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## **An Exploratory Analysis of Bias Formation, Prejudice, and Discrimination Through Contextual and Functional Similarities Using the Theoretical Framework of Relational Density Theory**

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**AN EXPLORATORY ABALYSIS OF BIAS FORMATION, PREJUDICE, AND  
DISCRIMINATION THROUGH CONTEXTUAL AND FUNCTIONAL  
SIMILARITIES USING THE THEORETCAL FRAMEWORK  
OF RELATIONAL DENSITY THEORY**

A Master's Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Applied Behavior Analysis

By

Elana Keissa Sickman

August 2022

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DISCRIMINATION THROUGH CONTEXTUAL AND FUNCTIONAL  
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Psychology

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Master of Science

Elana Keissa Sickman

**ABSTRACT**

Behavior Analysis “attempts to improve the human condition through behavior change”, with behavior being the primary target (BACB, n.d.). However, considering the way people perceive, interact with, and establish relational frames within different contexts is widely misunderstood. Much of this research has expanded on the components found in Stimulus Equivalence (SE) and Relational Frame Theory (RFT) by providing a more modern approach to examining language and its treatment approach. Relational responding of individuals and groups may contribute to implicit biases, prejudice, and discrimination as well as how they operate within nested contingency systems. While critical theorists have provided foundations for examining the implications and barriers continued by oppressive systems, the formation of the complex interplay within relational behavior as it relates to issues of oppression have not been adequately explored. Thus, the purpose of this study, to attempt to explore how organization of arbitrary stimuli along with the pre-existing relational frames as a function of the history and how it may attribute such bias. The present study occurred in two phases. Phase one being a relational training task to establish bias in favor of or against an Arbitralien, a creature with arbitrary features interacting within an arbitrary planet with a deep cultural divide. The second phase of the study was a Multidimensional Scaling Procedure (MDS) where participants were presented with a series of pairwise combinations and instructed to scale them on a 0 (not related) – 10 (most related) scale in terms of relatedness to one another. Results found that there were distinct formations of relational classes that resulted from the direct training as well as the derivative responses of the remaining Arbitraliens. Results provide many implications for understanding the way bias is formed in correspondence with functional and contextual similarity.

**KEYWORDS:** discrimination, bias, prejudice, relational frame theory, relational density theory

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In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

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## TABLE OF CONTENTS

Introduction	Page 1
Literature Review	Page 3
Discrimination, Bias, and Prejudice	Page 3
Critical Theories	Page 5
A Behavioral Account of Verbal Behavior	Page 10
Stimulus Equivalence	Page 12
Relational Frame Theory	Page 14
Relational Density Theory	Page 18
The Present Research Study	Page 22
Methods	Page 24
Participants	Page 24
Setting & Materials	Page 25
Procedure	Page 26
Results	Page 34
Discussion	Page 39
References	Page 46
Appendices	Page 53
Appendix A. Human Subjects IRB Approval	Page 53
Appendix B. Demographics	Page 54
Appendix C. Relational Training Script Group 1	Page 55
Appendix D. Relational Training Script Group 2	Page 56
Appendix E. Exemplar MDS Procedure Phase 2	Page 57

## LIST OF TABLES

Table 1. Multidimensional scaling procedure adjectives stimuli

Page 31



## LIST OF FIGURES

Figure 1. Experimental procedural flowchart	Page 32
Figure 2. Multidimensional scaling procedure Arbitraliens stimuli	Page 33
Figure 3. Geospace results Group 1	Page 37
Figure 4. Shepard diagram and stress test for Group 1	Page 37
Figure 5. Geospace for Group 2	Page 38
Figure 6. Shepard diagram and stress test for Group 2	Page 38

## INTRODUCTION

Concepts such as bias, prejudice, and discrimination have recently been assessed through a scientific lens and further focused on specific groups impacted. Much of the evolution of this research has been termed within critical theories covering topics such as Critical Race Theory (Delgado & Stefancic, 2001), Feminist Theory (Hooks, 2000), and others. A critical theory is a social theory that attempts to provide further reasoning of the social world while continuing to be critical of society and its assumptions within it (Horkheimer, 1993). Horkheimer (1993) claimed that critical theorists must aim to integrate the social sciences and philosophy to further the social world from domination and oppression. Each of the critical theories continues to add to the literature and foundations of what it may mean to act within a biased response to create overt systemic barriers for a multitude of groups. Systemic specifically relating to systems at large operating within policies and lawmaking (Belisle, Payne, & Paliliunas, 2022). Examples of systemic barriers are racism, sexism, poverty, and discrepancies within healthcare. Barriers are presented in many ways for groups oppressed by systems, this can be in the form of every day microaggressions towards a Black person and redlining at large. Microaggressions being the subtle discrimination towards members of a group (Merriam-Webster online dictionary, n.d). Bowleg (2013) shared these challenges among individual members and the shared experiences of members in Black and LGBTQIA+ communities. Common representations of microaggressions were “driving while Black”, police harassment, and clutching a handbag while shopping (Bowleg, 2013). Redlining is the occurrence of creating regional lines, attributed to racial segregation (Massey & Denton, 1987), suburbanization (Pieretti, 2014) and spatial

reorganization designed along racial lines (Krieger et al., 2020). Among others, similar experiences of discrimination at the systemic level occur.

Unfortunately, the field of behavior analysis has historically lacked in attempting to address such barriers and holds a small portion of peer reviewed research regarding such topics, racism as an example (Dennis, 2021). However, the theoretical work that is established in the science of human behavior could present contribution to understanding these barriers. For example, verbal behavior (Skinner, 1957), stimulus equivalence (Sidman, 1994), verbal relations and frame families (Horne & Lowe, 1996; Hayes, Barnes-Holmes, & Roche, 2001), and more recently higher-order relational networks through volume-mass-density, Relational Density Theory (RDT) (Belisle & Dixon, 2020). Behavioral scientists have contributed to the exploration of language and how it operates within more complex systems but has yet to establish how it continues biased relational responding. Thus, the purpose of the proposed research study to attempt to add to what is known about language and cognition as well as the evaluation of discrimination and bias and attempt to explore it further using arbitrary features and narrative.

## LITERATURE REVIEW

### **Discrimination, Bias, and Prejudice**

Discrimination, bias, and prejudice are leading factors to human suffering (Okazaki, 2009) which create personal, group, systemic and systematic barriers for many marginalized or minority groups (Andersen & Taylor, 2011). Social scientists (social psychologists, sociologists, anthropologists, among others) have developed language to describe these events as they occur within social systems, including within the United States where the current study took place. Discrimination describes “the unequal treatment of an individual or group on the basis of their statuses (e.g., age, spiritual beliefs, ethnicity, sex) by limiting access to social resources (e.g., education, housing, jobs, legal rights, loans, or political power)” (Andersen & Taylor, 2011). Bias is an implicit or explicit objective influence to favor one thing over another that often leads to judging, choosing, and/or accounting for the preference (e.g., homophobia, sexism, racism) (Belisle, Payne, & Paliliunas, 2022). Lastly, prejudice as a type of bias that is intentional and destructive being defined as “a favorable or unfavorable preconceived feeling or opinion formed without knowledge, reason, or thought that prevents objective consideration of an idea, individual, group, or thing (object)” (Andersen & Taylor, 2011). Within each of these definitions is an emphasis on the behavior of people towards others because of their identified or assigned group membership.

Approaching behavior from a functional contextual perspective necessitates not only an evaluation of the structure or topography of the behavior, but also the context within which behavior occurs (Hayes, Barnes-Holmes, & Roche, 2001). Functional contextualism is also grounded in pragmatism (Gifford & Hayes, 1999), or the idea that to work more successfully

within nature, we must identify relevant contextual variables for prediction and influence. Within functional contextualism, prediction and influence refer to the behavior of interest as it occurs within an external context. Critical theories are also grounded in pragmatic thought in that they must be practical, explanatory, and normative (Horkheimer & Adorno, 1973). Critical theories can be separated from other theories in that it must be able to identify current social phenomenon and the criticisms within it, specify those who are affected, continuing it, and those who are able to change it, and lastly to properly provide achievable and practical solutions (Horkheimer & Adorno, 1973). Contextualism is rooted in the philosophy of pragmatism and is separated by two subcategories, descriptive contextualism and functional contextualism. The field of behavior analysis empirically evaluates behavior within a variety of different contexts to predict and influence such behavior (Biglan & Hayes, 1996; Gifford & Hayes, 1999). This approach within behavior analysis seeks “the development of an organized system of empirically-based verbal concepts and rules that allow behavioral phenomena to be predicted and influenced with precision, scope, and depth” (Biglan & Hayes, 1996, p. 50-51). Such approach lends itself to Skinner’s point of the evolution of behavior and its selection by consequence (Skinner, 1981) as well as the interpretation of cultural practices (Skinner, 1981; Biglan, 1995). Thus, considering behavior from a contextual and pragmatic approach corresponds with the scientific principles that the function and context (environmental events) are influencing factors of behavior. The behavior of influence in the case of the current analysis is discrimination, bias, and prejudice as it occurs within different arbitrary contexts.

The concept of Intersectionality, introduced by Crenshaw (1989), is incorporated throughout critical theories, where misinformation, ignorance, and denial of the impact of these barriers on self and others cannot simply be ignored (Else-Quest & Hyde, 2016). Some critical

theories that address such are, critical race theory (CRT) (Delgado & Stefancic, 2001), feminist theory (Hooks, 2000), queer theory (De Lauretis, 1991), as well as sociological approaches to globalization and the interactions of such (Crenshaw, 1989). Crenshaw (1989) proposed intersectionality considering the lived experiences of Black women. Both identities being historically oppressed, but not necessarily represented in the overlap (Crenshaw, 1989). Further, the lived experience of someone experiencing racism alone and sexism alone may be vastly different from the lived experience of someone identifying within both. Specifically, intersectionality can be defined as the approach to examining how oppression overlaps among systems and creates experiences for those who identify within multiple identities (Crenshaw, 1989). Meaning that personal identifications within any category of oppression such as disability, weight, old age, race, neurodivergent, LGBTQIA+, lower socioeconomic status, and the overlap and/or combination of these categories and others may impact someone directly or indirectly. Of course, rendering various degrees of severity and implications for some groups as opposed to others. The following is a brief review of theories that have explored the influence of discrimination and prejudice on groups overtly effected.

## **Critical Theories**

**Critical Race Theory.** Critical race theorists have examined racial bias and its impacts on the Black community for decades and have noted that America and its systems are fully immersed in discrimination based on skin pigmentation (Ladson-Billings, 1998). Critical Race Theory (CRT; Bell Jr., 1980; Ladson-Billings, 1998; Delgado & Stefancic, 2001) applies the scholarly work and social movement to assess the impact of the intersection of the lived and shared experience of the Black community in relation to power differential and institutional

racism (Ladson-Billings, 1998; Delgado & Stefancic, 2001). The assumption of the theory is expansive of previous movements and broadly examines “economics, history, context, group- and self-interest, and even feelings and the unconscious” and includes advocacy to assert change (Delgado & Stefancic, 2001, p. 3). Five central tenants are assumed in CRT: (1) racism is “ordinary, not aberrational” (Delgado & Stefancic, 2001 p. 7), (2) the eradication of racist systems and structures is not incentivized by the white community as they are the primary beneficiaries of these given systems, (3) race as it presents, is a social construct, (4) multiple identities and experiences influence perception of race and is therefore anti-essential and intersectional, and (5) all voices are valuable and should be elevated to gain experience and perspective of the minority voice (e.g., counter storytelling) (Delgado & Stefancic, 2001; Belisle, Payne, & Paliliunas, 2022). These foundational tenants shape theorist approach to examining the impact of racial biases as they are present and evolve over time as well as how they are heavily engrained within the American systems.

Perceptions of race being dependent on the social and political representation of such, causing barriers in the daily lives of Black individuals as well as continuing systems that oppress the group at large (Ladson-Billings, 1998; Delgado & Stefancic, 2001). Leading to a constant re-examination of race and the role of intersectionality as it changes based on the evolving nature of social, political, and economic climate (Belisle, Payne, & Paliliunas, 2022). Theorists have found in their explorative analysis that the lived and shared experiences of the Black community and the social construct of racism relies heavily on the “social thoughts and relations” (Delgado & Stefancic, 2001, p. 9). Thus, the purpose of exploring the social narrative surrounding race, gender, and other socio-cultural identities that inform experience and perception (Belisle, Payne, & Paliliunas, 2022). Social narrative of the privileged (white, men, upper and/or middle class,

heterosexual) normative are often overshadowed in history and are known as the majoritarian story (Solórzano & Yosso, 2002). This representation of history and narrative of the Black community is part of what continues the oppressed systems. Therefore, the purpose of counter storytelling to reclaim and amplify the self-identified narrative and lived experiences of Black communities (Belisle, Payne, & Paliliunas, 2022). Further examination of language and bias based on racial and ethnic differences is describes in The Nested Model of Racism (Belisle, Payne, & Paliliunas, 2022). The nested model of racism expands on relational frames as well as the contingencies that further discrimination, specifically within the Black community.

**Feminist Theory.** In brief, Feminist Theory (FT) poses that “the best ways to understand and improve the lives of women and also of men, children, all species, the planet” is to engage in critical intersectional perspectives (Ferguson, 2017). Feminist theory and feminism is a multi-wave historical movement, each of which refining the former and is currently within its “fourth wave”. The “wave” metaphor is in reference to the ongoing evolution of the movement within different stages of development, as a means for illustrating the “similarities among research and action produced during various timeframes” (Parry, Johnson, & Wagler, 2018, p. 2). The intention of defining the fourth wave of the feminist movement is to encapsulate the violence and often extremist circumstances that women face in society (Kaplan, 2003). A distinction of this wave, as an extension of the third, is the involvement of mass media representation and social media involvement (Sternadori, 2019). All waves, however addressing media, accountability, empowerment, and the dismantling of sexist and misogynistic ideologies (Evans & Chamberlain, 2015). Sexism describing the shared group-based disadvantages that continues negative stereotypes and unequal status based on gender and gender expression (Glick & Fiske, 1996, 2001). Benevolent sexism (BS) and hostile sexism (HS) are the two subcategories of sexism as



proposed by Glick & Fiske (1996, 2001). BS noted as the subjective approach men have on women as being inept to care or make decisions for themselves without the guidance of male presence. While HS occurs within opposition, noted as women pushing a feminist agenda and using sexual narrative or advances to pursue the control of men (Glick & Fiske, 2001).

An often-misleading representation of feminist theory and the feminist movement at large is that it only posits benefit to the woman. However, this false narrative is exactly the opposite of the movement and study (Hooks, 2000; Samulowitz, et al., 2018). Butler, Gambetti, & Sabsay (2016) put feminist theory into practice when they addressed the engagement of vulnerability as an agent of strength as opposed to a previously understood weakness. Stating that in order to enact change within the political movement, one must resist the oppressor, and that in itself is a position of strength. This is a strength of the theorists' narrative and continues to push the movement forward in addressing discrimination, prejudice, bias, and intersectionality for women and people of all genders just as it has historically.

**Queer Theory.** Similar to the other theories mentioned, Queer Theory (QT) holds significance in that it advances intersectionality and multiple perspectives, much of which expanding from FT. De Lauretis (1991) termed Queer Theory as a means for exploring the construct of sexuality. QT, as researched today, is the blending of the multiple perspectives of theorists such as Butler, Halperin, and Jagose about gender identity as well as sexuality (Jagose, 2015). One position of the theory is to combat the normative standard, meaning the standards that lead to stereotyping and judgement based on someone's sexual identity (Cohen, 2004). In addition, it reticulates the importance of challenging the binary as the ordinary. Binary being seen as a distinctive, but rather looking at the societal perspective of gender (male/female), choice (right/wrong), and sexuality (heterosexual/homosexual) as a spectrum that is and will be

ever changing. Another focus of QT is the concept of heteronormativity being defined as “the institutions, structures of understanding, and practical orientations that make heterosexuality seem not only coherent—that is, organized as a sexuality—but also privileged” (Berlant & Warner, 1998, p. 548). This concept being reinforced by society as it sets the foundations for political decision making and the created systems. For example, the heteronormative agenda is embedded institutionally within basic human rights like marriage, employment, and adoption rights (Sumara & Davis, 1999). Specifically illustrating the urgency to combat the dominant normative position and the systems that continue this position.

Following the review of the above theories, the current study utilizes what is known about biased language as well as relational behaviors and how it encompasses actions that contribute to systems of oppression. Specifically, the dominant normative positions addressed in the specified critical theories. Examining bias as complex relational behavior that encompasses actions that in turn creates systems of oppression may contribute to the current research within critical theories. Especially, when assessing how a person shares conceptual and/or functional similarity to an oppressed group. Functional similarity meaning that the behavior or classes of behavior hold the same utility in its effects on the environment (Wilson & Dixon, 2015). Where conceptual similarity is the way, one responds given these similarities (within the same class) and differences (within a different class) of a group (i.e., how we treat a group of people based on a narrative).

However, the science of behavior analysis has historically been absent from diversity, equity, and inclusion (DEI) research even though it may provide many theoretical and conceptual analysis of verbal behavior that may lead to a deeper understanding of how and why people interact with their world the way that they do (Zarcone, Brodhead, & Tarbox, 2019). In defense,

this type of analyses does indeed have a position within behavior analysis. As the position of the field is those in behavior analysis should “attempt to improve the human condition through behavior change (e.g., education, behavioral health treatment)” with behavior being the primary focus (BACB, n.d.). Further exploration of how behavioral perspectives have and may contribute to this research is described.

### **A Behavioral Account of Verbal Behavior**

Humans are unique in that vocal musculature and communication has evolved within the human species. Skinner later termed this phenomenon verbal operant behavior (Skinner, 1963). To further clarify, an operant behavior is established through reinforcement or punishment (positive or negative) and the behavior is conditioned (i.e., learned) over time (Skinner, 1963). Verbal behavior later being defined as “behavior reinforced through the mediation of other persons must be responding in ways which have been conditioned precisely in order to reinforce the behavior of the speaker” (Skinner, 1957, p. 225).

The concept of language contributes to the wellbeing of people in that it can be used to build meaningful relationships, perceive, and identify environmental contexts, and assist in better understanding self and others. However, it may also greatly attribute to human suffering (Barnes-Holmes et al., 2017). An example as it relates to the current paper is within bias and prejudice. Specifically, being how bias is likely contained within language and how it may be used to when navigating the world and through interactions with others. The continuation of biased language as it is described by Skinner is that language contacts reinforcement from the verbal community thus continuing it. An example of this may be seen within the gender binary and the gendered biases that come from it, for example, this biased relational behavior is highly and overtly

reinforced by the verbal community. Gender reveal parties operate along assumptions of the gender binary that may perpetuate discrimination and prejudice as one example. Specifically with the representation of the binary through stereotypical traits attributed within the gender binary (e.g., blue/pink, trucks/dolls). This is furthered by Drake, Primeaux, & Thomas (2018) in which researchers found that children can successfully identify male, and female faces as young as 9 months old. Discriminating along the binary genders, male and female, is reinforced when caregivers, friends, and society at large attribute words like “pretty” to a girl who is wearing a dress. Or “tough” and/or “adventurous” to boys when they are playing outside. Biased language is reinforced and continued at a larger scale when it creates shared narrative and/or stories that then become societal norms. This can be advantageous in some contexts such as believability in sexual assault claims. An example of this can be found in a study completed by Paliliunas and Frizell (2021), where researchers examined the believability of sexual assault claims of survivors who were wearing “modest” or “sensual” clothing items. Results from this analysis showed that there were significant biases towards believability when modest clothing was worn (Paliliunas & Frizell, 2021). This may also be seen in narrative furthered by social media regarding what the woman was wearing at the time of the assault.

Skinner may further account for biased action and language while addressing culture and survival, as it may be in the best interest for the survival of a species, in this case humans, to react in terms of bias. Specifically providing notion to stay away from the things that may not present as safe or continue the human species. Skinner (1963) described this as cultural evolution and cultural survival as a process of behavioral selection. Within Skinner’s examination of cultural survival and evolution, it is stated that there are two relevant components: (1) physical survival of member and (2) cultural survival in terms of social reinforcement and environmental

contingencies (Skinner 1963). “A culture, like a species, is selected by its adaptation to an environment: to the extent that it helps its members to get what they need and avoid what is dangerous, it helps them to survive and transmit the culture” (Skinner, 1971, p. 128).

To Skinner’s point, people may engage in bias and prejudice because reinforcement is available from the verbal community for doing so. The constructs of race and gender are social constructions that guide social behavior and are continued in society. Biased language forms on the premise of social rules that may further remove the human species from punishing contingencies of oppression. However, what may be needed is a more advanced conceptualization of how rules emerge within complex contexts. Perhaps a more dynamical approach would contribute to the larger implications of bias and discrimination. Examination of relational frames demonstrated in Stimulus Equivalence (SE) and further within Relational Frame Theory (RFT) may provide some premise for this.

### **Stimulus Equivalence**

First beginning with Stimulus Equivalence (SE) (Sidman, 1971; Sidman & Tailby, 1982) as RFT is the behavioral theoretical extension of such and posits that people form equivalence classes (Hayes, Barnes-Holmes, & Roche, 2001). The basis of stimulus equivalence relies on the concept that verbal behavior is further evoked or elicited in the absence of reinforcement from the verbal community as well as the pre-existing history and interaction of stimulus events through transfer of stimulus function (Catania, Horne, & Lowe, 1989). Or more simply described as the elicit of the same response in the presence of multiple related stimuli, otherwise known as stimulus-stimulus relations. Stimuli are considered within an equivalence class when conditional discrimination has reflexive, symmetrical, and transitive properties (Minster et al., 2006).

Emergent classes are established when stimulus relations are demonstrated through derived relational responding, otherwise known as untrained responding (Minster et al., 2006). Transfer of stimulus function through equivalence classes is when the function of one of the stimuli alters the function of another without direct training (Dymond & Rehfeldt, 2000). Meaning that through verbal relations, socially mediated behavior is influenced. Stimulus function is simply the relationship between the stimulus and the behavior that is evoked and maintained by the consequence that follows (Sidman & Tailby, 1982). This is expressed in the following example:

If a person is taught that a physically present doll (A) is named “Rosie” (B) and vice versa that “Rosie” is a doll (B; B-A) and that “Rosie” (B) is also called the spoken word “doll” (C; B-C) then the person might derive that the physical doll is also the spoken word “doll” (A-C). SE is a form of derived relational responding. To further the example and represent the importance of transfer of stimulus function, if the learner is a boy and has been directly told that “playing with dolls is only for girls” (C-D) and has also been reprimanded for engaging in play with a doll (D-reprimand/punishment – E), then the learner may now avoid Rosie the doll (A/B-D/E) as well as generalize the response to all dolls and/or any feminine presenting toys despite not having direct reprimands of those toys (generalized A/B – D/E).

Given the example, SE may account for discrimination in that “stimuli can acquire control over behavior in the absence of direct training” in the process of obtaining psychological functions (Guinther & Dougher, 2015). Sidman, Wilson-Morris, & Kirk (1986) contributed to research of stimulus equivalence and summarized its importance with the following, "by reacting to a word as an equivalent stimulus - the meaning of a word - a person can behave adaptively in an environment without having previously been exposed to it. The emergence of equivalence from conditionality permits Behavior Analysis to account for the establishment of at least simple semantic correspondences without having to postulate a direct reinforcement history for every instance. Instead of appealing to cognitions, representations, and stored correspondences to

explain the initial occurrence of appropriate new behavior, one can find a complete explanation in the...units that are prerequisites for the emergent behavior." (Sidman, Wilson-Morris, & Kirk, 1986, p. 236). SE is at the basis of RFT, however expands beyond the simplicity of sameness as language and the way one interacts within their world is much more complex than SE can account for.

### **Relational Frame Theory**

Thus, the consideration of other relational frame families and transformations of stimulus function through the positions of speaker and listener. There are a few main differences between SE and RFT although for the purposes of this paper RFT will only be reviewed through its account of complex verbal behavior that not only extends Sidman but also aligns with Skinner's interpretation for verbal behavior. Specifically, the different types of relational responding as opposed to equivalence relations only. RFT posits that language, and the various forms of verbal behavior are arbitrarily applicable in that it does not have to have formal similarities, nor does it have to be directly trained, but rather can come under an arbitrary or neutral context (Hayes, Barnes-Holmes, & Roche, 2001). There are three main types of relational frames: (1) mutual, (2) combinatorial entailment, and (3) transformation of stimulus function.

The first process beginning with mutual entailment, like Sidman's version of symmetry where the relationship that is established between two stimuli are indeed the same and possess the same function. To simplify, a stimulus can be directly trained that A is equal to B and the reversed B is equal to A is then derived. The next being combinatorial entailment when another relation is established that is not equivalent to A and B. Rather the relationship between the stimuli are based on common stimulus events and expand beyond formal similarity (Hayes,

Barnes-Holmes, & Roche, 2001). Following the introduction of C to the described example and directly training that C is bigger than B, therefore deriving that B is less than C. To further the relationships, C is then derived as more than A and A is derived as less than C. This is unique again in that the human species are the only species capable of achieving combinatorial entailment. Lastly, the process of transformation of stimulus function, described similarly to the example from above with the doll. For example, if A holds a function that has been historically reinforced or punished over time, a person does not have to come into contact or have any direct exposure to B as the functions are obtained through verbal behavior (Hayes, Barnes-Holmes, & Roche, 2001). The functions may be aversive or appetitive in nature and transfer to the other relations.

In the instance of bias, discrimination, and prejudice, for example, this can be examined within the context of race and ethnicity. Beginning with a physical feature of an individual (A) and a descriptor of ethnic background and racial identity (B) (A=B). In the presence of physical features such as a darker skin pigmentation with the descriptor “Black” we can mutually entail that the person identifies within the Black community (A=B and B=A). Personal identity within society may hold significance and is due to socio-cultural conditioning around different racial identification (B) and descriptors that may be differentially obtained with one race over the other (C) (B=C). An example of this is within common stereotypes for or against certain racial groups such as “white” historically being mutually entailed with country music and ball caps (B=C and C=B) and people in the Black community being mutually entailed with hip-hop and natural hair such as dreadlocks. However, this can become problematic through association and combinatorial entailment in that stereotyping under the assumption of these characteristics is formed (C) under the assumption of the presentation of the physical features (A). This



phenomenon may be specifically describing transformation of stimulus function, when a group of people that hold formal similarities in their appearance such as hair and type of music constitutes racial stereotyping or differential responding based on the verbal relations society places on the person. A critical difference between RFT and SE is that not all relations are related through “sameness”, rather verbal relations expand beyond this simplicity and equate for much further complexities such as coordination, opposition, distinction, comparison, deictic, and hierarchical (Hayes, Barnes-Holmes, & Roche, 2001). Utilizing the example above, comparison could represent common stereotypes such as white people are better than Black people, therefore Black people are worse than white people. An example within opposition could lead to believability of sexual assault claims among physical appearance, females who are “attractive” as opposed to “ugly” or “modest” as opposed to “immodest” (Paliliunas & Frizell, 2021). While coordination is based on formal similarity (i.e., all stimuli in the relational network are the same regardless of being directly trained or derived), deictic relations depend on perspective taking not based on formal dimensions (Hayes, Barnes-Holmes, & Roche, 2001). Researchers described deictic relations as “learning to respond verbally from the perspective of self or I in relation to others about events that occur” (Hayes, Barnes-Holmes, & Roche, 2001).

Some of the theoretical foundations of RFT are founded in non-arbitrary applicable responding (NARR) and arbitrarily applicable relational responding (AARR). NARR is when responding is based on the relationship between non-arbitrary or formal properties of the stimuli and are not subject to social notion (Hayes, Barnes-Holmes, & Roche, 2001). A simple example of this is color or shape. AARR is that despite the non-arbitrary features of a stimuli, the relations are more contextual and therefore possess various characteristics (Barnes-Holmes et al., 2017). AARRing refers to the relational frames of coordination and distinction as an example.

AARR also can be utilized to explain psychological human suffering. Specifically, how language is used to establish incoherence from verbal behavior (Barnes-Holmes et al., 2017). Consider gaslighting as an example. According to American Psychological Association (APA) this term refers to the manipulation of “another person into doubting his or her perceptions, experiences, or understanding of events” (APA, n.d.). In a situation of gaslighting a person inflicting the manipulation may cause another to experience self-doubt of their own perception of the events. Following the self-doubt, the manipulator may follow the interaction with an apology or even attempt to establish feelings of love and connection. In this example a frame of coordination may be established by the party being gaslit between manipulation and the feelings of love and connectedness.

A highly studied research line that has expanded from RFT and how one relates to their environmental contexts with language at large is Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2006) and Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). Both of which assess the latency or time between the presentation of stimuli to the response of the participants within a given context (Murphy, MacCarthaigh, & Barnes-Holmes, 2014). Much of this research has been completed with gender (Errasti et al., 2019; Fleming, Foody, & Murphy, 2020), race (Hughes, Watford, & Del Toro, 2016), ageism (Curtis et al., 2020), and sexism (Hussey et al., 2016) to name a few. The arrangement of these studies is typically done using visual basic software to present stimuli and opposing relations such as “consistent”/ “inconsistent”, “pro-white”/ “pro-Black”, and “anti-white/anti-Black”. IRAP and IAT research is one research line that has progressed in areas of implicit and explicit bias and is one of the foundations for the current paper.

While RFT and the described considerations of verbal behavior into relational classes are impactful contributions to the sciences when examining basic two to three member classes, verbal behavior and language surrounding discrimination, bias, and prejudice are much more complex. The review of language thus far has only been described at its basic levels but may go far beyond the simplicity that has been offered in these accounts. Consequently, the proposal of the framework used for the current research study as an expansion of the above work, Relational Density Theory (RDT).

### **Relational Density Theory**

RDT, although new, offers the start of examining more complex frames as they exist within context. RDT can be defined as the extension of Stimulus Equivalence (Sidman, 1971; Sidman & Tailby, 1982) and RFT (Hayes, Barnes-Holmes, & Roche, 2001) that considers how relational classes and networks predict how they, organize broadly and self-organize more specifically, and differ in size (volume =  $Rv$ ) and strength (density =  $Rp$ ) (Belisle & Dixon, 2020). The components of RDT are provided: (1) Relational density ( $Rp$ ), (2) Relational volume ( $Rv$ ), and (3) Relational mass ( $Rm$ ) are known as higher-order properties. The first being relational density, described as the strength of the relative relational class. Relational volume is the amount of space that the relational class takes up. A relevant example of this may be with how the word *FEMALE* operates in a high-mass network of stereotypes such as *long hair* and/or *makeup* and contained within the class of *gender* and is opposite of *MALE* and may strongly identify with things such as *motherly* or *gentle* which operate within dense relations.

Self-organization is an important factor of RDT as it has large influence on the prediction of behaviors, defined as the organization of biological and physical systems through complex

pattern-formation (Camazine et al., 2003). The way that someone interacts within their contexts is also a main position of RDT in that reinforcement strengthens new relations and may occur in more arbitrary or ambiguous contexts without any direct training (Belisle & Dixon, 2020). This is the type of predisposition of the theory that becomes relevant to real world experiences that have recently been examined within translational research (Sellers et al., 2022; Sickman et al., 2022) and now the current research study described within this paper.

RDT does not provide reasoning for how bias may be formed, rather it gives an account that could describe how new information organizes around existing information that could contribute to the complexities of biased relational framing including intersectionality. Belisle and Clayton (2021) began to examine how language and cognition operates using relational density to predict which relational classes were more likely to merge and which classes were more likely to be resistant, otherwise termed as relational coherence (Belisle & Dixon, 2020). Relational coherence is shown within a geometrical space (further described as a geospace) obtained by responses from a multidimensional scaling procedure (MDS; Clayton & Hayes, 2004), meaning the more compact or close the classes are, the more “related” they are to one another. The further apart they are, the less related. Researchers specifically examined this by using stimulus equivalence training to create four, four member classes, each of the classes containing one familiar word, and three random symbols (Belisle & Clayton, 2021). The familiar words being, King, Queen, Salt, and Pepper. The researchers followed the initial training by splitting the participants into two groups to attempt to merge coherent and non-coherent classes. One group (non-coherence group) being trained with one member of the non-coherent class and the random symbols which did not successfully merge, and no real discrimination was made within the geospace. The opposing group responses, the coherence group, separated into two distinct

classes because of the relational training and the pre-existing history of coherence between the stimuli of king, queen, salt, and pepper.

The concept of RDT has since gone beyond basic research and has now attempted to examine gender discrimination (Sickman et al., 2022) and racism (Sellers et al., 2022). The first research study to attempt translational research utilizing RDT is examining gender discrimination (Sickman et al., 2022). Specifically, how words, stigmas and stereotypes are placed on women or female presenting individuals within the context of the gender binary (Sickman et al., 2022). Researchers examined this by presenting four phases to the participants: (1) Multidimensional scaling procedure (MDS 1), (2) non-gendered scenario responding, (3) gendered scenario responding, and lastly (4) the reintroduction to a multidimensional scaling procedure (MDS 2). Within the first phase, stereotypically gendered adjectives were provided to the participants to determine pre-experimental history within a gendered context. When provided with the initial MDS, four distinct classes were formed based on participants responding, specifically within the gender binary (e.g., male and female) and the function, whether appetitive or aversive, of the provided stimuli/words, (e.g., aggressive, fickle, nagging, masculine, affectionate, feminine, handsome). Like the coherence/non-coherence study (Belisle & Clayton, 2021), participants were split into two groups and provided with scenarios and arbitrary names and pronouns that either cohered within the binary stereotypes or did not cohere within the binary stereotypes. Changes in scoring was assessed through a pairwise paired samples t-test and found that changes in responding occurred in the coherence class when it matched the stereotype and decreased or stayed the same if it did not match the stereotype. Little to no changes occurred for either group in the second presentation of the MDS scale. Researchers concluded that this

may attribute to the social construct of gender having higher density and holding more history and bias within the binary relational classes.

RDT has also been utilized to assess racial biases (Sellers et al., 2022). The adjectives were obtained through four previously conducted IRAP and IAT research (Ziegert & Hanges, 2005; Barnes-Holmes et al., 2010; Xu, Nosek, & Greenwald, 2014; Power et al., 2017). The final stimuli list was stereotypical to descriptor words and names of white and Black communities as well as stereotypically biased names. The stimuli list acquired created 30 stimuli, a total of 900 pairwise combinations for the MDS procedure and included, Latonya, Tyree, Andrew, and Emily (Ziegert & Hanges, 2005), safe, dangerous, white, Black (Barnes-Holmes et al., 2010), friendly, honest, hardworking, good, deceitful, bad (Power et al., 2017), freedom, happy, death, disaster (Ziegert & Hanges, 2005), and lastly eight images, a Black man and woman, a white man and woman, a Black and white man carrying a camera and a Black and white man carrying a gun (Xu, Nosek, & Greenwald, 2014; Power et al., 2017). Different from the previous RDT research and MDS procedures, a time limit of one minute was added as to maintain the length of the experiment. This is distinctive of the previous studies and adds a potentially interesting component to how we assess implicit relational frames surrounding bias. Results found that there were tightly clustered relational responses between the appetitive and aversive functions of the adjectives (Sellers et al., 2022). As well as the members of the white and Black classes clustering at opposing ends of the geospace. The Black class clustering closer to the aversive class and the white class clustering closer to the appetitive cluster. Implying that there are perceptions and beliefs towards the Black community as being “bad” as a group and in opposition that members of the white class as “good”. Implications of these results depict a divide between the races as

seen in the geospace as well as an immensely problematic stereotype against the Black community without having any prior experimental training in either direction.

RDT provides a way to dynamically assess for relational behavior within contexts bigger than the typical work with two to three relations. Such potential work for RDT and its importance within that space can be shown in the above in the review of literature regarding the critical theories. Theories that were constructed to examine real world and lived experiences of the oppressed by the oppressors and how they are maintained within social systems. Thus, the interest for the present study, to use RDT and begin assessing dynamical systems of bias within an arbitrary or seemingly neutral context.

### **The Present Research Study**

The purpose for the current research study, which was intended to explore how self-organization of arbitrary stimuli, pre-existing relational frames and learning history may attribute to bias formation. One challenge in the previous research on implicit bias within RFT (Hayes, Barnes-Holmes, & Roche, 2001) and RDT (Belisle & Dixon, 2020) was that the biases exist pre-experimentally and are explored within the experiment, where that shared cultural history is a confounding variable. Moreover, this does not provide a contextual account of how those biases emerge in the first place. Within critical theories, and emphasis is placed on storytelling and counternarrative. Therefore, unfamiliar stimulus arrangements were created to evaluate if a context where bias emerges. This was completed with the construction of Arbitraliens, arbitrary creatures made with a variation of six features to create a symbolic representation of formal similarity. Functional and contextual similarity was established through a relational training video which was then followed by a Multidimensional scaling (MDS) procedure. Thus, the

interest in the current study to examine how verbal behavior, language, and cognition interact with bias, either for or against, certain groups based on the arbitrariness of physical features and narrative.



## METHODS

This study was approved by the Missouri State University Institutional Review Board on November 26, 2019 and received Approval #-FY2020-359 (see Appendix A).

### Participants

Fifty-two undergraduate students enrolled in an introductory Psychology course at a midwestern university completed the online procedure for course credit. Data from the participants was retained if 90 percent or more of the surveyed questions were completed and all blank surveys were excluded before data analysis. Of the original 52 participants, 35 were retained meeting the inclusion criteria. Participants were split into two groups to complete the survey to control for potential pre-experimental exposure or history that may affect the participants responding as the first phase of the study was a relational training task that trained association of positive and negative attributes. Group one had 18 participants while group two had 17 participants. Of the total 35 participants, 27 identified as female, seven identified with male, and one identified with the pronouns of she/they. Basic demographics of the participants are as follows: 24 identified as white, three identified as Hispanic, one person identified as Black, one person as Pacific Islander and one participant as being biracial (white and Hawaiian). Lastly, the ages of participants ranged from 19 to 28 with the mean age of 20 years old. See Appendix B for the full demographic questionnaire.

## Setting & Materials

Participants were recruited from an undergraduate psychology hybrid course during their online section. Participants were able to consent or not consent to participate in the study after being read a recruitment form. Following recruitment, participants were provided with a distribution link to the online survey provided via email. Administration of the survey for this research study was through Qualtrics (Qualtrics, Provo, UT), a secured online survey platform through Missouri State University.

Materials were adapted from previous RDT studies and customized for the purposes of this study. The first process in creating the materials was to produce the Arbitraliens for the visual representation for phase one and the scaling procedure for phase two. The Arbitraliens were first drawn out and later created on PowerPoint using online pictures edited and compiled to create the first two variations of Arbitraliens. Once the physical features for the first two Arbitraliens were finalized the remaining six were made with a variation of the features, none of which were the exact same.

During the first phase of the research study, participants were provided with a relational training video. The video was created using an online graphic design program, Canva. This platform allows for modifying images, music, etc. to generate a variety of different graphics. For the purposes of this study, five slides were made. Each of the slides represented different parts of the narrative described in the following sections. The slideshow was then recorded via Zoom and voiced over with the story that aligned with the correct relational training procedure.

The MDS procedure was customized from a previous RDT study that utilized previously conducted Implicit Relational Association Procedure and Implicit Attitudes Test (IAT) stimuli (Sellers et al., 2022). The stimuli were condensed after mutual IOA was obtained and both

stereotypically appetitive and stereotypically aversive words were acquired. Stereotypically appetitive words that remained were *freedom, love, honest, friendly, safe, and good*. Stereotypically aversive adjectives were *dangerous, death, bad, horrible, disaster, deceitful*. A total of 12 stereotyping adjectives and eight Arbitraliens were utilized for the MDS procedure (20 x 20 combinations = 400 questions).

## **Procedure**

The research study was a randomized control trial evaluation and comprised of two phases, including (1) A Relational Training Task and (2) A Multidimensional Scaling Procedure (MDS), followed by a demographic questionnaire. See Figure 1 for a flowchart representative of the experimental progression of the current research study. Prior to completion, participants were recruited from a basic psychology course and instructed that participation in the experiment, or an alternative assignment would result in extra credit for the course.

Recruitment briefly described the research study and the inclusion for participation. Those who chose to participate in the research study would obtain five points of extra credit or be given the option to obtain the extra credit through an alternative assignment. Participants were also told that responses would be anonymous and that if at any point throughout the study they decide to stop participating, then they would not be penalized. A brief excerpt from recruitment is as follows:

The research study will consist of two parts, the first you will be required to watch a 3 and half minute video, it will prompt you to download it to your computer and you can click play to begin. Please watch the video in full as this is what phase two of the research study is based on and you will be asked questions regarding the video. Phase two will be a series of scaling questions. Participation will take no longer than 45 minutes. If you have any questions, please email the myself whose contact information is on the consent form. After the study is concluded results will be shared with you if

interested. Your consent to continuing the study will be in the survey. Please take time to review the consent and thank you for participating in the research study.

Following recruitment, participants who chose to continue with the study were split into two groups and provided with the associated distribution link.

**Phase 1: Relational Training Task.** A Relational Training Task is a common procedure that is used to directly train or establish networks in favor of or against certain stimuli through exposure and teaching (Dymond et al., 2008; Nastally & Dixon, 2010). In the current case, this was established through the introduction of a divided planet that was the home to two Arbitraliens fighting for survival. To establish the basis of the scenarios descriptor words were obtained from a prior research study (Sellers et al., 2022). These adjectives were not directly used in the scenarios as to ensure that the first exposure was in the pairwise relating task as well as to keep the neutral integrity of the story. In the context of this experiment, this would be in the following phase of the study. The scenarios presented with positive bias towards one of the original Arbitraliens and negative bias towards the other. Each of the scenarios operated with a positive/negative leaning bias within a hypothetical planet and storyline about a divide among the arbitraliens. One Arbitralien keeping the participant, a wondering traveler from earth, safe and feeling loved and the other taking advantage of your situation and potentially harming you.

The direct training videos were presented to participants for three minutes and twenty-seven seconds each and utilized the two original Arbitraliens and a voice over of a portion of the following narrative:

Welcome to the planet of ECN-EICS, where there is a deep divide between the creatures. One of them creates disaster, torturing all other living creatures on the planet. Another creating harmony and peace. A divide so strong that it could create or destroy another universe. The fear in the eyes of the creatures when one enters their territory is shivering. While the other protects all creatures and the planet by warding off the bad. In order to

stay protected you must choose the right creatures to be with during your time on the planet. Choosing the wrong one might result in non-reversible corruption.

See Appendix C and Appendix D for the full Relational Training scripts for Group 1 and Group 2. An example for the attempt to establish networks in favor of one Arbitralien is shown in the above excerpt, “stay alive, healthy, and prosperous” as it alludes to the adjectives “safe” and “freedom” which are used subsequently in the relating task. The participants in group one were directly trained to have positive bias toward the Arbitralien with a round head, a spiral, and snakelike body and to have a negative leaning bias toward Arbitraliens with square head, a horn, and claw extensions. Participants in group two were given the same scenarios but directly trained to have positive bias toward the Arbitralien square head with a horn and claw and a negative leaning bias toward the Arbitralien with a round head and spiral with a snakelike body. The experimental manipulation of two groups was to account for any pre-existing relational frames or biases that participants may have had to the physical features described prior to partaking in the study.

**Phase 2: Multidimensional Scaling Procedure.** Once the relations were established with the directly trained Arbitralien of “good” and directly trained Arbitralien of “bad” the participants completed a 20x20 multidimensional scaling procedure (400 total pairwise combinations) and asked to rank each stimulus-stimulus pairing on a sliding scale using their computer mouse from zero to ten. Ranking was based on how related the different sets of stimuli were to one another. A MDS establishes the degree to which each participant relates sets of stimuli and is used to create the two-dimensional geometric special analysis for all participants, as described in the below sections (Clayton & Hayes, 2004). In the case of the current study the stimuli were comprised of 12 (6 positively associated, 6 negatively associated) adjectives

condensed from the previous Relational Density Theory race study along and a set of six new variations of Arbitraliens with an assortment of features from the original two that were directly trained (8 total Arbitraliens). Such findings gave premise to create a condensed version of the stimuli list along with features that provide more neutrality and arbitrariness. See Table 1 and Figure 2 for the completed stimuli used in the MDS procedure. All stimuli were used in this phase to test for the interaction and relatedness of positive and negative descriptors as well as the contextual and formal similarities and dissimilates of the Arbitraliens' physical features. A series of word-word and word-Arbitralien pairing were presented to participants.

The participants were provided with the following introduction to the pairing procedure:

During this phase of the study, you will be judging how closely related or unrelated words/images are to one another. Because people judge things in different ways, there are no right or wrong answers. We are interested in finding out how you as an individual compare these stimuli. You will be presented with a word/image and then instructed to indicate the relatedness of other words/images to that word/image. This will be presented on a sliding scale, 0 being least related and 10 being most related. You will rate the relatedness of all pairs presented on the screen before progressing to the next screen.

Each of the pairwise combinations were rated based on how the participants perceived how coherent or non-coherent the relations of stimuli were to one another. The MDS scale followed the presentation of the relational training videos to test if the directly trained relations of the original two Arbitraliens was established, as well as to test if participants derived any relations based on the formal and contextual similarities. See Appendix E for examples of the MDS presented to participants via the Qualtrics survey.

**Demographic Questionnaire.** Following the two phases of the research study, each of the participants were given a set of demographic questions that consisted of their gender (female, male, transgender, non-binary, specified fill in the blank), ethnic group (white/non-Hispanic,

black/non-Hispanic, Hispanic, Asian/pacific islander, native American/indigenous, biracial fill in the blank, ethnicity unknown, specified fill in the blank), age, and student classification. Due to the research questions posed for this experiment, the demographics portion of the research study was left to the end of the survey to avoid for any potential pre-experimental priming effects.

**Dependent Variable and Data Analysis.** Within this study the dependent variable was the participants responding to the sets of stimuli after being presented with the video. Data analysis was obtained from the responses from the MDS procedure and turned into a matrix that was then put into the statistical software, Statistica as described by Belisle & Clayton (2021) and put within a two-dimensional visual analysis referred to as a geospace. The software utilizes the matrix and computes a two-dimensional geometric spatial analysis based on the total area (i.e., relational volume) between the classes as well as the relative distance each point is to one another in terms of their coherent and non-coherent relatedness (Clayton & Hayes, 2004). The relational classes that emerged for Group 1 and Group 2 and represented within the geospatial analysis. This information is determined by the classes' relative strength ( $R\rho$ ) in accordance with the other relations within that relational class. This was consistent with relational volume ( $Rv$ ) and its relational mass ( $Rm$ ). Relational distance was calculated from the center point of the class and shown with the sub classes that were established that distinguished between the directly trained "good" and directly trained "bad" Arbitraliens and their coherent stimuli. The dimensions (Dimension X & Dimension Y) are arbitrary in nature in that their only utility is to coordinate the center point of the relational class and show the distance between the opposing classes center point (Hintze, 2007). The participant responses to the stimuli were then used to determine the dimensions of the current geospace as well as a representative visual analysis of bias formation

towards or against the given stimuli. Further implications for the results for each group will be provided in the below sections.

Following the MDS analysis a Shepard plot stress test, otherwise termed as a monotone regression, was conducted. A Shepard plot is utilized to assess for the strength of the visual geospace analysis of the MDS. Hintze (2007), described the utility of the stress score to obtaining the difference in distance of the stimuli and their predicted values. This analysis of the data assures that if the stress score is below 0.13, then the visual analysis represented in the geospaces is representative and stable for the given participants (Kruskal, 1964).

Table 1. Multidimensional scaling procedure adjectives stimuli

Positive Stimuli	Negative Stimuli
Freedom	Disaster
Love	Horrible
Safe	Death
Friendly	Dangerous
Honest	Bad
Good	Deceitful



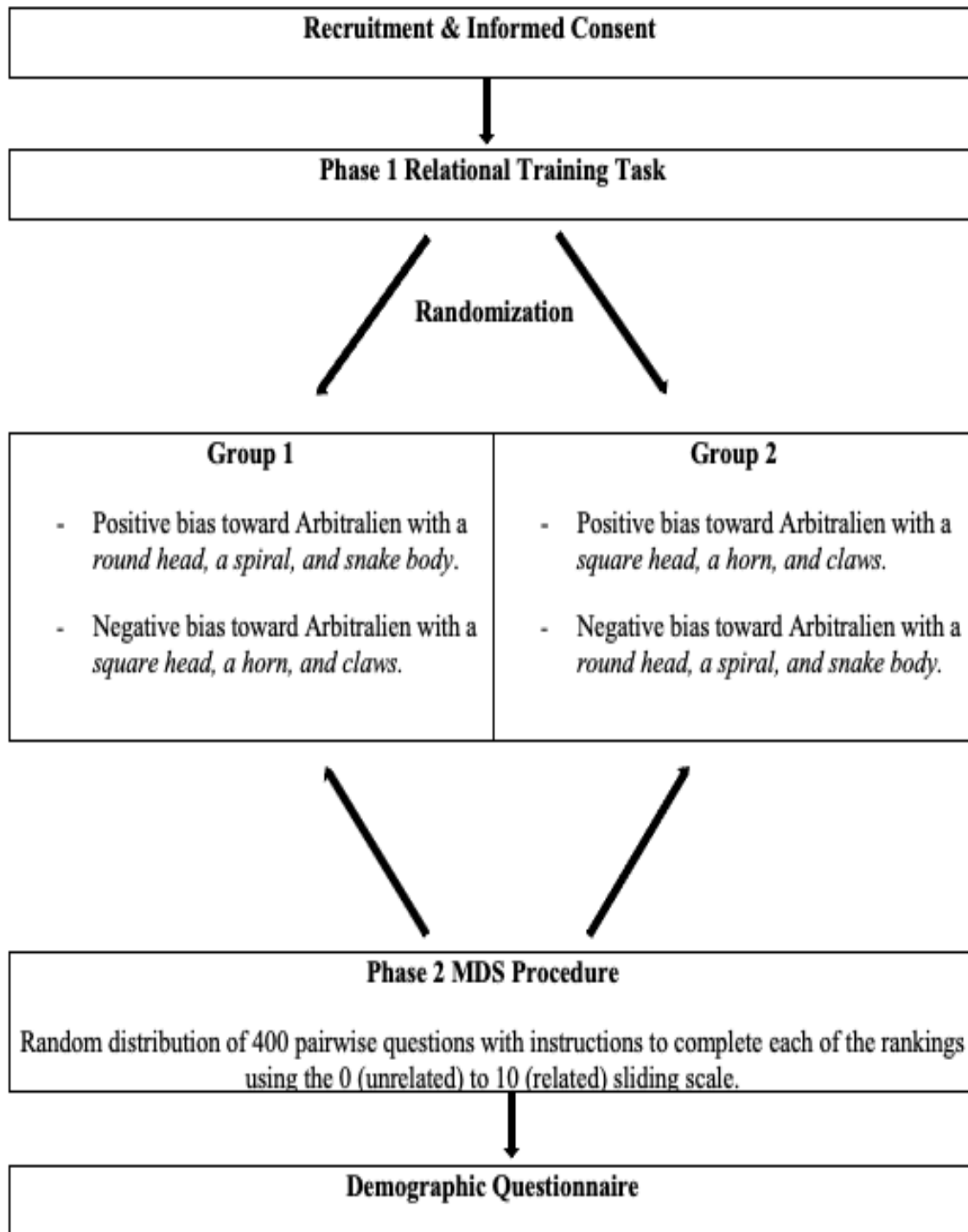


Figure 1. Experimental procedural flowchart

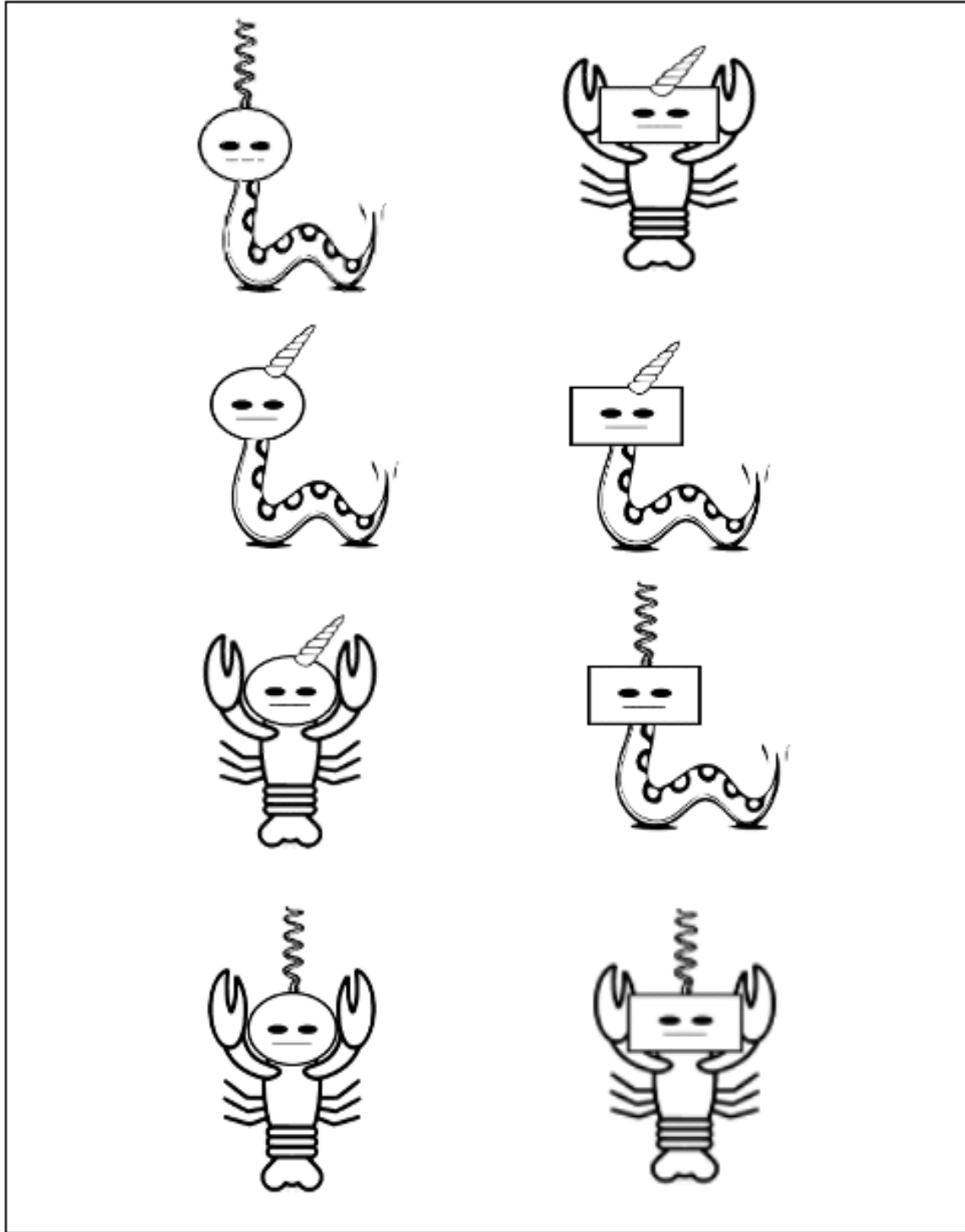


Figure 2. Multidimensional scaling procedure Arbitraliens stimuli

## RESULTS

In the case of the current studies MDS, dimension X is not noted as anything based on the premise that the Arbitraliens are in fact, arbitrary and dimension Y is noted to be the function of the stimuli. Function being the utility of the presented stimuli and its reasoning for the evoked response. Moreover, how the participants relate the stimuli on a zero (least related) to ten (most related) scale in terms of appetitive (approach function) or aversive (avoid function). Further this is shown in the clusters in the geospatial analysis, where words that hold similar function (safe, freedom, love) fall relatively close to one another demonstrating that the words more closely cohere. Whereas the stimuli that cluster further from one another (e.g., safe, dangerous, good, bad) are represented at opposing sides of the geospace to represent their non-coherence to one another. While there are distinct clustering's of stimuli, this is not to say that the stimuli that cluster at opposing sides of the geospace are not related to one another, in fact everything is related to one another regardless of the relative distance between the stimuli. In terms of the current dataset, the stimuli that are further apart are less related and the stimuli that are closer together are more related.

Represented in Figure 3 is the geometric space for group one's responding where the participants were trained to have positive bias toward the Arbitralien with a round head, a spiral, and snake body and negative bias toward square head, a horn, and claws. A distinct separation is represented in the geospace between the appetitive and aversive functions as the directly trained Arbitraliens associate coherent with what was trained and learned by the participants. Further, the Arbitraliens with similar features begin to migrate towards the cluster that may best cohere within that group. This distinction between the classes is representative of prior research (Sellers

et al., 2022; Sickman et al., 2022) and represent the tightly formed and highly biased relational class. For example, the “avoid” cluster are much larger and have more Arbitraliens closely associated with it based on the physical similarities of a horn and claws. In opposition is the physical feature that seemed to be most prominent in the “approach” cluster is the snakelike body, while as there is one Arbitralien that migrates towards that cluster and creating its own distinctive class. While there are distinctive clusters formed, there are Arbitraliens that form their own relational class, however, still hold some orderliness. Shown at the bottom of the geospace are two migrated Arbitraliens, both of which have a snakelike body and square heads. The difference is in the horn physical features, either spiral or horn, clustering closer to the “avoid” class. Similarly, there is an Arbitralien that migrates closer to the “approach” cluster but does not tightly group within it. Its physical features are the snakelike body, a circle head, and a horn.

Shown in Figure 4 is the Shepard Diagram where the red line is the expected value ( $\hat{D}$ ), and the blue data path represents the distance in responding from the  $\hat{D}$ s. For this two-dimensional dataset the program calculated the best number of iterations as 24. The blue circles (obtained data) should cluster closely to the red data path (expected value) to test for goodness of fit. The stress test score is also accounted for in group one data analysis. The stress value is utilized to determine the stability of a given system and ranges between zero and one. The lower the stress score the more statistically stable the model is and the greater likelihood that if the analysis was run again with the same group of participants the same or statistically similar outcome would occur. For group one’s geometric spatial analysis the stress score was 0.039.

Results from Group two MDS can be seen in Figure 5 where participants were directly trained a negatively biased association toward the Arbitralien with a round head, a spiral, and

snake body and a positively biased association toward the Arbitralien with a square head, a horn, and claws. The interpretation of this data is similar to that of Figure 3 but with the flipped Arbitraliens trained and later derived as either “good” or “bad”. In this group, Arbitraliens clustered in the aversive relational class if presented with circle heads as the prominent similar physical feature. The Arbitraliens with square heads tightly clustered within the appetitive group. However, there are two Arbitraliens that migrate to the bottom of the geospace and like group one, are the Arbitraliens that possess features of a snakelike body and a square head.

Lastly, Figure 6 depicts the results of the Shepard diagram and stress test score for group two. As noted for the Shepard diagram the blue circles are closely clustered with the D-hats value. The number of iterations computed for this two-dimensional analysis was 27. While the stress score was 0.045 and considered low for group two. Again, suggesting that the model used was adequately stable for this given group and the stimuli used and does not require the dimensions to be increased with this group of participants.

Results were compared between group one and group two to determine the effect of the relational training task. The results indicated that this type of visual analysis could be crucial to the understanding of relational behaviors as they operate under the context of bias. The geospace analysis represents the associations made in favor or against the stimuli that were provided in phase two of the study. The closer the stimuli cluster to one another the stronger the relational class, as the further the stimuli are from one another the weaker the relational class. The implications of this are further explained and interpreted in the discussion. However, it should be noted that the stimulus-stimulus pairing of adjectives and the pictures of the Arbitraliens clearly resulted in distinct bias.

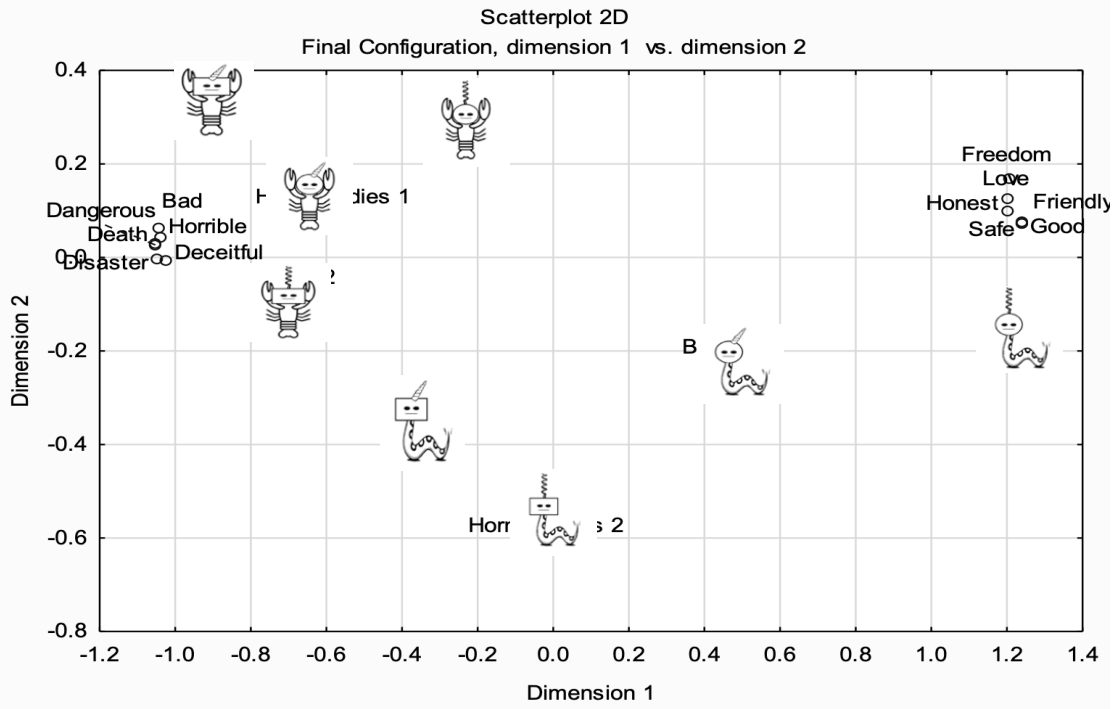


Figure 3. Geospace results Group 1

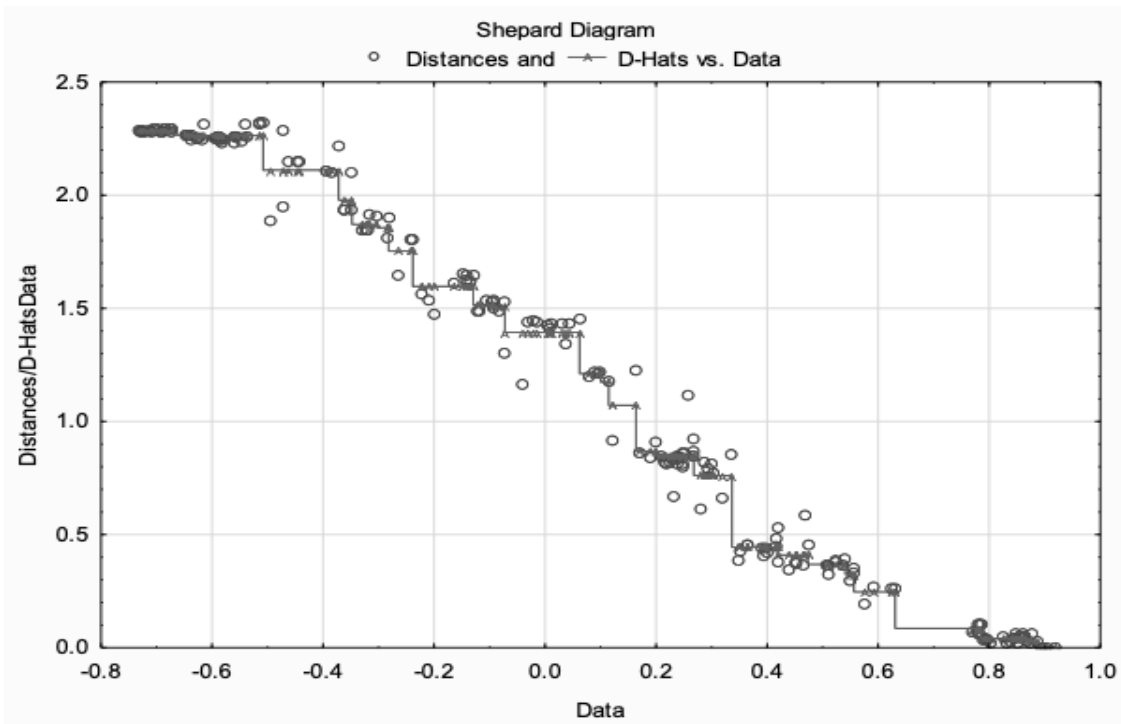


Figure 4. Shepard Diagram and Stress score Group 1

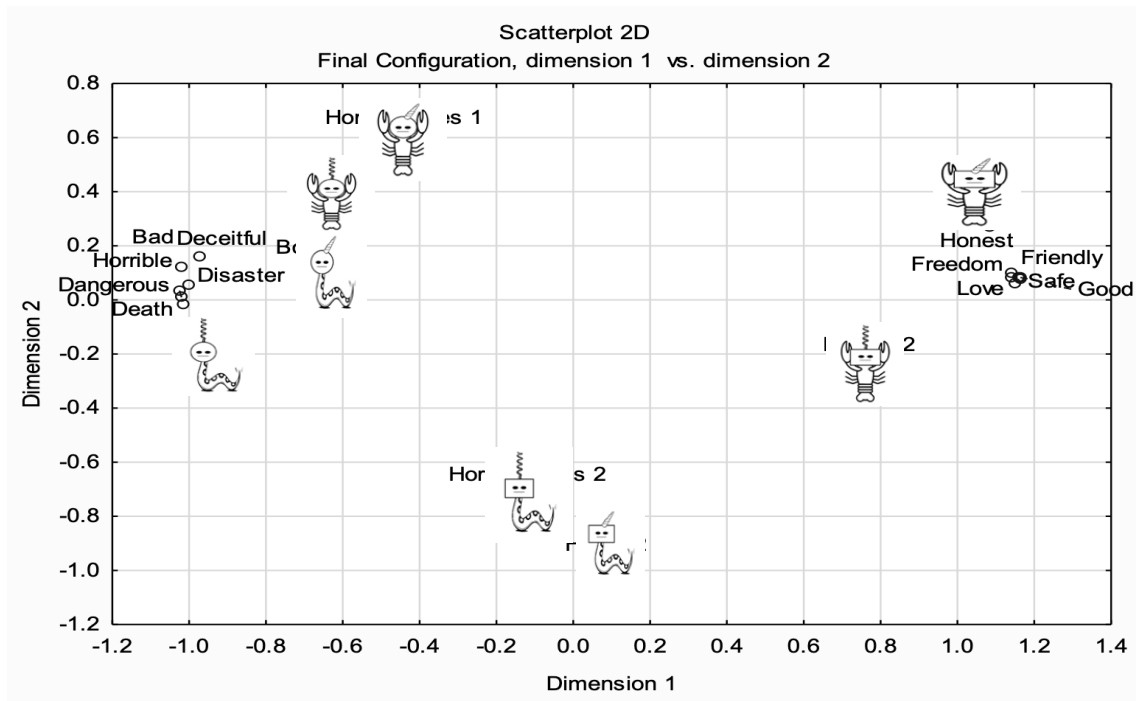


Figure 5. Geospace results Group 2

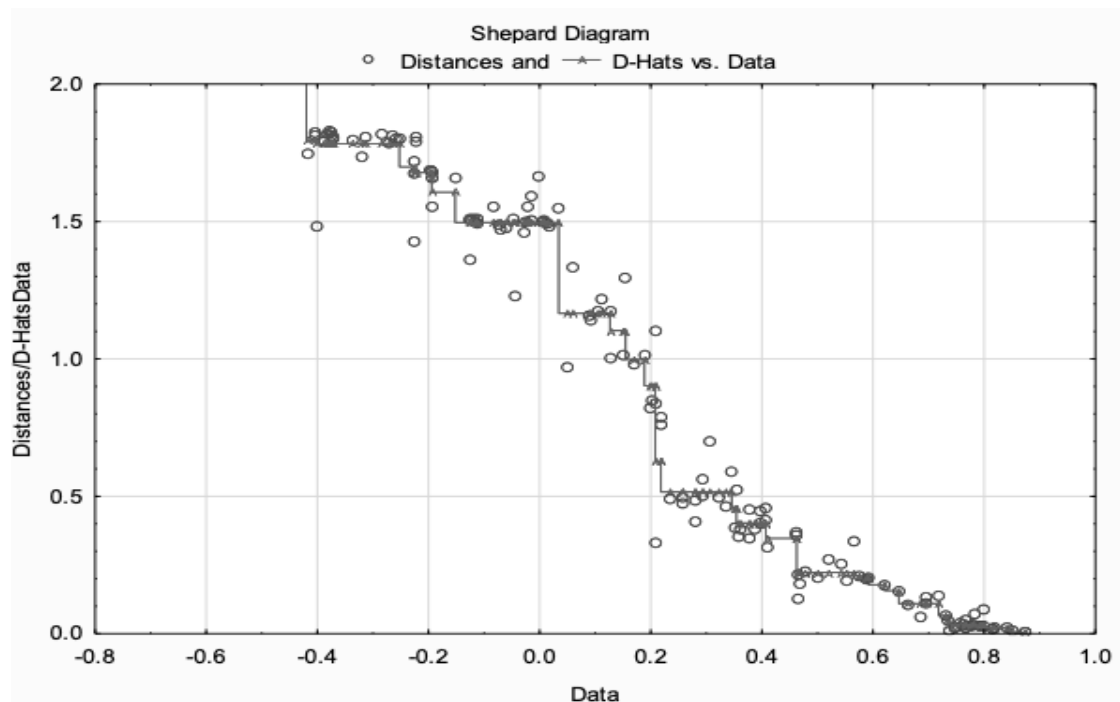


Figure 6. Shepard Diagram and Stress score Group 2

## DISCUSSION

Results from this analysis are the beginning stages of translational work utilizing relational density theory and may provide potential for understanding the deeply rooted and highly held beliefs, attitudes, and associations of bias formation. As shown in the results of the geospaces with the short amount of time it took to directly train (phase one) the participants as well as derivative relations (phase two). The visual analysis of the geospace is based on the groups responding and may hold significant value in that it represents group responding to Arbitraliens that hold no real value in society, as they are arbitrary. Where the positive words cluster closer to the directly trained original Arbitralien as well as the Arbitraliens that hold formal similarity. In opposition is the cluster of negative clustered words and the original Arbitralien trained to associate within it. The “avoid” cluster seeming to be much larger (volume). According to Belisle and Dixon (2020) when volume is held constant but relational density is higher, the relational classes themselves may be more resistant to change. This may be due to many factors and should be considered at a deeper level of analysis. However, in the case of how one might relate to these Arbitraliens given the context of “good” and “bad” we might consider one of those factors to be survival instincts. As briefly discussed in the introduction, survival of a species is determinate on how one relates to the present context. If in the context of this study relational training is considered, then it is logical to assume that the one Arbitralien directly trained as good, should be more approachable and hold functions with positive bias. For the Arbitralien that is directly trained as bad, it is understood better that the responses of the group to then associate that Arbitralien as not safe and hold more aversive functions.



Like the social narrative found in critical theories, this assumes that members that associate within a specific relational class and hold formal similarities to members of that group are also subject to bias and discrimination. This may become harmful when members of the society begin to engage in biased relational responding towards other members of the group along these constructed dimensions. This may also be present in the rules established within society that are socially constructed and lead to common stereotypes and discrimination towards marginalized groups. Indicated in the results the clusters as the other six, not directly trained Arbitraliens clustered based on their similar features. Both negative clusters holding more relations within its class, this is in reference to the density as well as the volume. The relations made regarding the other six Arbitraliens were not directly trained but rather derived by the participants as a group as holding more aversive functions. As this may be an indicator as to how society associates the features and narrative made of a specific group to align with their pre-existing views more strongly towards or against a given group. Further, the false narrative that all members of the group are the same because they have similar features is what may lead to blatant discrimination and prejudice which at large is at the formation of human suffering. Findings from the current research are consistent with prior relational density theory research that examined stereotypes and bias where distinct clusters formed dependent on the dimensions on the function, approach and avoid, across the target stimuli of binary gender (Sickman et al., 2022) and race (Sellers et al., 2022).

The implications of the findings may be further explained through concepts of RFT and transformation of stimulus function, in which the experiences and stories that we tell about members of groups can transfer and transform to other members of that group based on formal similarity and conceptual similarity. Again, RFT providing an account for how members within

specific relational classes such as the adjectives found within this study and how they transform and transfer to people, creating biases and actions that further perpetuate negative social consequences for people. RDT and RFT are unable to account for bias and discrimination at large. However, this may account for the relational networks and verbal behavior one engages in when interacting with certain stimulus events. The types of negative relations that are described within this study may be already accounted for within the critical theories. Critical theories provide accounts for individuals and groups that experience oppression which continued within systems (Horkheimer, 1993). Whereas behavior analysis has opportunity to provide empirically researched evidence of verbal and behavioral accounts for such oppression. Perhaps this is the missing link between the current information and the actionable steps needed to minimize the barriers of those who experience it. The potential missing link needed is that that can be provided by critical theorists and functional contextualists. While this study expands on the previously conducted RDT research and relates back to RFT research at large, there are some limitations and possible expansions worth motioning.

One limitation of the current study may be the demographics of the convenient sample recruited for the study. All participants were college students from a midwestern university and do not account for the diverse population at large. Whereas the participants were mainly females in their early to mid-twenties and more than 50% of them identifying as white. Future research can expand on the participant pool and asses for a larger review of societal biases that lead to discriminatory behaviors. Again, this a convenience sample and does give a foundation to this research line and its potential. Given that this research study was based on arbitrary features, future analysis at larger scales could be easily replicable. The study can be replicated and can be used as a basis for understanding bias in the context of physical features. All features being

arbitrary in the beginning and not obtaining significance until continued narrative of collectives are established and passed along. Specifically addressing the intersectionality found within these physical features that is representative and generalizable to the population. Being critical and intentional with this study and the implications of such could progress not only the field of behavior analysis, but the social sciences at large.

Another possible limitation is while the Arbitraliens themselves are arbitrary the features of them are not absolute in their neutrality. While this was accounted for with the split of the two groups, the features of claws that present like a lobster and the unicorn horn is not unknown to the participants. It is almost seemingly impossible to establish something as definite in its arbitrariness and personal history prior to experimental analysis but is not necessarily bad. This type of pre-existing knowledge of the stimuli presented can act as another future line of research. Specifically, the study of symbolism and how relations are formed and strengthened over time to become meaningful not only for the individual but for the cumulative whole.

Lastly, another limitation may be that the data was only obtained once and within one context and we cannot assume that a comprehensive relational analysis of complex frames like bias and discrimination can be found within this dataset. However, this may also be a strength of the MDS procedure used to analyze relational frames in that the stress score was below the .01 threshold and still produced a rather strong analysis with the stimuli used in the study. Future research can expand on this by adding more stimuli found within critical theory research to account for the complexities of human language and how people relate to their world within given contexts.

Further possible expansions of this line of research could be establishing the utility in developing an intervention technology based on the premise of RDT. The visual analysis and

representation of the geospace may provide unique accounts to relational networks. It has been represented in the other translational work mentioned and the current study that we can visually see how groups of people relate to sets of stimuli based on their personal history, directly trained narrative, and their own derivative account. There are implications of the visual representation of the MDS to be used individually and in group and may have protentional for having a role in breaking down or changing strongly held relational networks. For example, as previously shown within RDT research that relational networks can change and evolve when provided with information that either coheres or does not cohere with previously understood information (Belisle & Clayton, 2021; Frizell, 2022; Sellers et al., 2022; Sickman et al., 2022). The approach to examining verbal behavior and stereotypes using RDT may play a role in predicting the resistance of relational networks that perpetuate discrimination. That is to say that if predictions can be made, the amount of resistance to certain networks hold (e.g., racist and sexist ideologies), then we should also be a part of the sciences who discover how to disrupt them. Again, the position of Skinner and the account for language, relational behavior, and verbal operants. Language is learned and reinforced, while potentially harmful this notion also makes it so that society can learn and expand our verbal repertoire to be in support of inclusivity and cultural humility. Disrupting harmful relational frames such as psychological inflexibility or experiential avoidance has already been accounted for with the approach of Acceptance and Commitment Therapy (ACT) (Hayes, Strosahl, & Wilson, 2011).

ACT is an empirically supported and widely studied approach to the disruption of harmful frames. The premise of ACT and dismantling detrimental frames is held within its six core processes, values, committed action, present moment awareness, defusion, acceptance, and self-as-context. There are many potential implications of utilizing an already existing tool such

as ACT to then dismantle bias and discrimination with the visual analysis that RDT proposed in the geospace. One example of this being to use the geospace as a pre and post measure to an ACT-based intervention. Intervention could be used following the race MDS, for example, to show how defusion could work to disrupt the harsh frames built around the Black community. Defusion is used to build the skill of separating oneself from thoughts and emotions that get in the way of living a value driven life (Hayes, Stosahl, & Wilson, 2011). Given that, if values are established in favor of shared humanity as an example, then defusing from biased attitudes and assumptions such as “Black people are dangerous, deceitful, bad.” Through an ACT-based intervention then there is potential for slowly dismantling biased behavior. This, however, has yet to be done and will require extensive work as well as collaborative research and discussion with those who work diligently within critical theories. Following the intervention, an MDS could be reintroduced to assess the relational networks that have or have not shifted. Providing further premise to new targets within the intervention. The limitations within this potential line of research may be that it has not yet been completed and other limitations and future avenues for research are still obtainable.

The presented research study shows contextual control over discrimination using narrative and storytelling as the contextual event that may attribute to biased relational responding. Language, as it exists, is the only thing that separates humankind from other species. Leaving the collective with the opportunity to acknowledge the differences and similarities that exist among people while continuing to question, analyze and be critical of the sciences, and applications of the practice so that the science of human behavior can persist forward in being a part of the change that improves the human condition. As it is not about the Arbitraliens within this research but rather it is about real people and their sex, gender expression, who someone

chooses to love, the neurological differences, ones' age, race and ethnicity, someone's body shape and physique, and intersectionality's of these and more that makes people uniquely human. It is how we choose to respond to the non-arbitrary differences that make our world what it is.

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## APPENDICES

### Appendix A. Human Subjects IRB Approval



**To:**

Jordan Belisle  
Psychology  
Ashley Payne

**RE:** Notice of IRB Approval

**Submission Type:** Modification

**Study #:** IRB-FY2020-359

**Study Title:** Relational Density Theory- Stereotyping

**Decision:** Approved

**Approval Date:** January 21, 2021

This submission has been approved by the Missouri State University Institutional Review Board (IRB). You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

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This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.

Researchers Associated with this Project:

**PI:** Jordan Belisle

**Co-PI:** Ashley Payne

**Primary Contact:** Jordan Belisle

**Other Investigators:** Erinmarie Travis, Elana Sickman

**Appendix B. Demographics**

1. What is your gender (select all that apply)
  - a) Female
  - b) Male
  - c) Transgender
  - d) Non-binary
  - e) Please Indicate Here \_\_\_\_\_
  
2. Ethnic Group (select all that apply)
  - a) White/Non-Hispanic
  - b) Black/Non-Hispanic
  - c) Hispanic
  - d) Asian/Pacific Islander
  - e) Biracial \_\_\_\_\_
  - f) Ethnicity unknown
  - g) Other \_\_\_\_\_
  
3. Age
  - a) \_\_\_\_\_
  
4. Student Classification
  - a) Freshman
  - b) Sophomore
  - c) Junior
  - d) Senior
  - e) Graduate
  - f) Non-Traditional
  - g) Other \_\_\_\_\_

## Appendix C. Relational Training Script Group 1

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### Relational Training Task Script:

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#### *Group One:*

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Welcome to the planet of ECN-EICS, where there is a deep divide between the creatures. One creates disaster, torturing all other living creatures on the planet. Another creating harmony and peace. A divide so strong that it could create or destroy another universe. The fear in the eyes of the creatures when one enters their territory is shivering. While the other protects all creatures and the planet by warding off the bad. In order to stay protected you must choose the right creatures to be with during your time on the planet. Choosing the wrong one might result in non-reversible corruption. Stick with the correct chosen creature and you will be able to stay alive, healthy, and prosperous. Keep an eye out for them and befriend them. They will warmly welcome you. Once taken back to their land, they will all greet you with protection, disguise, food, shelter, and a comfortable place to live. Look for the circle heads with a spiral on top. They will have a long-spotted body, something that helps them move around quickly and defend themselves when the time comes. You will live on a beautiful part of the planet, where the clouds are bright, and the air is fresh. You will be able to act carelessly because you know that there will be no chance of the bad getting to you anytime soon. Soon you will realize that all of the good creatures make you feel warm inside. Giving you a sense of happiness. You will be able to build a positive life there, creating endearing and real relationships and connections. These creatures are good. These creatures will help guide you to live like them. They will cherish your friendship and grow fond of you being there with them. They will care about you no matter what and never let the bad get to you. Keep a look out for these creatures. The creatures with a long-spotted body and a spiral on their head. In order to stay protected you must stay away from the bad creatures. These creatures are evil and destructive of everything around them. If you do not belong in their group, disguised or not, they will know and they will quickly turn against you. They are known to kill anything in sight, especially if you enter their territory. Choosing to not stay away from these creatures might result in non-reversible corruption of the planet. Keep an eye out for them and separate yourself from them immediately. Escape from the square headed creatures with a horn and a long body with claws. Finding yourselves among them will make your experience dark, frightening, and gloomy. It will be an awful experience and create only negativity and division for yourself and the rest of the planet. These creatures are bad. These creatures will make you fearful, hurt you, and will isolate you to make you feel separated from all other beings of life. The planet will implode and create physical and emotional corruption. Keep a look out for these creatures. The creatures with square heads, a horn, and a long body with claws. Stay away from them.

The end.

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## Appendix D. Relational Training Script Group 2

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### Relational Training Task Script:

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#### *Group Two:*

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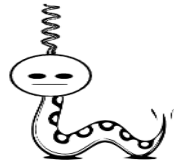
Welcome to the planet of ECN-EICS, where there is a deep divide between the creatures. One of them creates disaster, torturing all other living creatures on the planet. Another creating harmony and peace. A divide so strong that it could create or destroy another universe. The fear in the eyes of the creatures when one enters their territory is shivering. While the other protects all creatures and the planet by warding off the bad. In order to stay protected you must choose the right creatures to be with during your time on the planet. Choosing the wrong one might result in non-reversible corruption. Stick with the correct chosen creature and you will be able to stay alive, healthy, and prosperous. Keep an eye out for them and befriend them. They will warmly welcome you. Once taken back to their land, they will all greet you with protection, disguise, food, shelter, and a comfortable place to live. Look for the square heads with a horn. They will have a long body with claws, something that helps them move around quickly and defend themselves when the time comes. You will live on a beautiful part of the planet, where the clouds are bright, and the air is fresh. You will be able to act carelessly because you know that there will be no chance of the bad getting to you anytime soon. Soon you will realize that all of the good creatures make you feel warm inside. Giving you a sense of happiness. You will be able to build a positive life there, creating endearing and real relationships and connections. These creatures are good. These creatures will help guide you to live like them. They will cherish your friendship and grow fond of you being there with them. They will care about you no matter what and never let the bad get to you. Keep a look out for these creatures. The creatures with a long body with claws and a horn on their head. In order to stay protected you must stay away from the bad creatures. These creatures are evil and destructive of everything around them. If you do not belong in their group, disguised or not, they will know and they will quickly turn against you. They are known to kill anything in sight, especially if you enter their territory. Choosing to not stay away from these creatures might result in non-reversible corruption of the planet. Keep an eye out for them and separate yourself from them immediately. Escape from the circle headed creatures with a spiral and long body with spots. Finding yourselves among them will make your experience dark, frightening, and gloomy. It will be an awful experience and create only negativity and division for yourself and the rest of the planet. These creatures are bad. These creatures will make you fearful, hurt you, and will isolate you to make you feel separated from all other beings of life. The planet will implode and create physical and emotional corruption. Keep a look out for these creatures. The creatures with circle heads, a spiral, and a long body with spots. Stay away from them.

The end.

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## Appendix E. Exemplar MDS Procedure Phase 2

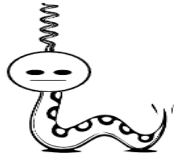
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and

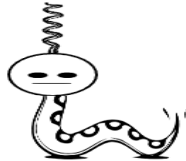


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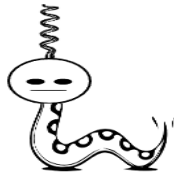
and good

Unrelated 0 1 2 3 4 5 6 7 8 9 Related 10



and horrible

Unrelated 0 1 2 3 4 5 6 7 8 9 Related 10



and



Unrelated 0 1 2 3 4 5 6 7 8 9 Related 10

