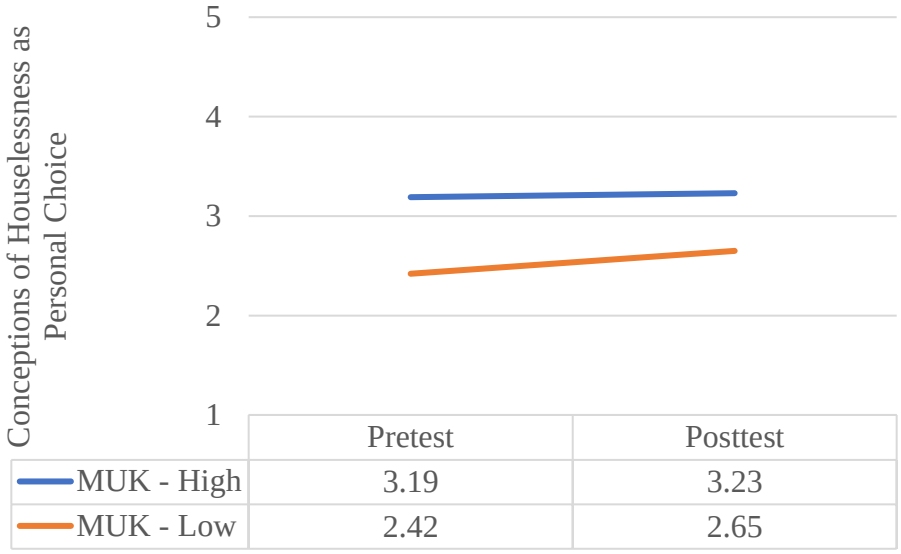
participants with high and low MUK was attenuated on the posttest. There was a significant interaction between test and personal experience such that the difference between participants with high and low personal experience was attenuated on the posttest. Table 11 contains the full model and Figure 5 shows the interaction between MUK and test.

Table 11.
LME Model Predicting Conceptions of Houselessness as Personal Choice by Test (pre, post), Vocabulary, MUK, and the Interactions of Test by Vocabulary and Test by MUK.

Predictor	**Estimate**	**SE**	**t**	**p**
Test (Posttest)	0.62	0.085	7.29	**<0.01**
General Academic Knowledge	-1.11	0.390	-2.81	**<0.01**
MUK	0.26	0.075	3.52	**<0.01**
Personal Experience	-0.02	0.014	-1.48	0.14
Test * General Academic Knowledge	-0.37	0.089	-4.21	**<0.01**
Test * MUK	-0.72	0.017	-4.18	**<0.01**
Test * Personal Experience	0.01	0.003	3.47	**<0.01**

Figure 5.

Estimated Marginal Means of Conceptions of Houselessness as a Personal Choice as a Function of Test and MUK, holding General Academic Knowledge Constant.



Note. For the conceptions scale 5 = Strongly Agree, 1 = Strongly Disagree. The line "MUK – High" is the EMM of conceptions at the 75th percentile of MUK. The line "MUK – Low" is the EMM of conceptions at the 25th percentile of MUK.

In the model predicting conceptions of houselessness as a result of societal failure, there were no main effects. There was a significant interaction between academic knowledge and test such that the difference between high and low knowledge participants was attenuated on the posttest. There was a significant interaction between MUK and test such that the difference between participants with high and low MUK was enhanced on the posttest, Table 12 contains the full model and Figure 6 shows the interaction between MUK and test.

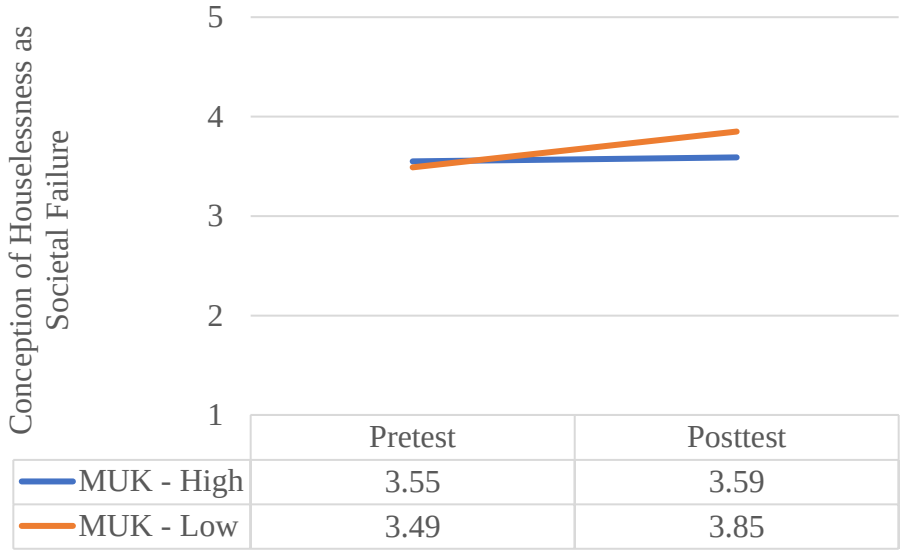
Table 12.

LME Model Predicting Conceptions of Houselessness as Societal Failure by Test (pre, post), Vocabulary, MUK, and the Interactions of Test by Vocabulary and Test by MUK.

Predictor	**Estimate**	**SE**	**t**	**p**
Test (Posttest)	0.04	0.10	0.27	0.79
General Academic Knowledge	-0.07	0.04	-0.21	0.84
MUK	0.02	0.01	0.35	0.72
Personal Experience	0.01	0.01	0.47	0.64
Test * General Academic Knowledge	0.65	0.15	4.21	**<0.01**
Test * MUK	-0.13	0.03	-4.38	**<0.01**
Test * Personal Experience	0.01	0.01	-0.52	0.59

Figure 6.

Estimated Marginal Means of Conceptions of Houselessness as a Societal Failure as a Function of Test and MUK, holding General Academic Knowledge Constant.



Note. For the conceptions scale 5 = Strongly Agree, 1 = Strongly Disagree. The line "MUK – High" is the EMM of conceptions at the 75th percentile of MUK. The line "MUK – Low" is the EMM of conceptions at the 25th percentile of MUK.

The slopes of the individual participants' conceptual change by MUK score were examined, however there were no immediately apparent trends in the data (see Appendix J.). Overall, the results of the LME models suggest that general academic knowledge was the strongest predictor of conceptions and of conceptual change. However, there was a significant interaction between MUK and test on each of the four models, indicating that the extent to which participants reported that their knowledge of houselessness filled a fundamental motive affected their conceptual change.

Study 2 Discussion

Study 2 was conducted to assess MUK as a construct that explains differences between misconceptions that are perceived as inconsequential and misconceptions that

are perceived as self-implicating. In addition, we sought to determine whether MUK may predict individual differences in conceptual change.

Consistent with our hypothesis, MUK was significantly correlated with conceptions such that participants who strongly agreed with misconceptions of houselessness also thought their knowledge afforded them physical safety, status, etc. This finding indicates that participants with strong beliefs or conceptions *also* tend to identify those conceptions as fulfilling fundamental motivations. Within the Cognitive Affective Model of Conceptual Change (CAMCC: Gregoire, 2003), challenges to misconceptions that are perceived as self-implicating can either be challenging or threatening: challenging if the learner is sufficiently skilled and motivated to change conceptions, threatening if they are neither. Previous work on the CAMCC has focused on motivation in terms of self-efficacy or task interest (e.g., Gill et al., 2022). The findings of this study suggest that fundamental motives may also play a role in whether learners perceive challenges to misconceptions as either inconsequential, challenging, or threatening. Further work should examine whether specific sub-motives (i.e., physiological, status/esteem, etc.) predict differences between challenging and threatening misconceptions, and whether the sub-motives interact or differ between topics.

In addition, there were small effects of MUK on conceptual change such that the difference in conceptions between participants with low and high MUK was enhanced on the posttest. This finding is consistent with past research on conceptual change that demonstrates the importance of personal value or importance in predicting knowledge

revision (e.g., Trevors et al., 2016). While these effects were small, the study was not designed as a conceptual change study (e.g., there was no refutational text or conceptual change messaging), and the overall findings were in the predicted direction. Thus, this study provides preliminary evidence that MUK may be a useful paradigm in describing *why* individuals deem certain knowledge as valuable or important.

As noted earlier, the major limitation of this study also provides an avenue for future study. There were no refutational materials nor conceptual change strategies implemented in the study. Thus, any conceptual change could only be attributed to the arguments in the texts, or random error. In either case, we did observe a small, differential effect of MUK in the hypothesized direction. Thus, one future area of study is to examine whether implementation of conceptual change materials or strategies may be more effective for individuals who perceive their misconceptions as low MUK compared to individuals perceive their misconceptions as high MUK.

CHAPTER 4

STUDY 3: TEXT COMPREHENSION

Comprehension

Comprehension as a behavioral phenomenon is somewhat difficult to define (Kintsch, 1998; Kintsch & Rawson, 2005). Kintsch (1998) defined it broadly as a constraint satisfaction process and theorized that comprehension was a paradigm for general cognition. This dissertation is situated in the domain of work by McNamara and colleagues, who define comprehension as "the processing of information to extract meaning" (McNamara & Magliano, 2009). Comprehension is the act of generating a *mental representation* that reflects the overall meaning of a set of information (i.e., a text). The study of comprehension has primarily been situated in the domain of text comprehension (Kintsch, 1998; McNamara & Magliano, 2009). Models of text comprehension assume that comprehension is constrained by memory capacity and information availability. Consistent with connectionist models, comprehension models assume activation of concepts spreads to related concepts and that readers generate a mental representation while reading that consists of both the information derived from the text and text-based inferences (McNamara & Magliano, 2009).

While there are several models of text comprehension (see McNamara & Magliano, 2009 for a review). The foundational model of text comprehension is the Construction-Integration (CI) model (Kintsch, 1988; Kintsch 1998). It is parsimonious and able to explain readers' comprehension of a variety of texts, including textbooks, mathematical word problems, and narrative texts (Kintsch, 1998). The model portrays

comprehension as a two-step process. The first is construction, during which the reader activates information from the text and prior knowledge based on the current input from the text, resulting in a propositional network. This stage of activation is called "dumb activation" because it is assumed that top-down processes do not initially constrain activation. In the second step, the propositional network is integrated into the reader's mental representation through the spreading of activation until there is no further change in activation patterns. The construction-integration process occurs in cycles, such that each propositional network is immediately processed and integrated into the mental representation (Kintsch, 1998). Empirical evidence for the CI model includes experiments demonstrating sentences with more propositions are read more slowly than sentences of the same length with fewer propositions (Graesser, Hoffman & Clark, 1980; Kintsch & Keenan, 1973), simulations of the spreading activation through a connectionist network (Kintsch, 1998); and the observation that the effects of text cohesion and prior knowledge interact (McNamara et al., 1996).

According to the CI model, the product of the comprehension process is a *mental representation* consisting of two levels: a textbase, and a situation model. The textbase is the propositions that were derived from the explicit textual information during reading and the *automatic* inferences generated while reading. For example, consider these two sentences (Kintsch & Rawson, 2005):

The turtle sat on a log.

A fish swam under the log

The reader can automatically generate the inference that the fish is under the turtle. The situation model includes the inferences that the reader purposefully generates that extend *beyond* the explicit information in the text. The twofold nature of the mental representation has been demonstrated by studies designed to examine extreme cases where either the textbase or situation model are all that is remembered. Bransford and Franks (1971) found that when readers are disrupted or read sentences out-of-order, they retain little to none of the textbase, but are still able to generate extra-textual inferences and answer conceptual questions on the text because they generated a stable situation model. In contrast, a study by Moravcsik and Kintsch (1993) demonstrated that a sufficiently coherent text affords skilled readers enough information to construct a stable textbase representation; however, because they possessed limited knowledge of the topic, they were unable to elaborate beyond the text, nor answer questions about the deeper concepts in the text.

From the beginning of research that led to and instantiated the CI model, it was theorized that prior knowledge is a key aspect of successful comprehension. Prior knowledge is thought to affect both the construction of the mental representation as well as the integration of the representation (Kintsch, 1998). Prior knowledge affords readers the ability to generate inferences between words and sentences in the text. The effect of readers' differences in knowledge on inferencing is stronger in domains such as chemistry or physics that require specialized knowledge to understand the connections within the text (Kendeou & van den Broek, 2007). In comparison, narrative texts afford the reader the opportunity to generate inference with only general world knowledge. Prior

knowledge also affords readers the ability to integrate the newly formed mental representation into memory (McNamara & Kintsch, 1996). The importance of prior knowledge to comprehension was underscored in a landmark study by McNamara and colleagues (1996) that found that the effects of readers' prior knowledge interact with the effect of text cohesion.

A review of prior knowledge in comprehension studies found that prior knowledge accounts for between 30%-60% of the variance in performance on comprehension tasks (Shapiro, 2004). Further research in the years since Shapiro's review has continued to demonstrate that learners' prior knowledge is linked to their comprehension. For example, students with more prior knowledge are better able to generate bridging inferences and elaborations while reading (Goldman et al., 2012). The growing body of research on prior knowledge has begun to inform the research on misconceptions, and specifically, refutation texts (e.g., Kendeou et al., 2019; Lassonde et al., 2016; Mason et al., 2019; Watanabe & McNamara., 2020). In addition, there has been growing research on specific dimensions of knowledge, such as specificity or knowledge value. For instance, McCarthy and colleagues (2018) examined the effects of knowledge specificity on comprehension. The primary line of research in which knowledge importance or value has been examined is the research on the text-belief consistency effect.

Text-belief consistency

The text-belief consistency effect is the finding that participants' comprehension is enhanced when reading a text that is consistent with their beliefs, and inhibited when

reading a text that is inconsistent with their beliefs. Maier and Richter (2013) conducted the foundational study on the text-belief consistency effect. Students read a set of four texts on global warming, two texts arguing that global warming is manmade, and two arguing that global warming is naturally occurring. Students' mental representations of the texts were biased towards their beliefs, and the students better remembered the belief-consistent texts (Maier & Richter, 2013). Further research into the text-belief consistency effect has found that students read belief-inconsistent texts more slowly compared to belief-consistent texts (Maier, Richter, & Britt, 2018) and metacognition and metacognitive strategies mediate the text-belief consistency effect (Maier & Richter, 2014; Wolfe & Williams, 2018). The text-belief consistency effect has been found at different levels of education (Abendroth & Richter, 2020) and among second-language learners (Karimi & Richter, 2021).

The text-belief consistency effect has been studied on a variety of topics, including controversial scientific topics (e.g., global warming, vaccination) and socio-scientific topics (e.g., gender roles, teaching credentials). Participants are typically asked to rate their agreement with beliefs or conceptions around these issues, as well as whether the texts conflict with their beliefs (Abendroth & Richter, 2020; Maier & Richter, 2013). However, the nature of the belief-inconsistency has not been assessed. For instance, while two individuals may both strongly agree that global warming is manmade, one individual may be an environmental scientist, for whom the conflict is related to their employment and social standing, whereas the other may not perceive the conflict as threatening their fundamental needs. Thus, one question is whether individual differences

in the *value* that participants place on their beliefs may enhance the text-belief consistency effect.

Research Question 3: Is the text-belief consistency effect moderated by the motivational utility of knowledge?

Based on the research on the text-belief consistency effect, it was hypothesized that there would be an interaction between belief conflict and MUK such that among participants who reported the text conflicted with their beliefs, participants with high MUK would have worse text comprehension compared to participants with low MUK.

Study 3 Results

Research Question 3

Our third research question was to examine differences in comprehension as a function of participants' general academic knowledge, conceptions of homelessness, MUK, emotions while reading, and personal experience with homelessness. An omnibus, linear mixed effects (LME) model was conducted predicting comprehension score by text, general academic knowledge (i.e., prior knowledge and vocabulary summed together), averaged pretest conceptions of houselessness, averaged MUK, personal experience with houselessness, reported conflict with text, surprise while reading, positive emotion while reading, negative emotion while reading, and two interactions. The interaction between pretest conceptions and text were tested, as the texts presented different viewpoints on the topic of houselessness and conceptions were hypothesized to affect comprehension of belief-consistent or belief-inconsistent texts. The interaction

between MUK and text conflict was tested because it was hypothesized that the text-belief consistency effect would be enhanced when participants reported that their related knowledge fulfilled fundamental motives. Text was entered in the model as a covariate, and item and ID were entered as random variables. Table 13 shows the full model.

Table 13.
Omnibus Linear Mixed Effects Model Predicting Text Comprehension.

Predictor	**Estimate**	**SE**	**t**	**p**
Responsibility Text	0.03	0.049	0.64	0.51
Shortage Text	-0.01	0.048	-0.34	0.73
USA Text	0.07	0.049	1.49	0.14
Pretest Conceptions of Houselessness	-0.03	0.017	-1.81	0.07
General Academic Knowledge	0.42	0.057	7.31	**<0.01**
Personal Experience	-0.01	0.001	-2.95	**<0.01**
Reported Text Conflict (Yes)	0.09	0.036	2.49	**0.01**
MUK	-0.02	0.013	-1.31	0.24
Surprise	0.01	0.005	0.31	0.70
Positive Emotions	-0.01	0.009	-1.44	0.17
Negative Emotions	0.02	0.007	2.45	**0.01**
Responsibility Text x Pretest Conceptions	-0.01	0.018	-0.02	0.97
Shortage Text x Pretest Conceptions	0.04	0.019	2.11	0.03
USA Text x Pretest Conceptions	-0.01	0.019	-0.73	0.47
Reported Text Conflict (Yes) x MUK	0.04	0.014	-2.81	**<0.01**

There were significant main effects of academic knowledge, personal experience with houselessness, reported conflict with the text, negative emotions while reading. There was a significant interaction between pretest conceptions and the Shortage text which was not hypothesized and was considered spurious.

There was a significant interaction between reported text conflict and MUK such that among participants who reported they felt text conflict, text comprehension depended on MUK. This finding is consistent with the hypothesis that the text-belief consistency

effect would be enhanced when participants had high MUK. Table 14 summarizes the correlations between MUK and Comprehension Test Score by text and reported belief conflict. Figures 7-14 show the scatterplots of MUK by comprehension test score categorized by reported belief conflict (Yes, No), and text (Epidemic, Responsibility, Shortage, USA).

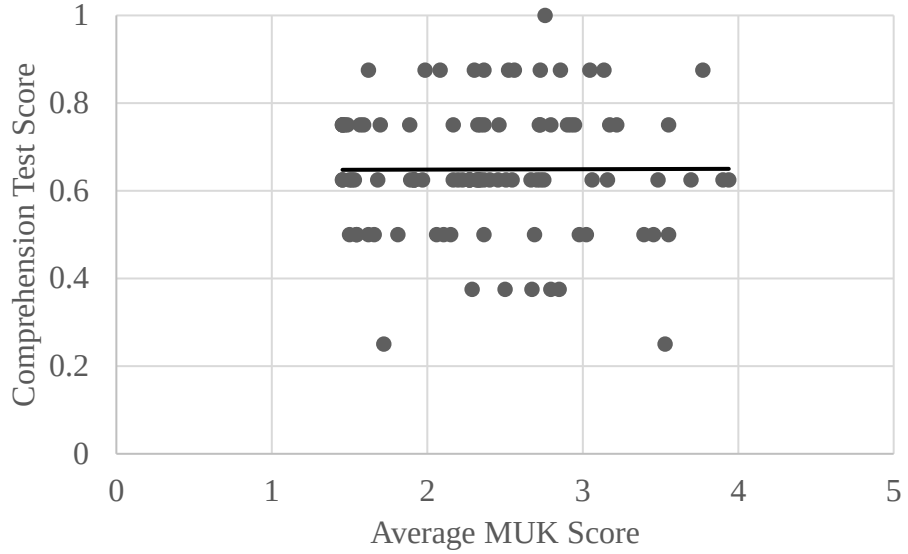
Table 14.
Correlations between MUK and Text Comprehension by Text and Reported Belief Conflict.

	Correlation with MUK	
Text	**Conflict**	**No Conflict**
Epidemic	**-0.43**	0.05
Responsibility	**-0.28**	**-0.27**
Shortage	**-0.28**	0.04
USA	**-0.23**	-0.18

Note. **Bolded** correlations were significant at $p < 0.01$

Figure 7.

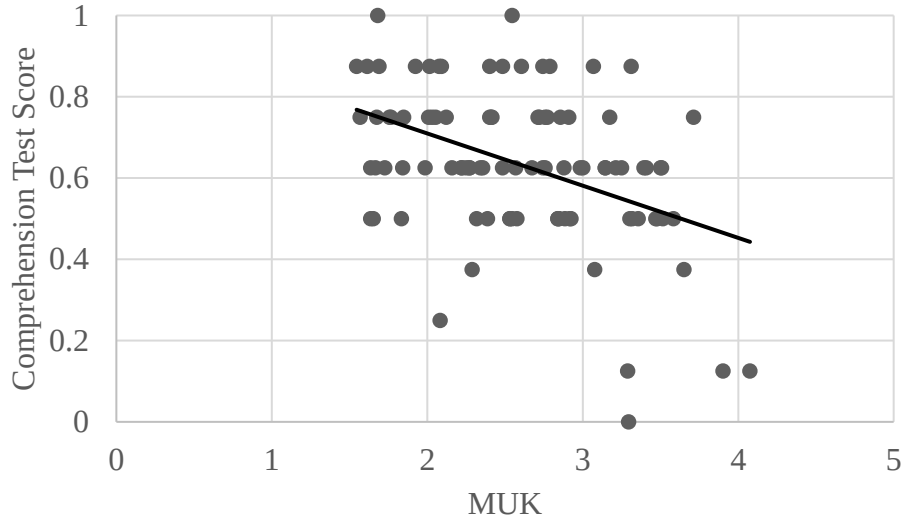
Scatterplot of Comprehension Score for the Epidemic Text by Average MUK Score for the Participants Who Reported the Text Did Not Conflict with Beliefs.



Note. n = 95, *r* = 0.05

Figure 8.

Scatterplot of Comprehension Score for the Epidemic Text by Average MUK Score for the Participants Who Reported the Text Did Conflict with Beliefs.

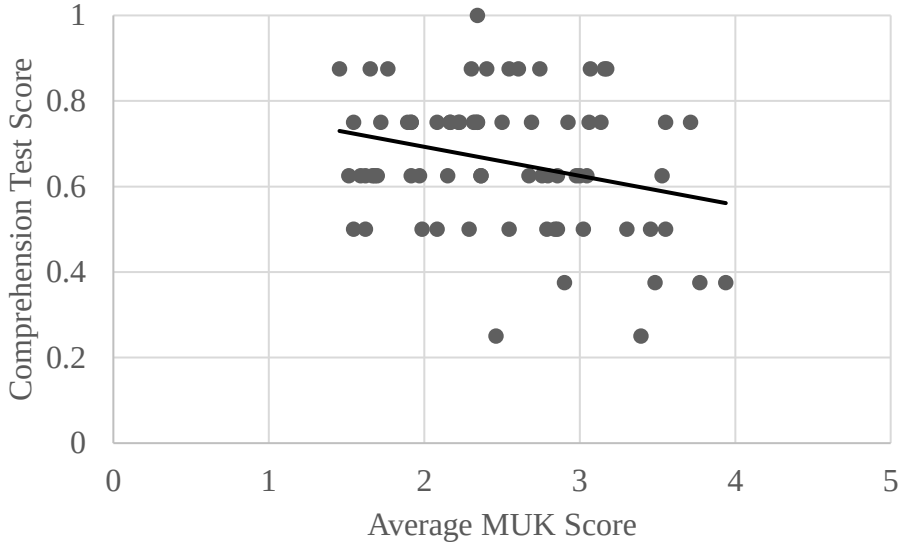


Note. n = 95, *r* = -0.43[2]

[2] *r* = -0.33 when the four outlying scores in the bottom right corner were removed

Figure 9.

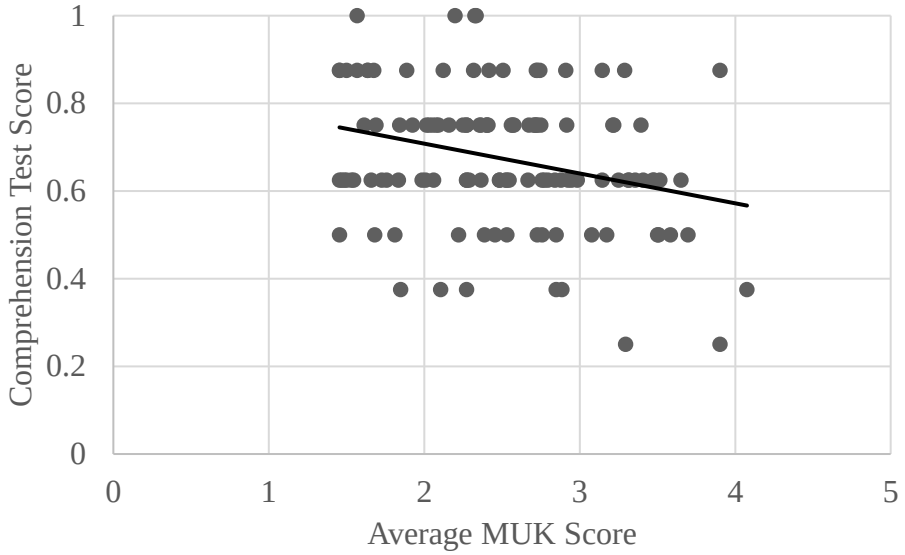
Scatterplot of Comprehension Score for the Responsibility Text by Average MUK Score for the Participants Who Reported the Text Did Not Conflict with Beliefs.



Note. n = 71, *r* = -0.27

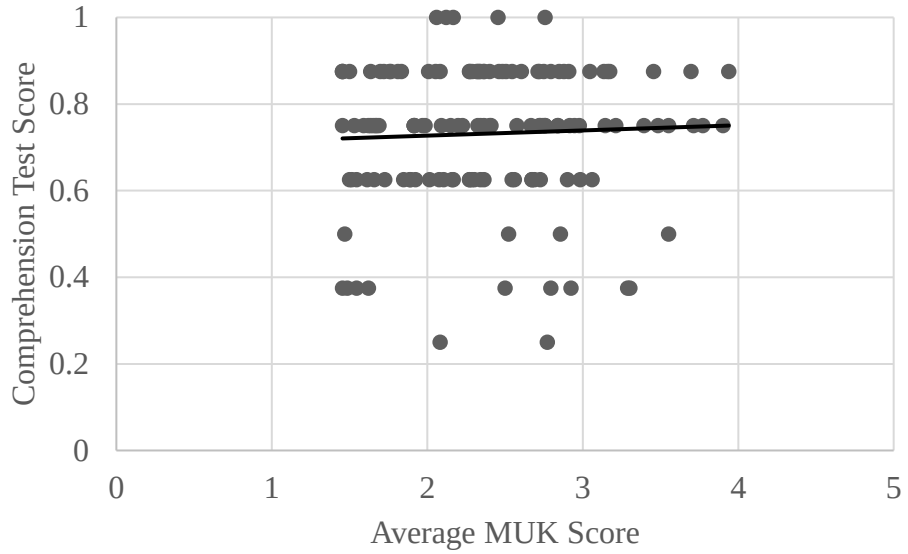
Figure 10.

Scatterplot of Comprehension Score for the Responsibility Text by Average MUK Score for the Participants Who Reported the Text Did Conflict with Beliefs.



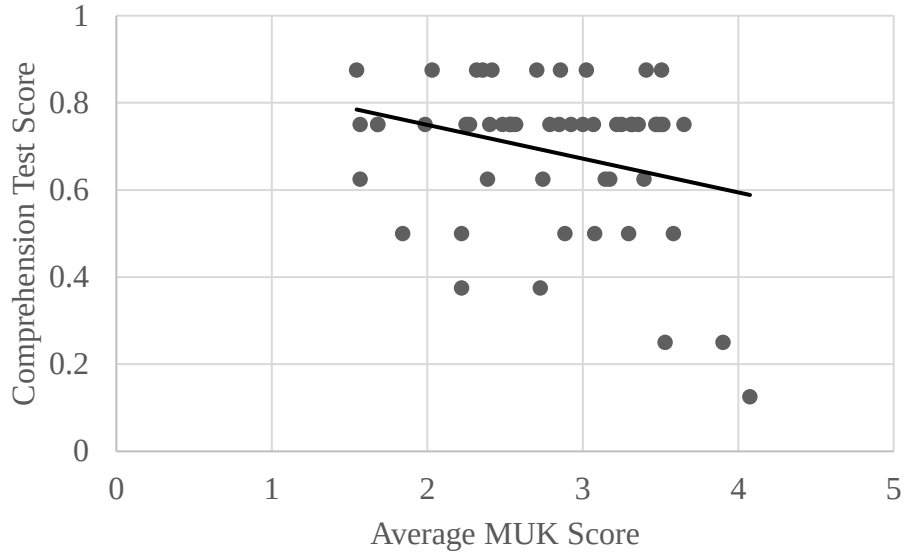
Note. n = 119, *r* = -0.28

Figure 11.
Scatterplot of Comprehension Score for the Shortage Text by Average MUK Score for the Participants Who Reported the Text Did Not Conflict with Beliefs.



Note. n = 136, r = 0.04

Figure 12.
Scatterplot of Comprehension Score for the Shortage Text by Average MUK Score for the Participants Who Reported the Text Did Conflict with Beliefs.

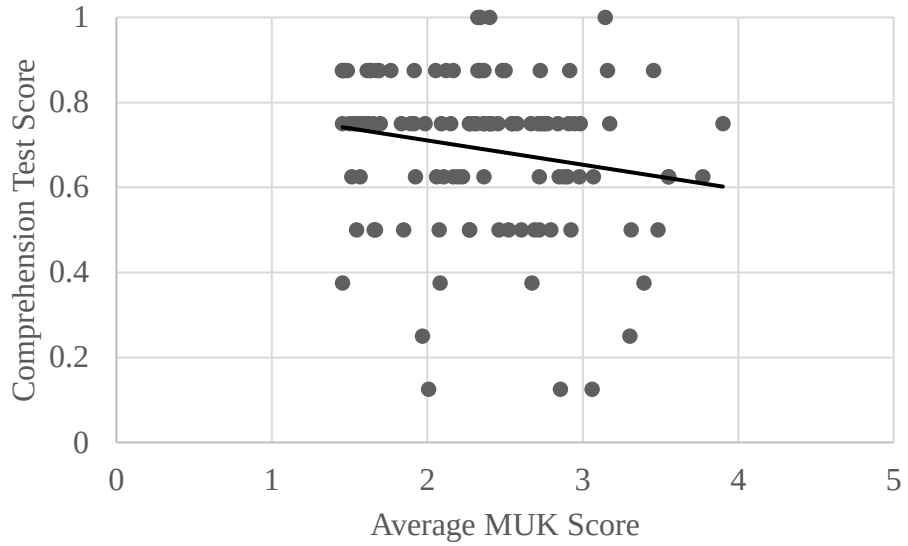


Note. n = 154, r = -0.28[3]

[3] r = -0.17 when the 3 outlying scores in the bottom right corner were removed.

Figure 13.

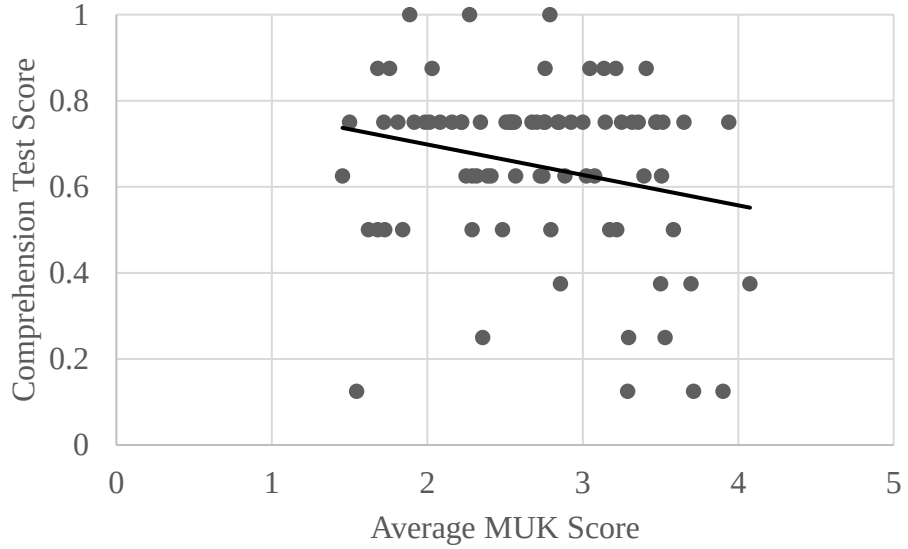
Scatterplot of Comprehension Score for the USA Text by Average MUK Score for the Participants Who Reported the Text Did Not Conflict with Beliefs.



Note. n = 111, *r* = -0.18

Figure 14.

Scatterplot of Comprehension Score for the USA Text by Average MUK Score for the Participants Who Reported the Text Did Conflict with Beliefs.



Note. n = 79, *r* = -0.23

Study 3 Discussion

Study 3 was conducted to answer theoretical questions about the text-belief consistency effect. Specifically, it was hypothesized that the strength of the text-belief consistency effect would depend on MUK, such that for the participants who reported the text conflicted with their beliefs, participants with high MUK would have lower comprehension scores compared to participants with low MUK.

Consistent with our hypothesis, there was an interaction between MUK and text conflict such that among the participants who reported the text conflicted with their identity, participants with high MUK had worse comprehension than participants with low MUK. While there were differences between the texts, the overall pattern was consistent with our hypotheses in that there was a significant, negative correlation between MUK and comprehension whenever participants reported the text conflicted with their beliefs. The differences in correlations between texts suggest that while MUK is related to comprehension when a text is belief-inconsistent, MUK may also be related to comprehension even when the text is belief-consistent. For instance, if the text is belief-consistent, differences in perceived importance or value (i.e., differences in MUK) may affect task-interest, emotions, or strategy use while reading, which in turn affects comprehension of the text. The text effects were not predicted, and as such were considered exploratory. However, examining the relationship between MUK and comprehension of non-controversial topics may illuminate how personal value of knowledge affects normal comprehension processes.

While the findings of this study replicated the text-belief consistency effect, there were inconsistencies with past research. Specifically, there was no effect of conceptions on comprehension. One potential explanation is that the effect of conceptions on comprehension is mediated by MUK and/or negative emotions. Thus, the final study will examine whether MUK has a mediatory role between conceptions, negative emotions, and comprehension.

CHAPTER 5

STUDY 4: MEDIATION AND PATH ANALYSIS

Study 3 investigated the direct and interactive effects of MUK on text comprehension. Inconsistent with past research, there was not an effect of conceptions of comprehension. There are two possible explanations: first, that the effect of conceptions on comprehension was mediated by MUK. Second, past research has found that negative emotions may have a mediatory role in comprehension (e.g., Zaccoletti, Altoe, & Mason, 2020). Thus, the effect of participants' conceptions of houselessness on comprehension may depend on both MUK and their emotions while reading.

MUK as a Mediator of Comprehension

Research into readers' behavior when reading about controversial topics has consistently shown that alignment between conceptions and the text influences comprehension. As described in Study 3, the text-belief consistency effect is a repeated finding in comprehension research. However, beyond just comprehension and memory for the text, studies have shown that learners evaluate belief-consistent and belief-inconsistent information differently (Kardash & Scholes, 1995; McCrudden & Barnes, 2016), which is thought to be related to confirmation bias (Nickerson, 1998). A related study by Wolfe, Britt, and Butler (2009) found that readers were more likely to produce belief-consistent information when generating arguments compared to belief-inconsistent information. Research in the domain of misinformation has found that individuals maintain their conceptions and beliefs when confronted with alternative or contradicting conceptions (Chinn & Brewer, 1993; Limon & Mason 2002).

Study 3 was consistent with these findings as an effect of text conflict was found. In addition, there was an interactive effect between MUK and reported text conflict. However, there was no effect of conceptions on comprehension, a finding that is *inconsistent* with the field of research on beliefs, conceptions, and comprehension. One potential explanation for this inconsistency is that conceptions affected comprehension only when individuals also thought their conceptions were important to fulfilling fundamental needs. Thus, our fourth research question was whether the effect of conceptions on comprehension was mediated by MUK.

Research Question 4: Does MUK mediate the relationship between conceptions and comprehension?

Based on the research on conceptions and comprehension, it was hypothesized that the relationship between conceptions and text comprehension would be mediated by MUK.

Emotions while Reading

In addition to text-belief consistency, a subfield of reading comprehension research has examined the role of emotions on reading comprehension. Bohn-Gettler (2019) proposed the Process, Emotion, Task (PET) framework for understanding how emotions influence comprehension. Central to her framework was the assumption that both positive and negative emotions could enhance or impede comprehension depending on the task and processes involved. The focus on task is important, as the findings on negative emotions in comprehension research are mixed. For instance, Hamedi and colleagues (2020) found that negative emotions (boredom, anxiety) predicted lower

cognitive engagement and lower text comprehension. A finding consistent with other research on negative emotions and comprehension (e.g., Bohn-Gettler & Rapp, 2011; Scrimin, Mason, & Moscardino, 2014; Zaccoletti, Altoe, & Mason, 2020). However, other studies have shown that negative emotions can improve comprehension by improving attention to detail (D'Mello & Graesser, 2012; von Hecker & Meiser, 2005).

In research on conceptual change and controversial topics, negative emotions are consistently found to impede conceptual change. For example, Jacobson, Thacker, and Sinatra (2022) participants who demonstrated a backfire effect (i.e., stronger belief in misconceptions after an intervention) had reported significantly more negative emotions (anger, confusion) than participants who revised their misconceptions. Trevors and colleagues (2016) reported that negative emotional reactions (anger, anxiety) were related to individuals' perception that refutational messages were self-implicating. Thus, as the topic of houselessness is thought to be a controversial and individuals are thought to hold many misconceptions of houselessness, we sought to examine the extent to which MUK mediates the relationship between readers' conceptions and negative emotions while reading, which in turn would impact their comprehension.

Research Question 5: Does MUK mediate the relationship between conceptions and emotions while reading?

Based on the research on personal importance as a mediator of negative emotions, it was hypothesized that relationship between conceptions and negative emotions would be mediated by MUK.

Research Question 6: Is there a dependent relationship such that MUK mediates the relationship between conceptions and emotions, and emotions predict comprehension?

Furthermore, based on the research on negative emotions in comprehension of controversial topics, it was hypothesized that the relationship between conceptions and comprehension would be mediated by negative emotions.

Study 4 Results

In these analyses, conceptions of houselessness, MUK, and negative emotions were reduced to individual latent constructs. The survey measures of three conceptions of unhoused people (threatening, out-group, personally responsible) were highly correlated and thus thought to reflect an underlying construct of *negative conceptions of unhoused people*.

The survey measures of MUK were reduced to an underlying construct of *MUK – Safety* from the survey measures MUK – Physical Safety and MUK – Safety-Security for three reasons. First, a reduction in the number of scales loading onto the latent construct was deemed necessary to ensure that the SEM models converged. Second, past research on houselessness has consistently found that conceptions of unhoused people are influenced by fear for physical safety (Speak & Tipple, 2006; Tsai et al., 2019). Third, in Study 2, both of those measures were found to correlate with multiple conceptions of houselessness (see Study 2: Table 8).

Research Question 4

Our fourth research question was whether the effect of conceptions on comprehension depended on MUK. It was hypothesized that conceptions would

negatively predict comprehension (e.g., holding the conception that unhoused people are threatening would predict worse comprehension), and that this relationship would be mediated by MUK, which itself would negatively predict comprehension (e.g., perceiving your knowledge was valuable would predict worse comprehension).

A structural equation model (SEM) was specified with text comprehension as the dependent variable, conceptions of houselessness as the predictor, MUK as the mediator, and text as a within-subjects factor. Conceptions were derived from the measures of pretest conceptions of houseless people as threatening, outgroup, and houselessness as a result of personal choices. MUK was derived from the measures of MUK – physical safety and MUK – safety/security. In each of the models, prior knowledge and vocabulary were held constant.

Table 15 shows the total, direct, and indirect effects of the SEM models, as well as the RMSEA fit index. Overall, the model fits were acceptable, and the hypotheses were not supported by the findings. In every model, the only significant predictors of text comprehension were vocabulary and prior knowledge. The models were also evaluated with only one covariate, or with no covariates, and the results did not change.

Table 15.
Total, Direct, and Indirect (Mediated) Effects and RMSEA Model Fit of the Models Predicting Comprehension of the Texts.

Text	Total effect (p)	Direct effect (p)	Indirect effect (p)	RMSEA
Shortage	0.01 (0.58)	0.00 (0.44)	-0.01 (0.62)	0.09
USA	-0.01 (0.42)	-0.02 (0.98)	-0.02 (0.31)	0.09
Responsibility	-0.04 (0.03)	-0.05 (0.96)	-0.01 (0.56)	0.10
Epidemic	-0.12 (0.32)	-0.01 (0.97)	-0.02 (0.07)	0.08

Overall, there was a strong correlation between conceptions of houselessness and MUK on each of the four models (see Appendix K for the mediation model graphs). However, inconsistent with the hypotheses, there were null or small effects of conceptions on comprehension.

Research Question 5

Our fifth research question regarded the extent to which the effect of conceptions on negative emotions while reading depended on MUK. It was hypothesized that conceptions would positively predict negative emotions (e.g., holding the conception that Four SEMs were conducted predicting negative emotions for each text from conceptions of houselessness, mediated by MUK. Negative emotions were specified as a latent construct derived from reported confusion, worry, and anger while reading. The same latent constructs for conceptions and MUK used in the previous set of SEMs were used. Table 16 shows the total, direct, and indirect effects of the SEM models, as well as the RMSEA fit index. Overall, the model fits were acceptable.

Table 16.
Total, Direct, and Indirect (Mediated) Effects and RMSEA Model Fit of the Models Predicting Negative Emotions while Reading.

Text	Total effect (p)	Direct effect (p)	Indirect effect (p)	RMSEA
Shortage	-0.04 (0.58)	-0.22 (0.03)	0.18 (<0.01)	0.05
USA	0.00 (0.97)	-0.26 (0.03)	0.26 (<0.01)	0.09
Responsibility	-0.08 (0.57)	-0.39 (0.01)	0.31 (<0.01)	0.08
Epidemic	0.26 (0.02)	0.12 (0.38)	0.15 (<0.05)	0.09

Figures 15-18 show the 4 SEM models predicting negative emotions. Overall, the relationship between conceptions and negative emotions was mediated by MUK such that

participants who strongly agreed with conceptions of houseless people as threatening, outgroup, and personally responsible positively predicted MUK, and participants with higher MUK reported more negative emotions.

Figure 15.

Mediation Model Predicting Negative Emotions while Reading the Shortage Text from Conceptions of Houselessness Mediated by MUK.

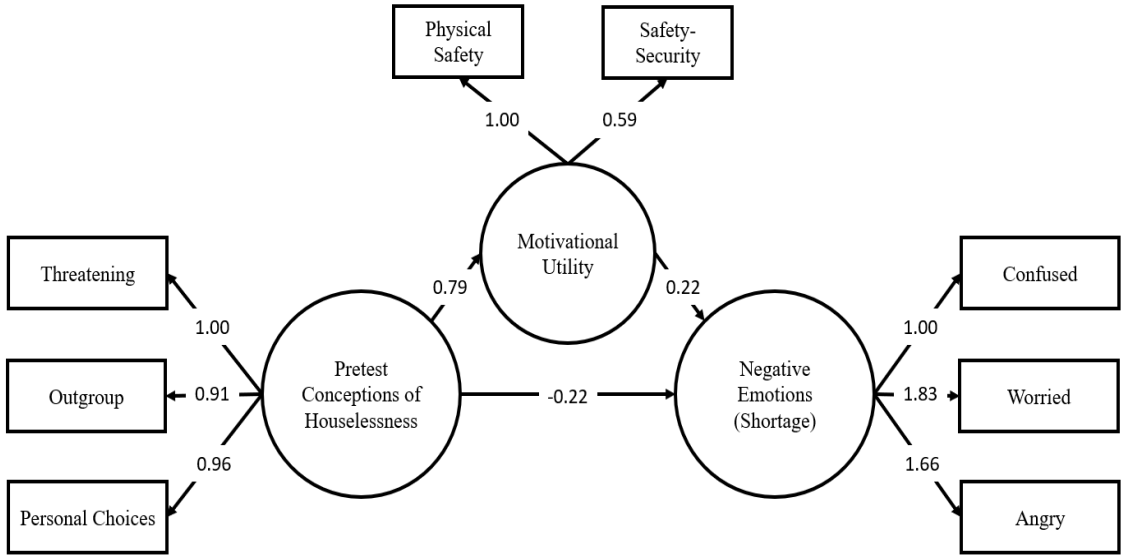


Figure 16.

Mediation Model Predicting Negative Emotions while Reading the USA Text from Conceptions of Houselessness Mediated by MUK.

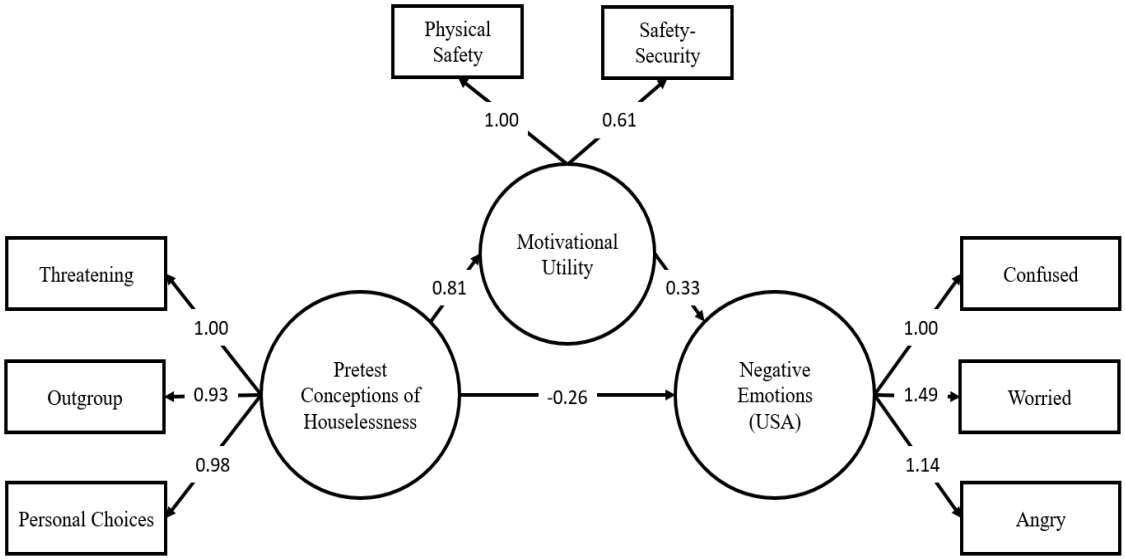


Figure 17.

Mediation Model Predicting Negative Emotions while Reading the Responsibility Text from Conceptions of Houselessness Mediated by MUK.

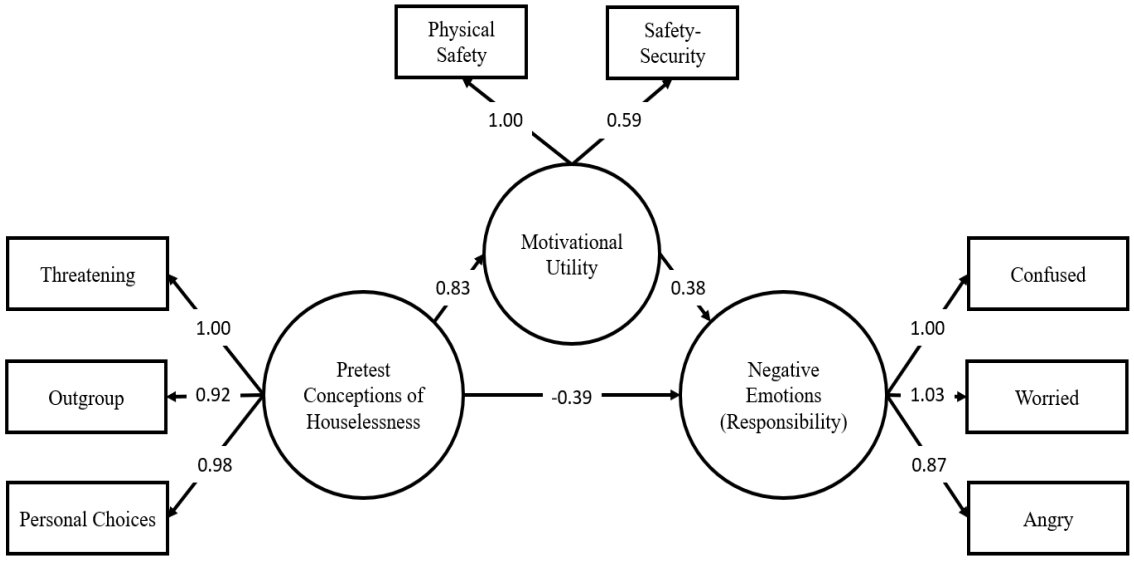
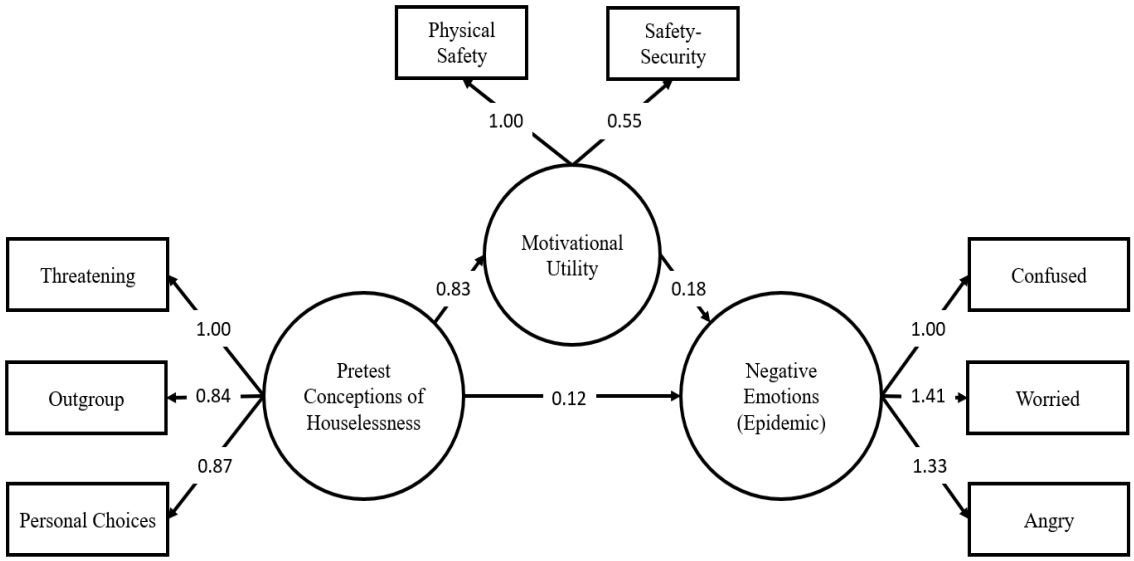


Figure 18.

Mediation Model Predicting Negative Emotions while Reading the Epidemic Text from Conceptions of Houselessness Mediated by MUK.

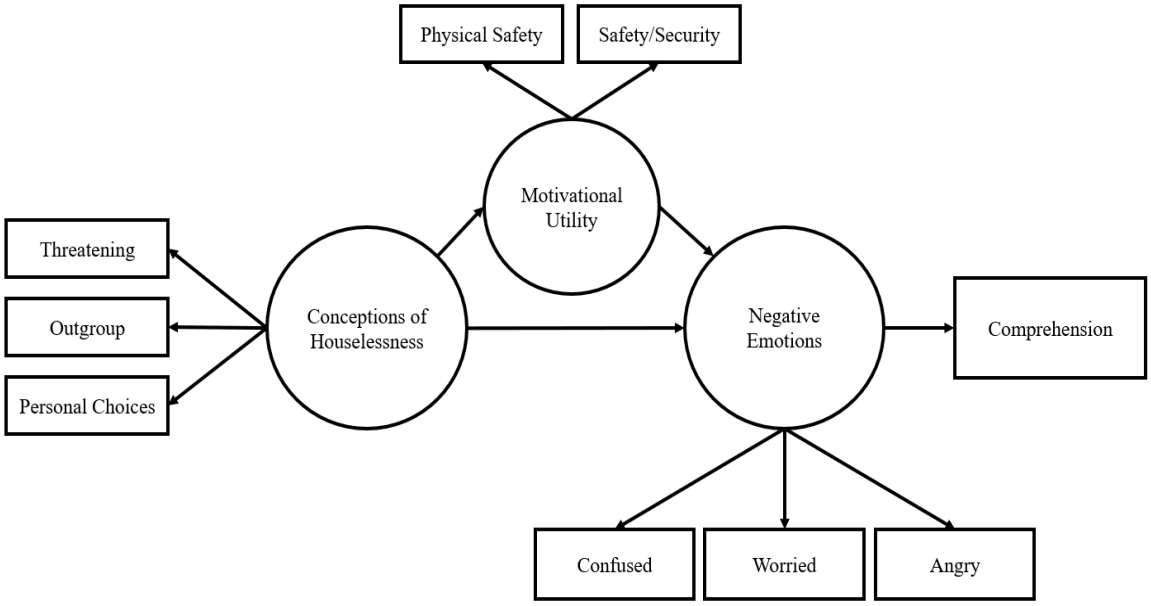


Research Question 6

We found that conceptions and MUK have strong effects on individuals' emotions while reading. Thus, our final research question was whether the effect of conceptions and MUK on comprehension is mediated by negative emotions.

A set of four path models were constructed predicting text comprehension from negative emotions, holding prior knowledge constant. Negative emotions were predicted by conceptions, mediated by MUK. Figure 19 shows the structure of the path models.

Figure 19.
Path Model Predicting Comprehension from Negative Emotions Holding Vocabulary and Prior Knowledge Constant, and Predicting Negative Emotions from Conceptions, Mediated by MUK.



It was hypothesized that negative emotions would negatively predict comprehension. Table 17 shows the model fit indices for each of the texts. Overall, the model fit was acceptable, and the hypotheses were not supported. In each of the four models, the only significant predictors were vocabulary and prior knowledge.

Table 17.
Total, Direct, and Indirect (Mediated) Effects and RMSEA model fit of the Models Predicting Comprehension from Negative Emotions.

Text	Effect of Negative Emotion (β)	RMSEA
Shortage	-0.04 (0.11)	0.09
USA	0.02 (0.40)	0.09
Responsibility	0.01 (0.68)	0.10
Epidemic	0.01 (0.08)	0.08

Study 4 Discussion

Study 4 was conducted to examine the potential mediatory effects of MUK on conceptions, emotions, and comprehension. Latent traits of negative conceptions of unhoused people, MUK – Safety, and negative valence emotions were derived from the survey measures because the survey measures were highly correlated and were thought to reflect single, underlying constructs. Three research questions were tested using structural equation modeling (SEM).

The first research question was whether the relationship between negative conceptions and text comprehension was mediated by MUK – Safety. There was no direct nor mediated relationship in any of the four SEM models. This finding is inconsistent with decades of past research that has found that conceptions, beliefs, and knowledge of a topic are related to comprehension of texts in that topic. As such these findings should be taken cautiously, as many other factors influencing the comprehension process were not measured (e.g., strategy use, self-efficacy, working memory, etc.) and thus, they cannot be ruled out as potential confounds.

The second research question was whether the relationship between negative conceptions and negative emotions while reading was mediated by MUK such that participants with high MUK reported more negative emotions while reading. This is consistent with past research that has indicated personal value or importance can enhance emotional responses when reading about controversial topics (e.g., Jacobsen, Thacker, Sinatra, 2022). This finding has implications beyond comprehension research, as the role of negative emotions when processing controversial information is a topic of interest in social media and misinformation research (e.g., Featherstone & Zhang, 2020). MUK provides a paradigm to predict why certain messages "trigger" negative emotions – messages that individuals perceive as either threatening or providing an opportunity to fulfill a fundamental motive. Interestingly, the mediated relationship was positive for all four texts, indicating that participants with high MUK generally felt more negative emotions than participants with low MUK, regardless of the content of the text.

The final research question was whether negative emotions, as predicted by negative conceptions and MUK – Safety, predicted text comprehension. A set of four path models were conducted and there were no effects of negative emotions on comprehension. This finding also was inconsistent with past research demonstrating a relationship between emotions and reading (e.g., D'Mello & Graesser, 2012). One explanation is that the wrong emotional valence was tested, and that in controversial topics, positive emotions may better predict comprehension than negative emotions as negative emotions reduce cognitive engagement (Hamedi et al., 2020). As noted above,

another potential explanation is that too many facets of the comprehension process were un-measured, and potential confounds cannot be ruled out.

CHAPTER 6

GENERAL DISCUSSION

Summary

The goal of this dissertation was to introduce a novel dimension of knowledge, the Motivational Utility of Knowledge (MUK), based on the frameworks of fundamental human motives proposed by Maslow (1943) and Kenrick and colleagues (2010). MUK was situated within the Multidimensional Knowledge in Text Comprehension framework (MDK-C: McCarthy & McNamara, 2021) as a dimension assessing the value or importance individuals place on knowledge in comprehension and conceptual change tasks. MUK was operationalized with a novel measure containing 11 subscales, which was administered to a sample of adults in the United States. In addition, participants were given a reading task and conceptual test on houselessness and assessed on their individual differences in knowledge, emotions while reading, and demographics. A set of four studies were conducted (1) exploring MUK as a construct and testing the factor structure of the subscales; (2) examining whether MUK predicted difference in participants' value judgements of conceptions and conceptual change; (3) testing the interactive effect of MUK with a known predictor of text comprehension; and (4) assessing the mediatory effects of MUK on the relationships of conceptions, comprehension, and emotion.

In Study 1, the conceptual tests of unhoused people (threatening, outgroup, personally responsible) were all correlated. In addition, the subscales of MUK were found to be highly correlated with each other. The correlations among the subscales of MUK were further tested using exploratory factor analysis. The analysis indicated that

the MUK subscales were reflecting a single latent construct – overall value of houselessness knowledge. These two findings have implications for research on attitudes towards houselessness, as previous work has indicated that individuals may hold perceptions of unhoused people as violent, out-group, or both (Olufemi, 2002; Speak & Tipple, 2006; Tsai et al., 2019).

In Study 2, MUK was used to assess whether individuals' conceptions of houselessness were inconsequential or self-implicating, and whether individuals' conceptual change differed as a function of MUK. We found that there was a strong relationship between participants' conceptions of unhoused people as threatening, out-group, and personally responsible, and their reported MUK of their knowledge. The findings suggest that participants with strong misconceptions *also* valued their knowledge more highly than participants with weaker misconceptions, or true conceptions. Furthermore, even though no conceptual change materials were used (e.g., refutation messages, strategy instruction), participants' conceptual change was related to their MUK. The difference between participants with high and low MUK was enhanced in the posttest compared to the pretest. This finding suggests that MUK plays a role in whether individuals engage in knowledge revision, and further study on the interactive effects of MUK with conceptual change interventions is warranted.

In Study 3, we tested the relationship between MUK and the text-belief consistency effect (Maier & Richter, 2014). For each text we found that among participants whose beliefs conflicted with the view in the text, there was a significant, negative relationship between text comprehension and MUK. Our findings suggest that

when participants' beliefs conflict with the text, MUK predicts the extent of their comprehension impairment.

Study 4 was built on Study 3. The analyses in Study 3 showed no relationship between conceptions and text comprehension, a finding inconsistent with previous research on conceptions, knowledge, and comprehension (Shapiro, 2004). Thus, Study 4 examined whether the relationship between conceptions and comprehension was mediated by MUK, and if negative emotions were included in the mediatory relationship. We found that there was no direct nor mediated relationship between conceptions, MUK, and comprehension. However, there was a mediated relationship between conceptions, MUK, and negative emotions such that participants with stronger misconceptions of houselessness felt more negative emotions when they also had high MUK. This effect was consistent across texts, suggesting that even though some of the texts presented views *agreeing* with misconceptions of unhoused people, exposure to the topic in general was sufficient to "trigger" negative emotions in participants with misconceptions and high MUK. Finally, we tested whether the mediated relationship of conceptions and MUK on negative emotions predicted comprehension and found null results. Again, this is inconsistent with past research on comprehension, suggesting that factors beyond the range of this study (e.g., strategy use, working memory, etc.) may further influence text comprehension.

Conclusions

The overall goal of this dissertation was to introduce and test a novel dimension of knowledge – the Motivational Utility of Knowledge. The overall findings of this study

indicate that motivational utility is an important dimension of knowledge. Individuals' comprehension, conceptual change, and emotions while reading depend in part on the value they place on their knowledge. MUK was situated within the research on categories or dimensions of knowledge (McCarthy & McNamara, 2021). In order to further test MUK as a dimension, future studies should examine how MUK interacts with other dimensions (i.e., Amount, Specificity, Accuracy, Coherence). For instance, readers with less accurate knowledge tend to have worse comprehension (Kendeou & van den Broek, 2007). That effect may interact with MUK. A reader with less accurate knowledge and lower MUK may not be motivated to generate inferences or use strategies to comprehend a contradicting text, whereas a reader with higher MUK may be more likely to notice and resolve the inconsistency. Overall, findings of this study show that consideration of multiple dimensions of knowledge, including MUK, is essential to understanding the role of prior knowledge in text comprehension.

Further work should test whether MUK can be divided into multiple constructs in different domains. The findings of study 1 demonstrated that the MUK subscales were loading into a single latent construct, past research into fundamental needs has demonstrated that sub-motives (Physical Safety, Affiliation, etc.) differentially predict personality traits and other behavioral measures (Neel et al., 2016). The findings of this dissertation were somewhat inconsistent, suggesting that either the measure needs to be refined, or the topic (houselessness) did not require participants to discriminate between needs. In either case, future research utilizing the measure of MUK on different topics would provide a way to identify whether the measure requires refinement.

The findings of this dissertation have several implications for the study of misconceptions and conceptual change. First, this study is consistent with past research indicating that personal importance and identity are important contributors to conceptual change (Trevors, 2016; 2022). In addition, it confirms findings related to the Cognitive-Affective model of conceptual change (Gregoire, 2003) which identify personal importance or value as a differentiator between inconsequential or self-implicating misconceptions. While research operationalizing the model confirmed the role that personal importance may play in conceptual change (Gill et al., 2022; Trevors et al., 2022). MUK provides a new method to assess the *extent* to which participants perceive misconceptions as inconsequential or self-implicating, in comparison to simply organizing misconceptions categorically. Misconceptions that individuals rate as high in MUK can be considered self-implicating, as high MUK indicates that individuals view the misconception as either providing an opportunity for, or removing a threat to, fulfilling a fundamental need.

In addition to informing conceptual change research, MUK was examined in relationship to comprehension research. MUK was found to interact with the text-belief consistency effect. This finding has implications both for text comprehension research, as well as intervention studies. In text comprehension research, the personal importance of knowledge has the potential to explain past findings, for example in this study, MUK was used to examine differences in how negative emotions affect comprehension. MUK may also play a role in the use of strategies while reading. For instance, individuals with high MUK may engage in more strategic processing because a topic is more important to

them. This could further enhance differences between skilled and less skilled readers or attenuate those differences. In the same vein, MUK may play a role in individuals' propensity to engage in deliberate training. Past research on comprehension strategy training has not attempted to match participants' training sets to a personally important topic. Learners may be more engaged in strategy training when the text they are practicing on is a personally important one.

Finally, this dissertation has implications for research on studies on houselessness. The findings of Study 1 suggests that participants overall had a single conception of "unhoused people are bad", and either valued their knowledge of houselessness as fulfilling multiple fundamental motives (e.g., physical safety, status, etc.) or fulfilling no motives. Individuals may not hold nuanced knowledge or knowledge values about houselessness, but rather hold unhoused people on a single spectrum from "good" to "bad".

Overall, this set of studies was an important step in the field of research on knowledge and comprehension. To our knowledge, this is the first study of its kind to investigate the role of knowledge *value* in comprehension and conceptual research. We determined that knowledge value plays an important role in understanding how individuals comprehend texts about controversial topics. In addition, we replicated known effects such as the text-belief consistency effect and general findings on the role of vocabulary and knowledge in comprehension and conceptual change. The findings of these studies also provide opportunities for future research, including examining whether individuals' MUK influences the efficacy of comprehension and conceptual change

interventions and testing MUK in new topics and domains. Expanding the research on MUK can further unravel the mechanisms behind the personal value of knowledge, and its effects on conceptual change and comprehension.

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APPENDIX A.
PILOT STUDY OF THE TEXTS AND COMPREHENSION QUESTIONS

The goal of the pilot study was to assess the validity of the texts and comprehension questions that would be use in the

Method

Participants

Undergraduate students (N=174) were recruited from introductory psychology classes. Participants who scored below chance on the knowledge or vocabulary test, or who spoke English as a second language were removed from the sample, leaving a final N = 133. The average age of the participants in the final sample was 19 (SD = 1.2). The participants were asked to self-report biological sex, ethnicity, and college year. The majority of the participants were male (n = 67). The majority of the participants were Caucasian (n=94), with smaller groups of Hispanic (n = 17), East Asian (n = 12) and African American (n = 8) participants. The majority of the participants were Freshmen (n = 103), with smaller groups of Sophomore (n = 19) Junior (n = 8) and Senior or above (n = 3).

Measures

Texts

A set of four texts was used in the study. The texts were drawn from newspaper articles and edited lightly by the researcher for clarity. Each text presented a different view of unhoused people and the causes of houselessness. The texts were presented to students with no title or author information, and order was randomized for each participant to control for the effects of text order.

Titles, lengths, and Flesch-Kincaid grade level of texts.

Title	Length in Words	FKGL
Houselessness Epidemic	356	12
Individual Responsibility of the Unhoused	300	12
Housing Shortage	353	12
Houselessness in the USA	519	12

Reading Comprehension Questions

Reading comprehension for each text was measured with a set of eight multiple-choice comprehension questions. Responses were scored such that a correct answer was given a one, and an incorrect answer was given a zero. From these scores, the proportion of correct responses was derived for each text. The reliability of the comprehension tests was good.

Crohnbach's alpha of the comprehension questions.

Title	α
Unhoused Epidemic	0.61
Individual Responsibility of the Unhoused	0.62
Housing Shortage	0.67
Houselessness in the USA	0.70

General Prior Knowledge

Students' prior science knowledge of science, literature, and history was assessed using a 30-item measure of prior knowledge. The items were general domain knowledge that were not related to the misconception statements. The test has been used previously in studies on comprehension and learning. (McNamara, O'Reilly, Best, & Ozuru, 2006; O'Reilly, Best, & McNamara, 2004; O'Reilly & McNamara, 2007; O'Reilly, Taylor, & McNamara, 2006). The reliability in the pilot study was good ($\alpha = 0.76$).

Vocabulary

Students' individual differences in vocabulary were assessed because vocabulary knowledge accounts for unique variance in reading comprehension skill (e.g., Braze et al., 2007). The vocabulary test from the Gates–MacGinitie Reading Test (GMVT; MacGinitie & MacGinitie, 1989) because it is a standardized test that has been used previously in studies on reading and learning (e.g., McCarthy et al., 2018). The test consists of 45 multiple-choice questions in which a word is presented in the context of a sentence and students must select the word or phrase most synonymous with the target word. The reliability in the pilot study was excellent ($\alpha = 0.89$).

Procedure

Students were recruited from undergraduate psychology classes and compensated for their participation with course credit. The students participated in the entire study online. After completing the consent form, the students read the four texts in a randomized After each text, participants were administered the comprehension questions for that text. Finally, the participants were tested on their general prior knowledge and vocabulary. The study took an average of 48 minutes to complete (SD = 17 minutes).

Pilot Study Results

Preliminary Analyses

Both prior knowledge and reading skill were significantly correlated with text comprehension questions,

Means, Standard Deviation, Range, and Correlations of the Comprehension Questions and Individual Differences Measures in the Pilot Study.

Variable	Mean	SD	1.	2.	3.	4.	5.
1. Epidemic – Comp	0.56	0.21					
2. Responsibility – Comp	0.66	0.19	0.35				
3. USA – Comp	0.51	0.22	0.50	0.33			
4. Shortage – Comp	0.65	0.25	0.51	0.22	0.48		
5. General Prior Knowledge	0.59	0.14	0.39	0.31	0.46	0.27	
6. Vocabulary	0.70	0.16	0.45	0.24	0.40	0.45	0.58

Note. Bolded correlations are significant at $p < 0.05$

Predicative Modeling

Four linear regressions were conducted predicting reading comprehension on each of the four texts. The dependent variables were text comprehension score, and the independent variables were pretest conception score, general prior knowledge, and vocabulary. Both general prior knowledge and vocabulary were significant predictors in all four models.

R^2, F values, and significance test for the four linear regressions predicting reading comprehension score from general prior knowledge and vocabulary knowledge.

Model DV	R^2	F	p
Epidemic – Comp	0.23	19.1	<0.01
Responsibility – Comp	0.11	7.29	<0.01
USA – Comp	0.31	29.7	<0.01
Shortage – Comp	0.16	12.5	<0.01

The regressions were also tested with biological sex and ethnicity as factors, and the results of the models did not change, and sex and ethnicity were not significant predictors.

Pilot Study Discussion

The pilot study was conducted to assess the validaty and reliability of the comprehension questions. Participants read four texts on the causes and effects of houselessness and answered comprehension questions about each text. They were administered as a general prior knowledge test and a vocabulary test. The correlations showed general prior knowledge and vocabulary were highly correlated with reading comprehension, indicating that the comprehension questions had construct validity. In addition, the reliability measures indicated that the comprehension questions had good internal reliability. Thus, the texts and questions were determined to be suitable for the primary study of the dissertation.

APPENDIX B.
DEMOGRAPHIC QUESTIONNAIRE

Demographic Information Collected
Age
Biological Sex
Ethnicity
Highest education level
How much do you enjoy reading?
How confident are you in your reading ability
How many books do you read each year that are not required by teachers/employer?
How many hours per week do you spend reading?
Is English your first language?
If No
What is your native language?
What language do you speak at home?
How many years have you been speaking English?
Please list the languages you speak
What types of texts do you generally read in English?
Do you like reading in English?

APPENDIX C.
TEXTS AND COMPREHENSION QUESTIONS

Homelessness Epidemic

When you ask residents of Land Park in Sacramento why they chose to buy a home here, many times sacrificing square footage, yard space and modern amenities, you will hear responses such as wanting to walk to nearby restaurants and shops, and close proximity to the historic park and Sacramento Zoo. But most of all, you will hear that Land Park has been the safest neighborhood in Sacramento for decades and an ideal place to raise a family.

However, since the passage of Proposition 47, The Safe Neighborhoods and Schools Act which decriminalized serial theft and drug possession, the community lovingly referred to as "the Central Park of Sacramento" is now riddled with drug dealing and use, dirty needles, human feces, burglaries, car break-ins, violent encounters and angry residents who no longer feel safe.

Gina Fippin, an 18-year resident of Land Park, believes the Sacramento elected officials are neglecting its taxpaying citizens and more importantly their safety. She and her family have had their vehicles broken into. She has witnessed drug use and vomiting while walking or running errands with her children.

The Sacramento police department is one of the most depleted in the country, and every one of the propositions declassifying crimes only ties their hands more. The men and women in uniform work tirelessly, but they are spread too thin. Many residents have had to hire private security firms to patrol the neighborhoods because there simply isn't enough law enforcement.

Jim Jeffers, who has been a real estate agent for 35 years in Land Park, says clients are deciding to sell their homes because of the rampant crime. "Their cars are being broken into, drug addicts are hiding in their bushes and they're being screamed at on the street and in restaurants. When homeowners believe that our politicians either don't know what to do, ignore our complaints or show us statistics about how good things are, their last resort is to leave."

Jeffers added, "I'm all for trying to help someone who wants help, but you have to also make sure that the ones that do not want help do not encroach on others."

Question	**Answer 1**	**Answer 2**	**Answer 3**	**Answer 4**
Why are residents of the Land Park neighborhood selling their homes?	The Sacramento Zoo is closing	The passage of Proposition 47	**The rise in crime**	The Sacramento Police are depleted
What government policy changed with the passage of Proposition 47	Housing taxes increased	The Sacramento police lost funding and personnel	It became legal to use any recreational drugs	**Drug possession and serial theft were decriminalized**

What was the primary reason people moved to the Land Park neighborhood	**It was the safest neighborhood in Sacramento**	It had the most restaurants and shops in Sacramento	The homes were the largest and newest for the price	The elected officials were known to respond to the residents
What has happened to the "Central Park of Sacramento"	New construction has destroyed the natural features such as trees and meadows	It has become an overcrowded tourist area	**Theft, litter, and drug dealing have increased**	More homeless people have moved to the neighborhood
Why have residents of the Land Park neighborhood started hiring private security?	Vehicle break-ins are at an all-time high	**There is not enough law enforcement presence**	There have been incidents of drug use	Politicians have ignored their complaints
Why are the Sacramento Police becoming less effective?	There are not enough police officers	Politicians are pressuring them to change practices	There is more crime than ever before	**Propositions have tied their hands**
How are the elected officials neglecting citizens?	Reducing the police presence in response to protests	**Ignoring citizen complaints and using statistics to guide policy**	Building more low-cost housing that undercut home prices	Passing laws allowing people to commit crimes without punishment
How did Proposition 47 change the community of Land Park?	Increased the amount of litter on the ground	The residents of Lands Park began to feel unsafe and angry	**Increased the drug use and crime**	All of the above

Note. Bolded answers are the correct answers

Homelessness in the USA

Homelessness is defined as "the state of having no home." In the 1950s, the idea of homelessness was just that, an idea. However, according to U.S. Department of Housing and Urban Development's (HUD) 2018 Annual Homeless Assessment Report to Congress, an estimated 553,000 people experienced homelessness on a single 2018 night. During December of 2017, Philip Alston, the United Nations special rapporteur on extreme poverty, visited California, Alabama, Georgia, Puerto Rico, West Virginia, and Washington, D.C., and compiled his findings into an associated report. Here, he introduces the U.S. as one of the world's richest societies, a trendsetter, and a sophisticated place to live. After such praise, he contrasts the country with his own observations and data gathered from OECD. He also attacks the U.S., noting the at-the-time recent policies that the U.S. had enacted, such as tax breaks and financial windfalls (a sudden, unexpected profit or gain) for the wealthy, reducing welfare benefits for the poor, eliminating protections (financial, environmental, health, and safety) that benefit the middle class and the poor, removing access to health insurance for over 20 million people, increasing spending on defense, and many more. One of the solutions proposed to such an important issue was to decriminalize being poor.

For example, Los Angeles and other central cities are constantly seen with "giant cranes and construction" building towers and other magnificent architecture solely to "house corporate law firms, investment banks, real-estate brokerages, tech firms" and other 'big-money' companies. However, in those same cities there exist "encampments of tattered tents, soiled mattresses, dirty clothing, and people barely surviving on the streets." Alston even goes so far as to call out Los Angeles Mayor Eric Garcetti for allowing the city to fine the homeless $300 for having an encampment rather than developing affordable housing for the many people unable to pay for their homes and places of residence. This exacerbates the living conditions of those charged because they are struggling to make necessary payments on time, such as healthcare, food, water, and some sort of shelter, be it a tent or living out on the street. This demonstrates that criminalizing homelessness presents an ethical issue that drags people into an endless cycle of poverty.

Alston proposed a variety of solutions that could potentially reduce the rate of homelessness if not put an end to the issue once and for all. These solutions span a wide range of projects and solutions, some listed below:

- Housing First: Providing people with support services and community resources to keep their housing and not to become homeless again.
- Rapid Re-Housing/Affordable Housing: Helping individuals quickly "exit homelessness and return to permanent housing" while also being affordable to even those living in deep poverty. Access must also be available according to need.
- Healthcare: Having healthcare would allow these households to treat and manage those conditions that limit them from getting a job in the first place.
- Career Pathways: Providing accessible job trainings and employment for those living without a home.
- Schools: Providing children with schooling can be a sign of safety and connections to a broader community.

Question	Answer 1	Answer 2	Answer 3	Answer 4
In a report to Congress, approximately how many people did the U.S. Department of Housing and Urban development estimate were homeless in 2018?	50,000	100,000	250,000	**500,000**
What solution did the U.N. reporter propose to the issue of homelessness in Los Angeles?	Increasing taxes on the wealthy	Increase investment in affordable housing	**Decriminalize being poor**	Increase access to healthcare
How much does the city of Los Angeles fine people living in a homeless encampment?	**$300**	$500	$700	$900
How does the U.N. Reporter think schools can reduce the rate of homelessness?	Young adults with college degrees are rarely homeless	Schools provide free lunches and childcare so parents can work	Enrolling children in school helps get them off the streets where crime is prevalent	**Schools provide safety for children and connect families to the larger society**
What contrast does the U.N. reporter show in the city of Los Angeles?	The wealthy who go to beaches and the poor who have to work year-round	The employed who spend on luxuries and the jobless who do not know where the next meal comes from	**The buildings that house big money companies and encampments of people**	The upper class who receive tax breaks and the lower class who are fined

			barely getting by	
How does criminalizing homelessness lead to a cycle of poverty?	People who have been arrested are more likely to become homeless	People who have been arrested are less likely to find jobs	The fines levied against homeless people are used to provide tax benefits for the wealthy	**The fines levied against homeless people prevent them from using the money on housing and food**
How do recent policies in the U.S. exacerbate the problem of homelessness?	The policies increase spending on land and buildings, which leads to increase in housing prices	**The policies eliminate protections such as healthcare**	The policies criminalize being homeless	The policies end government investment in housing
What is the difference between a Housing First policy and an Affordable Housing policy	One policy focuses on increasing investment in housing repairs, the other focuses on investing in new housing	One policy focuses on helping those about to lose their homes, the other focuses on passing policies to reduce the current housing	**One policy focuses on helping those about to lose their homes, the other focuses on investing in new homes**	One policy focuses on housing as the first solution to homelessness rather than jobs, the other focuses on increasing investment in affordable housing

Note. Bolded answers are the correct answers

Housing Shortage

The National Association of Realtors recently released a study calling for a dire, "once-in-a generation" response to a housing shortage.

The study, "Housing Is Critical Infrastructure: Social and Economic Benefits of Building More Housing," written by members of Rosen Consulting Group, was remarkable, as it brought together some of the housing industry's most recognized observers, who lent their particular expertise to bear on a seemingly intractable problem: There are now anywhere from 5 million to 6.8 million housing units (including single-family homes, townhouses, condos and rental units) missing from housing inventory.

In short: Housing prices and rents are rising astronomically because the demand is so great, and the supply is so thin.

The study argues that there has been a decades-long gap in investment — that the United States faces "an acute shortage of available housing, an ever-worsening affordability crisis, and an existing housing stock that is aging and increasingly in need of repair — all to the detriment of the health of the public and the economy. The scale of underbuilding and the existing demand-supply gap is enormous and will require a major national commitment to build more housing of all types by expanding resources, addressing barriers to new development and making new housing construction an integral part of a national infrastructure strategy."

"There is a strong desire for homeownership across this country, but the lack of supply is preventing too many Americans from achieving that dream," said Lawrence Yun, NAR's chief economist, in the news release announcing the report. "It's clear from the findings of this report and from the conditions we've observed in the market over the past few years that we'll need to do something dramatic to close this gap."

For the first time in a dozen years, we're starting to hear people talk about a housing bubble. But when you're more than 5 million homes short, and builders are only building 1.5 million homes per year, it will take a long time for supply to catch up with demand. Too long. Which is why the NAR is calling for a once-in-a-generation (maybe lifetime?) push to build more housing.

Question	Answer 1	Answer 2	Answer 3	Answer 4
What is preventing Americans from owning homes?	**A lack of housing supply**	Rising housing prices because of inflation	An increase in short-term rentals for vacations	Lack of job security
According to a study by the Rosen Consulting Group, how many housing units need to be built?	1-3 million	**5-7 million**	9-11 million	13-15 million
According to the National Association of Realtors, how many	**1-2 million**	2-3 million	3-4 million	4-5 million

homes are being built each year?				
What national commitment needs to be made?	Building more housing of all types by expanding resources	Addressing barriers to construction and development	Making housing part of a national infrastructure strategy	**All of the above**
What are the consequences of a decades-long investment gap?	An acute shortage of available housing	An affordability crisis	Aging and decrepit housing	**All of the above**
Why was a study on housing commissioned?	Astronomically rising prices	**Housing supply is thin**	Available housing is aging	All of the above
What market conditions demonstrate a need for dramatic action?	**Demand is greater than supply**	There is a housing bubble	There are more homes in need of repair	Not enough capital investment in housing
Why would a response to the housing crisis be "once-in-a-generation"?	The amount of money spent on housing	**The number of homes that must be built**	A future commitment to maintaining affordable housing	The number of Americans who need housing

Note. Bolded answers are the correct answers

Individual Responsibility of the Homeless

As a Los Angeles native, I have become accustomed to the concept of homelessness as a part of the urban city's culture since I can remember. I understand that some homeless people do have their unfortunate stories and circumstances as to why they have resorted to sleeping on public benches and begging for money from every passer-by. However, there exists a portion of these people who are simply lazy and do not seem to possess this desire to help themselves elevate from their current situations.

Yes, some view this laziness aspect of homeless people as a mere stereotype or myth. However, there definitely exists some truth in this stereotype. As unsympathetic as it may sound, it becomes difficult to want to help a homeless person that sits on the same park bench day after day asking for money. And I am supposed to give these people money? I just need some sort of indication from the homeless person's part that shows some sort of effort or desire to overcome their particular adversity.

I once witnessed a homeless person rummaging through the dumpsters in the parking lot behind a restaurant in LA. He was collecting all the cans and bottles from the dumpsters and putting them into his shopping cart. That one small scene did show that aside from the services and opportunities that a shelter can provide, there exists other ways for a homeless person to proactively break his cycle of homelessness.

Perhaps the constant rejection that homeless people face when begging for money will encourage them to stop dwelling on their unfortunate circumstances and actually take control of their lives. Perhaps the constant rejection will force them to stop solely relying on the donations of other people, which will hopefully ignite an internal desire to overcome their hard times.

Question	**Answer 1**	**Answer 2**	**Answer 3**	**Answer 4**
Why does the writer find it hard to help some homeless people?	**The writer doesn't see any indication that they want to overcome their circumstances**	The writer is struggling and doesn't have the resources to help	The writer sees the homeless using drugs or committing crimes every day	The writer thinks money doesn't solve the larger issues facing the homeless
How does the writer think that constantly rejecting the homeless who are begging will help?	It will cause the homeless people to move to a new neighborhood	**It will ignite a desire to change their circumstances**	It will force the homeless people to get jobs	It will weed out the people who are lazy from the ones who need help
What lesson did the writer learn from watching a homeless man collect soda cans?	**There are ways for homeless people to actively break**	Shelters and government resources are not always sufficient	The homeless people can have a positive impact on society	Most homeless people can do something other than beg

	the cycle of homelessness			
What reasons does the writer think people become homeless?	Unfortunate circumstances	Losing control of their lives	A lack of effort to overcome adversity	**All of the above**
Why does the writer think it is wrong for homeless people to beg for money?	It is against the law	Most people do not have enough money to give to homeless people	**It shows they have no desire for significant change**	They could make more money in a job
Why is begging not productive for homeless people?	No one will give them money	**They could be looking for ways to earn money**	They could be using the services of a shelter	It reinforces a lazy attitude
What evidence is there that some homeless people do not want to change their circumstances?	**They are begging for money**	They do not use the resources of shelters	Most homeless people do not collect cans	Some homeless people talk about stealing
What evidence does the author use to demonstrate their knowledge of homeless people?	The author encounters homeless people every day	The author has witnessed lazy and productive homeless people	**The author has lived in Los Angeles**	The author talks to homeless people about their motivation

Note. Bolded answers are the correct answers

APPENDIX D.
CONCEPTIONS OF THE HOUSELESSNESS SURVEY

Each item was presented as a 5-point Likert question with the following options:
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree

Unhoused People are Threatening
Most homeless people are threatening
Most homeless people are violent
Most homeless people are harmless
Homeless people are dangerous
Most homeless people abuse substances

Unhoused People are Outgroup
Most homeless people are not part of society
Homeless people are different than me
Most homeless people are similar to me
I would never be homeless

Houselessness is caused by personal choices
Most homelessness is caused by personal choices
Homelessness is caused by unexpected circumstances and events
Most homeless people choose to live on the streets
Homeless people should get a job

Houselessness is caused by societal failures
There are enough social services to support the homeless
Increases in affordable housing reduce homelessness
Increases in social service spending reduce homelessness

Note. Italicized items were reverse coded.

APPENDIX E.
MEASURES OF EMOTIONS AND BELIEF CONFLICT

For the emotion scale, participants were shown the emotions one at a time, and asked how strongly they felt the emotion while reading. They were given 5 Likert-item response options. 1 = Not at all, 2 = A little, 3 = Moderate, 4 = Strongly, 5 = Very Strongly.

Valence		
Surprise		Surprised
		Amazed
		Astonished
Positive	*Curious*	Curious
		Interested
		Inquisitive
	Happy	Happy
		Joyful
		Excited
Negative	*Confused*	Confused
		Muddled
		Puzzled
	Worry	Nervous
		Worried
		Anxious
	Anger	Angry
		Dissatisfied
		Irritated

In addition, participants were asked the belief conflict question:

Does the information presented in the text you just read conflict with	Your personal views The views of your community Both Neither/No conflict

APPENDIX F.
MOTIVATIONAL UTILITY OF KNOWLEDGE MEASURE

Participants were presented with the stem "Does your knowledge about homelessness..." followed by the statement. They were given 5 Likert-item response options. 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

Fundamental Motives (Based on Neel et al., 2016)

Physical Safety	Keep you safe from dangerous people
	Keep yourself safe from others
	Cause worry about dangerous people
	Protect you from dangerous people
	Help avoid people that might carry disease
	Help avoid people that might have a contagious illness
Affiliation	Make you part of a group
	Help your groups stay together
	Get along with other people in your group
	Prevent you from being rejected
Reverse	Cause worry about being accepted
	Help make friends
Status	Cause others to look up to you
	Improve your social standing
	Increase your rank or position
	Increase the respect you receive
	Prevent you from losing status
	Prevent you from being at the bottom of a hierarchy
Mate Seeking	Provide ways to meet possible dating partners
	Increase your desire to find a romantic/sexual partner
	Prevent you from meeting people to flirt with/date
	Improve your ability to attract potential dating partners
	Cause worry about finding romantic/sexual partners
	Increase the amount you think about finding a partner
Mate Retention	Decrease the likelihood your partner will leave you
Reverse	Cause worry about your romantic/sexual partner leaving

	Enhance the strength of the relationship between you and your partner
	Increase you or your partners' sexual loyalty
	Increase you or your partners' emotional loyalty
	Cause worry that other people are interested in your romantic/sexual partner
Parenting	Help you take care of your children
	Increase the time you spend with your children
	Prevent bad things from happening to your children
Reverse	Cause worry about protecting your children
	Improve your ability to provide for your children
	Improve your relationship with your children
Maslow's Hieracrchy (Based on Taormina & Gao, 2013)	
Physiological	Increase the amount of food that you eat every day
	Increase the amount of water that you drink every day
	Increase the quality of your physical health
Reverse	Decrease the quality of your sleep
	Increase the amount of your exercise to stay healthy
Reverse	Decrease your overall physical strength
Safety-Security	Increase the security of your house/apartment
	Improve the safety of your neighborhood
	Cause worry about your financial security
	Increase your safety from disasters
Belongingness	Increase the intimacy you share with people
	Increase the affection you receive from friends
	Increase the affection you receive from family
	Enhance the love received from your spouse/partner
Reverse	Cause worry that you are unwelcome in your community
	Improve the feeling of togetherness in your family
Self-Esteem	Improve the esteem you have for yourself
	Increase how much you like yourself
Reverse	Decrease your self-respect
	Improve your sense of self-worth

Self-Actualization	Increase your sense of fulfillment
	Help you realize your innermost desires
	Help you act according to your values
	Improve your ability to live life to the fullest
	Increase the enjoyment you receive from your life
	Help you accept all aspects of yourself

APPENDIX G.
PRIOR KNOWLEDGE TEST

Science Questions: 1, 3, 4, 8, 10, 13, 14, 19, 23, 26
History Questions: 2, 7, 9, 11, 17, 18, 20, 22, 24, 28
Literature Questions: 5, 6, 12, 15, 16, 21, 25, 27, 29, 30

Q1: **The edible part of the sweet potato is the**
Stem tissue.
Root tissue.
Fruit.
Seed.

Q2: **The ancient Romans' most significant contribution to Europe has been in the area of**
Economics.
Poetry.
Drama.
Law.

Q3: **Which represents a chemical change in matter?**
A metal beginning to rust.
Water dissolving salt to form a solution.
Water undergoing evaporation.
Carbon dioxide undergoing sublimation.

Q4: **The poisons produced by some bacteria are called**
Antibiotics.
Toxins.
Pathogens.
Oncogenes.

Q5: **Who is the author of the mystery fiction "Sherlock Holmes?"**
Agatha Christie
Arthur Conan Doyle
Edgar Allan Poe
James Joyce

Q6: **Which of the following is the setting used in "The Great Gatsby?"**
New York
Boston
New Orleans
Paris

Q7: **The writers and philosophers of the Enlightenment believed the government decisions should be based on**
Fundamental religious beliefs.

The concept of divine right of kings.
Laws of nature and reason.
Traditional values.

Q8: **An acidic solution could have a pH of**
7.
10.
3.
14.

Q9: **In the Soviet Union, a negative aspect of the Cold War Era was the**
Attempt to preserve democratic ideals.
Development of peaceful uses for modern technology.
Development of effective means of international cooperation.
High cost of maintaining the arms race.

Q10: **Which of the following tissues produces voluntary body movements?**
Skeletal muscle
Cardiac muscle
Smooth muscle
Fibrous connective tissue

Q11: **Which statement best describes a characteristic of the Renaissance in Europe?**
The social structure became very rigid.
Creativity in the arts was encouraged.
The political structure was similar to that of the Roman Empire.
Humanism decreased in importance.

Q12: **Who is the author of "A Street Car Named Desire?"**
William Faulkner
Tennessee Williams
Marlon Brando
Arthur Miller

Q13: **Which of these causes ocean tides on Earth?**
The gravitational pull of the moon
The revolution of the earth around the sun
Differences in wind speed around the earth
The tilt of the earth's axis

Q14: **Which of these is a compound?**
Oxygen in the air
Liquid nitrogen
Neon in lights
Carbon dioxide gas

Q15: **Which of the following most closely captures the central theme of "Animal Farm?"**

Environmental problems
Struggle in the animal kingdom
Vulnerability of the socialist system to corruption
Problems in capitalist society

Q16: **Which theme is most prominent in the book "Catcher in the Rye?"**

Teenagers' identity crisis
Teenagers' curiosity for adult life
Teenagers' desire for success
Teenagers' drug problem

Q17: **The American Revolution was primarily motivated by**

Land disputes between France and England.
Taxation without representation.
The confrontation at the Alamo.
A decline in the price of cotton.

Q18: **A painter who was also knowledgeable about mathematics, geology, music, and engineering was**

Michelangelo.
Cellini.
Titian.
da Vinci.

Q19: **Blood is supplied to the heart wall by the**

Hepatic portal vein.
Coronary arteries.
Auricular artery.
Coronary veins.

Q20: **One important result of the French Revolution was that**

France enjoyed a lengthy period of peace and prosperity.
The church was restored to its former role and power in the French government.
Political power shifted to the bourgeoisie.
France lost its spirit of nationalism.

Q21: **Which of the following best captures the theme of "Lord of the Flies?"**

The dark side of human nature without civilization and order

A utopia in an isolated tropical island
The horror of a nuclear war
Love relations between poor children

Q22: **From the following lists of states, which state was the last state to join the union?**

Tennessee
Florida
New York
Missouri

Q23: **According to the protoplanet hypothesis, the solar system began as which of the following?**

A star
A vacuum
A huge cloud of dust and gas
A group of comets

Q24: **The first successful colonial settlement in the United States was located in**

Salem, Massachusetts.
Roanoke, North Carolina.
Plymouth, Massachusetts.
Jamestown, Virginia.

Q25: **Who is the author of the poem "The Raven?"**

Edgar Allan Poe
Walt Whitman
Allen Ginsberg
Arthur Rimbaud

Q26: **Which of these has a positive charge and is found in the nucleus of an atom?**

Neutrons
Protons
Electrons
Elements

Q27: **In "Of Mice and Men," what is the job of the main character?**

A car salesman
A ranch owner
Part time ranch helper
Police officer

Q28: **In the 1920's and 1930's, the rise of totalitarian governments in Germany, Italy, and Spain was largely the result of**

The success of the Communists in establishing a command economy in the Soviet Union.
Severe economic and social problems that arose in Europe after World War I.
The active support of the United States.
Movements demanding the return of the old monarchies.

Q29: **Who is the author of "Great Expectations?"**

Hemingway
Shakespeare
Elliot
Dickens

Q30: **What is the setting of "Les Miserables" by Victor Hugo?**

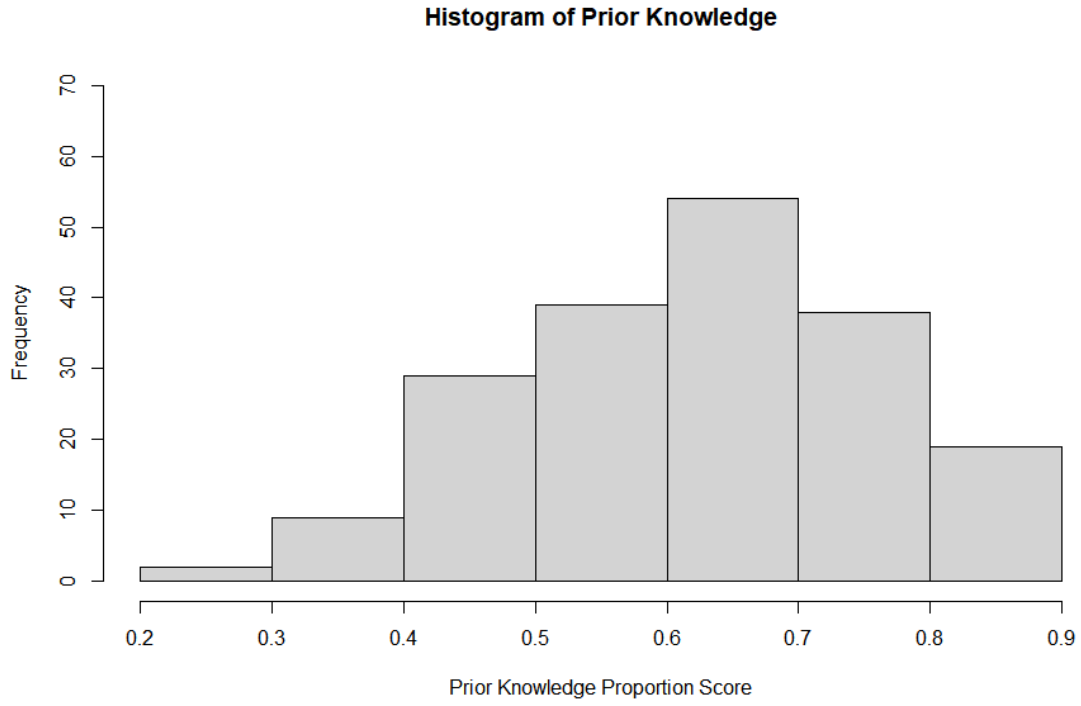
19th Century France
12th Century Italy
12th Century France
19th Century Italy

APPENDIX H.
LEVELS OF HOMELESSNESS SCALE

HUD Level of Houselessness	Question(s)	Number of Participants Responding "Yes"
Level 4a	Have you, a family member, or a close friend ever lacked fixed, regular, and adequate nighttime residence? (e.g., primary nighttime residence in a place not meant for human habitation)	30
Level 4b	Have you, a family member, or a close friend ever lived in a publicly or privately operated shelter designed for temporary living conditions?	19
Level 3a	Have you, a family member, or a close friend ever lacked the resources to obtain permanent housing?	49
Level 3b	Have you, a family member, or a close friend ever left permanent housing with no subsequent residence?	43
Level 2b	Have you, a family member, or a close friend ever spent more than 60 days without permanent housing? (e.g., a lease or occupancy agreement)	35
Level 2a	Have you, a family member, or a close friend ever moved three or more times in a 60-day period?	20
Level 2b	Have you, a family member, or a close friend ever spent more than 60 days without permanent housing? (e.g., a lease or occupancy agreement)	35
Level 1	Have you, a family member, or a close friend ever fled, or attempted to flee, domestic violence with no ability to obtain permanent housing?	25
Level 0	(Responded "No" to all of the questions.)	122

Note. The total participants exceed the sample N because some participants reported personal experience with multiple levels of houselessness.

APPENDIX I.
DISTRIBUTIONS OF ALL MEASURES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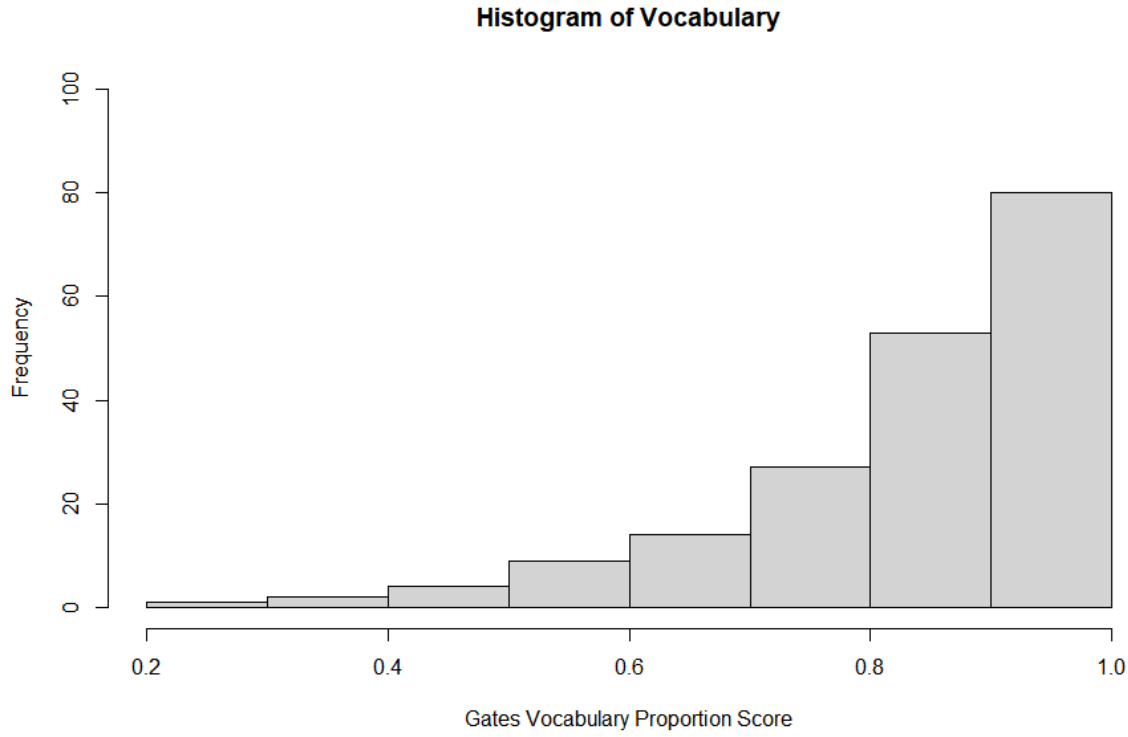
Prior Knowledge Proportion Score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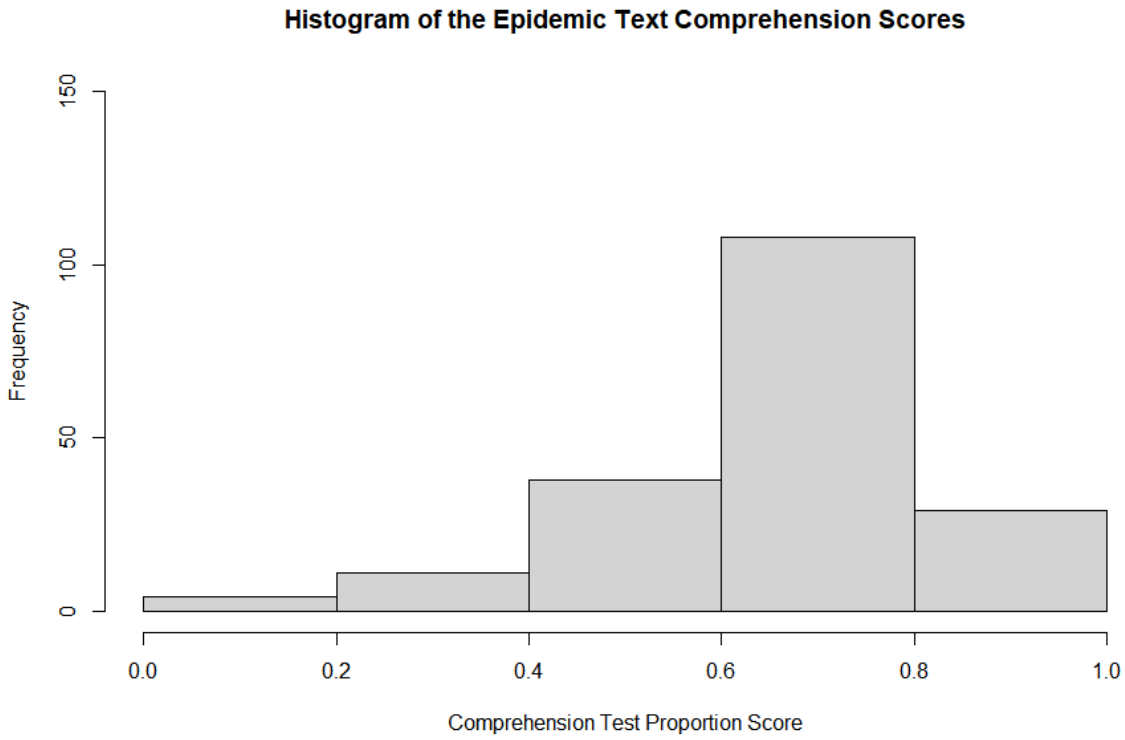
Gates Vocabulary Proportion Score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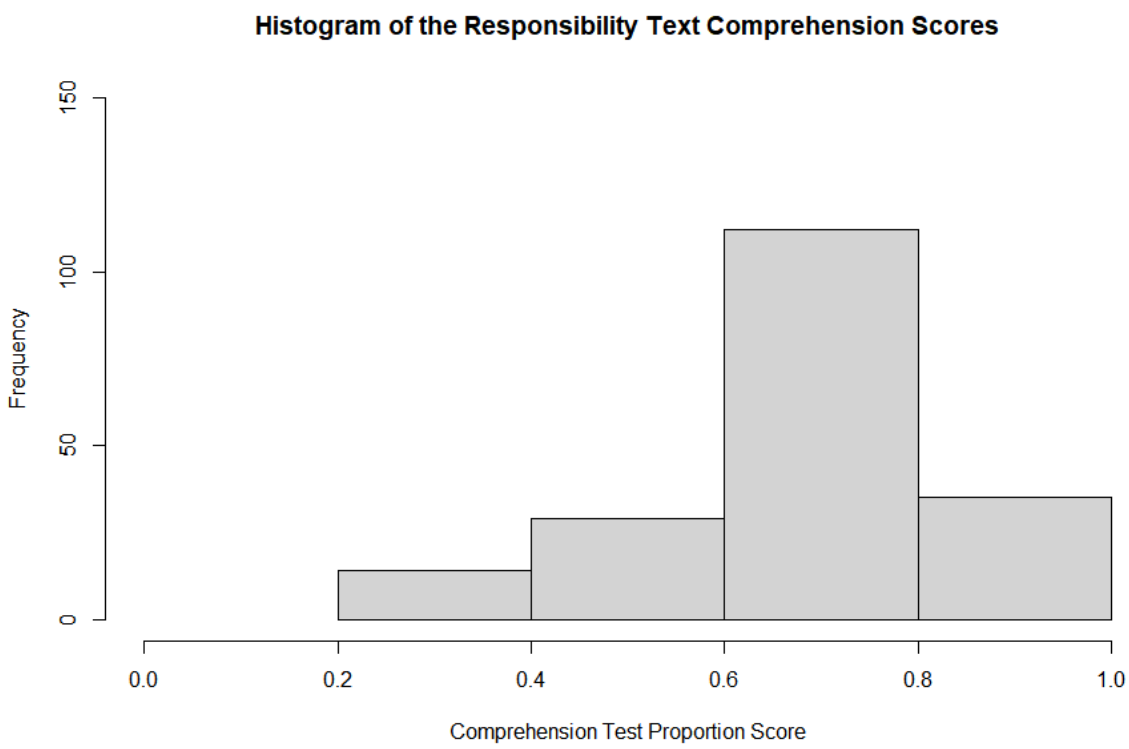
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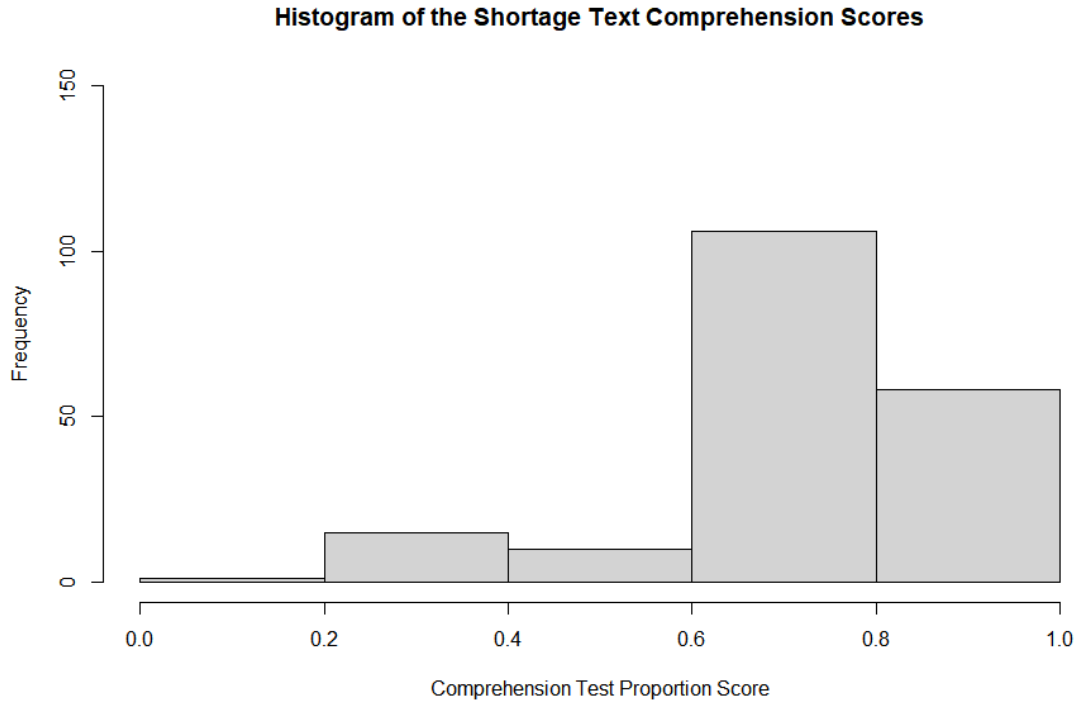
Comprehension Test Proportion Score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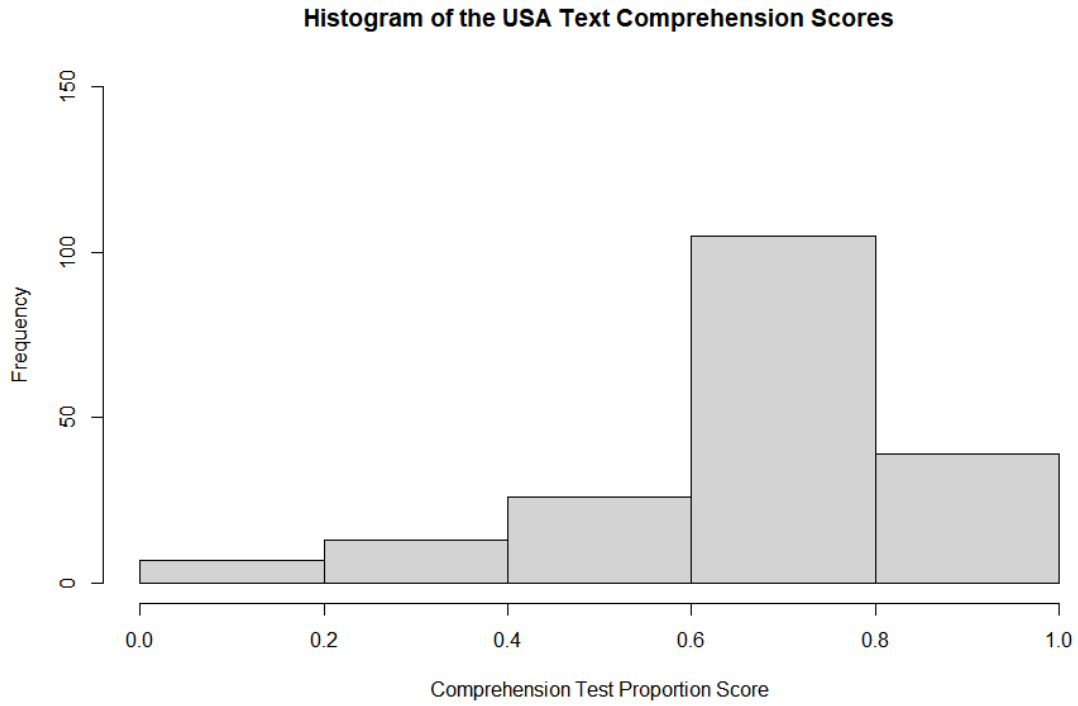
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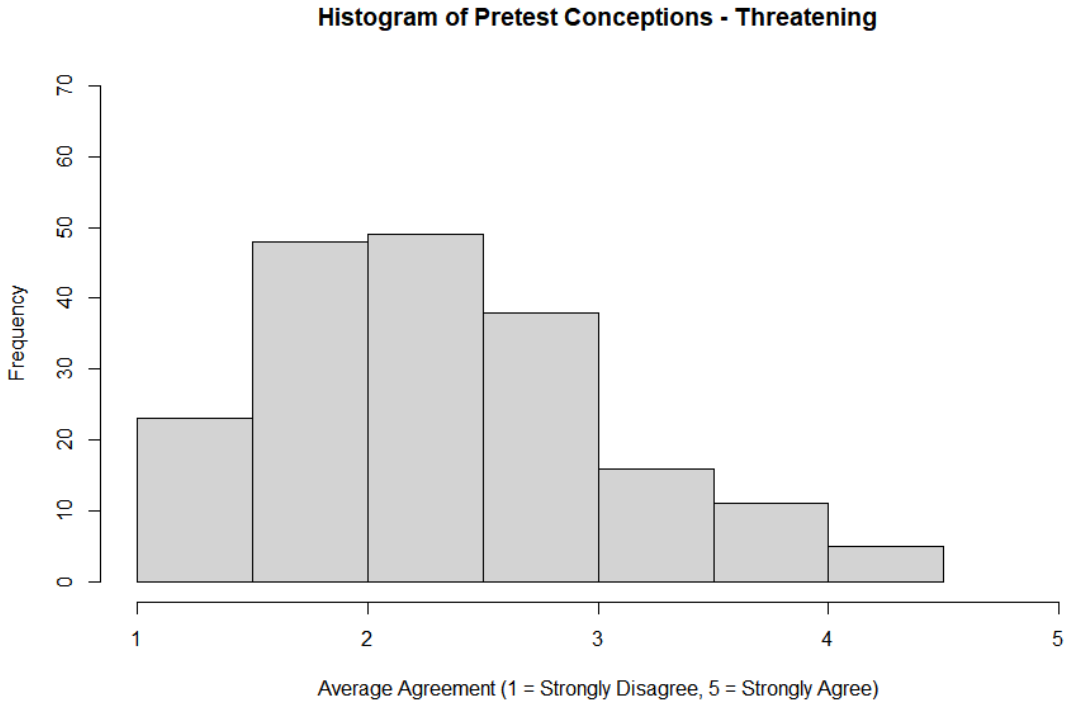
Comprehension Test Proportion Score


Histogram of Pretest Conceptions - Threatening
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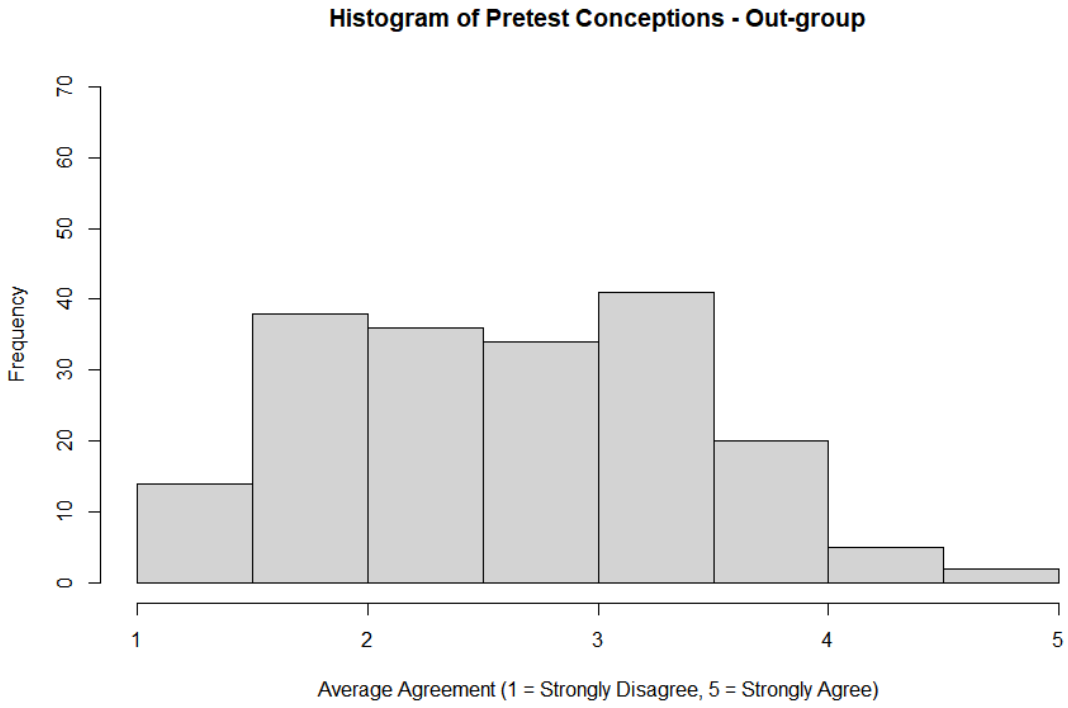
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)


Histogram of Pretest Conceptions - Out-group
Frequency
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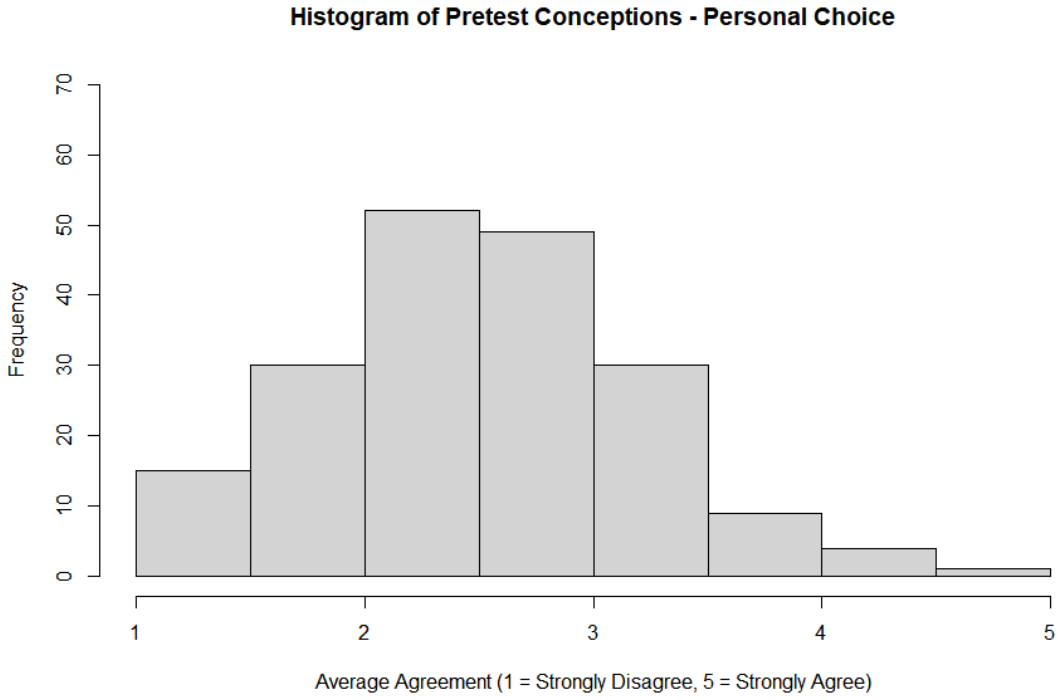
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)


Histogram of Pretest Conceptions - Personal Choice
Frequency
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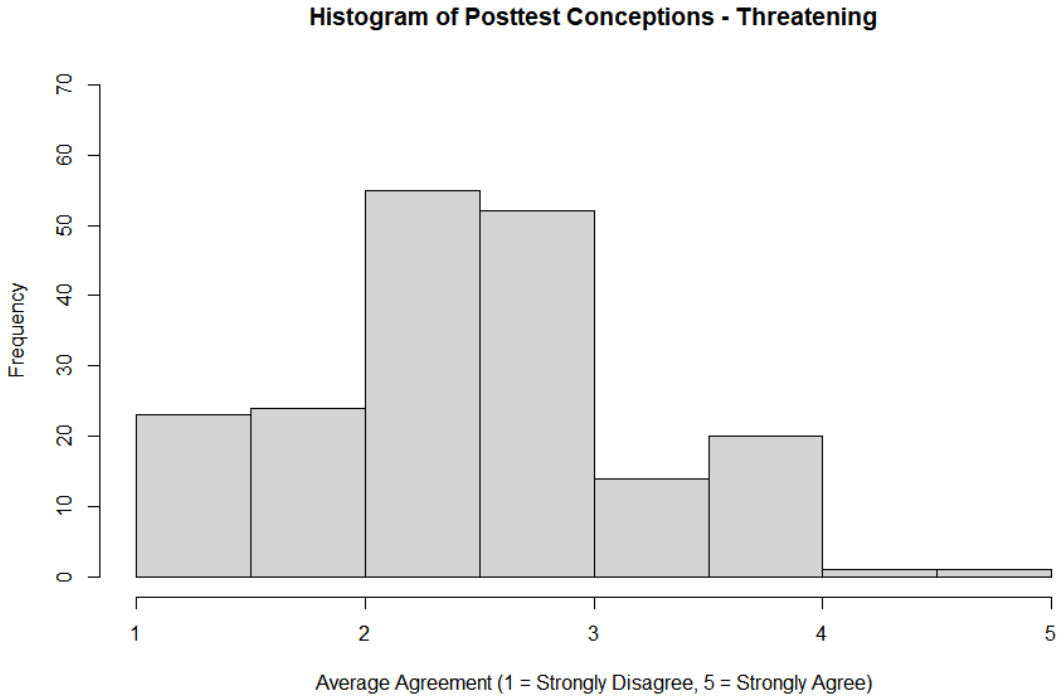
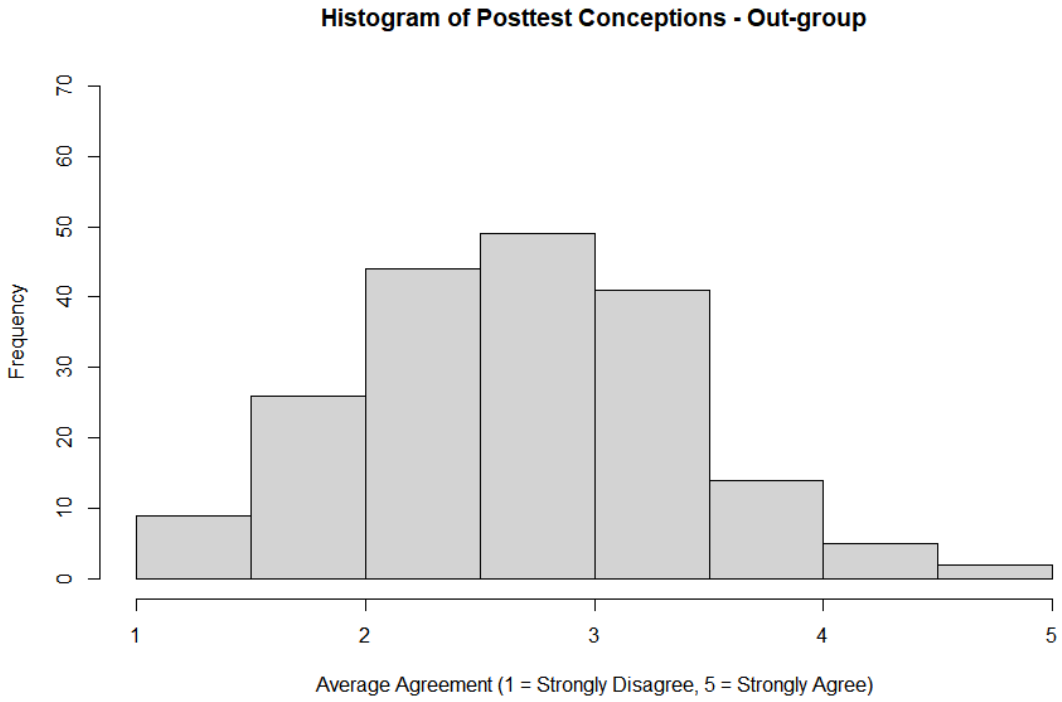
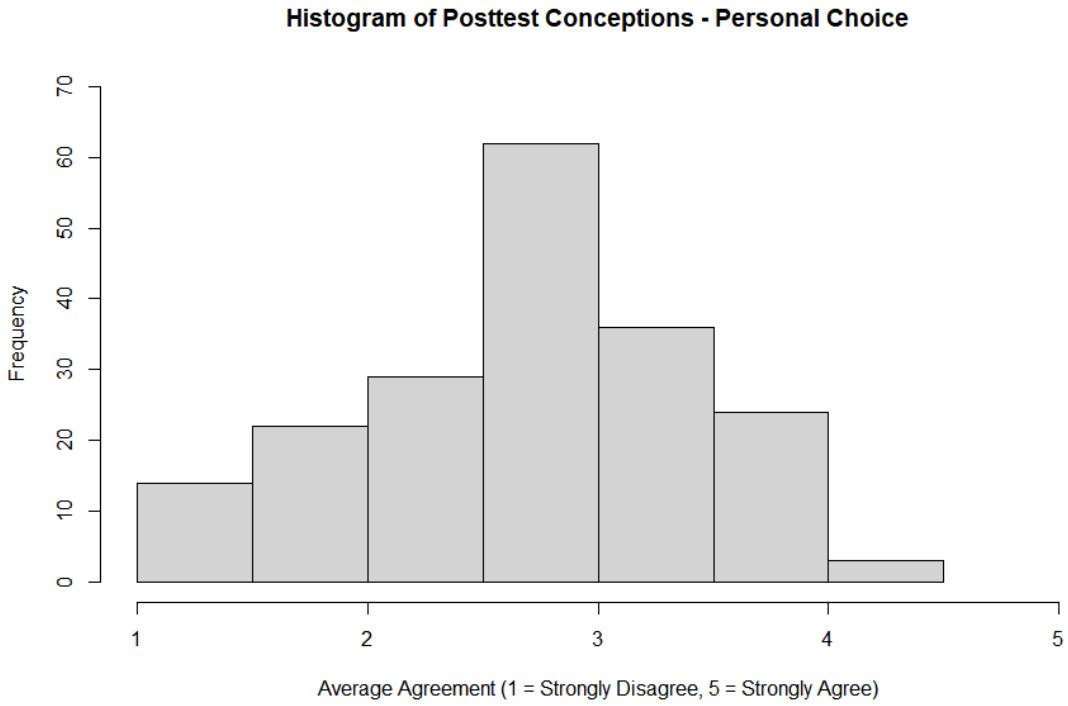
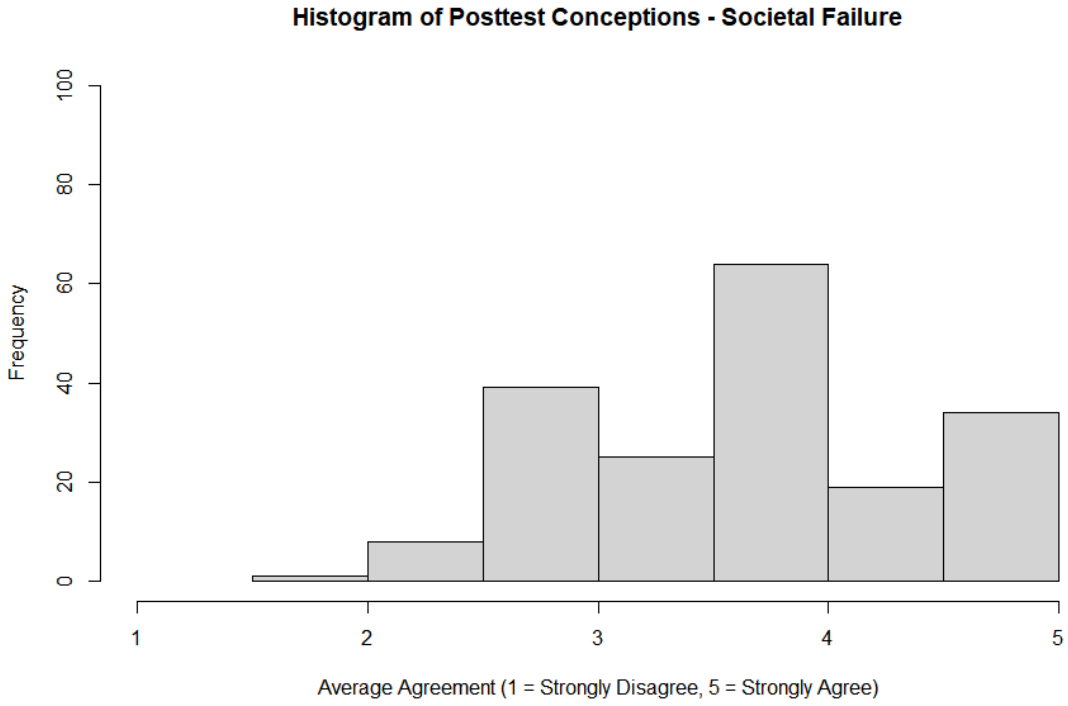
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

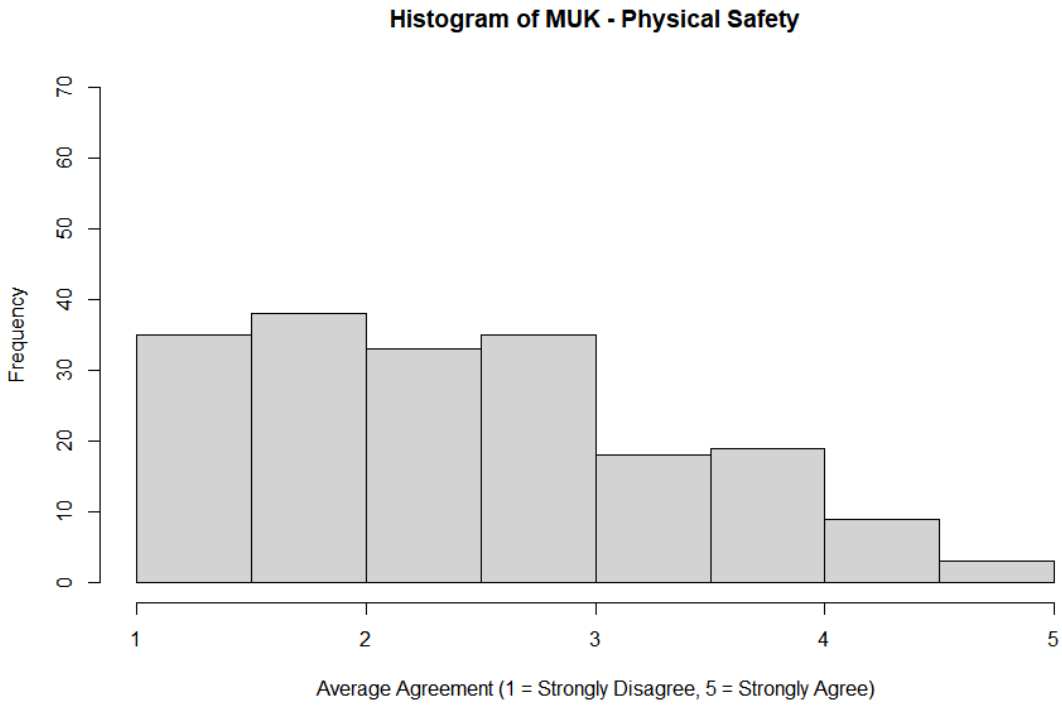

Histogram of Pretest Conceptions - Societal Failure
Frequency
0
20
40
60
80
100
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

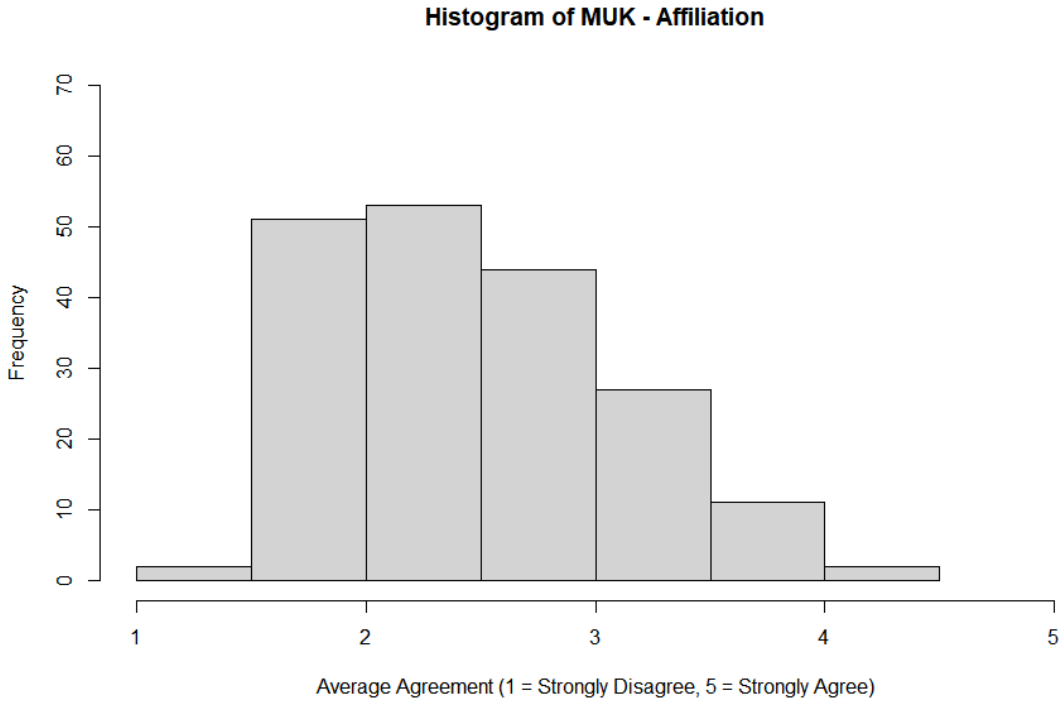

Histogram of Posttest Conceptions - Threatening
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

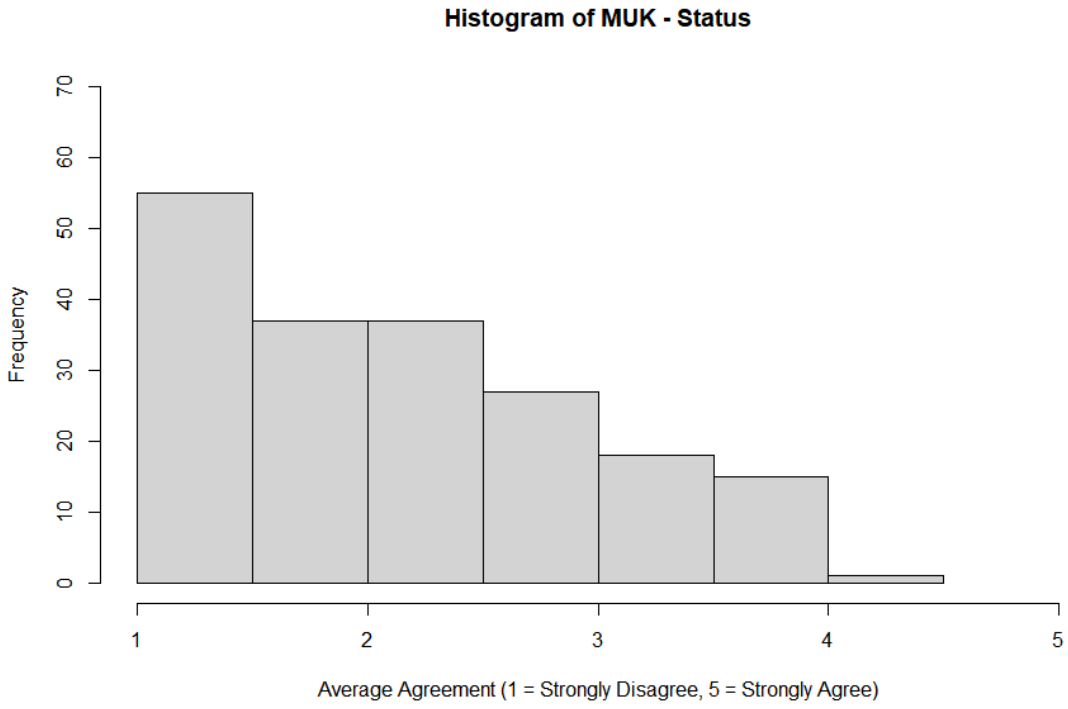

Histogram of Posttest Conceptions - Out-group
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

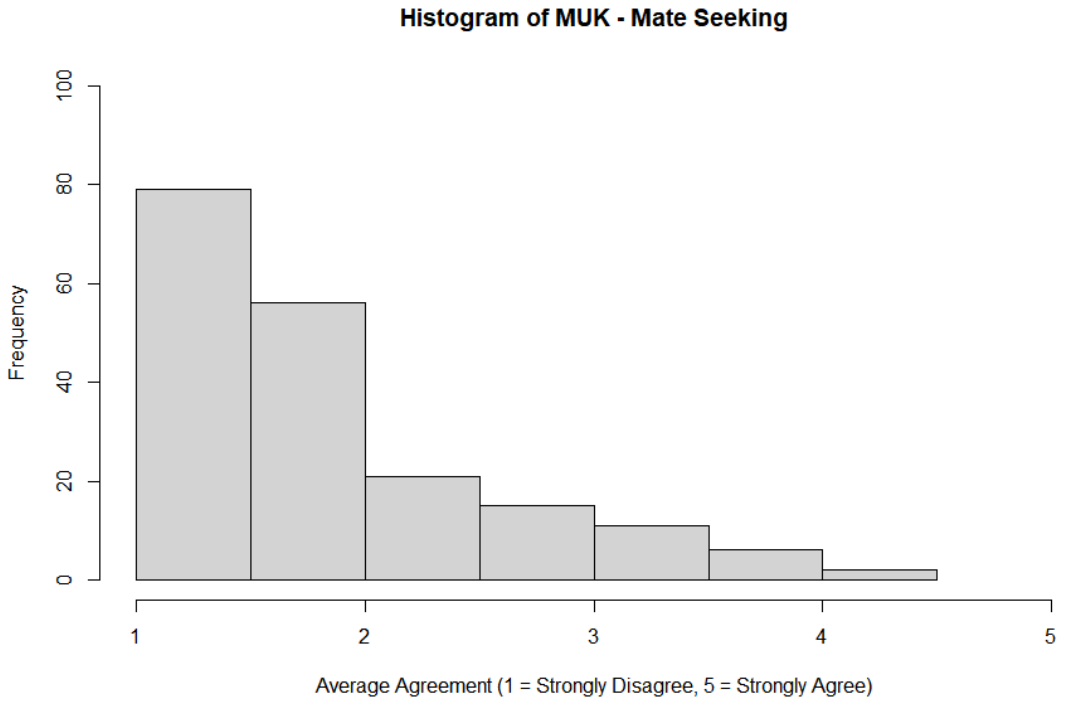

Histogram of Posttest Conceptions - Personal Choice
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

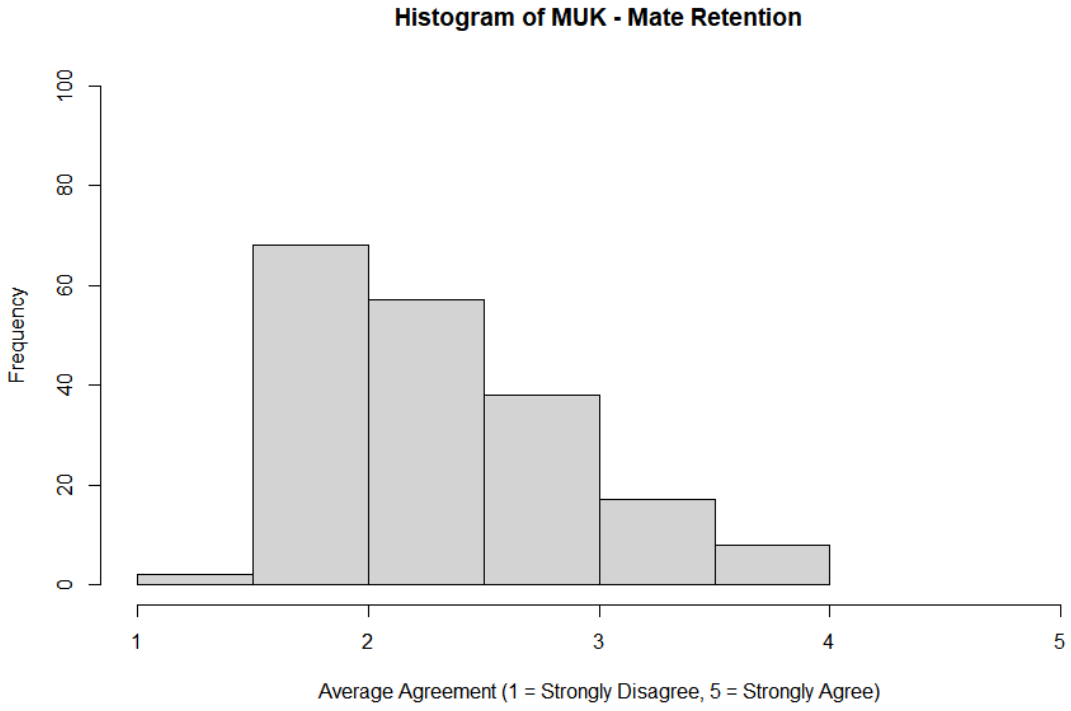

Histogram of Posttest Conceptions - Societal Failure
Frequency
0
20
40
60
80
100
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

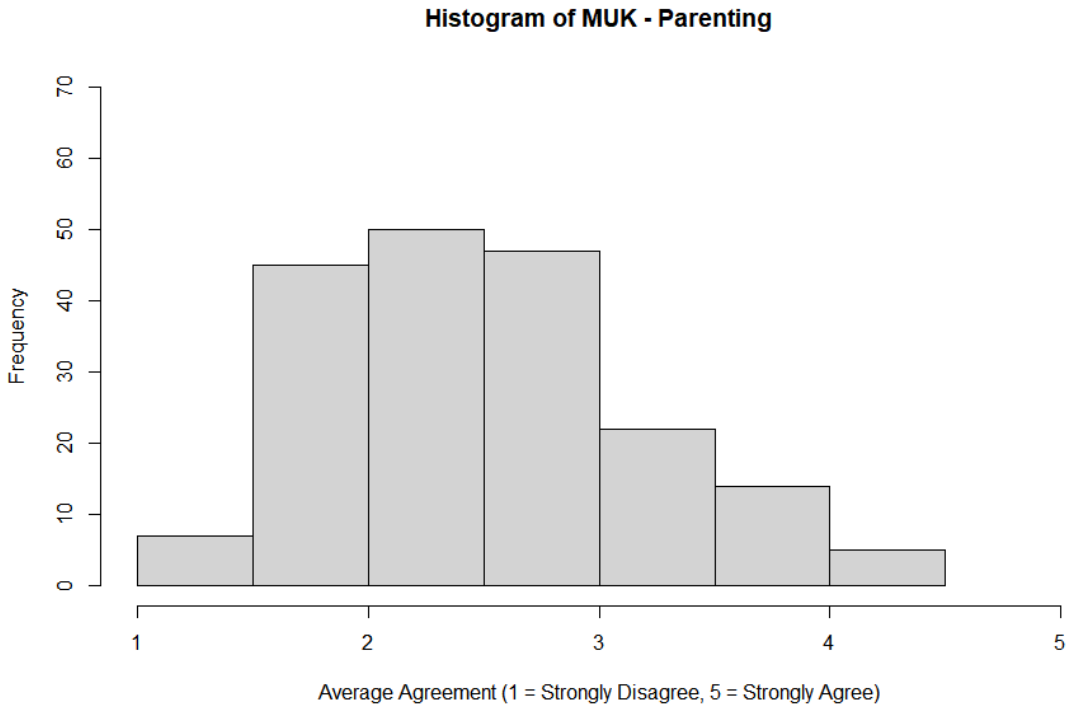

Histogram of MUK - Physical Safety
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

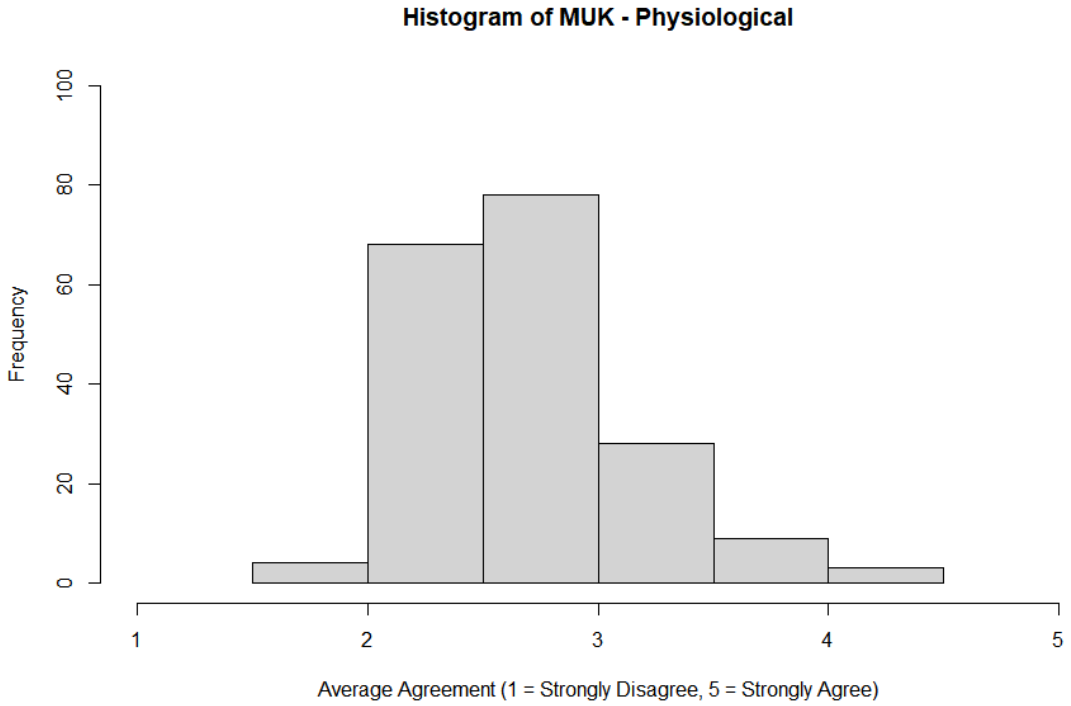

Histogram of MUK - Affiliation
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

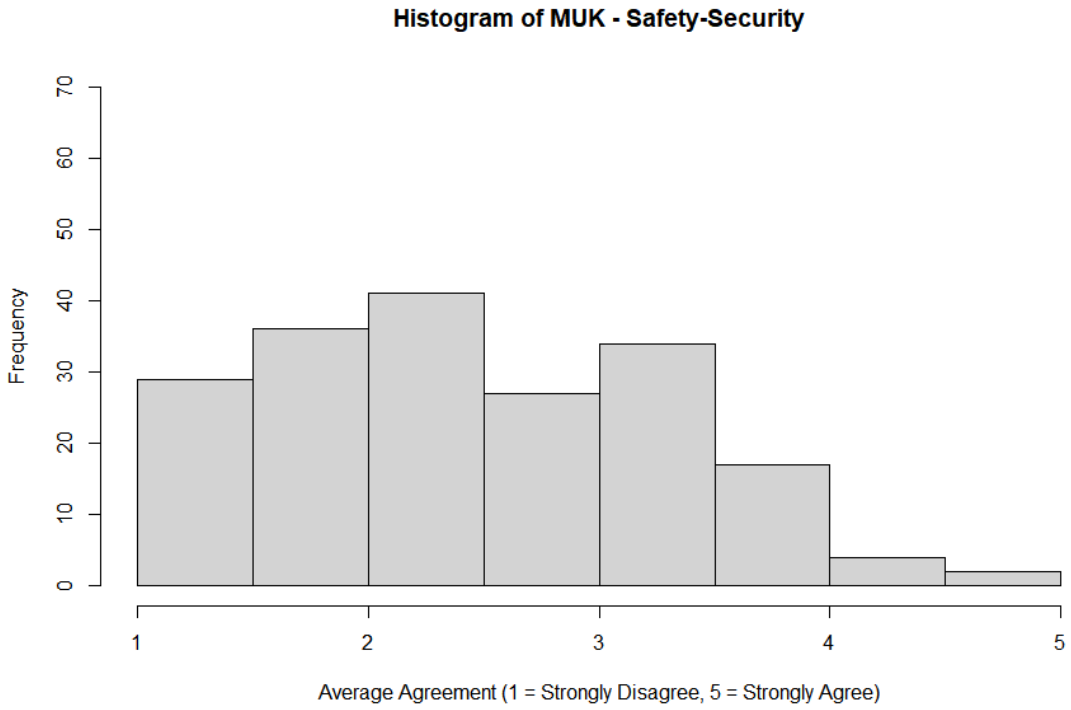

Histogram of MUK - Status
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

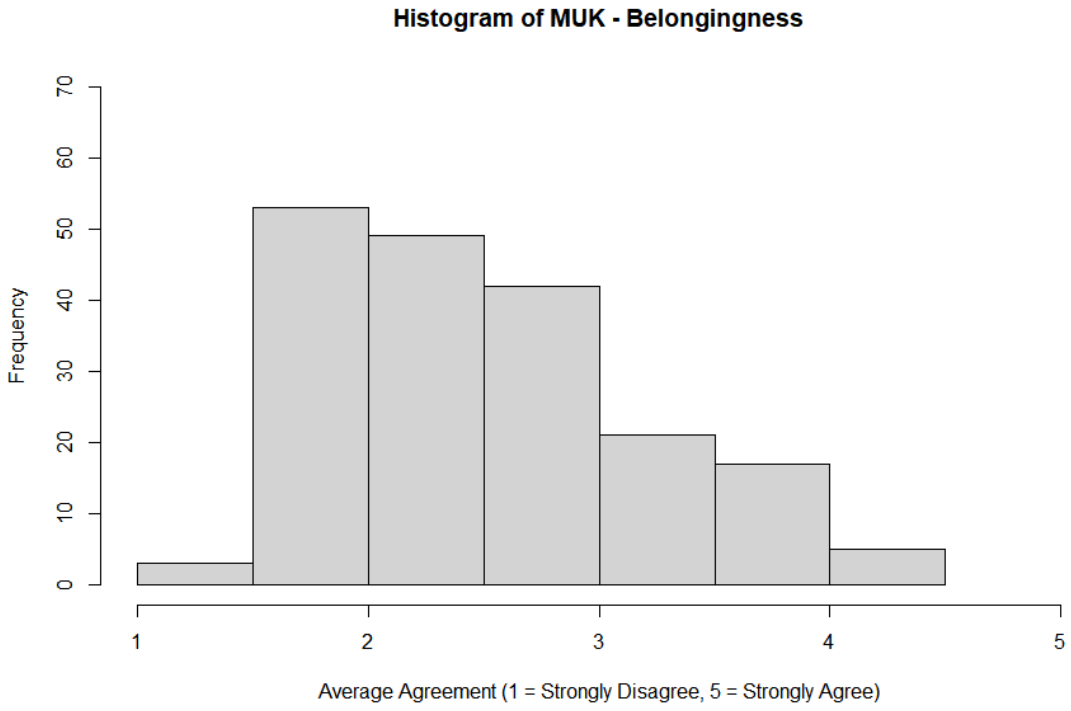

Histogram of MUK - Mate Seeking
Frequency
0
20
40
60
80
100
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

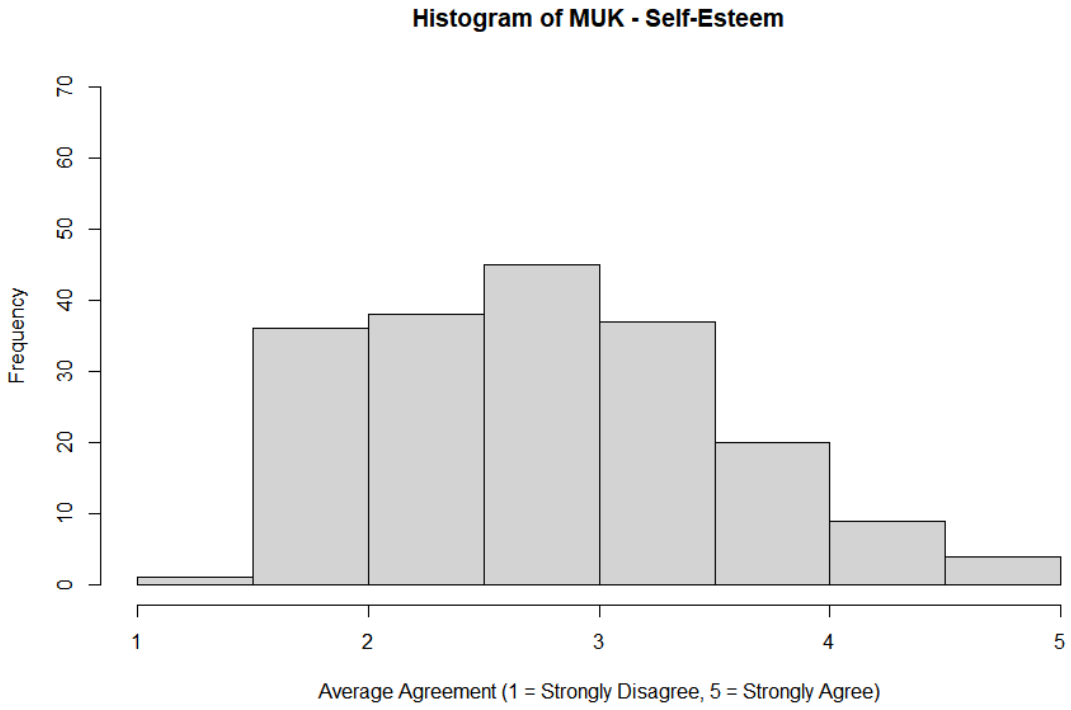

Histogram of MUK - Mate Retention
Frequency
0
20
40
60
80
100
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

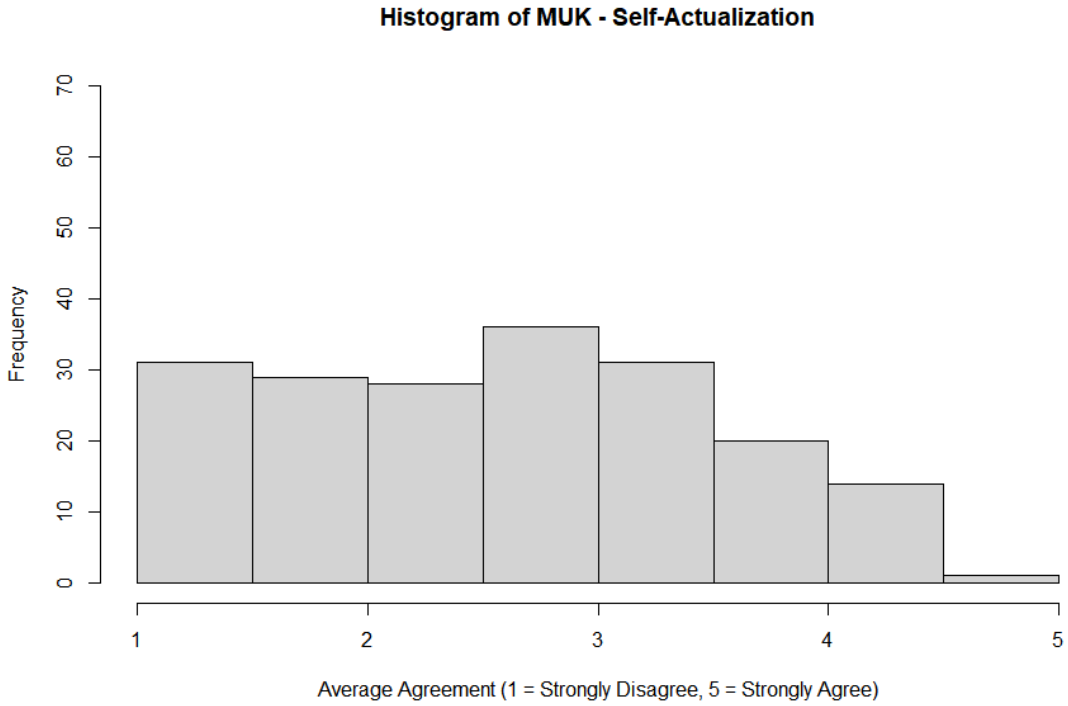

Histogram of MUK - Parenting
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)


Histogram of MUK - Physiological
Frequency
0
20
40
60
80
100
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)


Histogram of MUK - Safety-Security
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

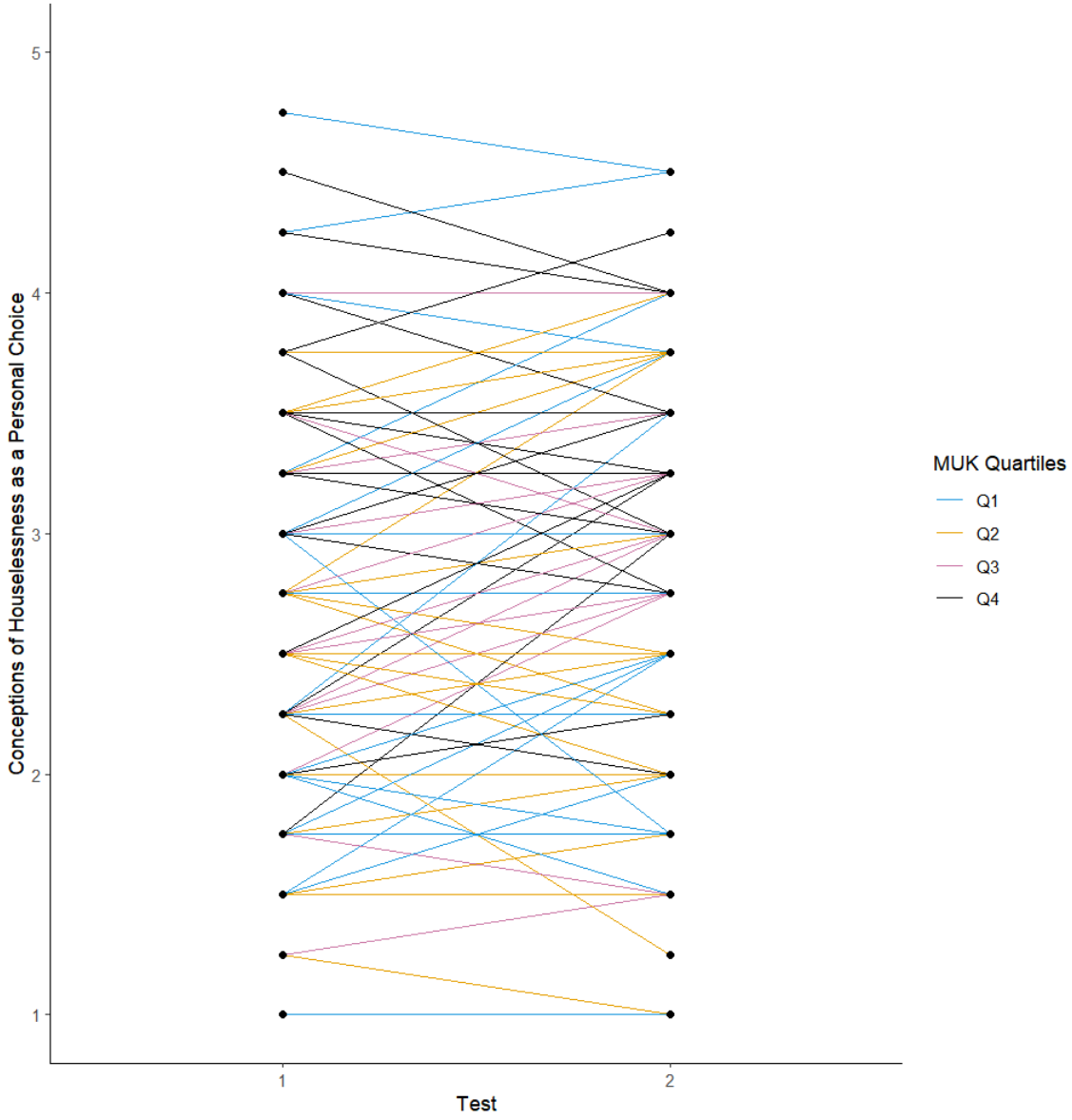

Histogram of MUK - Belongingness
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)


Histogram of MUK - Self-Esteem
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

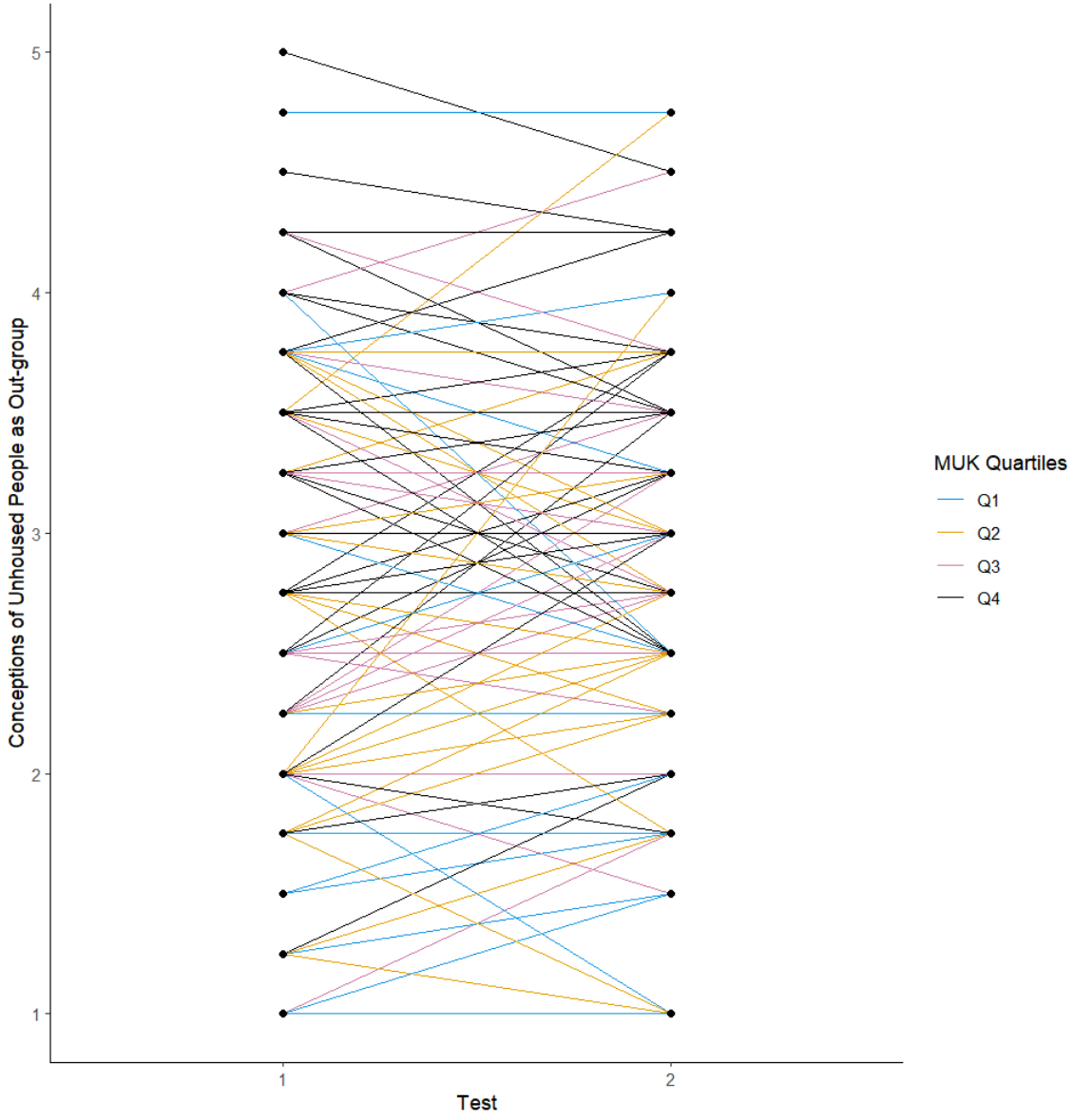

Histogram of MUK - Self-Actualization
Frequency
0
10
20
30
40
50
60
70
1
2
3
4
5
Average Agreement (1 = Strongly Disagree, 5 = Strongly Agree)

APPENDIX J.
INDIVIDUAL SLOPES OF CONCEPTUAL CHANGE

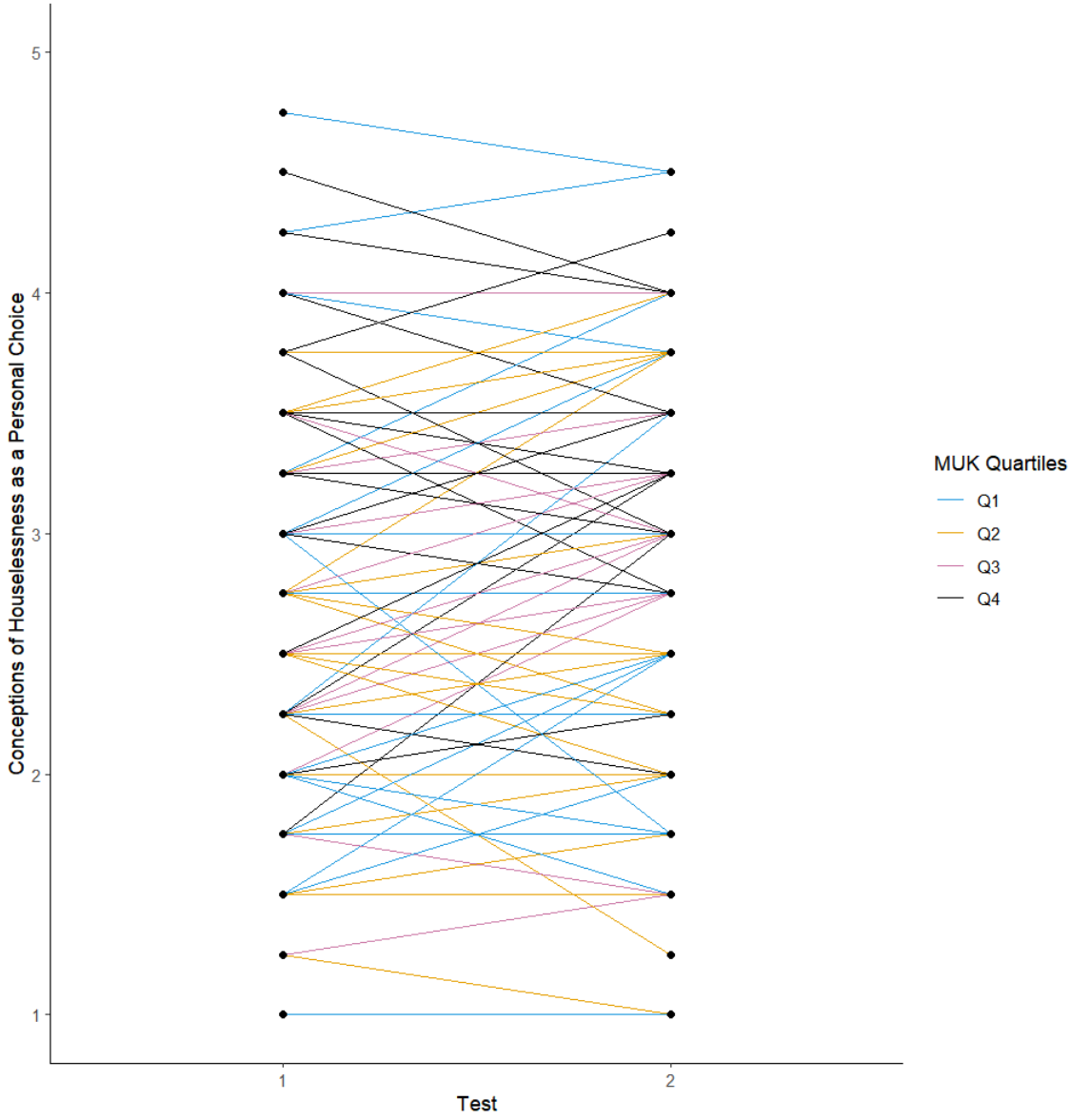
Graph of Each Participants' Conceptions of Unhoused People as Threatening as a Function of Test, Grouped by Quartiles of MUK Score.



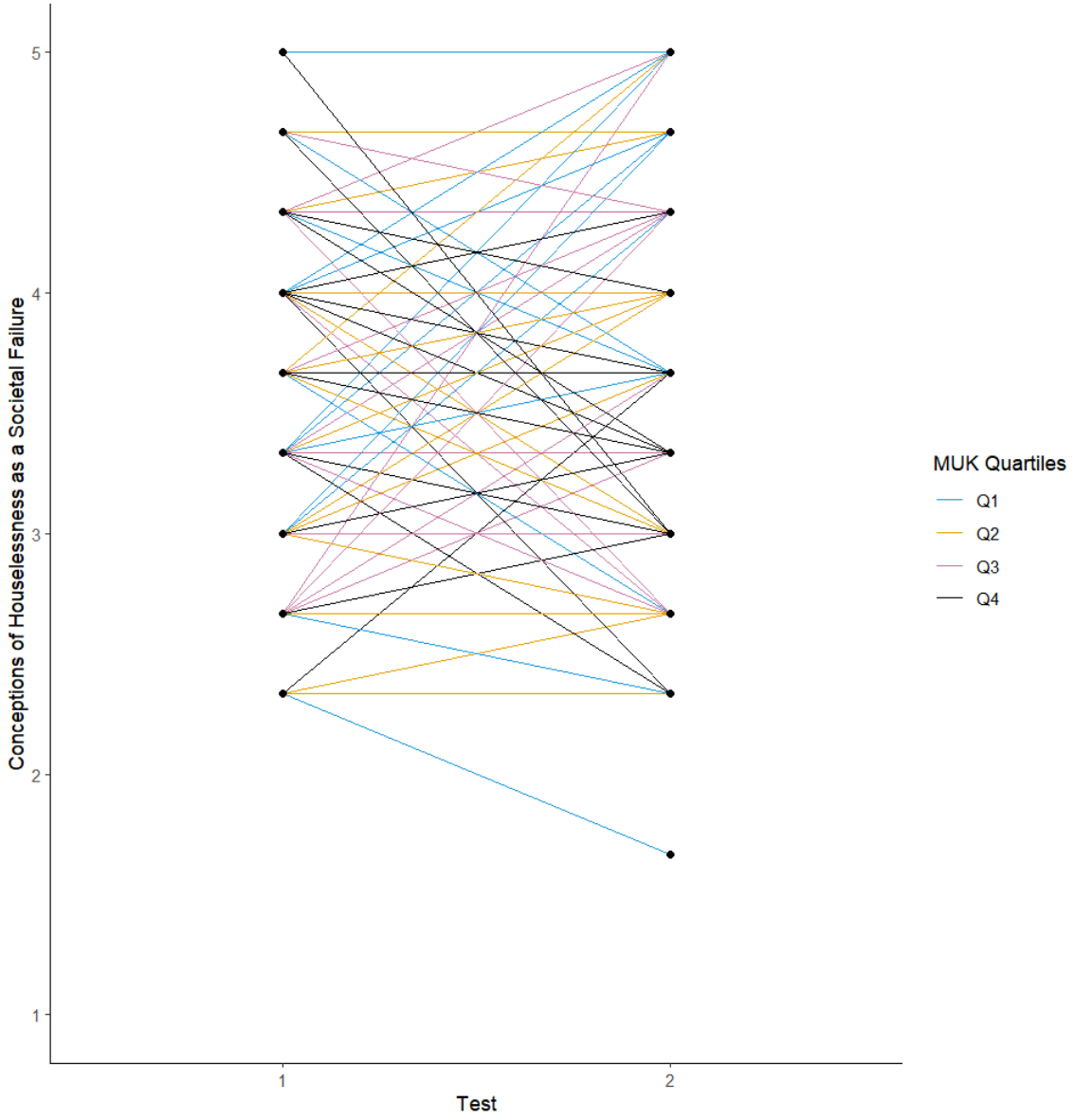
Graph of Each Participants' Conceptions of Unhoused People as Out-group as a Function of Test, Grouped by Quartiles of MUK Score.



Graph of Participants' Conceptions of Houselessness as a Personal Choice as a Function of Test, Grouped by Quartiles of MUK Score.

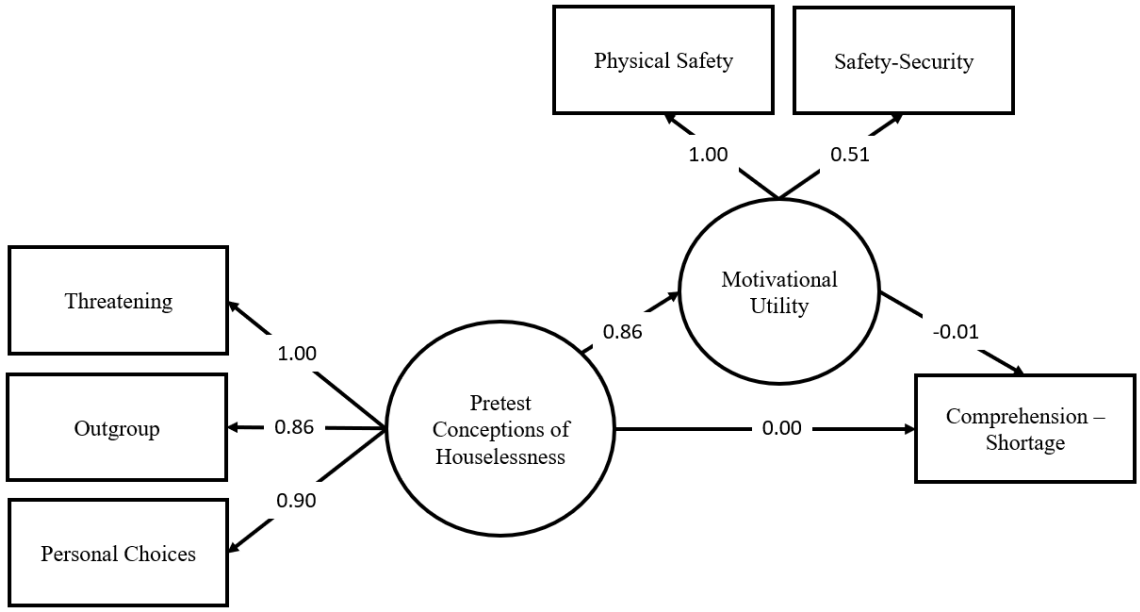


Graph of Participants' Conceptions of Houselessness as a Societal Failure *as a Function of Test, Grouped by Quartiles of MUK Score.*

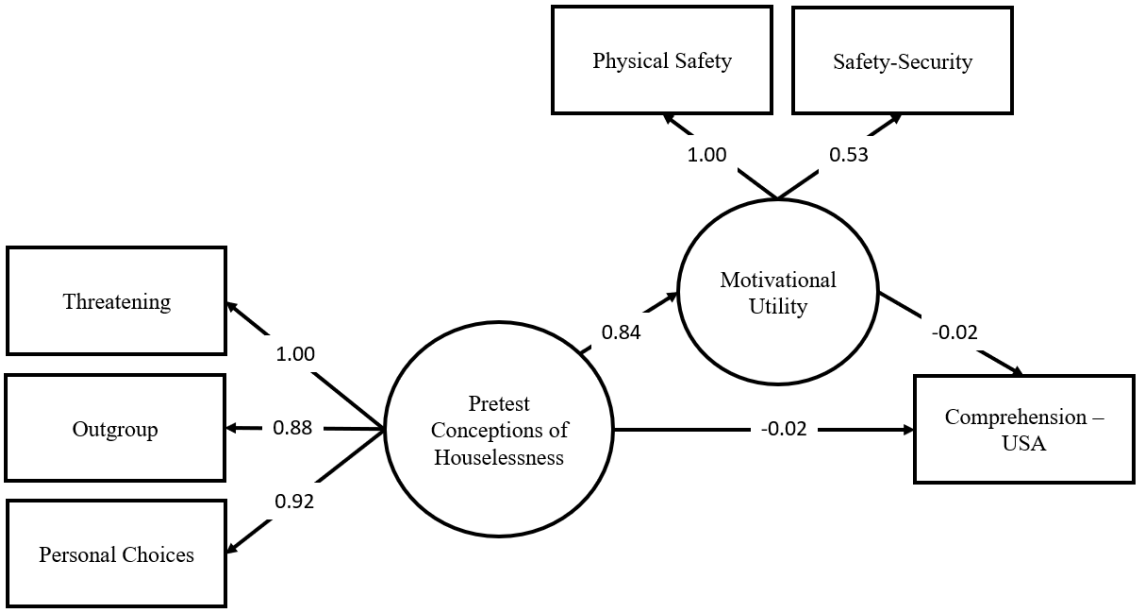


APPENDIX K.
MEDIATION MODELS OF CONCEPTIONS, COMPREHENSION, AND MUK

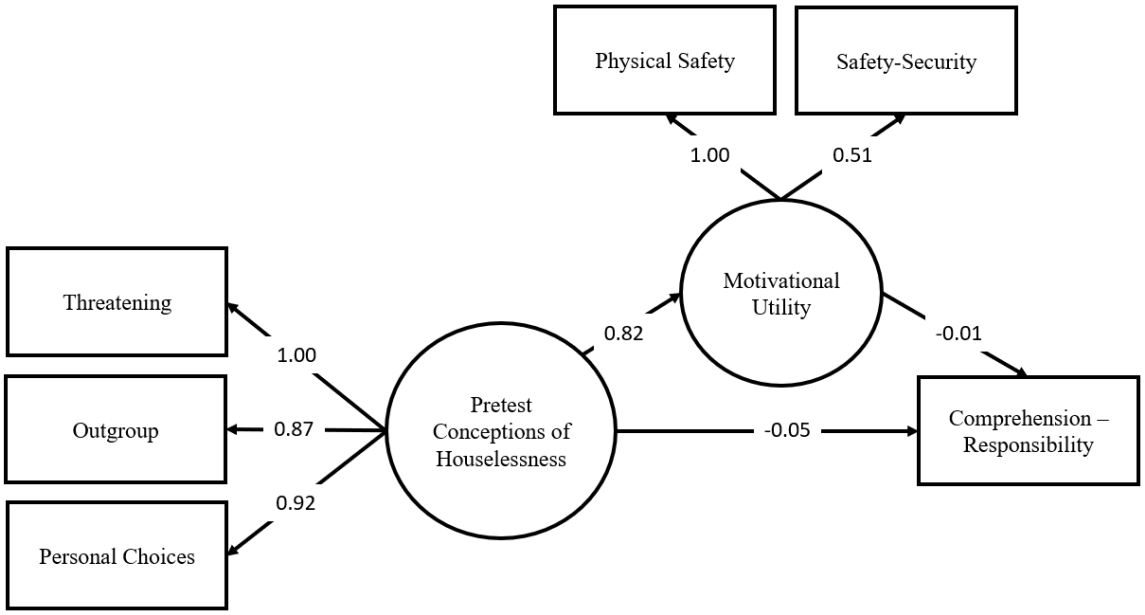
Model predicting comprehension of the shortage text from conceptions of houselessness mediated by MUK holding vocabulary and prior knowledge constant.



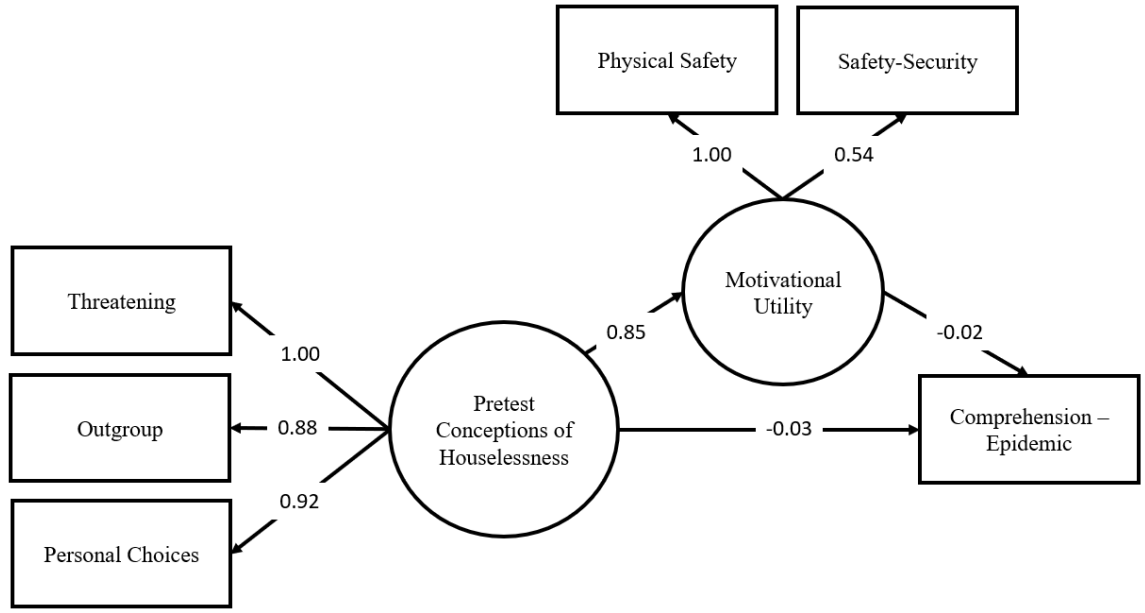
Model predicting comprehension of the USA text from conceptions of houselessness mediated by MUK holding vocabulary and prior knowledge constant.



Model predicting comprehension of the responsibility text from conceptions of houselessness mediated by MUK holding vocabulary and prior knowledge constant.



Model predicting comprehension of the epidemic text from conceptions of houselessness mediated by MUK holding vocabulary and prior knowledge constant.



APPENDIX L.
IRB APPROVAL DOCUMENT

EXEMPTION GRANTED

Danielle McNamara
Psychology
480/727-5690
Danielle.McNamara@asu.edu

Dear Danielle McNamara:

On 3/13/2019 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Developing a Deeper Understanding of Cognitive Processes Driving Multiple Document Comprehension
Investigator:	Danielle McNamara
IRB ID:	STUDY00009493
Funding:	Name: DOEd: Institute of Education Sciences (IES), Grant Office ID: FP00012432
Grant Title:	FP00012432;
Grant ID:	FP00012432;
Documents Reviewed:	• Multi-Doc Appendix A Question Examples.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • MD proposal 8-15-17 final4.docx, Category: Sponsor Attachment; • SONA Posting.pdf, Category: Recruitment Materials; • Multi-Doc IRB Adult Studies.docx, Category: IRB Protocol; • Informed Consent_MTurk.pdf, Category: Consent Form; • Informed Consent College.pdf, Category: Consent Form;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 3/13/2019.
In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,
IRB Administrator