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Depersonalization and Projection in Groups: Two Paths to Uncertainty Reduction

Jiin Jung
Claremont Graduate University

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APPROVAL OF THE DISSERTATION COMMITTEE

This dissertation has been duly read, reviewed, and critiqued by the Committee listed below, which hereby approves the manuscript of Jiin Jung as fulfilling the scope and quality requirements for meriting the degree of Doctor of Philosophy in Psychology.

Dr. Michael A. Hogg, Chair

Claremont Graduate University

Professor of Psychology

Dr. Jason Siegel

Claremont Graduate University

Professor of Psychology

Dr. William D. Crano

Claremont Graduate University

Professor of Psychology

Dr. Richard J. Crisp, External examiner

Durham University

Professor of Psychology

Abstract

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This dissertation develops and tests a new integrative model, the *depersonalization-projection model*, which proposes that uncertainty reduction is a key motivation underlying depersonalization and projection processes in groups. The proposed model describes the conditions under which people in group contexts define themselves in terms of group attributes (depersonalization) and/or define the group in terms of attributes of themselves (projection). The locus of uncertainty (about the group, about self, about self-prototypicality/self-group fit) determines the directional flow of definitional information, as well as (a) effectiveness of uncertainty reduction, (b) strength of inference, (c) strength of identification, (d) information processing time, and (e) perception of relative self-prototypicality and interchangeability. The proposed model is compared to previous integrative models. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) between-subjects experiment (N = 257) tested two core hypotheses. (H1) Self locus-of-uncertainty yields (a) greater uncertainty reduction, (b) stronger inference, (c) stronger identification, (d) shorter information processing time, and (e) lower relative self-prototypicality (higher interchangeability) than Group locus-of-uncertainty. (H2) These effects of locus-of-uncertainty are moderated by self-prototypicality. When the locus-of-uncertainty is the group, high self-prototypicality yields (a) greater uncertainty reduction, (b) stronger inference, (c) stronger identification, (d) shorter information processing time, and (e) higher relative self-prototypicality (low interchangeability) than low or unknown self-prototypicality; when the locus-of-uncertainty is self, self-prototypicality will have no effect. Results revealed that as predicted under H1a and H1b, Self locus-of-uncertainty yielded greater uncertainty reduction and stronger inference than Group locus-of-uncertainty. As predicted under H2c, results revealed the significant two-way interaction on identification. However, there were no significant effects on reaction time and the perception of relative self-prototypicality/interchangeability. The closing discussion explores implications of this research for newcomer innovation, intragroup communication, innovative leadership, and faction formation.

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CHAPTER ONE

Introduction

How did the early American settlers, and later the Founding Fathers, create a distinct American identity? How do Americans reconstruct American identity when each wave of immigrants has changed the composition of the American population? Do established settlers and new immigrants have a similar or different sense of American identity? How do different definitions of American identity emerge, and what are the consequences for American society? Some social groups, such as those defined by nationality, political affiliation, ethnicity, or gender, can be a significant part of people's self-concept and thus provide people with an important and clear sense of who they are. However, groups and their defining attributes are not always stable and clearly defined. They can change, sometimes rapidly and dramatically, in response to changed circumstances, and this can raise group members' uncertainty about the group's identity and about themselves as group members. In such uncertain times, how do people reduce uncertainty about their social group and identity and maintain a clear sense of who they are?

This dissertation provides and tests an explanation of the inferential mechanics of how people reduce uncertainty in groups. It is proposed that two processes may be involved: depersonalization and projection. *Depersonalization* is a process where people contextually categorize themselves in terms of a self-inclusive category and this self-categorization process assigns the category's defining attributes, its prototype, to self as an evaluative and prescriptive self-definition−group defining attributes flow from group to self (Tajfel & Turner, 1986; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987; for recent review see Abrams & Hogg, 2010; Hogg, 2018).

Projection is a process where people construct a group prototype from their own personal attributes or nested subgroup attributes−personal attributes flow from self to group (Cadinu & Rothbart, 1996; Epley, Keysar & Va Boven, 2004; Krueger & Clement, 1996) or subgroup attributes flow from a subgroup to a superordinate group (Mummendey & Wenzel, 1999). Depersonalization and projection have been well documented in the social psychological literature. However, less is known about *when* depersonalization or projection prevails; how these two processes interplay, and how effectively they construct a clear sense of self.

In this dissertation, drawing on uncertainty-identity theory (Hogg, 2007, 2012, 2015)—a theory that attributes to self-uncertainty reduction a fundamental motivational role in group identification—it is explained how the locus of uncertainty determines the relative predominance of depersonalization or projection. There are three primary loci of uncertainty: people can feel uncertain about (a) who I am (*self*), (b) what the group's identity is (*group*), and how well I fit in the group (*self-prototypicality*). Building on this, depersonalization-based social identity and projection-based social identity can be contrasted in terms of (a) effectiveness of uncertainty reduction, (b) strength of inference, (c) strength of identification, (d) information processing time/steps, and (e) perception of relative self-prototypicality and interchangeability. This research has implications, which are discussed in the closing section, for an understanding of majority and minority influence and social change, newcomer innovation, innovative leadership, and faction formation.

Social Identity, Self-Categorization, and Depersonalization

Originating in research by Tajfel on social categorization, social perception, and intergroup relations, social identity theory has developed over the past 45 years into a general analysis of how self-definition in group terms (social identity) influences and is influenced by group and intergroup processes (Tajfel & Turner, 1986; Turner et al., 1987; also see Abrams & Hogg, 2010; Hogg, 2018; Hogg, Abrams, & Brewer, 2017). Social identity theory initially focused on how mere social categorization could trigger intergroup discrimination and how, in the service of evaluatively positive intergroup distinctiveness, people's social beliefs about the nature of intergroup relations guides the form taken by ingroup favoritism and intergroup behavior (e.g., Tajfel & Turner, 1986).

Tajfel (1969) believed that cognitive processes play a key role in group and intergroup phenomena. Specifically, when people *categorize* themselves and others into discrete groups they perceptually accentuate the differences between groups and minimize differences within each of the groups—the meta-contrast principle (Tajfel & Wilkes, 1963). Although the meta-contrast principle implicitly regards a contextually-salient outgroup as an information anchor to construct an ingroup norm, Tajfel noted that how group attributes are formed was less of a social psychological concern. He stated that:

> "The content of the categories to which people are assigned by virtue of their social identity is generated over a long period of time within a culture; the origin and development of these ideas are a problem for the social historian rather than for the psychologist" (Tajfel, 1969, p.86).

It was self-categorization theory, the more cognitively focused social identity theory of the group, that developed the language of group prototypicality and depersonalization (Turner et al., 1987). A key premise of self-categorization theory is that when a self-inclusive category becomes contextually salient, groups are cognitively represented as *prototypes* – fuzzy sets of attributes that describe, and in the case of the ingroup prescribe, who we are, how we should feel, think and behave. Social identity research has documented that group prototypes not only maximize ingroup similarities, but also intergroup differences. They are polarized away from relevant outgroups and are thus reflected in behavioral conformity to a polarized ingroup norm (e.g., Abrams, Wetherell, Cochrane, Hogg, & Turner, 1990; Hogg & Turner, 1985).

People obtain information about prototypes, particularly ingroup prototypes by observation and communication. They pay close attention to ingroup members (Hogg & Giles, 2012; Hogg & Rinella, 2018; Postmes, Haslam & Swaab, 2005; Smith, Thomas, & McGarty, 2015), particularly leaders (Hogg, 2018, 2020; cf: the social identity theory of leadership: Hogg, 2001; Hogg, Van Knippenberg, & Rast, 2012) and oldtimers (Levine & Moreland, 1994). People also cognitively average the shared characteristics of group members (Hinsz, Tindale, & Vollrath, 1997).

No matter how a group prototype is cognitively constructed, people depersonalize themselves and others in terms of the relevant group-defining prototype. From the perspective of an individual person, social identity is effectively a category/group prototype that is internalized as a part of the self-concept. As a result of depersonalization, self and ingroup others are perceived as relatively interchangeable members of the same ingroup.

Self-Anchoring, Social Projection, and Ingroup Projection

A number of researchers have proposed that the attributes of a specific social identity and associated group can be constructed from the idiosyncratic attributes of an individual group member, especially self. This process is called *projection* in which people project their own personal attributes onto a self-inclusive category (self-anchoring theory - Cadinu & Rothbart, 1996) and onto other members in that category (social-induction model - Krueger & Clement, 1996; ego-centric anchoring and adjustment - Epley, Keysar, & Van Boven, 2004)

Projection was initially conceptualized as a psychodynamic self-defensive process by which people could see their own undesirable and negative traits in others (Freud, 1936). More recently projection has been conceptualized from a socio-cognitive perspective. Social projection theory argues that people tend to overestimate the prevalence of their attributes in the population – there is a false consensus effect (Marks & Miller, 1987; Ross, Greene, & House, 1977) or a self-based consensus effect (Hansen & Donoghue, 1977). Similarly, self-anchoring theory (Cadinu & Rothbart, 1996) has argued that in minimal group situations where a group norm is not established, people project personal attributes onto an ingroup, which leads to cognitive overlap/similarity between self and group. Furthermore, the ingroup projection model has argued that people project subgroup attributes onto a superordinate group (Mummendey & Wenzel, 1999; Wenzel, Mummendey, & Waldzus, 2007).

Overall, projection is a process whereby people define a higher-level (more inclusive) category in terms of the attributes of a lower-level (less inclusive) category. For example – an individual Angelino might define the social category "Angelino" in terms of his/her own attributes, Californians in terms of the attributes of Angelinos, and Americans in terms of the attributes of Californians.

Projection is a robust phenomenon that persists even when people are instructed not to project (Krueger & Clement, 1994), and when people are cognitively busy or are given accurate information about others (Alicke & Largo, 1995; Krueger & Clement, 1994). Empirical studies show that in minimal groups, self-anchoring rather than self-stereotyping is the dominant process of social identification whereas in real groups, although self-stereotyping is dominant, self-anchoring is sometimes correlated with social identification, especially its affective components (Van Veelen, Otten, & Hansen, 2011, 2013, 2014).

The degree of projection is notably more prominent when participants are asked to estimate the prevalence of their own attributes among ingroup members as opposed to outgroup members (Clement & Krueger 2002; Krueger & Stanke, 2001) and when the target person is similar to self (Ames, 2004a, 2004b). A meta-analysis of ten empirical studies (Robbins & Krueger, 2005) showed that projection does indeed occur significantly more for the ingroup than the outgroup. This indicates that group membership may be a prerequisite for projection as well as for depersonalization. Projection is stronger among high status members and when people have an unclear and complex sense of a group. It is weaker among those who have lower status compared to other members or when people are aware of membership diversity (Waldzus et al., 2003, 2005; Wenzel et al., 2003) and have a clear and well-defined understanding of the similarity and difference among members within a category (Peker, Crisp, & Hogg, 2010).

In summary, people sometimes use knowledge about self as an informational base for constructing their cognitive representation of their ingroup. Self-knowledge is always readily available and accessible to be used as an informational anchor, so people often use self-attributes to make an inference about others in the same group (e.g., Cadinu & Rothbart, 1996; Clement & Krueger, 2000; Otten, 2002; Otten & Wentura, 2001). This analysis stands in direct contrast to the depersonalization process. Projection entails defining the group in terms of self attributes, whereas depersonalization entails defining self in terms of group attributes.

Depersonalization vs. Projection

A key difference between depersonalization and projection is the direction of definitional information flow. Depersonalization is a top-down process−group defining attributes flow from group to self. Projection is a bottom-up process−idiosyncratic personal attributes flow from self to group and subgroup attributes flow from subgroup to superordinate group. Otten and her colleagues (Otten & Epstude, 2006; Otten & Mosckowitz, 2000; Otten & Wentura, 1999, 2001; Van Veelen et al., 2013, 2016) argue that projection is more prevalent in novel groups where group defining attributes have not been defined or are unknown, whereas depersonalization is more prevalent in established groups where group norms are clearly known to group members.

Citing Hogg's uncertainty identity theory (Hogg, 2000, 2007, 2012, 2015), Otten suggests that when one is uncertain about the nature of one's group there is a motivation to more clearly define the group, and that this can be achieved by using the self as an informational anchor–by projecting one's own attributes onto the group. There is good empirical evidence that self-categorization-based depersonalization resolves self-uncertainty by defining self in terms of the relevant ingroup prototype (Hogg, 2012). However, no empirical studies have conclusively tested whether and how projection might resolve uncertainty about a group identity.

There have been some attempts to integrate depersonalization and projection. Balanced identity theory (BIT; Cvencek, Greenwald, & Meltzoff, 2012; Greenwald et al., 2002) assumes a triangular associative structure among self, group, and attribute−social identity is defined as a self-group association, stereotype as a group-attribute association, and self-concept as a self-attribute association (see Figure 4 in Greenwald et al., 2002, p. 9). An integrative model of social identity (IMSI; Van Veelen, Otten, Cadinu, & Hansen, 2016) combines self-anchoring and self-stereotyping as dual cognitive paths to self-group overlaps.

However, these models have limitations. First, they argue that projection alone can be sufficient for social identification. However, from a social identity perspective, projection is one of many ways that people construct a group prototype (see Table 1). To complete the social identification process, depersonalization should follow projection.

Second, projection researchers argue that because self-knowledge is always more accessible, available, and certain than group knowledge, projection is more prevalent than depersonalization. However, some empirical evidence has disconfirmed this assumption; Wagoner, Belavadi and Jung (2017) found that Americans did not feel more uncertain about their American identity and membership than their personal self.

Third, even when self-knowledge is accessible, available and psychologically important, there can be instances where self-knowledge is less relevant or applicable to defining a group; for example, when people consider themselves a poor fit to the group. Hogg and Sunderland (1991) pointed out that previous research has failed to consider that in minimal group settings people do not know how prototypical they are of the minimally defined ingroup–people in a minimal group paradigm are not aware of whether they would be a good fit with the group, how similar they are to other members, and how normatively matched they are. This type of uncertainty is not uncertainty about personal self but uncertainty about self-prototypicality or fit (i.e., membership uncertainty; Goldman & Hogg, 2016; Wagoner, Belavadi, & Jung, 2017; also see Hogg & Mahajan, 2018). This type of uncertainty has not been addressed in previous integrative models.

Table 1. Social Identity Processes

Process	Description
1. Categorization	People categorize themselves and others as members of a group (e.g., ad hoc laboratory minimal group, newcomers/prospective members in an existing group,)
2. Prototype construction	a. Given prototypes (e.g., socialization and culture) b. Accentuation from outgroup (meta-contrast in intergroup contexts) c. Inference from prototypical members (e.g., leaders or old timers) d. Averaging via observation e. Interaction and communication → Most consensual f. Projection (e.g., minimal groups without outgroup info) → Least consensual
3. Depersonalization	People internalize a prototype into their self-concept (Figure 1), and perceive and evaluate themselves and other group members in terms of the group prototype.

In the following section of the paper, a new model is proposed that resolves the limitations of the previous models. Drawing on uncertainty identity theory, depersonalization and projection processes are here integrated into a single model with uncertainty reduction as a key psychological principle. This new integrative model proposes that the loci of uncertainty (about the group, about self, about self-prototypicality/self-group fit) determine the prevalence of depersonalization and projection. It also specifies that depersonalization-based social identity and projection-based social identity differ in terms of (a) effectiveness of uncertainty reduction, (b) strength of inference, (c) strength of identification, (d) information processing time/steps, and (e) perception of relative self-prototypicality and interchangeability.

Uncertainty Identity Theory

Uncertainty-identity theory (Hogg, 2000, 2007, 2012, 2015) describes how self-uncertainty motivates social identity processes. According to uncertainty identity theory, a feeling of uncertainty is generally aversive; particularly when people feel uncertain about important dimensions of their self-concept. People are therefore motivated to reduce uncertainty. Identification with a group can resolve uncertainty because, as specified by self-categorization theory (Turner et al., 1987) an ingroup prototype, once internalized as a part of one's social identity, provides a descriptive and prescriptive self-definition.

The relationship between uncertainty and identification is moderated by attributes of the group and its social identity. Most notably, highly entitative groups (e.g., Hamilton & Sherman, 1996; Lickel, Hamilton, Wieczorkowska, Lewis, & Sherman, 2000) are distinctive and tend to have unambiguous and clearly defined prototypical attributes that are best suited to uncertainty reduction.

Research has provided good evidence for uncertainty-identity theory (see Hogg, 2012).

When people are uncertain about themselves, they identify with groups (see meta-analysis by Choi & Hogg, in press), especially highly entitative groups (Grant & Hogg, 2012; Sherman, Hogg, & Maitner, 2009) and weaken their ties with low entitativity groups or uncertainty-inducing groups (Hogg, Adelman, & Blagg, 2010; Hogg, Meehan, & Farquharson, 2010; Hogg, Sherman, Dierselhuis, Maitner, & Moffitt, 2007).

Most research has focused on self-uncertainty and depersonalization. However, although self-uncertainty drives depersonalization-based identification with entitative groups, it is possible that uncertainty about the group's social identity-defining attributes (essentially, "what is the group's identity?") may drive projection-based identification with such diffuse groups. Jung and colleagues provide indirect support for the role played by locus of uncertainty in depersonalization and projection (Jung, Hogg, & Choi, 2018; see also Jung, Hogg, & Choi, 2016; Jung, Hogg, & Lewis, 2018).

Their first experiment found that subgroup identity uncertainty triggered superordinate-to-subgroup depersonalization, such that subgroup identity uncertainty reduced superordinate identity uncertainty and strengthened superordinate identification regardless of whether or not people perceived their subgroup to be prototypical of their superordinate group. Experiment 2 found that superordinate identity uncertainty was reduced by subgroup-to-superordinate projection (i.e., ingroup projection), such that when ingroup projection was low, superordinate identity uncertainty spilled over to make subgroup identity uncertain as well (superordinate-to-subgroup depersonalization). However, when ingroup projection was high, superordinate identity uncertainty did not spill over to subgroup identity.

In the section below, depersonalization and projection are integrated into a single model – the *Depersonalization-Projection Model*. A key argument is that when people feel uncertain about themselves, they engage in depersonalization in the context of well-defined groups. This happens regardless of high, low or unknown self-prototypicality. When people experience uncertainty about their group's identity, they engage in projection, especially when they are prototypical, representative members or they are not informed of their prototypicality. This projection-based group prototype is then depersonalized to self and other group members. Non-prototypical, peripheral members may not readily engage in projection.

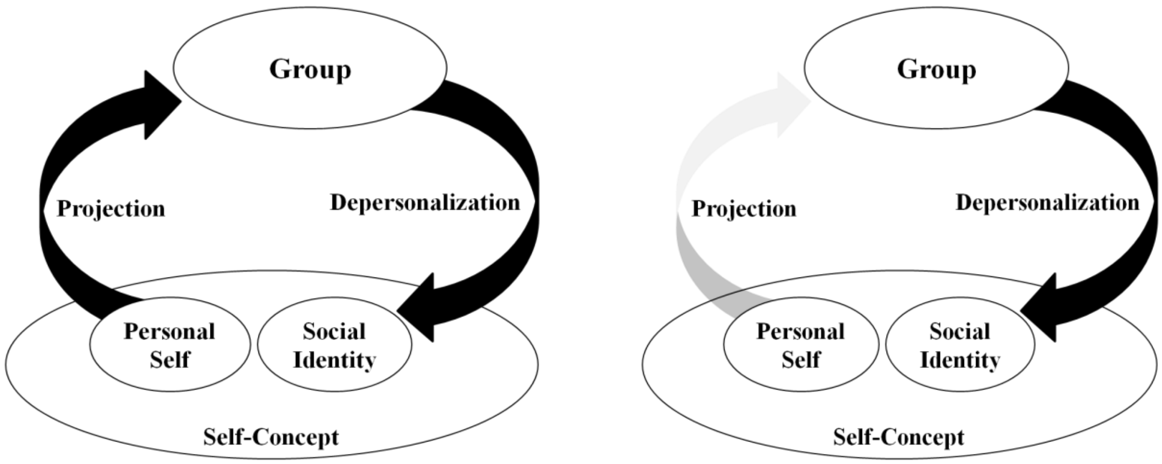
CHAPTER TWO

Depersonalization-Projection Model

The Depersonalization-Projection Model invokes uncertainty reduction as a key psychological motivation that underlies the depersonalization and projection processes. It is proposed that whether depersonalization or projection prevails depends on the locus of uncertainty: (a) how uncertain/certain one is about oneself (self-uncertainty), (b) how uncertain/certain one is about one's group identity (group uncertainty), and (c) how uncertain/certain one is about one's position within the group (uncertainty about self-prototypicality).

The Principal Locus of Uncertainty: Self, Group, and Self-Prototypicality

When the principal locus of uncertainty is self, depersonalization occurs. When people feel uncertain about self but certain about the group's identity, self-uncertainty can be resolved by depersonalization–group defining attributes flow from group to self. Because group attributes are known and shared among group members, people feel certain and confident to use the group attributes in defining self and other members (Echterhoff, Higgins, & Levine, 2009; Festinger, 1954; Hardin & Higgins, 1996; Hogg & Rinella, 2018; Koriat, Adiv, & Schwartz, 2016; Orive, 1988; Tormala, DeSensi, Clarkson, & Rucker, 2008). People can strongly identify with that group and use the group knowledge to infer attributes of self and other members. Depersonalization fosters perceived interchangeability among group members and similarity between self and others (Figure 2b). This happens quickly because it involves only one inferential step–depersonalization alone–and is cognitively economical (Figures 1b and 2b).

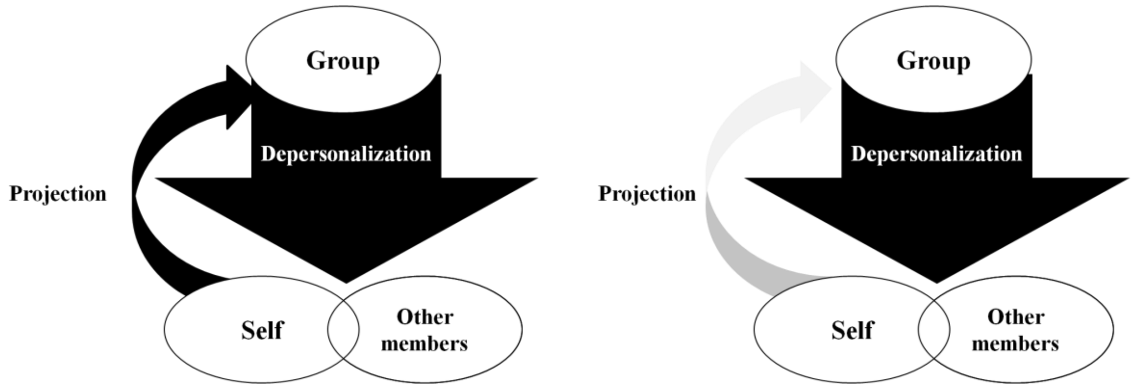


(a) When the principal locus of uncertainty is the group's prototype, both projection and depersonalization dynamically construct a person's social identity.

(b) When the principal locus of uncertainty is self, depersonalization predominantly constructs a person's social identity.

Figure 1. Social identity construction via projection and/or depersonalization

When the principal locus of uncertainty is group, both projection and depersonalization occur. When people feel uncertain about the group's identity but certain about self, they first project their idiosyncratic self attributes onto the group, which constructs a group prototype. Then, the group prototype, constructed by projection, is depersonalized to self and other group members. This is a two-step process of social identity formation, which is slower and less cognitively economical (Figures 1a and 2a). People cannot effectively reduce group-uncertainty because self attributes are not shared or consensually validated by other group members. Therefore, they do not use their self attributes strongly to infer attributes of the group and other members, and do not identify with this group strongly. However, because self is an informational anchor in projection, people perceive themselves to be more prototypical members of their group relative to other members (Figure 2a).



(a) Projection-based social identity results in high self-prototypicality relative to other members.

(b) Depersonalization-based social identity results in interchangeablilty of self and other.

Figure 2. Asymmetrical application of prototype information

When a group's prototype is unclear or unknown, there is no clear criterion for prototypicality judgments (Hogg & Sunderland, 1991). Members evaluate how prototypical or representative they and other members are by prototype-based comparison (cf. Hogg & Gaffney, 2014). In this situation, self is the only accessible and available informational anchor, although the idiosyncratic attributes of self may not be particularly applicable or relevant - so projection occurs with little confidence. If people are informed that they are prototypical and representative of a group, they will project self attributes onto a group with greater confidence and certainty. If they are informed that they are peripheral and marginal, they will be less inclined to project their personal attributes onto the group, or do so with little confidence. In more extreme cases, depersonalization leads to uncertainty spillover from group uncertainty to self (see Jung, Hogg, & Choi, 2018, Experiment 2). Although there is some empirical evidence that judgments about the attributes of categories are more strongly inferred from the characteristics of other representative members than peripheral members (Rothbart & Lewis, 1988, Study 3; Zuckerman, Mann, & Bernieri, 1982, Study 4 & 5), there is no direct evidence showing the effect of self-prototypicality.

Table 2 . Locus of Uncertainty, Projection and Depersonalization, and their Consequences

		Principal locus of Uncertainty	
		Group	**Self**
Self-Prototypicality	**High**	• Projection and Depersonalization (two-step) • Intermediate reaction time • High group-uncertainty reduction • High/moderate self-to-group inference • High/Moderate identification • High relative self-prototypicality	• Depersonalization (one-step) • Short reaction time • High self-uncertainty reduction • Strong group-to-self inference • Strong identification • High interchangeability
	Low	• Depersonalization (one-step) • Long reaction time due to high uncertainty • Low group-uncertainty reduction • Weak self-to-group inference • Weak identification • High self-prototypicality uncertainty	
	Unknown	• Projection and Depersonalization (two-step) • Long reaction time • Low group-uncertainty reduction • Weak or moderate self-to-group inference • Weak or moderate identification • High relative self-prototypicality	

Overall, summarizing the arguments above, the principal locus of uncertainty - self, group, or self-prototypicality – determines the prevalence of depersonalization and projection (Table 2).

Comparing the Proposed model to Previous Integrative Models

Unlike previous integrative models (e.g., Balanced Identity Theory, Greenwald et al, 2002; Integrative Model of Social Identification, Van Veelen et al., 2016) that have provided partial explanations about social identification but not about uncertainty reduction, inferential strength and time, and perceptual consequences (interchangeability, relative self-prototypicality), the theoretical model proposed here provides a full specification.

There are some key differences between the proposed model and previous integrative models. First, the proposed model focuses on uncertainty reduction as a unifying principle. Second, from a social identity perspective, it treats projection as a process of prototype formation.

Unlike the previous integrative models that argue that projection alone can form social identity, the proposed model argues that a projection-based prototype requires a subsequent depersonalization process for it to effectively become self-conceptually internalized as a person's social identity. Third, Integrative Model of Social Identification (IMSI) argues that because self-attributes are always accessible and available, projection is more prevalent than depersonalization in social identity formation. However, the proposed model indicates that depersonalization is the final step of social identity internalization no matter how a group prototype has been formed (Table 1).

Last, the proposed model addresses a full range of social identification-cognitive (e.g., how similar they feel themselves to a group prototype), affective (e.g., how glad they are to be a member), and behavioral (e.g., how much they feel strong ties to other members; Cameron, 2004; Hogg & Hains, 1996) aspects unlike previous models that focus primarily on cognitive aspects of group identification. BIT defines identification as a cognitive association of self and group measured by response times on Implicit Association Tasks (IAT: Cho & Knowles, 2013; Dunham, 2013; Otten & Epstude, 2006). However, shorter reaction times not only imply strong identification but also a low level of uncertainty (Koriat & Adiv, 2011; Koriat, Adiv, & Schwartz, 2016). Also, IMSI defines identification as a cognitive overlap between self and group measured by the Venn diagram or profile *r* coefficient (Swann, Gómez, Seyle, Morales, & Huici, 2009; Van Veelen et al., 2013, 2014). These concepts and measures are not only a proxy for social identification but also for prototypicality and similarity. Prototypicality may be an important subcomponent of social identification; however, they are distinct constructs. In our theoretical integration, the immediate, direct, unmediated outcome of projection is increased perception of self-prototypicality, and social identification is a delayed outcome of projection. Although social projection and self-anchoring theorists have not thought like this, the ingroup projection model actually uses a measure of relative ingroup prototypicality as evidence of ingroup projection in a way that is consistent with our point.

Current Studies

This dissertation tests the general proposition of the depersonalization-projection model: that the principal locus of uncertainty (self, group, or self-prototypicality) determines the prevalence of depersonalization and projection in social identity formation. An experiment was conducted to test these core hypotheses:

Hypothesis 1. Self locus-of-uncertainty yields (a) greater uncertainty reduction, (b) stronger inference, (c) stronger identification, (d) shorter reaction time, and (e) the perception of lower relative self-prototypicality and higher interchangeability than Group locus-of-uncertainty.

Hypothesis 2. These effects of the locus-of-uncertainty are moderated by self-prototypicality.

When the locus-of-uncertainty is group, high self-prototypicality yields (a) greater uncertainty reduction, (b) stronger inference, (c) stronger identification, (d) shorter reaction time, and (e) the perception of higher relative self-prototypicality and lower interchangeability than low or unknown self-prototypicality. When the locus-of-uncertainty is self, there is no significant effect of self-prototypicality.

CHAPTER THREE

Empirical Validation

A pilot study and a main experiment were conducted to empirically validate the depersonalization and projection model. To appropriately test the propositions of the depersonalization-projection model, the current study used the minimal group paradigm to induce locus-of-uncertainty and included four interrelated dependent variables: IAT reaction time, identification, relative self-prototypicality, and uncertainty.

The Minimal Group Paradigm

The minimal group paradigm (MGP: e.g., Tajfel et al., 1971) was used to manipulate the locus-of-uncertainty. People in the minimal group paradigm do not have information about their group's prototype whereas people in real groups do. There are two main variants of the MGP (Pinter & Greenwald, 2011): (a) group assignment based on false feedback (e.g., under- and over-estimators based on an estimation task, Tajfel et al., 1971, Study1; Klee and Kandinsky group based on aesthetic preferences, Tajfel et al., 1971, Study2); (b) random assignment (e.g., X and Y groups, Brewer & Silver, 1978; Gaertner & Insko, 2000; Perreault & Bourhis, 1999; blue and green groups, Rabbie & Horwitz, 1969; Rabbie & Wilkens, 1971). In the classic group assignment procedure based on false feedback, participants have some knowledge about the characteristics of their own group and the other group. In the random assignment procedure, participants have no knowledge about the attributes of their own group and the other group. In terms of group uncertainty, group uncertainty is lower in the classic than random group assignment paradigm.

In the current study, the two types of the MGP were combined to manipulate locus-of-uncertainty. Participants were randomly assigned into X or Y group, and then they were asked to perform dot estimation tasks. In the Group locus-of-uncertainty condition, participants were informed that they are an “underestimator”; however they were not informed of how their group performed. In the Self locus-of-uncertainty condition, participants were informed that their group’s performance indicates it is an “underestimator” group; however they were not informed of their own performance.

Four Interrelated Dependent Variables

The current experiment included a set of four interrelated DVs – response time (IAT), identification, relative self-prototypicality, and uncertainty. The proposed model makes a different prediction regarding the number of cognitive steps. However, IAT reaction time is used as not only an index of the number of cognitive steps but also identification strength (Greenwald et al., 2002) and the degree of uncertainty (Koriat & Adiv, 2011). The current study parsed out identification strength and uncertainty from the IAT reaction time to use the IAT reaction time as evidence for the number of cognitive steps.

Furthermore, relative self-prototypicality was measured to test whether projection-based social identification amplifies perceived self-prototypicality relative to other group members and whether depersonalization-based social identification increases perceived interchangeability of self and other group members. Self-prototypicality has often been measured as part of a broader set of measures of group identification (e.g., Hogg & Hains, 1996) and is typically correlated highly with other measures.

Table 3. Comparing the paradigms of key previous experiments

	MGP	Uncertainty Manipulation	IAT	Identification	Uncertainty	Self-Prototypicality
Otten & Epstude (2006)	X	X	O	X	X	X
Cho & Knowles (2013, Study 4)	X	X	O	X	X	X
Cho & Knowles (2013, Study 3)	O	O	X	X	X	X
Durham (2013)	O	X	O	X	X	X

Note: O indicates that a study includes a specified paradigm, manipulation, or measure; X indicates that a study does not include a specified paradigm, manipulation, or measure.

There has been no empirical research that meets the two methodological requirements discussed here. However, there are some studies that come close (see Table 3). Otten & Epstude (2006) used IAT response times to measure the association of self and group, but viewed it as identification. They did not parse out uncertainty and prototypicality from the response time measure. Also, they used gender, an established content-rich category, rather than minimal groups. Possibly the main limitation of Otten and Epstude's experiment is that they did not manipulate self or group uncertainty. Rather, they considered the midpoint of a self-descriptiveness rating as indicating uncertainty (p. 959).

Cho & Knowles (2013, Study 4) revisited Otten and Epstude's (2006) experiment and argued that the degree to which traits are accurate definitions of self and ingroup can be measured more effectively by confidence ratings than Otten and Epstude's descriptiveness ratings. But Cho & Knowles (20013)'s Study 4 has the same limitations as Otten and Epstude (2006) in that they did not manipulate self or group uncertainty.

Cho & Knowles's (2013) Study 3 used the dot estimation version of the MPG but did not include an IAT measure nor identification, uncertainty, and prototypicality. It failed to detect the effect of an information anchor (group vs. self).

Dunham (2013) used a version of the MGP in which participants memorized the names of ingroup members. However, none of the experiments manipulated uncertainty. IAT response times in associating self and group were treated as a measure of group identification. Uncertainty and self-prototypicality were not measured. All in all, none of the studies described above predicted or tested whether different social identity formations yields different consequences in terms of uncertainty reduction, inference strength, identification strength, the number of information processing steps, and the perception of relative self-prototypicality and interchangeability.

Pilot Study

A pilot study was conducted to create (a) the descriptions of underestimators and overestimators that are equivalent in terms of valence, favorability, and desirability, and (b) the IAT trait stimuli of underestimators and overestimators that are equivalent in terms of valence, desirability, and familiarity.

Developing Stimuli

The descriptions of underestimators and overestimators. A draft of the descriptions of two visual perception styles was written with the objective of producing equivalent descriptions of underestimators and overestimators (Appendix A). The description of underestimators consisted of three characteristics: "Underestimators tend to see details in tasks, be careful, and be meticulous in their approach." The description of overestimators consisted of three characteristics: Overestimators tend to see big pictures in tasks, be adventurous, and be bold in their approach (Appendix E).

IAT stimuli. To create equivalent trait stimuli for the IAT, a list of traits for each group (underestimators and overestimators) was generated (Appendix A). Candidates for underestimator trait stimuli were: alert, cautious, circumspect, focused, mindful, and vigilant (Some backup stimuli were also included: assiduous, attentive, chary, conscientious, heedful, punctilious, scrupulous, wary, prudent, and pedant). Candidates for overestimator trait stimuli are: brave, bold, exploratory, heroic, resolute, and unafraid (Some backup stimuli were audacious, adamant, courageous, daring, dashing, dauntless, fearless, heedless, intrepid, unafraid, valorous, valiant, and, venturesome).

Method

Participants. One hundred two participants (Amazon Mechanical Turk workers) completed the study. There were 39 female (38.2%), 62 male (60.8%), 1 other (1.0%) participants. They ranged in age from 19 to 70 years of age (M = 31.36, SD = 9.79). The majority (54, 52.9%) self-identified as White, Caucasian, or European American, with 35 (34.3%) reporting Asian or Asian American, 4 (3.9%) Hispanic or Latino, 4 (3.9%) Black or African American, 4 (3.9%) American Indian, Alaskan Native, Native Hawaiian or Pacific Islander, and 1 (1.0%) reporting preferred not to answer. The citizenship breakdown was: 62 USA (60.8%), 37 India (36.3%), 1 Italy (1.0%), 1 UK (1.0%), 1 (1.0%) other.

Procedure. Participants read the draft and provided their evaluations of underestimators and overestimators on 4 semantic differentials: (*1 bad, 7 good; 1 negative, 7 positive, 1 unfavorable, 7 favorable; 1 undesirable, 7 desirable*).

Next, they indicated their evaluations of each of the IAT trait stimuli on three dimensions (*1 negative, 7 positive; 1 undesirable, 7 desirable; 1 unfamiliar, 7 familiar*).

Last, they completed demographics questions, received thanks, and were debriefed (Appendix I).

Results

The description of underestimators and overestimators. A within-subjects ANOVA revealed no significant differences in participants' evaluations of underestimators and overestimators, all $F \leq 0.531$, $p \geq .468$.

Furthermore, a two-way mixed design ANOVA, with the visual perception style (underestimator and overestimator) as a within-subject factor and the nationality (USA and India) as a between subject factor, was conducted to test whether American and Indian participants would perceive the description of underestimators and overestimators differently. Results indicated no significant difference between American and Indian participants in their evaluations of underestimators and overestimators.

IAT stimuli. A within-subject ANOVA revealed that the final six underestimator trait stimuli (alert, cautious, circumspect, focused, mindful, and vigilant) were not significantly different in positivity, desirability, and familiarity (*Ms* = 5.07, 5.06, 5.07; *SDs* = 1.16, 1.05, 1.01) from the final six overestimator trait stimuli (brave, bold, exploratory, heroic, resolute, and unafraid) (*Ms* = 5.01, 4.94, 5.03; *SDs* = 1.12, 1.09, 1.08), all $Fs \leq 2.103$, $ps \geq .150$.

Furthermore, a two-way mixed design ANOVA, with the visual perception style (underestimator and overestimator) as a within-subject factor and nationality (USA and India) as a between subjects factor, was conducted to test whether American and Indian mTurkers would perceive the underestimator and overestimator trait stimuli differently. Results revealed no significant difference between American and Indian mTurkers in their evaluations of underestimator and overestimators trait stimuli.

Study1

Method

Participants and Design. A priori power analysis (GPower - Faul & Erdfelder, 1992) indicated a sample size of 206 to be sufficient to detect a medium sized effect (f = .25, see Cohen, 1977) with six conditions in a two by three between-subjects design with a power of .90 and an alpha of .05. Four hundred seventy five Amazon MTurk workers were recruited and randomly assigned to one of six conditions in a 2 locus-of-uncertainty (group vs. self) x 3 self-prototypicality (high vs. low vs. unknown) between-subjects design.

There were 475 participants; however, a significant number of these were excluded from analyses due to failure to meet boundary conditions. One hundred nine participants were excluded on the basis of guidelines suggested by Greenwald and colleagues (Greenwald, Nosek, & Banaj 2003) recommending exclusion of participants 10% of whose response times were less than 300 *ms*. Then, 49 participants were excluded because they failed to pay attention to instructions–those who incorrectly reported that they were assigned Team Y, reported two or three incorrect elements of the three digit member code, incorrectly sorted two or three of the three underestimator attributes as underestimator, and incorrectly sorted two or three of the three overestimator attributes as overestimator traits.

The remaining 257 participants met boundary conditions and were included in the analyses. There were 78 female (30.4%), 175 male (68.1%), 1 transgender female (0.4%), 1 gender variant/non-conforming/non-binary (0.4%), and 2 other (0.8%) participants. They ranged in age from 19 to 73 years of age (M = 34.44, SD = 9.17). The majority (142, 55.3%) self-identified as White, Caucasian, or European American, with 67 (26.1%) reporting Asian or Asian American, 20 (7.8%) Hispanic or Latino, 14 (5.4%) Black or African American, 10 (3.8%)

American Indian, Alaskan Native, Native Hawaiian or Pacific Islander, and 9 (3.1%) reporting mixed ethnicity or preferred not to answer. The citizenship breakdown was: 193 USA (75.1%), 52 India (20.2%), and people from various countries (Italy, Canada, Albania, Brazil, Netherlands, Pakistan, Poland, Sri Lanka, and South Asia).

Procedure. Participants were informed that they were participating in a study of the role of visual perception style in virtual team performance, and they would be randomly assigned to a team (Appendix B). They were informed that other people who had signed up to participate in this study would be called shortly and they were asked to answer trivia questions as a filler task while assembling teams (e.g., All natural numbers (1, 2, 3, 4, 5...) can be grouped as 'odd' and 'even.' 'Even numbers' are specifically those numbers which, when divided by ___, give a remainder of zero). Within a second after a third question was presented, they were led to a next page where they were informed that they and 11 other participants had been randomly divided into two 6-person virtual teams, simply referred to as Virtual Team X or Virtual Team Y, and that they had been assigned to Virtual Team X along with five other participants. They were also told that their member code was “X92*” and that the last digit was starred to preserve data confidentiality as well as to maintain their privacy. The other members of Virtual Team X shared the first three digits but had a different number as their last digit (Appendix B). However, the team assignment instruction was false. There were no actual other members. All participants conducted the study individually.

Dot estimation task. Participants performed a visual perception task, in which they estimated the number of dots presented in each of eleven slides (Appendix C). Each slide displayed a large number of dots (in the range of 40 to 300) and was presented for 1 second (Tajfel et al., 1971, p.155, Cho & Knowles, 2013, p.449). The actual number of dots from 11 slides was 1655, and participants tended to underestimate dots in general (*M* = 1133.72, *SD* = 795.04). There was no significant difference in participants' actual estimation tendency across the 6 experimental conditions, all *Fs* < 2.33, *ps* > .129, η_p^2 <.010.

Upon completion of the task, participants were presented with the description of two perception styles (underestimators and overestimators), and read that underestimators were generally careful, detail-oriented, and meticulous in their approach whereas overestimators were generally adventurous, big-picture oriented, and bold in their approach. The descriptions of underestimators and overestimators were pilot-tested to check the equivalence (Appendix D). This procedure has been widely used in earlier research as a standard technique for creating minimal groups in laboratory settings (e.g., Brewer & Weber, 1994; Cho & Knowles, 2013).

Participants then provided their general evaluation of underestimators and overestimators, *1 not very positive, 9 very positive*. A one-way within-subjects ANOVA revealed no significant difference in their evaluation of underestimators (*M* = 6.11, *SD* = 1.71) and overestimators (*M* = 6.11, *SD* = 1.71), *F* (1, 256) = 0.002, *p* = .961, η_p^2 < .001. Furthermore, a three-way mixed ANOVA revealed no significant difference in evaluations of underestimators and overestimators across the six experimental conditions, all *Fs* < 2.65, *ps* >.105. These analyses indicated the descriptions of underestimators and overestimators were equivalent overall and across the conditions.

Locus-of-uncertainty (Group vs. Self). Locus-of-uncertainty was manipulated by the amount of information provided to participants about themselves and about Virtual team X. Participants in the 'Group' locus-of-uncertainty condition were informed that they were *an Underestimator,* but remained uninformed of the team average. Participants in the 'Self' locus-of-uncertainty condition were informed that their team was *an Underestimator group*, but remained uninformed of their individual visual perception style (Appendix E).

Self-prototypicality (High vs. Low vs. Unknown). Self-prototypicality was manipulated by presenting information about how similar their visual perception style was to that of their team. Participants in the high prototypicality condition were informed that their estimation bias was *very similar* to the rest of their team. Participants in the low prototypicality condition were informed that their estimation bias was *not very similar* to the rest of their team. Participants in the unknown prototypicality condition remained uninformed (Appendix E).

Attention checks. Participants were asked to indicate which virtual team they were assigned (*X team, Y team, other*) and what their member code was. They were also asked to identify each of six attributes either as an underestimator or an overestimator trait.

Manipulation checks. Participants also completed manipulation check items by indicating which perception style they were (*an Underestimator, an Overestimator, uninformed*) and which perception style their team was (*an Underestimator team, an Overestimator team, uninformed*). Also, the manipulation check of group uncertainty was measured by how uncertain or certain they were about their perception of the team's visual perception style (*1 uncertain, 9 certain*) - reverse-coded so that higher scores indicate greater uncertainty (M = 3.39, SD = 2.09). The manipulation check of self uncertainty was measured by how uncertain or certain they were about their perception of their own visual perception style (*1 uncertain 9 certain*) - reverse-coded, so that higher scores indicate greater uncertainty (M = 3.55, SD = 2.26).

The manipulation check of participants' self-prototypicality perception was measured with one item: How do you think about your fit with your team (*1 I fit well with my team, 0 I don't fit well with my team*). Uncertainty about their self- prototypicality perception was measured with one item: How uncertain or certain are you about your answer above (*1 uncertain,* *9 certain*) - reverse-coded so that higher scores indicate greater uncertainty (M = 3.95, SD = 2.04).

Dependent variables. There were five dependent measures: (a) response time, (b) group identification (implicit, explicit, and behavioral measure), (c) relative self-prototypicality and interchangeability, (d) inference of the unknown target and (e) uncertainty in the unknown target.

Response time (IAT). The Implicit Association Test (IAT; Greenwald et al., 1998) was administered. A web-based IAT was created (Carpenter et al., 2018). In the upper left and right corners of each slide, targets (X team member vs. Y team member) and the category dimension (underestimator vs. overestimator) were presented (see Appendix F for sample display).

The IAT measures associations between targets (X team member, Y team member) and the category dimension (underestimator, overestimator). The IAT assumes that making a response is easier when a target and a category dimension that are cognitively associated share the same response key.

In each trial, participants viewed a stimulus in the center of the slide. Stimuli represent the team membership (e.g., X923, X926, Y534, Y532) or the visual perception style (e.g., focused, exploratory). When stimuli appeared, the participant sorted the stimulus as quickly as possible by with either their left hand (the ‘e’ key) or their right hand (the ‘i’ key) on the keyboard. For example, in the sample display (Appendix F), a participant might have pressed with the left hand for all Y team member + overestimator stimuli (e.g., Y534, exploratory) and with their right hand for all X team member + underestimator stimuli (e.g., X923, focused).

The starting positions (left/right) for both targets and categories were counterbalanced. “X team member” could start on the right, initially paired with “Underestimator” (Appendix F). “X team member” could start on the left initially paired with “Underestimator.” These were compatible configurations because the information anchor was given as underestimator. “X team member” could start on the left, initially paired with “Overestimator.” “X team member” could start on the right, initially paired with “Overestimator.” These were incomparable configurations.

The response times were measured in milliseconds and averaged for each participant to test the hypothesis (*M* =1059.46 *ms*, *SD* =361.01 *ms*). This was a measure of information processing time (one-step vs. two-step process).

Group identification. Identification with Virtual Team X was measured by (a) IAT d-scores (implicit measure), (b) identification scale (explicit measure), and (c) second dot estimation task (behavioral measure).

The implicit measure of identification was a d-score for each participant calculated following Greenwald et al. (2003) (*M* =.14, *SD* =.37). A positive IAT d-score indicated that in general participants had a cognitive association between X team members and Underestimator.

The explicit measure of identification was adapted from previous social identity research (e.g., Grant & Hogg, 2012; Hogg & Hains, 1996) which included four items (1) How much do you identify with your team, (2) To what extent do you feel that being part of your team gives you a good feeling, (3) How much do you feel a bond with your team, and (4) How much would you stand up for your team if it were criticized (1 *not very much*, 9 *very much) (α* =.95. *M* = 5.51, *SD* = 2.23).

The behavioral measure of identification was the difference score of the initial and second dot estimation task. Participants performed the dot estimation task one more time (*M* = 1132.80, *SD* = 726.54). Difference scores were calculated by subtracting participants’ pre-scores from post-scores (*M* = - .92, *SD* =368.28). A larger, negative difference score indicates stronger identification. This is based on the assumption that when people identify with a group more strongly they would behave more normatively–in this case an underestimator tendency in the second dot task.

The three measures were not significantly intercorrelated ($r < +/- .06$).

Relative self-prototypicality/Interchangeability. Self-prototypicality has typically been measured by four items adapted from previous social identity research (e.g., Hogg & Hains, 1996): (1) How well do you think you match the definition of X group, (2) How well do you think you represent as a typical member of X group, (3) How well do you think you fit in with X group, and (4) How similar do you think you are to other X group members. Because these measures do not specifically measure *relative* prototypicality, a set of four specific measures of relative self-prototypicality were devised: (1) In comparison to your fellow team members do you feel you are less representative of the team or more representative of the team, (2) In comparison to your fellow team members do you feel you are a less typical member or a more typical member, (3) In comparison to your fellow team members how closely do you feel you embody the team's attributes, and (4) In comparison to your fellow team members how close a fit are you to the team (1 *less*, 9 *more*) (α =.96. *M* = 5.53, *SD* =1.86).

The perception of interchangeability was measured with four items adapted from a perceived similarity measure (Campbell, 1958; Crump, Hamilton, Sherman, & Thakka, 2010): (1) How similar do you think members of your team are to one another in terms of their visual perception style, (2) How similar do you think members of your team are to one another in terms of their personality, (3) How similar do you think members of your team are to one another in terms of their ability, and (4) . In general, how much do you think members of your team are similar to one another (1 *not very similar*, 9 *very similar*) (α =.93. *M* =5.87, *SD* =1.59).

Inference of the unknown. For the participants in the Self locus-of-uncertainty condition, group-to-self inference was measured with one item: Which visual perception style do you think you have (*1 An underestimator, 0 An overestimator*).

For participants in the Group locus-of-uncertainty condition, self-to-group inference was measured with one item: Which visual perception style do you think your team has (*1 An Underestimator Team, 0 An Overestimator Team*).

Uncertainty about the unknown. For the participants in the Self locus-of-uncertainty condition, uncertainty about their group-to-self inference was measured with one item: How uncertain or certain are you about your answer above (*1 uncertain, 9 certain*) - reverse-coded so that higher scores indicate greater uncertainty (M = 3.77, SD = 2.23).

For the participants in the Group locus-of-uncertainty condition, uncertainty about their self-to-group inference was measured with one item: How uncertain or certain are you about your answer above (*1 uncertain, 9 certain*) - reverse-coded, so that higher scores indicate greater uncertainty (M = 4.36, SD = 2.40).

Participants provided demographics (Appendix H) and were thanked and debriefed (Appendix I).

Table 4. Reliabilities, means, SDs, and zero-order correlations among composites (*N*=257)

	Variable	α	M	SD	1	2	3	4	5	6
1	Uncertainty	-	4.06	2.33	-					
2	IAT d-score	-	.14	.37	-.01	-				
3	Identification scale	.95	5.51	2.23	-.49***	.06	-			
4	Dot difference score	-	- 0.92	378.28	-.01	-.03	-.05	-		
5	Reaction Time	-	1059.46	361.01	-.19**	.04	.10	-.08	-	
6	Rel self proto	.96	5.53	1.86	-.39***	.03	.72***	.01	.14*	-
7	Interchangeability	.93	5.87	1.59	-.46***	.04	.74***	.05	.06	.66***

Note. †*p* < .10; **p* < .05; ***p* < .01; ****p* < .00

Results

Reliabilities, means, standard deviations, and intercorrelations of the dependent variables are presented in Table 4. Gender, ethnicity composition, and age did not differ significantly across conditions (χ^2, *Fs* < 1.5).

A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA was conducted on manipulation checks and all the dependent variables: (a) response time, (b) group identification (implicit, explicit, and behavioral measure), (c) relative self-prototypicality and interchangeability, (d) inference of the unknown target and (e) uncertainty in the unknown target.

Manipulation checks.

Locus-of-uncertainty. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA was conducted on perceived group uncertainty and perceived self uncertainty. On perceived group uncertainty the main effect of locus-of-uncertainty was significant, F (1, 251) = 35.90, $p < .001$, η_p^2 = .125. Participants in the group locus-of-uncertainty condition (*M* = 4.36, *SD* =240) perceived higher group uncertainty than participants in the self locus-of-uncertainty condition (*M* = 2.75, *SD* = 1.79). On perceived self-uncertainty the main effect of locus-of-uncertainty was significant, *F* (1, 251) = 8.24, *p* = .004, η_p^2 = .032. Participants in the self locus-of-uncertainty condition (*M* = 3.77, *SD* = 2.23) perceived higher self uncertainty than participants in the group locus of uncertainty condition (*M* = 3.02, *SD* = 1.87).

Inclusion of relevant covariates (self-uncertainty and perceived fit in the analysis of group uncertainty and group uncertainty and perceived fit in the analysis of self-uncertainty) - did not change the results. The manipulation of uncertainty was clean and effective.

Self-prototypicality (High vs. Low vs. Unknown). The dichotomous measure of perceived self-prototypicality (How do you think about your fit with your team, *1 I fit well with my team, 2 I don't fit well with my team*) was used to check on self-prototypicality. Univariate and hierarchical binary logistic regression tested the contribution of locus-of-uncertainty and self-prototypicality in predicting the likelihood of self-prototypicality perception (0 = poor fit, 1 = good fit). Participants in the low prototypicality condition felt they were less likely to think they fit well with the group than participants in the high and unknown condition (59% vs. 93% and 84%), χ^2 (2, 257) = 31.32, *p* < .001. The manipulation of self-prototypicality was effective.

Prototypicality uncertainty. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA was conducted on perceived prototypicality uncertainty. The main effect of self-prototypicality was marginally significant, *F* (2, 251) = 2.89, *p* = .058, η_p^2 = .022. Participants in the low prototypicality condition (*M* = 4.32, *SD* = 1.97) perceived higher prototypicality uncertainty than those in the high prototypicality condition (*M* = 3.59, *SD* = 1.96), *p* = .060, Cl.095: -0.02, 1.49. Participants in the unknown prototypicality condition (*M* = 3.88, *SD* = 2.15) was between the high and low prototypicality condition.

Inclusion of relevant covariates (self-uncertainty and group uncertainty) - did not change the results. The manipulation of self-prototypicality uncertainty was effective for the high and unknown prototypicality condition. However, the low prototypicality manipulation induced as much prototypicality uncertainty as the unknown prototypicality manipulation did.

Main Hypothesis Testing.

Uncertainty about the unknown. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA performed on perceived uncertainty about the unknown information (perceived group uncertainty in the group locus-of-uncertainty condition and perceived self uncertainty in the self locus-of-uncertainty condition) revealed, as predicted under H1a, the significant main effect of locus-of-uncertainty, F (1, 251) = 4.10, p = .044, η_p^2 = .016. Participants in the self locus-of-uncertainty condition (*M* = 3.77, *SD* = 2.23) reported lower uncertainty about their own perception style than participants in the group locus-of-uncertainty condition (*M* = 4.36, *SD* = 2.40) reported about their group's perception style. This supports the key proposition of the depersonalization projection model that depersonalization reduces self uncertainty more effectively than projection reduces group uncertainty.

Contrary to H2a, the two-way interaction was not significant, F (2, 251) = 0.31, p = .734, η_p^2 = .002, nor was the main effect of self-prototypicality, F (2, 251) = 1.28, p = .280, η_p^2 = .010.

Inference of the unknown. Univariate and hierarchical binary logistic regression tested the contribution of locus-of-uncertainty and self-prototypicality in predicting the likelihood of inferring underestimator for the unknown information (0 = overestimator, 1 = underestimator).

As predicted under H1b, the main effect of locus-of-uncertainty was significant, *B* = 1.29, *Wald* = 13.39, p <.001, *Exp(B)* = 3.64. Participants in the self locus-of-uncertainty condition were more likely to identify themselves as an underestimator than participants in the group locus-of-uncertainty were to identify their team as an underestimator group, 83.7% vs. 65.64%, χ^2 (1, 257) = 11.13, p = .001. This supports the key proposition of the depersonalization projection model that depersonalization results in stronger group-to-self inference than projection's self-to-group inference.

Although it was not hypothesized, the main effect of self-prototypicality was significant, *Wald* = 45.57, p <.001. Participants in the low prototypicality condition were less likely to think of themselves or their team as underestimators than participants in the high and unknown condition (48% vs. 94% and 85.2%), χ^2 = (2, 257) = 55.11, p < .001. Furthermore, pairwise comparisons (with the unknown prototypicality condition as a reference group) indicated that the proportion of participants who felt they or their team were underestimators was significantly lower in the low self-prototypical group than the unknown prototypicality group, *B* = - 1.99, *Wald* = 25.21, p < .001, *Exp(B)* = 0.136. There was no significant difference between the high and unknown prototypicality conditions, *B* = 0.99, *Wald* = 3.04, p =.081, *Exp(B)* = 2.678. On the contrary to H2b, the two-way interaction was not significant, *Wald* = 0.91, p =.634.

The pattern of results did not change when controlling for participants' actual estimation score on the first dot estimation task, and the participant's actual estimation score did not predict their social inference, *B* = - 0.0003, *Wald* = 2.40, p =.121, *Exp(B)* = 1.000.

Table 5. The number of participants who inferred underestimator or overestimator for the unknown information

	Locus of Uncertainty			
	Group		*Self*	
Self-Prototypicality	*Underestimator Group*	*Overestimator Group*	*Underestimator Self*	*Overestimator Self*
High	37	3	41	2
Low	14	32	31	16
Unknown	33	9	36	3

Table 6. Hierarchical binary logistic regression predicting the likelihood of understimator inference using locus-of-uncertainty (group, self) and self-prototypicality (high, low, unknown) (N=257)

		Wald Tests (chi-square)		Final Model		
Predictor	df	Alone	At entry	B	SE(B)	odds ratio
Locus of Uncertainty	1	10.73***	10.73***	1.293	.353	3.643***
Self-Prototypicality	2	44.35***	45.57***			
High	1	3.21†	3.04†	0.985	.565	2.687†
Low	1	23.35***	25.21***	- 1.995	.397	0.136***
Constant	1			- 0.023	.550	0.977

***p<.001, **p<.01, *p<.05, † p<.10; Overall model chi-square (3, N=257) = 59.38, p<.001. When self-prototypicality is in the model, each group is compared to the reference group (Unknown); In the tests for 'Alone,' each group is compared to all other groups combined; Locus-of-uncertainty is coded Group=1, Self=2.

Group Identification. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA was conducted on each of the three identification measures, respectively: (a) IAT d-score (Greenwald et al., 2003; a positive IAT d-score means that a participant was faster in the compatible (X team members + Underestimators, Y team members + Overestimators) than incomparable configuration (X team members + Overestimators, Y team members + Underestimators), (b) identification scale, and (c) dot estimation difference score.

IAT d-score (Implicit measure of identification). Contrary to H1c and H2c, no main or interaction effect was significant, all Fs < 0.87, ps > .421, η_{p}^{2} < .007.

Identification (Explicit, self report measure of identification). Contrary to H1c and H2c, the main effect of locus-of-uncertainty and two-way interaction of locus-of-uncertainty and self-prototypicality were not significant, all *Fs* < 0.28, *ps* > .755, η_p^2 < .002.

The main effect of self-prototypicality was significant, *F* (2, 251) = 3.25, *p* = .041, η_p^2 = .025. Post hoc pairwise comparisons (Scheffe's test) indicated that participants in the high prototypicality condition (*M* = 5.97, *SD* = 1.97) identified more strongly than participants in the low self-prototypicality condition (*M* = 5.12, *SD* = 2.28), *p* = .04, $Cl_{.95}$:.03, 1.68. There was no other comparison that significantly differed in identification, *ps* = .376, .550.

The pattern of results did not change when controlling for relative self-prototypicality, interchangeability, and uncertainty.

Table 7. Means and Standard Deviations for Dot Estimation Difference Score (Behavioral measure of identification)

	Locus of Uncertainty			
	Group		*Self*	
Self-Prototypicality	*M*	*SD*	*M*	*SD*
High	3.01_{ab}	37.78	0.46_{ab}	25.93
Low	11.00_{a}	25.45	-7.98_{b}	44.19
Unknown	-6.61_{b}	29.09	-0.38_{ab}	31.88

Dot estimation difference score (Behavioral measure of identification). The main effects of locus-of-uncertainty and self-prototypicality were not statistically significant, all *Fs* < 1.51, *ps* > .220, η_p^2 < .006.

As predicted under H2c, the two-way interaction of locus-of-uncertainty and self-prototypicality was significant, *F* (2, 251) = 3.27, *p* = .040, η_p^2 = .025. An analysis of simple main effects was conducted – see Table 13 for cell means. Within the self locus-of-uncertainty condition, there was no significant difference in participants' dot estimation difference scores across the high, low, and unknown self-prototypicality conditions *F* (2, 251) = 0.88, *p* = .414, η_p^2 = .007. Within the group locus-of-uncertainty condition, the simple effect of self-prototypicality was significant, *F* (2, 251) = 3.10, *p* = .047, η_p^2 = .024. Participants in the unknown prototypicality condition (*M* = - 6.61, *SD* = 29.09) underestimated dots in the second task as compared to the first task by a significantly larger amount than did participants in the low prototypicality condition (*M* = 11.00, *SD* = 25.45), *p* = .014, $Cl_{.95}$: -31.55, -3.67. No other simple main effects were significant.

Viewed differently, within the low self-prototypicality condition, participants in the self locus-of-uncertainty condition (*M* = - 7.98, *SD* = 44.19) underestimated dots on the second task as compared to the first task by a significantly larger amount than did participants in the group locus-of-uncertainty condition (*M* = 11.00, *SD* = 25.45), *p* = .006, $Cl_{.95:}$ = - 32.53, - 5.44. No other simple effect was significant.

The pattern of results did not change when controlling for relative self-prototypicality, interchangeability, and uncertainty.

IAT response time. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA was conducted on IAT reaction time. Contrary to H1d and H2d, no main effect or interaction was significant, all Fs < 0.066, ps > .516, η_p^2 < .005

Relative self-prototypicality/Interchangeability. A 2 locus-of-uncertainty (group vs. self) by 3 self-prototypicality (high vs. low vs. unknown) two-way ANOVA was conducted on relative self-prototypicality and interchangeability. Contrary to H1e and H2e, the main effect of locus-of-uncertainty and its interaction with self-prototypicality were not significant, *all Fs* < 0.28, *ps* >.752. Only the main effect of self-prototypicality was significant, *F* (2, 251) = 14.52, *p* < .001, η_p^2 = .104. Post hoc pairwise comparisons (Scheffe's test) indicated that participants in the high (*M* = 6.10, *SD* = 1.45) and unknown prototypicality condition (*M* = 5.84, *SD* = 1.58) perceived themselves more prototypical than participants in the low prototypicality condition (*M* = 4.75, *SD* = 2.13), *p* < .001, $Cl_{.95}$:0.69, 2.01; *p* < .001, $Cl_{.95}$:0.42, 1.75. There was no significant difference between the unknown and high prototypicality conditions.

On the interchangeability perception, contrary to H1e and H2e, the main effect of locus-of-uncertainty and the two-way interaction of locus-of-uncertainty and self-prototypicality were not significant, all *Fs* < 0.16, *ps* > .712, η_p^2 < .001. Only the main effect of self-prototypicality was significant, *F* (2, 251) = 7.28, *p* = .001, η_p^2 = .055. However, the pattern of results did not hold when controlling for identification, relative self-prototypicality, and uncertainty. When these covariates were entered into the analysis, the main effect of self prototypicality was no longer significant.

Overall, the results indicated strong evidence for the main effects of locus-of-uncertainty on uncertainty reduction (H1a) and inference (H1b), and the two-way interaction of locus-of-uncertainty and self-prototypicality on identification (H2c); however, the analyses provided no evidence supporing hypotheses involving information processing time, relative self-prototypicality, and interchangeability.

CHAPTER FOUR

General Discussion

In this dissertation, depersonalization and projection processes are integrated into a single model under the unifying principle of uncertainty reduction. This theoretical integration posits that the principal locus of uncertainty–uncertainty about one's self, one's group, and one's fit to the group (self-prototypicality)–determines the prevalence of depersonalization or projection. When the principal locus of uncertainty is self, depersonalization occurs - group attributes flow to self. This one-step process takes little time, reduces self-uncertainty effectively, and results in strong group-to-self inference, strong group identification, and stronger perceptions of interchangeability of self and others in the group. When the principal locus of uncertainty is group, both projection and depersonalization occur – self attributes first flow to the group to construct a group prototype, then the projected prototype depersonalizes self and others. This projection-based social identity formation is more prevalent among prototypical members, and less among peripheral members or when prototypicality is unknown. This two-step process takes longer, does not reduce group uncertainty effectively, and thus results in weaker self-to-group inference, weaker group identification, and the increased perception of self-prototypicality relative to other members.

A two-factor (locus-of-uncertainty and self-prototypicality) experiment was conducted to test the key propositions of this model. The study combined two versions of the minimal group paradigm to create the locus of uncertainty—first, participants were informed they were randomly assigned to team X, and received information either about their own dot estimation performance or about their team's performance. They were then informed that they were either highly prototypical of their group or not prototypical of their group, or they were not provided with any prototypicality information – the manipulation of self-prototypicality was a three-level independent variable.

Participants completed key dependent measures involving reaction time as measured by the IAT, group identification (implicit, explicit, and behavioral measures), perception of relative self-prototypicality and interchangeability, inference of the unknown, and uncertainty about the unknown. This study is a first attempt to include the minimal group paradigm, an uncertainty manipulation and an IAT reaction time measure within one design.

The results supported the core hypotheses: (H1a) depersonalization reduces uncertainty more effectively than projection; (H1b) depersonalization yields stronger inference than projection; (H2c) how projection constructs group identification is greatly affected by self-prototypicality, but how depersonalization constructs group identification is not strongly affected by self-prototypicality.

First, as expected under H1a, participants in the Self locus-of-uncertainty condition reduced uncertainty about self more than the Group locus-of-uncertainty condition reduced participants' uncertainty about their group.

Second, as predicted under H1b, participants in the Self locus-of-uncertainty condition used group information to make inferences about self more strongly than participants in the Group locus-of-uncertainty condition used self information to make inferences about their group.

Third, as predicted under H2c, within the Group locus-of-uncertainty, participants in the unknown prototypicality condition showed an underestimation tendency more than participants in the low prototypicality condition, indicating projection occurred to form a group prototype. As predicted under H2c as well, within the Self locus-of-uncertainty, self-prototypicality did not induce a significant effect on the dot estimation tendency.

Detailed Discussion of the Results

The findings supported the overarching hypothesis that depersonalization yields greater uncertainty reduction and stronger inference than does projection. This may occur for one or both of two reasons. First, a group prototype is shared among group members but self attributes are not, unless they know their high prototypicality. Second, a group prototype has more informational value about the whole group than one's self attributes. Especially in the current study, a group prototype was the average of all the team members' scores. Therefore, it contains more information than one's own score. Future research can tease apart how much uncertainty reduction can be attributed to sharedness and/or information value.

Effect of anchor on the degree of adjustment. An interesting finding that was not expected was that low prototypical participants did not project; rather they contrasted group away from self and inferred their group prototype as an overestimator group (contrast). The result of inference can be interpreted as anchoring and adjustment. As illustrated in Figure 3, for participants in the low prototypicality condition, when group was an information anchor, participants still tended to infer themselves as underestimators (small adjustment). Whereas, when self was an information anchor, they tended to infer a group prototype far away from self as an overestimator group (large adjustment).

It has not been documented that different anchors (group vs. self) can produce different degrees of adjustment. One possible explanation is that when a group prototype is clear but people don't know their self attributes, it may evoke a strong desire to belong, which can motivate people to place themselves within the group prototype. In contrast, when people know about their attributes but a group prototype is uncertain, group belonging only increases uncertainty which can motivate them to place themselves far from the group.

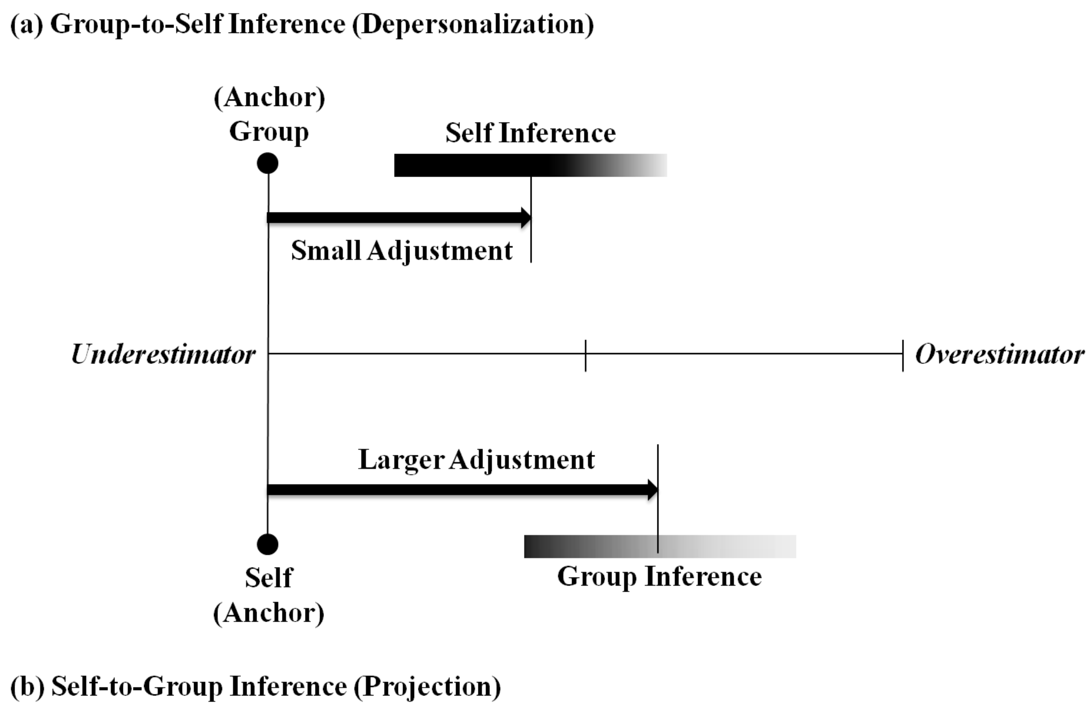


Figure 3. Different adjustment depending on information anchors (group vs. self) in the low self-prototypicality condition.

Inapplicability of actual self attributes in groups. Another fascinating finding is that participants' actual dot estimation scores did not predict their inference. This suggests a few possibilities − (a) people may not have access to actual attributes of themselves, (b) they may not have accurate evaluation of themselves, or (c) they may not use self attributes in group settings when they feel their self attributes inapplicable or irrelevant to the specific group setting and task. For example, given the current group context where the visual perception style of under- or over-estimator is an evaluative standard, self attributes of being ethical or being artistic are not relevant, and thus people may not use such irrelevant, inapplicable self attributes for their inference and identity formation.

Strength of depersonalization vs. projection. There was a strong main effect of locus-of-uncertainty on inference, such that participants used group as an information anchor to infer self more strongly than participants used self as an information anchor to infer a group prototype.

This finding is at odds with Cadinu and Rothbart's (1996) experiment 4. Cadinu and Rothbart compared inductive (projection) and deductive (depersonalization) inferences. They found that participants given feedback about self were more willing to generalize self information to the ingroup than participants given feedback about the ingroup were to generalize group information to the self.

Cardinu and Rothbart interpreted their result that "ingroup perception in minimal group settings is largely derived from self-perception rather than self-perception being derived from ingroup perception" (p. 674). They also argued that in minimal group situations where a group norm is not established, people project personal attributes onto an ingroup, which leads to cognitive overlap/similarity between self and group.

However, in the classic minimal group paradigm, group assignment was based on false feedback (e.g., under- and over-estimators based on a dot estimation task, Tajfel et al., 1971, Study1; Klee and Kandinsky group based on aesthetic preferences, Tajfel et al., 1971, Study2). In this case, participants had information only about ingroup but did not have information about self in terms of evaluative dimensions (whether they were personally an under- or over-esimtator, or preferred Klee or Kandisnky). This is comparable to the self locus-of-uncertainty and unknown self-prototypicality condition in the current study, and also to the self type-of-individual, and deduction type-of-inference condition in Cadinu and Rothbart (1996) experiment 4. In both conditions, depersonalization or deductive inference is a prevalent process, not projection or inductive inference.

Cadinu and Rothbart argued that self knowledge is always accessible and available; therefore, projection is a dominant process in the minimal group paradigm. However, the finding that participants' actual estimation scores did not predict their inference indicated that depersonalization (or deductive inference) is a dominant process of social identification.

Even so, there is a possibility that people may actually use self information in the random assignment type of minimal group paradigm. In the random assignment procedure (e.g., X and Y groups, Brewer & Silver, 1978; Perreault & Bourhis, 1999; Gaertner & Insko, 2000; blue and green groups, Rabbie & Horwitz, 1969; Rabbie & Wilkens, 1971, participants have knowledge neither of the ingroup's attributes nor their personal yet group-relevant attributes. In this case, people may use their personal attributes even though it may not be relevant or applicable to the specific group setting in which they are situated (e.g., dot estimation task, cognitive tasks).

However, neither the current study nor previous studies has theorized how people form social identity in the random assignment version of the minimal group paradigm (X group vs. Y group) where people do not have a group prototype and they do not know which self knowledge would be applicable in a given group context. Future studies should test this to explore how people deal with a situation where they do not know either group or self—dual uncertainty.

The condition for improving group performance. The analysis on the behavioral measure of identification (dot estimation difference score) indicated the condition for improving group performance – the Group locus-of-uncertainty and low prototypicality condition. Participants in this condition overestimated on the second dot task which contributed to more accurate dot estimation at the team level. However, this was derived not from motivation to improve group-level performance, but from inference that their team was overall an overestimator group and their conformation to that prototype.

IAT reaction time. There may be a few reasons for the insignificant results on IAT reaction time. It is possible that the current design may not have enough power to detect the difference if the effect size is small. For example, if the effect were small (f = .10), a sample size of 1269 would have been required to detect it.

Another possibility would be that the standard IAT may not be the best way to measure the number of cognitive steps. A more straightforward way would involve a simple judgment task where participants judge whether or not a particular attribute presented on the screen is an X team member trait (Henry & Smith, 1996).

It is also possible that when locus-of-uncertainty is group, projection may happen laterally from self onto other group members (Figure 4b) rather than vertically from self onto a group prototype (Figure 4a). Then, participants may average attributes from self attributes and projected attributes of others to construct a group prototype. To test this possibility, future research should use “X team” instead of “X team member” as an IAT category. If the reaction time is slower, it can be evidence for lateral projection.

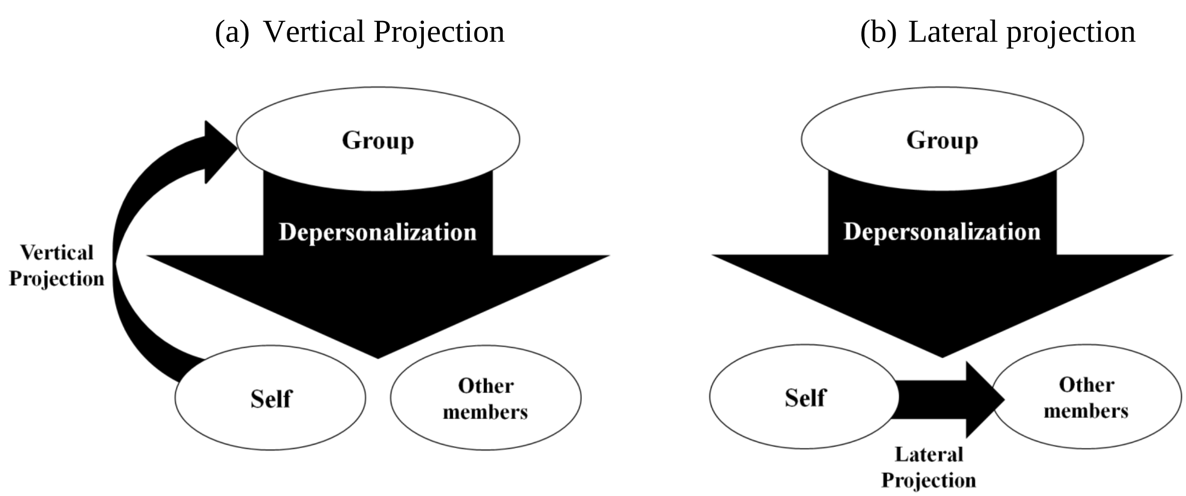


Figure 4. Two Types of Projections

Relative self-prototypicality and interchangeability. The analysis does not indicate that projection increases relative self-prototypicality more than depersonalization and that depersonalization increases interchangeability more than projection. The insignificant result can be attributed to the nature of prototype or norm in the current context. A group prototype was presented as a team average score. This is a descriptive prototype − being representative is being an average among team members. To clearly see the effect on relative self-prototypicality, a future study may need to portray a group prototype as an ideal.

Implications and Future Directions

The depersonalization-projection model has a number of implications for our understanding of a wide range of group phenomena. First, it specifies conditions under which newcomers or prototypical members bring about innovation. Newcomer innovation may be one benefit that a group can enjoy via projection. However, when a group has a clear norm, this may inhibit newcomer innovation. Thus, for newcomers to bring their unique knowledge and assets to a group, the group might benefit by allowing some degree of uncertainty about group norms.

Externally appointed group leaders are by definition newcomers. Such leaders may not always have accurate knowledge about the group and its members. For example, organizations hire a new CEO especially when they need to deal with changes (e.g., mergers and acquisitions, downsizing or expanding, market and technology changes). Often the new leader does not have accurate knowledge about the organization. In this situation, such leaders might implicitly project their own ideas about the group's identity onto the group. This might be beneficial - from the group's perspective it may lead to an effective process of social identity innovation. But if the apparent innovation is too extreme for the group – effectively a step too far – then there may be a backlash on the part of the group that compromises leader acceptance and undermines the leader's effectiveness (Abrams, Randsley de Moura, Marques, & Hutchison, 2008)

Last, although projection can partially and temporarily reduce uncertainty about the group and the identity of its members, it may not completely reduce such uncertainty unless other group members consensually validate their membership. Such consensual validation rests significantly on interaction and communication with other group members. However, uncertainty may inhibit communication. The reasoning is that if minority or marginal members expect the group consensus to ultimately be fashioned by majority opinions, they may be less motivated to engage in communication with the majority. Instead, they might seek out other minority members who can validate their ideas about the group, and communicate and coalesce with them to recreate the group prototype or create a new subgroup prototype. As a result, when a group navigates uncertain times, diverse factions can emerge within the group.

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APPENDICES

Appendix A: Pilot Study

I. Read the descriptions of two visual perception styles carefully and form impressions.

Underestimators tend to…	Overestimators tend to…
• see details in tasks	• see big pictures in tasks
• be careful	• be adventurous
• be meticulous in their approach	• be bold in their approach

II. Now tell us how positively you feel about underestimators and overestimators

1. Please provide your evaluation of **underestimators.**

1	2	3	4	5	6	7	8	9
Not Very Positive								Very Positive

2. Please provide your evaluation of **overestimators.**

1	2	3	4	5	6	7	8	9
Not Very Positive								Very Positive

A List of Attributes Stimuli

Underestimator attributes	Overestimator attributes
Conscientious	Audacious
Circumspect	Bold
Focused	Resolute
Vigilant	Adamant Exploratory
Punctilious	Courageous
Scrupulous	Daring
Mindful	Valiant
Attentive	Venturesome
Cautious	Intrepid
Seeing details	Brave
Careful	Dauntless
Meticulous	Fearless
Detailed	Unafraid
Heedful	Seeing the big picture
Assiduous	Adventurous
Wary	Valorous
Alert	Dashing
Prudent	Heroic
Chary	Heedless
Pedant	

Appendix B: Virtual Team Random Assignment

Welcome to the study.

The purpose of this study is to investigate how people's visual perception style affects the performance of virtual teams (that is teams that work together from different geographic locations and coordinate their work with electronic communication to accomplish team tasks).

You will be randomly assigned to a virtual team with a few other participants.

Other members who have signed up to participate in this study will be called shortly.

Please click the 'continue' button below.

Note: You cannot go back once you have clicked 'continue.'

Filler tasks

* One quiz will be presented at a time. Within 2 seconds after participants click to the page of the fifth quiz, they will be directed to the team assignment page.

While your virtual team is being assembled, please work through the following questions. When the team is assembled we will let you know.

Please click the 'continue' button below.

Note: You cannot go back once you have clicked 'continue.'

All natural numbers (1, 2, 3, 4, 5...) can be grouped as 'odd' and 'even.' 'Even numbers' are specifically those numbers which, when divided by ___, give a remainder of zero.

- ○ 13
- ○ 2
- ○ 7
- ○ 42009

Please click the 'continue' button below.

Name the title of the famous book written by George Orwell in 1948.

- Seventeen Eighty-Four
- Nineteen Eighty-Four
- Sixteen Eighty-Four
- Eighteen Eighty-Four

Please click the 'continue' button below.

Natural gas is composed of the chemical compound methane, one of the simplest organic compounds, have just one carbon atom per molecule. How many hydrogen atoms does a molecule of methane have?

- four
- three
- two
- zero

Please click the 'continue' button below.

Team Assignment

Thank you for your patience. Your team is now assembled

Please read carefully <u>Your Team Assignment Log</u> below.

You and 11 other participants have been randomly divided into two 6-person virtual teams. Your Virtual Team Membership: You with 5 other participants are members of: **Virtual Team X**. The other six participants are members of: Virtual Team Y.

Please click the 'continue' button to proceed to the next page.

Member Code

You have all been assigned 4-digit member codes that identify you and the team you are in. Codes will be used for team members to interact and communicate with one another during the study.

Please MEMORIZE the first three digits of your member code – you will need this information later in the study.

> You are in Team X.
>
> Your code is: **X92***
>
> *The last digit is masked to preserve data confidentiality and maintain your privacy.
>
> X team members: X921, X922, X923, X924, X925, X926
>
> Y team members: Y531, Y532, Y533, Y534, Y535, Y536

Please click the ‘continue’ button to proceed to the next page.

Attention Check

1. Which virtual team were you assigned?

- X Team
- Y Team
- Other

If “Other” selected, please indicate: _______________

2. What was your member code? _______________

Appendix C: Dot Estimation Task

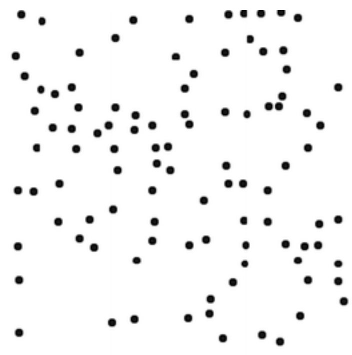
Instruction: Your first task is a visual perception task. You will view 11 slides - each presenting, for less than one second, a random pattern of dots. After each slide you will indicate how many dots you saw.

Please try to estimate the number of dots as accurately as possible. Do not try to count the dots, they will disappear too quickly.

To start the task, please click the 'continue' button below.

Dot Estimation Task: Sample Display

Slide #1

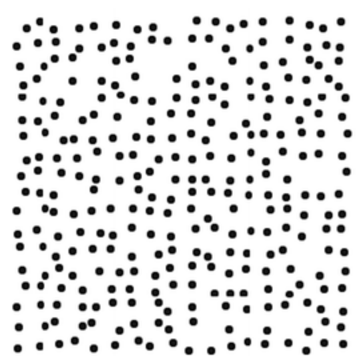


Slide #2

Please type in your estimate of how many dots you saw: ______

Please click the 'continue' button below.

Slide #3



Slide #4

Please type in your estimate of how many dots you saw: ______

Please click the 'continue' button below.

…

Slide #17 (last slide)

Thank you for providing your estimates.

Please click the ‘continue’ button to proceed to the next page.

Appendix D: Two Perception Styles: Underestimators and Overestimators

While we are calculating the dot estimation scores of you and your team, please read carefully the descriptions of two perception styles and take you time to form impressions. You will need this information in the following section of the study.

People tend to differ in how they perceive stimulus in their environment. Some tend to underestimate and others overestimate. There is no right or wrong way, but there are different tendencies. Previous research has found systematic tendencies in people to either underestimate or overestimate in perceptual judgments. "Estimation bias" is related to some other perceptual biases and personality predispositions.

Underestimators tend to…	Overestimators tend to…
• see details in tasks	• see big pictures in tasks
• be careful	• be adventurous
• be meticulous in their approach	• be bold in their approach

Valence Check

1. Please provide your evaluation of **underestimators.**

1	2	3	4	5	6	7	8	9
Negative								Positive

2. Please provide your evaluation of **overestimators.**

1	2	3	4	5	6	7	8	9
Negative								Positive

Appendix E: Manipulation

Condition 1: Locus of uncertainty: Group & Self-prototypicality: High

People tend to differ in the estimates they make on this dot estimation task – some tend to underestimate and others overestimate.

We will give you some information about how you and your team as a whole performed on the task now, and some at the end of the study.

You consistently underestimated the number of dots on each of the 11 slides You are an UNDERESTIMATOR You will learn at the end of the study whether your team (X team) is an underestimator or overestimator team. However, your “estimation bias” is **very similar** to the rest of your team.

Please click the ‘continue’ button to proceed to the next page.

Condition 2: Locus of uncertainty: Group & Self-prototypicality: Low

People tend to differ in the estimates they make on this dot estimation task – some tend to underestimate and others overestimate.

We will give you some information about how you and your team as a whole performed on the task now, and some at the end of the study.

> **You** consistently underestimated the number of dots on each of the 11 slides
> You are an UNDERESTIMATOR
>
> You will learn at the end of the study whether your team (X team) is an underestimator or overestimator team.
>
> However, your "estimation bias" is **not very similar** to the rest of your team.

Please click the 'continue' button to proceed to the next page.

Condition 3: Locus of uncertainty: Group & Self-prototypicality: Unknown

People tend to differ in the estimates they make on this dot estimation task – some tend to underestimate and others overestimate.

We will give you some information about how you and your team as a whole performed on the task now, and some at the end of the study.

> **You** consistently underestimated the number of dots on each of the 11 slides
>
> You are an UNDERESTIMATOR
>
> You will learn at the end of the study whether your team (X team) is an underestimator or overestimator team.

Please click the 'continue' button to proceed to the next page.

Condition 4: Locus of uncertainty: Self & Self-prototypicality: High

People tend to differ in the estimates they make on this dot estimation task – some tend to underestimate and others overestimate.

We will give you some information about how you and your team as a whole performed on the task now, and some at the end of the study.

Your team (X team) as a whole consistently underestimated the number of dots on each of the 11 slides. X Team is an **UNDERESTIMATOR team**

You will learn at the end of the study whether you are an underestimator or overestimator.

However, your "estimation bias" is **very similar** to the rest of your team.

Please click the 'continue' button to proceed to the next page.

Condition 5: Locus of uncertainty: Self & Self-prototypicality: Low

People tend to differ in the estimates they make on this dot estimation task – some tend to underestimate and others overestimate.

We will give you some information about how you and your team as a whole performed on the task now, and some at the end of the study.

Your team (X team) as a whole consistently underestimated the number of dots on each of the 11 slides. X Team is an **UNDERESTIMATOR team** You will learn at the end of the study whether you are an underestimator or overestimator. However, your "estimation bias" is **not very similar** to the rest of your team.

Please click the 'continue' button to proceed to the next page.

Condition 6: Locus of uncertainty: Self & Self-prototypicality: Unknown

People tend to differ in the estimates they make on this dot estimation task – some tend to underestimate and others overestimate.

We will give you some information about how you and your team as a whole performed on the task now, and some at the end of the study.

> **Your team** (X team) as a whole consistently underestimated the number of dots on each of the 11 slides. X Team is an **UNDERESTIMATOR team**
>
> You will learn at the end of the study whether you are an underestimator or overestimator.

Please click the 'continue' button to proceed to the next page.

Manipulation Check

Instructions: Please answer the following questions.

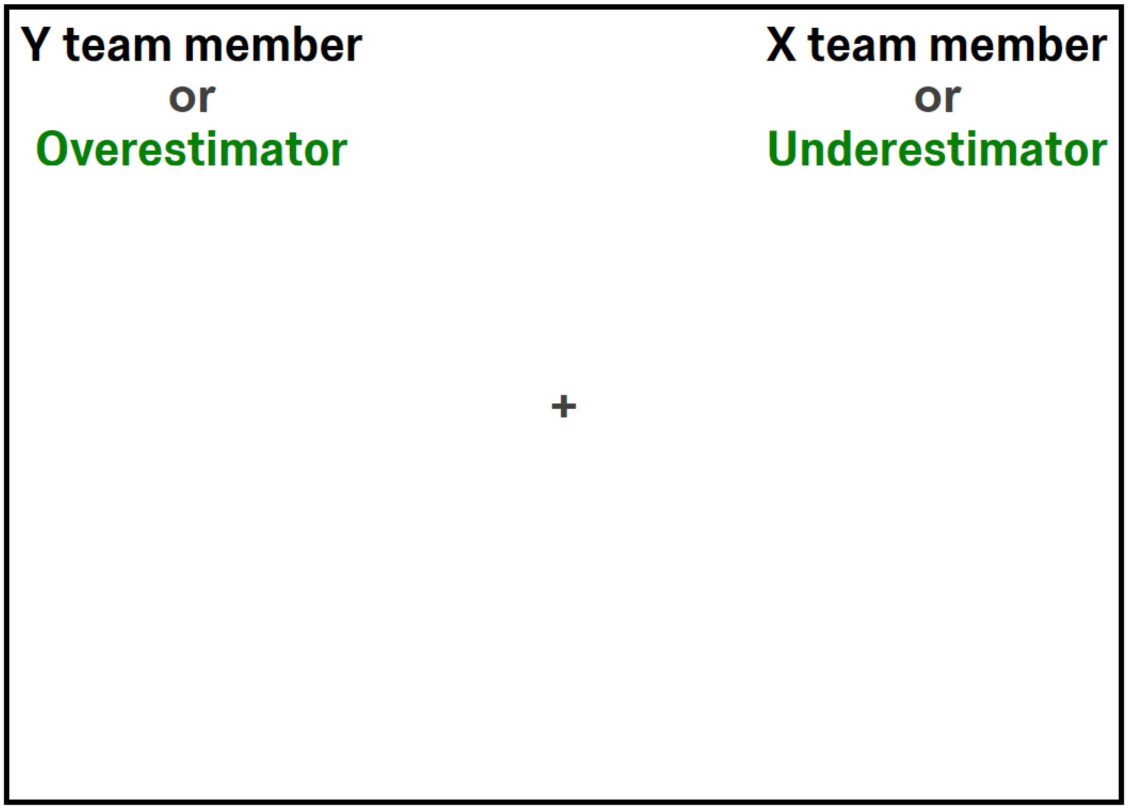
1. Which perception style are you?

- An Underestimator
- An Overestimator
- Uninformed

2. Which perception style is your team?

- An Underestimator Team
- An Overestimator Team
- Uninformed

Appendix F: Implicit Association Test Sample Display



X team member category stimuli: X921, X922, X923, X924, X925, X926

Y team member category stimuli: Y531, Y532, Y533, Y534, Y535, Y536

Underestimator attribute stimuli: Alert, Cautious, Circumspect, Focused, Mindful, Vigilant

Overestimator attribute stimuli: Bold, Brave, Exploratory, Heroic, Resolute, Unafraid

Appendix G: Dependent Variables

Identification (Hogg & Hains, 1996)

Instructions: Read the following questions carefully and indicate your feelings by selecting a number between *1* (not very much) and *9* (very much).

1. How strongly do you identify with your team?

1	2	3	4	5	6	7	8	9
Not Very Much								Very Much

2. To what extent do you feel that being part of your team gives you a good feeling?

1	2	3	4	5	6	7	8	9
Not Very Much								Very Much

3. How much do you feel a bond with your team?

1	2	3	4	5	6	7	8	9
Not Very Much								Very Much

4. How much would you stand up for your team if it were criticized?

1	2	3	4	5	6	7	8	9
Not Very Much								Very Much

Relative self-prototypicality

Instructions: Read the following questions carefully and indicate your feelings by selecting a number between *1* (less) and *9* (more).

1. In comparison to your fellow team members do you feel you are less representative of the team or more representative of the team?

1 2 3 4 5 6 7 8 9

Less More

Representative Representative

2. In comparison to your fellow team members do you feel you are a less typical or more typical team member?

1 2 3 4 5 6 7 8 9

Less More

Typical Typical

3. In comparison to your fellow team members how closely do you feel you embody the team's attributes?

1 2 3 4 5 6 7 8 9

Less More

Closely Closely

4. In comparison to your fellow team members how close a fit are you to the team?

1 2 3 4 5 6 7 8 9

Less More

Close Close

Intragroup Similarity/Interchangeability

(Crump, Hamilton, Sherman, Lickel, & Thakkar, 2010;

Soears et al., 1997; Ellemers, Kortekaas, & Ouwerkerk, 1999)

Instructions: Read the following questions carefully and indicate your feelings by selecting a number between *1* (not very much) and *9* (very much).

1. How similar do you think members of your team are to one another in terms of their visual perception style?

1	2	3	4	5	6	7	8	9
Not Very Similar								Very Similar

2. How similar do you think members of your team are to one another in terms of their personality?

1	2	3	4	5	6	7	8	9
Not Very Similar								Very Similar

3. How similar do you think members of your team are to one another in terms of their ability?

1	2	3	4	5	6	7	8	9
Not Very Similar								Very Similar

4. In general, how much do you think members of your team are similar to one another?

1	2	3	4	5	6	7	8	9
Not Very Much								Very Much

Inference and Uncertainty about The Unknown

Instructions: Please provide your answers to the following questions.

1. (Self inference) Which visual perception style do you think you have?

- o An Underestimator
- o An Overestimator

2. (Self uncertainty) How certain or uncertain about you about your answer above?*

1	2	3	4	5	6	7	8	9
Uncertain								Certain

3. (group inference) Which visual perception style do you think your team has?

- o An Underestimator Team
- o An Overestimator Team

4. (group uncertainty) How certain or uncertain about you about your answer above?*

1	2	3	4	5	6	7	8	9
Uncertain								Certain

5. (Self-prototypicality Uncertainty) How do you think about your fit with your team?

- o I fit well with my team.
- o I don't fit well with my team.

6. How certain or uncertain about you about your answer above?*

1	2	3	4	5	6	7	8	9
Uncertain								Certain

* reverse coded items

Appendix H: Demographics

1. Indicate your gender by checking the appropriate box below.

Female

Male

Transgender Female

Transgender Male

Gender variant/Non-conforming/Non-binary

Not listed

If “Not listed” selected, please indicate: _______________

Prefer not to answer

2. Age (please write in a number): _______________

3. Please indicate which race/ethnicity you identify yourself (please select one):

___ Asian/Asian-American

___ American Indian or Alaskan Native

___ Native Hawaiian or Pacific Islander

___ Black orAfrican-American

___ Hispanic or Latino

___ White/Caucasian/European-American

___ Middle Eastern Decent

___ Mixed ethnicity

If “Mixed” selected, please specify: _____________

___ Not listed

If “Not listed” selected, please specify: ______________

___ Prefer not to answer

4. Country of your citizenship: _______________

5. Country of your current residence: _______________

Appendix I: Informed Consent Form

You are being asked to participate in a research project conducted by Jiin Jung of Claremont Graduate University (CGU) located in Claremont in California, USA. Your participation in this study will be valued. This project is being supervised by Professor Michael A. Hogg.

PURPOSE. The purpose of this study is to investigate the role of visual perception style in virtual team performance.

ELIGIBILITY. To take part in this study, you must be over the age of 18, and your native language must be English.

PARTICIPATION. In this study, you will be randomly assigned to a virtual team. You will be asked to take a visual perception task to provide your thoughts about the virtual team, other members and yourself in the team. You and other members will perform various team tasks. This study will take you approximately 17 minutes to complete.

RISKS OF PARTICIPATION. The risks you run by taking part in this study are minimal and not higher than those faced in everyday life.

BENEFITS OF PARTICIPATION. We do not expect the study to benefit you personally. This study will benefit the field of social and political psychology by broadening our knowledge of virtual team science.

COMPENSATION: As an Amazon MTurk worker, you will receive $ 1.45 for completing this survey.

VOLUNTARY PARTICIPATION. Please understand that participation is completely voluntary. You may withdraw from the study at any time, or refuse to answer any question without penalty. Your decision whether or not to participate will have no effect on your current or future connection with anyone at Claremont Graduate University.

CONFIDENTIALITY: Your individual privacy will be maintained in all publications resulting from this study. Data will be stored on a password-protected computer. All individual answers will be presented in summary form in any papers, books, talks, or posts resulting from this study. In order to protect your confidentiality, you will not be asked to state your name anywhere below. Therefore, please be assured that your responses cannot be used to identify you.

If you have any questions or would like additional information about this research, please contact me at jiin.jung@cgu.edu. The CGU Institutional Review Board, which is administered through the Office of Research and Sponsored Programs (ORSP), has approved this project. You may also contact ORSP at (909) 607-9406 with any questions.

Clicking the "Yes" entry below means that you understand the information on this form, that any questions you may have about this study have been answered, and that you are eligible and voluntarily agree to participate. This link will direct you to the survey. Clicking the "No" entry will close this page and exit the survey.

- Yes, I agree to participate in this study and I am at least 18 years of age.
- No, I do not agree to participate in this study.

Debriefing

Thank you for your participation. You have now completed the study.

The purpose of this study is to explore how the amount of information people have about themselves and their team affects their perception about the team, other members, and themselves. Information presented to you about your and team's visual perception style has been created for the purpose of this study - Dot estimation results (e.g., under- or over-estimators) were presented to you ***not*** by your actual score but by the experimental condition you were assigned to. Also, ***no*** previous scientific research has found systematic tendencies in people to either underestimate or overestimate in perceptual judgments. Your cooperation has gone towards bettering our understanding of human behavior and is much appreciated.

If you have any questions or would like additional information about this research, please contact me at jiin.jung@cgu.edu.

If you have concerns regarding the ethics of this survey, please contact the Institutional Review Board at Claremont Graduate University at: Email: irb@cgu.edu; Phone: (909) 607-9406

Thank you again for your time and participation.

Please click the button below to get your validation code for mTurk.