Quasi-Experimental Examination of Voluntary Disfigurement, Stigmatization, and the Behavioral Immune System

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Abstract

With a steadily increasing number of people making the decision to become tattooed, stigma frequently associated with tattooing is also an issue of increasing concern. However, the underlying mechanisms of tattoo stigma have been poorly understood. Assuming the perspective of evolutionary psychology it was hypothesized that tattoo stigma is the result of evolved socially exclusionary mechanisms activated by heuristic cues signaling a potential threat of infectious disease. It was conjectured that perception of atypical morphology, like the discoloration associated with significant tattooing, would activate into working memory implicit associations linking tattooing with infectious disease, triggering an aversive reaction. Using a quantitative quasi-experimental approach, the study measured participant implicit associations between disease connoting concepts and the perception of images of tattooed people as compared with images of non-tattooed people. Implicit associations between disease connoting concepts and tattooing were measured using an Implicit Association Test. An assumption made by the IAT developers that people accomplish tasks faster and with greater accuracy when the tasks are based on well-established learned cognitive routines or associations that are the product of evolved adaptive mechanisms, as compared with unpracticed tasks. This study will provide the first empirical test of a causal link between tattooing, disease threat management, and stigma. Findings indicate that a significant majority of the sample associated tattooing with infectious disease, this association is not affected by the participants having tattoos or expressing a positive or neutral attitude toward tattooed people. Given these findings, it is recommended that future research more broadly test the construct of voluntary disfigurement (e.g., body scaring, piercing, and "face painting") which BIS theory predicts would be likely triggers for BIS reactions.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Making use of an evolutionary frame of reference, this research focused on a threat-management construal of the psychology of stigmatization. It was conjectured that stigmatization of tattooed people is best explained by the hypothesis that perception of tattooed people heuristically signals a threat of infectious disease. Major researchers have almost universally regarded stigmatization as a product of social learning (BIS; Crocker, Major, & Steele, 1998; Goffman, 1963; N. Jones & Corrigan, 2014). However, the tendency to stigmatize conspecifics seems to be a universal human behavior (Murthy, 2002; Weiss, Jadhav, Raguram, Vounatsou, & Littlewood, 2001). This characteristic is not easily explained by social learning. It is hypothesized that stigmatization is best explained from the perspective of evolutionary psychology because the ability to identify and avoid vectors of infectious disease would afford a fitness advantage. Thus, stigmatization is best construed as an evolved adaptation aimed at managing threats associated with sociality, especially the threat of infectious contagion (Neuberg, Kenrick, & Schaller, 2011; Neuberg & Schaller, 2016). According to Omenn (2010), infectious diseases have historically been the leading cause of morbidity and mortality for humans. Under such extreme selection pressure, the physiological immune system evolved to identify and destroy infectious pathogens which have entered the body. However, because the physiological immune system is metabolically costly, Schaller (2006b) argued that a proactive disease avoidance system would likely have evolved to identify and avoid pathogenic threats before they enter the body. Schaller referred to such a proactive system as the behavioral immune system (BIS). The BIS is a suite of psychological mechanisms designed to proactively resist pathogenic threats before they enter the body. Because infectious pathogens are

microscopic, and, thus, not directly perceptible, people tend to be acutely sensitive to heuristic cues reliably correlated with infection such as rashes, lesions, and discolorations. However, because such cues are inherently ambiguous, inference errors are common. Moreover, because failure to identify and avoid a source of infection carries such an excessive cost in fitness, the system is biased to overperceive or overgeneralize cues as signaling infection even when none is present (Miller & Maner, 2012). Examples of overperception include people with acne (Papadopoulos, Walker, Aitken, & Bor, 2000), obesity (Park, Schaller, & Crandall, 2007), facial birthmarks (Ackerman et al., 2009), aging (Duncan & Schaller, 2009a), and physical disability (Park, Faulkner, & Schaller, 2003). Thus, the BIS evolved to err in the direction of false positives—a tendency to misidentify healthy people as contagious (Haselton, Nettle, & Andrews, 2005). This means that the BIS is acutely sensitive to even slight deviations in normal morphology. Moreover, each of the preceding examples of overperception can also be characterized as examples of stigmatized groups.

Background

Infectious disease imposed significant selection pressure on ancestral populations resulting in a variety of adaptations designed to mitigate fitness costs (Schaller, 2011). The most obvious of these adaptations is the physiological immune system designed to detect and eliminate pathogens that have entered the body. Although the physiological immune system has obvious fitness benefits, it also exacts serious metabolic costs. According to Sheldon and Verhulst (1996) organisms have evolved a large variety of adaptations to fight infectious parasites, all of which require metabolic resources that the organism might have used for some other metabolic purpose. Moreover, the physiological immune system is *reactive*, prompted to action only after infectious pathogens have entered the body.

Because of the high costs associated with the physiological immune system additional fitness benefits would be gained from a *proactive* immune system, that is a system that prompted the organism to avoid pathogens before they entered the body (Schaller, 2011). The BIS is a suite of psychological mechanisms that induce adaptive behavioral responses to environmental cues heuristically suggesting the presence of pathogens. When a cue heuristically indicating a risk of infection is detected, a series of adaptive reactions are initiated which can include emotional, cognitive, and behavioral responses (Schaller, 2011). For example, the emotion of disgust is widely agreed to have evolved to motivate the avoidance of contact with materials reliably associated with pathogens (Tybur, Lieberman, Kurzban, & DeScioli, 2013). Other cognitive-behavioral mechanisms, believed to be part of the BIS, include stigmatization, prejudice, discrimination, stereotyping, xenophobia, ethnocentrism, neophobia, nepotism and, philopatry. For this research, stigmatization will be understood as a cognitive, emotional, or behavioral manifestation of an underlying BIS mechanisms, the purpose of which is to identify and avoid out-group conspecifics as likely sources of novel pathogens and likely violators of local hygienic norms.

Because heuristic cues are frequently ambivalent and thus difficult to interpret the BIS is biased to overperceive heuristic cues as signaling infectious disease even when none is present (Miller & Maner, 2012). This research will focus on testing a hypothesized case of overperception and a BIS reaction to that case. Specifically, the hypothesis that perception of people with significant tattooing will cause a behavioral immune system reaction, manifesting as stigmatization or other related concepts.

Bell (1999) made the distinction between "people who have tattoos and tattooed people" (p. 55). Those who have tattoos typically have only one or two and in places where they can be

easily concealed with clothing. Tattooed people, on the other hand, characteristically have many brightly colored and imprudent tattoos in obvious places. Tattooed people, claimed Bell, have decided to go beyond a point of no return, entirely accepting marginalization. For this study "significant tattooing" and "tattooed people" will be used interchangeably.

Statement of the Problem

Stigmatization is a universal human behavioral manifestation of a negative attitude toward specific categories or groups of conspecifics (e.g., foreign appearance, disfigurement, obesity, old age, mental illness, homosexuality and, many others). Because stigmatization can have serious untoward consequences, it is speculated that a better theoretical understanding of the mechanism of stigma will be of significant benefit in attempts to allay its detrimental effects. The problem that is addressed in this study is rooted in the widespread belief that stigma is culture-bound (Crocker et al., 1998; Goffman, 1963; E. E. Jones et al., 1984). According to Botterill and Carruthers (1999), humans have a natural proclivity to think that cognition is integrated into a single system open to introspection, a condition they called "the illusion of the transparent mind" (p. 50). However, one of the chief findings of the cognitive revolution has been the degree to which humans depend on a native cognitive endowment, in which processing tasks are assigned to modular structures each the solution to a specific adaptive problem faced by hominids living in an ancestral environment and each having a unique range of inputs and outputs. Accordingly, social science is currently undergoing a paradigm shift (Kuhn, 1962) from what Tooby and Cosmides (1992) called the Standard Social Science Model (SSSM or Standard Model) to what Wilson (1975) characterized as the new synthesis. Since the 1920's the Standard Model has dominated behavioral and social science research (Cosmides & Tooby, 2016). It is the view that human behavior is essentially unaffected by human biology; the human mind is viewed

as a blank slate the content of which being determined by experience (Pinker, 2002). By contrast, evolutionary psychology—a combination of evolutionary biology and cognitive psychology—holds that all normal human minds consist of a number of functionally specialized modules that shape the way experience is interpreted and imbues the mind with concepts, motivations, and universal frames of meaning (Cosmides & Tooby, 2016). The problem addressed in this study is a hypothesized link between disease avoidant-socially exclusionary behavior (e.g., stigmatization) and perception of tattooed people (Neuberg et al., 2011; Neuberg & Schaller, 2016). More specifically, the problem can be analyzed as follows: first, whether stigma is best explained as culturally bound learned behavior or evolved adaptive behavior based on a threat management system, namely, the BIS and second, whether the perception of tattooed people will activate a BIS response. If the perception of tattooed people acts as a BIS trigger, then tattoo stigma is likely best construed as a BIS mechanism and, thus, best explained as an evolved adaptation designed to avoid conspecifics heuristically signaling a threat of infectious disease. The problem addressed in the current study is a hypothesized link between disease avoidant-exclusionary behavior (e.g., stigmatization) and perception of tattooed people (Neuberg et al., 2011; Neuberg & Schaller, 2016).

Purpose of the Study

The purpose of this quasi-experimental study was to determine whether the perception of significant tattooing will cause a BIS reaction. Participants (N=328) were recruited by Project Implicit (Greenwald, Banaji, & Nosek, 2011), a non-profit organization and international collaboration between researchers who are interested in implicit social cognition. Project Implicit has agreed to run the Tattoo/Disease IAT described below via CGI scripts (i.e., common gateway interface) a protocol by which the Project Implicit server interacts with the computers of

participant volunteers' to administer the IAT. The Tattoo/Disease IAT explored a hypothesized link between tattooed people and BIS reactions such as stigmatization. The IAT measured response latencies of associations between perception of tattooed people and disease connoting concepts as compared with the perception of non-tattooed people and health connoting concepts. Developers of the IAT (Greenwald & Banaji, 1995; Greenwald, McGhee, & Schwartz, 1998) assumed that people accomplish tasks faster and with greater accuracy when the tasks are based on well-established cognitive routines or evolved associations, as compared with unpracticed tasks. It is further assumed that some cognitive associations are not a function of associational learning, but are rather the product of genetically evolved adaptations. Specifically, the association of disease with a wide range of atypical morphology of conspecifics is believed to be the result of an evolved disease avoidant-socially exclusionary adaption aimed at the avoidance of infectious disease.

Beyond exploring a hypothesized link between tattooing and infectious disease, the study also sought to answer two additional related questions. First, will people with tattoos associate tattooing with infectious disease? In other words, will being tattooed oneself have any effect on one's implicit attitude toward other tattooed people—will there be a significant difference in the D statistic (i.e., IAT effect) between participants with tattooing and non-tattooed participants? Second, will participants who report a positive or neutral attitude toward tattooed people still associate tattooing with infectious disease?

Theoretical Framework

The general research framework that supports the current research is evolutionary psychology. It should be understood that evolutionary psychology is not a sub-discipline of psychology; it is a research paradigm that can be productively applied to virtually any aspects of

psychology (Cosmides & Tooby, 1997). It is an approach to psychology which utilizes the findings and insights of evolutionary biology and cognitive psychology to understand the structure and workings of the human mind and human behavior. Because all manifest behavior depends on underlying psychological mechanisms, the central task of psychological research is the discovery, description, and explication of these mechanisms (Buss, 1995). Moreover, natural selection is the only known causal process capable of producing complex psychological mechanisms. Accordingly, the most effective way of identifying, describing, and understanding psychological mechanisms is to identify their function—what was the specific adaptive problem they evolved to solve. An explanatory hypothesis for a behavior (e.g., stigmatization of tattooed people) must begin with a hypothesis of how that behavior would, on average, have increased inclusive fitness for the organism exhibiting that behavior (Pinker, 2016). Tooby and Cosmides (2005) explained that these evolved psychological mechanisms are neural circuits in the brain, which function as computational programs that process information. According to Buss (1995), an evolved psychological mechanism is a set of processes carried out inside the organism. Such mechanisms exist in the form they do because they solved a recurrent survival or reproductive problem in the environment of evolutionary adaptation (EEA; Bowlby, 1969/1982; Hagen, 2002). These psychological mechanisms will accept only specific kinds of informational input and will transform that input through decision rules (also known as Darwinian algorithms or heuristics) to behavioral or cognitive output.

The adaptive behavioral system (ABS; D. W. White, Dill, & Crawford, 2007) is a theoretical frame of reference which organizes and analyzes behavior within a more comprehensive evolutionary framework. An ABS uses tactics directed by a hypothesized construct, the evolved processing unit (EPU). White et al. explained the EPU by analogy with a

computational central processing unit (i.e., the hardware) which runs Darwinian algorithms (i.e., the software). Developers of the ABS assumed that mechanisms yielding behavioral output are adaptations. Moreover, the developers assumed that the mechanism is a product of natural selection which evolved because it served inclusive fitness in the EEA. Consequently, the ABS process begins, as suggested by Buss (1995) and Simpson and Campbell (2016), by looking at the function of behavior in terms of adaptive problems it was designed to address. Although all adaptations must ultimately be understood in terms of their impact on inclusive fitness, the ABS must be understood in terms of the specific adaptive problem it was designed by natural selection to solve.

White et al. (2007) offers several examples to demonstrate how behaviors can be captured by the ABS framework. At least one EPU is postulated for each adaptive problem, such as avoiding toxic food. More specifically, the adaptive problem is avoiding ingestion of allyl isothiocyanate, a colorless oil responsible for the pungent taste of cruciferous vegetables, such as broccoli, cabbage, and rutabaga which serves the plant as a defense against herbivores (Williams, Rayburn, Cline, Sauterer, & Friedman, 2015). According to White et al., the strategy is the expulsion of food ingested containing allyl isothiocyanate. In this case, the EPU is a group of neurons sensitive to allyl isothiocyanate which activates vomiting, spitting and gagging when they fire. The heuristic or decision rule will be gag, spit, vomit if allyl isothiocyanate is detected. The predicted behavioral output is gagging, spitting, and vomiting whenever rutabaga or other cruciferous vegetables are ingested.

Another example offered by White et al. (2007) of a general adaptive problem is avoiding infectious disease. In this case, the general adaptive problem is survival. The specific problem is sustaining sound health by avoiding infectious disease. The strategy is to avoid potential vectors

of pathogens. The EPU includes sets of neurons which record memories (e.g., physical appearance, including morphology, coloration, and odors) of typical in-group members; sets of neurons which compare an encountered conspecific to memories of typical in-group members and fires when a discrepancy is detected; sets of neurons which trigger an emotional state such as disgust and other avoidance cognitions and behaviors such as stigma. The heuristic would be to avoid conspecifics exhibiting behavioral or physical features judged to be normatively unusual. The tactics would be encoding, retrieval, and comparison of memories. Predicted behavior would be stigma toward and avoidance of those who are asymmetrical, disabled, foreign, strange, or in some way aberrant or atypical.

Wolfe, Dunavan, and Diamond (2007) claimed that infectious disease has been a threat to humans throughout recorded history and presumably for the whole of hominid history. Because infectious disease would have exacted such a high cost in fitness, there would have been significant selection pressure on populations living in the EEA to evolve mechanisms that would address such high fitness cost. The body's immune system is perhaps the most obvious example—a system of physiological mechanisms designed to identify pathogens that have entered the body and organize a response to eliminate the infection (Schaller, 2011). The body's immune system has obvious fitness benefits; however, it also exacts substantial metabolic costs. When fighting an infection, the body is consuming large quantities of caloric resources that could be used to satisfy other metabolic needs. An immunological response can cause high fever and fatigue, leaving the organism open to exploitation and predation. Moreover, an immunological response is reactive—initiated only after pathogens have entered the body.

Considering the costs and limitations of the immunological defense system, Schaller (2011) argued that substantial fitness benefits would be gained from a proactive system that

directed the organism's behavior to avoid pathogens before they entered the body. A set of such prophylactic mechanisms permit organisms to identify the likely presence of infectious pathogens in their immediate environment and to activate behaviors (e.g., stigmatization) that inhibit proximity with pathogens. Like the physiological immune system, characterized by modules consisting of physiological responses to perceptual cues indicating pathogens present in the body, the BIS is also sensitive to perceptual cues in the immediate environment and upon detection will initiate cognitive, emotional, and behavioral responses aimed at pathogen avoidance.

As suggested above, evolutionary psychology is the study of human behavior informed by the knowledge of evolutionary biology, as such, psychology is a biological science (Cosmides & Tooby, 1997). Darwin (1859/2004) offered a theory of evolution that explained the functional design features of organisms. His theory of natural selection is a simple causal explanation for the relationship between adaptive problems recurrently faced by hominids living in the Pleistocene (a period from two million to 11 thousand years ago) and design features of organisms. An adaptive problem can be understood as an ecological circumstance that affects the reproductive success of an organism, examples include finding a proper mate, locating nutritious food, finding shelter, and avoiding infectious disease (Cosmides & Tooby, 1992). The logic of evolutionary theory is both simple and compelling. Evolution by natural selection depends on two integral factors: heritable variation and differential reproductive success (Workman & Reader, 2004). Heritable variation refers to the fact that within a population individuals differ in ways that are passed on to their offspring and differential reproductive success simply means that certain individuals will have more surviving offspring than other individuals. Given these two factors suppose that a chance mutation caused a slight alteration in the anatomical or

physiological design of the organism. Although most mutations either do not affect the overall functioning of the organism or they are harmful to the organism, nevertheless, they are sometimes useful to the organism (Gangestad, 2008). That is, such chance mutations can on occasion provide a solution or an improvement to an existing solution to an adaptive problem. For example, a slight improvement in muscle reflex speed might help the minnow escape the predatory bass. Such a mutation would give the minnow an adaptive advantage, that is, improved differential reproductive success in which muscle reflex speed is passed on to offspring via heritable variation. Over time the improved reflex will propagate through the entire species.

Research Question

The purpose of the study was to determine whether the perception of tattooed people will trigger a BIS reaction. Moreover, exploration of BIS parameters has increased the general understanding of the function of this complex of psychological mechanisms. Additionally, exploring this system has also increased the general understanding of evolutionary psychology and produced, at least tentatively, explanations for some puzzling aspects of contemporary human behavior, including stigmatization. The following research questions have guided this study.

Q1. Will participants implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Q2. Will participants who report having tattoos themselves implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Q3. Will participants who self-report either a neutral or positive attitude toward tattooed people implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Hypotheses

$H1_0$. Participants do not implicitly associate disease connoting concepts with the perception of tattooed people.

$H1_a$. Participants implicitly associate disease connoting concepts with the perception of tattooed people.

$H2_0$. Participants who report having tattoos themselves will not implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

$H2_a$. Participants who report having tattoos themselves will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

$H3_0$. Participants who self-report either a neutral or positive attitude toward tattooed people will not implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people.

$H3_a$. Participants who self-report either a neutral or positive attitude toward tattooed people will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Nature of the Study

The research was a quantitative, quasi-experimental study that examined a conjectured relationship between tattooed people, stigmatization, and the BIS (Kurzban & Leary, 2001; Neuberg & Schaller, 2016; Oaten, Stevenson, & Case, 2011; Tybur & Lieberman, 2016). The research design made use of a validated measure which has been used in previous studies concerned with implicit attitudes. The Implicit Association Test (IAT; Greenwald et al., 1998) was used to measure participants' implicit associations between perception of significant

tattooing and the emergence of disease connoting concepts into working memory compared with their associations between non-tattooed people and health connoting concepts. A statistically significant association between disease connoting concepts and perception of tattooed people was found and thus, constituted a confirmation that a BIS reaction has occurred.

In the context of this study, cognition, emotion, or behavior was interpreted as a behavioral manifestation of an underlying BIS mechanism, designed by natural selection, the function of which is to identify and avoid conspecifics exhibiting heuristic cues signaling infectious disease. Because being able to identify and avoid carriers of infectious disease would afford a fitness advantage, stigmatization is best construed as an adaptation aimed at managing threats associated with sociality, the threat of infectious contagion being one example among many types of threats (Neuberg et al., 2011; Neuberg & Schaller, 2016; Schaller & Neuberg, 2012). BIS reaction to significant tattooing is consistent with and therefore, tends to be a confirmation of the thesis that stigmatization is an evolved adaptation the purpose of which is infectious disease threat-management.

The independent variable is tattooing which has two levels—photographic models with significant tattooing and photographic models without tattooing. Thus, the independent variable will be operationalized as tattoos either present or absent in photographs of experimental models. The dependent variable will be health connoting concepts and disease connoting concepts that will be associated with the presentation of the independent variable. The dependent variable will be operationalized as IAT scores (i.e., *D* statistics) which measure degrees of correlation between perception of significant tattooing and disease connoting concepts and perception of non-tattooed models and health concepts or the reverse of these relationships.

Significance of the Study

Because all manifest behavior depends on underlying psychological mechanisms the central task of psychological research is the discovery, description, and explication of these mechanisms (Buss, 1995). Moreover, natural selection is the only known causal process capable of producing complex psychological mechanisms. Accordingly, the most efficacious way of identifying, describing, and understanding psychological mechanisms is to identify their function—what was the specific adaptive problem they evolved to solve.

For the purposes of this study, stigmatization will be understood as a cognitive, emotional, or behavioral manifestation of an underlying attitude toward certain classes of conspecifics, although the underlying attitude is frequently opaque to introspection. The behavior associated with stigmatization is typically rejection or avoidance of certain classes of conspecifics. Why would ultra-social Homo sapiens have evolved such an anti-social mechanism? What was the adaptive problem stigmatization evolved to solve?

It has been conjectured that infectious diseases have likely caused more deaths than all non-infectious diseases, natural disasters and wars combined (Inhorn & Brown, 1990). Under such extreme selection pressure, hominids evolved adaptive mechanisms aimed at combating infectious threats. This research aimed at increasing theoretical understanding of stigmatization and an increased knowledge of the overall nature of the BIS. Additionally, this research has contributed to the general theory of evolutionary psychology. No research is known to have examined the relationship between significant tattooing, stigmatization, and the BIS. This study is the first to postulate that stigma toward tattooed people is best explained as an adaptation evolved for the purpose of infectious disease threat-management.

Definition of Key Terms

The following are definitions of terms used in this research. Each definition is consistent with the empirical research literature.

Behavioral immune system. The behavioral immune system (BIS) is a proactive response to the threat of contagious disease. Unlike the physiological immune system, which reacts to pathogens which have entered the body, the BIS is a suite of psychological mechanisms designed to detect and avoid pathogens before they enter the body. The BIS is activated by the perception of specific kinds of stimuli such as morphologically atypical appearance in conspecifics (Schaller & Duncan, 2007).

Cognitive module. A genetically specified computational device in the brain or mind that generally operates independently and automatically on inputs associated with a specific cognitive domain (Sperber, 1994).

The computational theory of the mind. The basic idea is that thinking is a form of computation. The brain is understood as a computer and the mind understood as the computer program which is the finite description of an algorithm which prescribes a set of distinct actions that yields outputs based on inputs and system internal states (Fodor, 1983; Pinker, 1997).

The environment of evolutionary adaptation (EEA). This construct encompasses the selection pressures faced by hunter-gatherers living in their ancestral environments and the prevailing conditions at the time the problems were faced (Tooby & Cosmides, 2005).

Error management theory. A theory that proposes the utility of cognitive biases in which psychological mechanisms evolved to be predictably biased under conditions of uncertainty such as a single detection problem when heuristic cues are difficult to interpret causing the BIS to be prone to false identifications. When a signal detection problem occurs error

management theory predicts that a bias will develop to minimize the type of error with the greatest cost in fitness (Haselton & Buss, 2000).

Functional flexibility. Although psychological mechanisms typically operate automatically they do not operate invariantly. Psychological mechanisms are characteristically very flexible and predictably affected by environmental cues. In the case of BIS mechanisms, perceived vulnerability will cause an increased sensitivity to heuristic cues signaling possible infection (Schaller & Duncan, 2007).

Heuristic. It has been conjectured that there are two distinct cognitive systems for reasoning and judgment—system 1, heuristic and system 2, analytic (J. Evans, 2008). System 1, heuristic cognition is very old in evolutionary terms and is conjectured to be shared with other animals; it is unconscious and automatic. Moreover, heuristics are generally understood as modules in the Fodorian sense. System 2, analytic reasoning is slow, sequential, and makes use of working memory. It is recent in evolutionary history and is uniquely human; it allows abstract and hypothetical thinking (Carruthers, 2006).

Massive modularity hypothesis. The massive modularity hypothesis refers to the tendency for numerous domain-specific modular programs to evolve, each being the solution for a specific adaptive problem (Carruthers, 2006; Fodor, 1983).

Salience. The salience of an object is the characteristic by virtue of which it stands out relative to neighboring perceptual data. Saliency detection is thought to be an important psychological adaptation that enables organisms to focus their attention on what is most germane to their survival among sensory data. Disease salience refers to an increased vigilance or sense of vulnerability to infectious disease (Mortensen, Vaughn Becker, Ackerman, Neuberg, & Kenrick, 2010).

Satisficing. A cognitive heuristic that entails searching through available alternatives, ignoring much and likely most of the environmental information, until a good enough solution is found. A satisficing heuristic solution is contrasted with an optimal solution, a strategy specifically aimed at finding the best solution (Simon, 1955).

Signal detection problem. A problem that occurs because heuristic cues are difficult to interpret causing the BIS to be prone to false identifications—identifying healthy people as infectious and conversely, infectious people as healthy. When a signal detection problem occurs error management theory predicts that a bias will develop to minimize the type of error with the greatest cost in fitness—identifying an infectious disease as healthy (Kurzban & Aktips, 2006).

Stigmatization. C. P. Jones (1987) argued that the original use of the Greek word stigma referred to what is today meant by tattoo applied with needle and ink and not, as is frequently claimed, a mark or brand impressed by an iron or other means (e.g., Goffman, 1963; Pryor, Reeder, Yeadon, & Hesson-McInnis, 2004). Contemporary discussions of stigma originate almost entirely with Goffman (1963) who defined stigma as "an attribute that is deeply discrediting" (p. 3). Goffman's perspective is that of the stigma recipient, that is, the stigmatized person. The current study will reverse this perspective and focus on stigmatization as a behavioral manifestation of a negative attitude which functions as a socially exclusionary mechanism aimed at the avoidance of conspecifics heuristically signaling infectious disease. Stigmatization (and prejudice) will be operationalized as scores on the IAT.

Tattooed Person. In distinction to "people with tattoos," who have only one or two tattoos in places where they can be easily concealed, the "tattooed person" characteristically has many brightly colored and imprudent tattoos in obvious places. The tattooed person has made the decision to go beyond a point of no return, entirely accepting social marginalization (Bell, 1999).

The expression “significant tattooing” may be used in lieu of “tattooed person” and should be considered synonymous for the purposes of this paper.

Voluntary disfigurement. Voluntary disfigurement is a condition to be contrasted with involuntary disfigurement (e.g., accidental amputation) which can include tattooing, scarification, piercing, face painting (e.g., war paint and clown faces; S. Graham, 2015).

Summary

Because infectious disease can exact such a high-cost in fitness and can manifest in such a wide range of symptoms, disease detection and avoidance modules must be designed to respond to the widest possible range of cues that suggest the possibility of pathogens. Just as obesity, old age, birthmarks, physical disabilities, and other disfigurements are read as pathogenic by the disease avoidance module, it is conjectured that tattooing will also trigger BIS mechanisms. Pending empirical testing, it is conjectured that the disease avoidance system will not differentiate between voluntary and involuntary disfigurement.

Because BIS mechanisms are believed to be modular in nature and, thus, operate automatically and unconsciously, BIS induced attitudes will likely be unavailable to introspective self-reports. For this reason, it will be necessary to use an indirect research method capable of circumventing the opaque nature of implicit attitudes and the often cited foibles associated with self-report measures (Latkin et al., 2016). The most commonly used implicit measure of attitudes are those based on response time measurement (Wittenbrink & Schwarz, 2007).

The Implicit Association Test (IAT; Greenwald et al., 1998) is based on the assumption that tasks are easier (i.e., more accurate and faster) when they reflect cognitive associations that are familiar and well-rehearsed as compared with tasks that are atypical and conflict with well-

rehearsed associations (Rudman, 2011). Although it cannot be categorically denied that fixed associations might be the product of social learning, it seems unlikely that humans "learned" to stigmatize the old, the obese, and the disabled. Using abductive reasoning, it is more likely that modular neurological mechanisms functioning automatically and unconsciously are a better explanation. That is, the modular hypothesis has greater explanatory power than social learning. Indeed, social learning has no explanatory power in this case. Although it can account for the transmission of a behavioral attribute from one generation to the next (e.g., stigmatizing old people), it cannot account for the origination of the behavior. Why would such a practice have begun in the first place? On the modular hypothesis, the practice evolved as a solution to a reliable threat to fitness encountered in the EEA. Even though stigmatization is, perhaps, no longer adaptive in a contemporary environment, it persists, nevertheless, as a psychological fossil. Attitudes can certainly be moderated by social learning—we can learn not to be unkind to old people. However, if ageism is the product of impenetrable psychological mechanisms then the social learning is no more than an acquired need to control one's behavior superimposed on more primitive psychological mechanisms, the implicit attitude being unaffected, although, likely driven out of explicit awareness as a result of social pressure.

Chapter 2: Literature Review

The purpose of this literature review is to explore the functional contours of the behavioral immune system (BIS), the pathogen disgust system, stigmatization, and the relationships that exist between each and how these relationships are to be understood within the framework of evolutionary psychology. The goal of the research has been to determine whether the perception of significant tattooing will cause a BIS reaction, manifesting as disgust, stigmatization, or other similar constructs. Research participants were US citizens between the ages of 18 and 65 years (N = 328) who volunteered at the Project Implicit web site. Participants were tested to explore a hypothesized link between tattooed people, BIS reaction, and stigmatization. To identify people who tend to associate perception of significant tattooing with disease connoting concepts, the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) was used. The IAT measured response latencies of associations between perception of tattooed people and disease connoting concepts as compared with the perception of non-tattooed people and health connoting concepts. The IAT is based on the assumption that people accomplish tasks faster and with greater accuracy when the tasks are based on well-established cognitive routines, as compared with unpracticed tasks.

Documentation

The literature search is primarily a product of the Northcentral University Library Roadrunner Discovery search tool. The search focused on key terms including evolutionary psychology, disease management system, behavioral immune system, stigmatization, socially exclusionary psychological mechanisms, computational theory of mind, information processing

system, modularity, implicit attitudes, implicit association test, heuristics, optimality, overgeneralization, infectious disease, intergroup attitudes, xenophobia, and numerous others.

The Standard Social Science Model

The view that human behavior is to be explained exclusively as the result of sociocultural factors, disregarding or even proactively denying that biology had any effect on behavior, gained hegemony during the first half of the twentieth century (Carroll et al., 2017). It is this conceptual foundation for the social sciences that has resulted in them being, what Tooby and Cosmides (2016), described as "a stew of mutually contradictory claims, with no theoretical unity or clear progressive direction" (p. 4). Since the development of cognitive psychology and the information processing model, that is, the interpretation of cognitive functioning in terms borrowed from computer science, the evolutionarily based social sciences have been working to correct this view, which they generally consider to be a serious misconception (Carroll et al., 2017). This traditional conceptual foundation for the social sciences has been called the Standard Social Science Model (SSSM or Standard Model) by Tooby and Cosmides (1992). A model which, they insisted, is based on a number of dubious assumptions about the human psychological architecture. This study is based on the assumption that a negative reaction (e.g., stigmatization, prejudice, and related affect, cognition, and behavior) directed toward tattooed people is not entirely the result sociocultural factors as postulated by the Standard Model, but is better explained as a nurture-nature interaction, that is, a combination of sociocultural and biological factors working in unison.

In place of the Standard Model, Tooby and Cosmides (1992, 2016) proposed a progressive evolutionarily informed model which takes account of nurture-nature interaction and the computational theory of mind, an approach which they characterized as an Integrated Model.

The fundamental issue here is a contemporary social science iteration of the classical epistemological problem of empiricism versus rationalism that concerns the extent to which knowledge acquisition is dependent upon sense perception. Given the historical magnitude of this basic problem and its impact on contemporary psychology, a brief historical digression will be helpful to fully understand this important issue.

The rationalist Plato believed that genuine knowledge was a product of innate ideas, described by Plato as eternal Ideas or Forms (i.e., universals) acquired by the immortal soul during its tenure in a previous existence (S. Graham, 2010). A view rejected by the empiricist Aristotle who claimed that our knowledge of universals is an abstract generalization based on our sense experience of particulars—I have an idea (i.e., an abstract concept) of circularity because I have seen many circular objects. Thomas Aquinas, an ardent Aristotelian, proclaimed "There is nothing in the mind that was not first in the senses" (as cited in Tooby & Cosmides, 2016). A dominant issue of modern philosophy, the British empiricists Locke, Berkeley, and Hume were opposed by the Continental rationalists Descartes, Leibnitz, and Spinoza (Stumpf & Fieser, 2008).

The contemporary idea that human behavior is the product of social conditioning has its origin in the classical associationism of the British Empiricists, especially Locke and Hume (G. Graham, 2016). According to classical associationism, intelligent behavior is the product of associative learning. As a result of associations made between ideas and perceptual experiences, the individual gains knowledge of their environment, the causal structure of their environment, and how to behave in that environment. For the British Empiricists, there were no innate principles or ideas in the mind.

It should be noted that epistemological (or scientific) empiricism is the view that knowledge claims are to be justified by an appeal to reason and experience; it does not entail the claim that all knowledge comes from experience (Botterill & Carruthers, 1999). Developmental empiricism is a general hypothesis concerned with cognitive development. Developmental empiricism or more generally the Standard Model is the view that human cognition is a product of individual exposure to environmental experiences. The Standard Model holds that there are only a small number of innate psychological capacities for processing environmental input. Moreover, the psychological mechanisms capable of processing environmental input are general in nature, in that the same capacity can be applied to representations of many different kinds (Botterill & Carruthers, 1999, p. 51).

In the late eighteenth century, Immanuel Kant proposed a radically innovative hypothesis. Before Kant, it was presumed that knowledge must conform to the objects of knowledge. Our subjective experience of an object was to some degree a copy of an object in the external world (i.e., an object independent of consciousness). It was believed that our senses gave us knowledge of external reality. Kant reversed this process and proposed that objects must conform to the structure of our mind. He claimed that the empirical postulate, that all knowledge comes from experience, was insufficient to account for all human knowledge (S. Graham, 2012). Kant confesses that it was David Hume, "which first interrupted [his] dogmatic slumber" (p. 8). Hume had called into question the logical status of the concept of causality. In keeping with the empirical thesis, Hume claimed that "it is impossible for us to think of anything which we have not antecedently felt, either by our external or internal senses" (Hume, 2009, p. 74). Hume points out that there seems to be a universal idea of causality; an idea that some antecedent event is necessarily and predictably the cause of some consequent event. What, asks Hume, is the origin

of this idea? What is the impression that gives rise to this idea of causation? He insists that there is no such impression. What Hume is saying is that if all knowledge comes from experience, and there is no experience of causation, then there is, by hypothesis, no knowledge of causation. Our experience of causation is really no more, Hume claimed, than some antecedent event A, regularly followed by a consequent event B. What we choose to call causation is actually a regular association or constant conjunction, and not a necessary connection. Hume's account of causation undermines the very possibility of induction which is based on the assumption that the future will continue to be like the past. If there is no rational grounds for believing this, then there is, a fortiori, no rational bases for science.

Kant responded to Hume's skeptical attack on causation by arguing that even if there are no empirical grounds for our idea of causation, still, causation is clearly an ineluctable feature of our experience and, thus, must be the result of an innate feature of our mind (Kant, 1950/1748). Kant believed that we have no immediate or direct access to the supposed world that exists beyond our conscious mind, what he called the noumenal world that is furnished with Ding an sich (things-in-themselves). All that we can know in an immediate sense is our own subjective mental life, what Kant called the phenomenal world, i.e. the world of appearances that is, in part, the result of the noumenal world, but also in part the result of contributions of the mind. According to Kant, our mind actively structures experience in terms of various (innate) categories, which include time, space, and causality. Thus, our experience always has a temporal and spatial organization. Likewise, our experience is always structured in a causal sequence, not because the noumenal world includes such features, but because our mind structures experience in this way. What was important for the future of psychology was Kant's basic insight that the mind contributes in a very significant way to what is experienced as reality.

It is worth noting that gestalt psychology seems to have been suggesting an idea very similar to Kant's view (S. Graham, 2012; Hergenhahn, 1997). Both agreed that conscious experience amounted to more than the sum of elements that composed it. Similarly, they believed that it was impossible to reduce conscious experience to individual sense data without the loss of what was essential in the lived-experience. Moreover, both claimed there is a significant difference between perception and sensation. The difference issued from the mind or brain's disposition to organize or structure sensory input into meaningful configurations. Consequently, the world as we experience it is always more than what is given in mere sensation.

Another voice in conflict with Locke and the developmental empiricists' notion that experience is the sole source of knowledge and the complete determinant of human behavior was that of William James (1890/1962). At the beginning of the ninetieth century, James had just published his Principles of Psychology detailing his psychological theory which was based on a system of instincts. James defined instincts as "the faculty of acting in such a way as to produce certain ends, without foresight of the ends, and without previous education in the performance" (p. 392). Instincts can be understood in current psychological vernacular as genetically encoded dispositions to behave in a particular way given a particular set of environmental conditions. This characterization is quite consistent with the more recent characterization of modular mechanisms embodied in neurological material in which environmental input is converted via Darwinian algorithms to behavioral output. The essential point regarding Jamesian instincts is that they are adaptations evolved to solve recurrent problems encountered in ancestral environments (Buss, 2015).

Unlike James who argued that humans have many instincts, Watson (1924) believed that humans have very few instincts and what few they do have are very general nature. Moreover,

Watson believed he could explain why this was the case. He was probably the first important psychologist to adopt Locke's view that all knowledge comes from experience. As a behaviorist, Watson argued that an all-purpose mechanism called classical conditioning would associate two unrelated events (Buss, 2015). Classical conditioning is exemplified in Pavlov's experiment with a dog that came to associate food with the ringing of a bell (Pavlov, 1927). A decade after Watson, Skinner (2009/1974) proposed a new kind of behaviorism based on the principle of operant conditioning, according to which the positive reinforcement of behavior would tend to produce similar behavior in similar circumstances. Behavior followed by negative reinforcement would tend to extinguish such behavior in similar circumstances. Consistent with the general thesis of developmental empiricism, the behaviorists viewed the mind as essentially a tabula rasa and the only innate property the mind can be said to have is little more than a general capacity to learn.

Skinner (1957) was the first to offer a scientific explanation of language acquisition. His linguistic theory was closely related to his general theory of learning (i.e., behaviorism). He claimed that language acquisition was determined by two factors: the totality of environmental features affecting the child and the child's history of reinforcement. Accordingly, Skinner claimed that children acquired language by associating words with a meaning based on a schedule of reinforcement. Correct associations elicit positive reinforcement from which the child eventually learns the communicative value of words. For example, if the child points to a dog and utters the sound "doggie" the mother will smile and say "good boy" (Ambridge & Lieven, 2011). The child will find this experience positively reinforcing and associate the word "doggie" with the perception of a dog.

Scarcely two years after the publication of Skinner's Verbal Behavior, Noam Chomsky

(1959) published a ruinous critique of Skinner's work. Chomsky's most compelling argument was based on what is most commonly known as the poverty of stimulus argument, although it is also known as Plato's problem and the problem of acquisition (Botterill & Carruthers, 1999). According to Chomsky (Chomsky & Foucault, 1976/1971), a person that has acquired a language has been exposed, during the course of his life, to a certain amount of experience of a language. The problem, claimed Chomsky, is to account for the gap between the small and adulterated sample of language available to the language learner and "the very highly articulated, highly systematic, profoundly organized resulting knowledge" the learner is able to derive from such a niggardly sample (p. 3). Even individuals with exceedingly different language experiences, what Skinner characterized as his first essential factor (i.e., the totality of environmental features affecting the child) even very substantial variation will, nevertheless, yield systems congruent to one another. What is more, of languages studied so far, there is a striking similarity in the kinds of systems that emerge given the vast differences in environmental features to which the language learner is exposed. Chomsky contends there is but one possible explanation—the language learner contributes the preponderance of both the general schematic structure and content of the knowledge that has been derived from such an exiguous experience of language. It should be noted that Chomsky is making a suggestion very similar to Kant and the Gestaltists. The properties of this system of knowledge the child brings to language learning, Chomsky calls, an innate language or instinctive knowledge. As a brief summation, there is simply insufficient experiential data to support Skinner's theory of language and a fortiori the Standard Model.

The Standard Model is based on the assumption that the mind is a tabula rasa and all behavior is explained as a product of associative learning originating in external sociocultural

sources (Buss, 2015). Reports of cultural variability coming from anthropologists and other social scientist doing field work were taken as an important confirmation of the thesis that human behavior was the product of sociocultural sources. In 1925 Margaret Mead journeyed to Samoa to conduct a study of heredity and environment among "civilized and primitive" adolescents (Freeman, 1992). She hypothesized that if an exception could be found to a conjectured universal behavior, then such an exception would be a confirmation that the behavior in question was not the result of innate psychological mechanisms but entirely the result of sociocultural factors. Mead found the confirmation for which she was searching and published her findings in *Coming of age in Samoa* (Mead, 1928). According to Freeman (1992) "if she had been correct it would have been the most important conclusion of twentieth-century anthropology" (p. 25). However, claimed Freeman, it is now known that her findings were entirely false. The adolescent Samoan girls that Mead interviewed had played a prank, claiming Samoan adolescent girls were sexually promiscuous, attitudes and behavior the exact opposite of the actual practice of Samoan girls. Although there continues to be controversy over the validity of Mead's findings, no refutation of Freeman's analysis has been forthcoming to date.

Another important study that conflicts with the Standard Model is the research conducted by Harlow (1971) and his colleagues. In one experiment, infant monkeys were separated from their mothers six to twelve weeks after birth and raised by surrogate mothers. The infant monkeys were provided two versions of the surrogate mother. One made of wire mesh and the other made of wood covered with soft terry cloth. The wire mesh mother was equipped with a nipple from which the infant nursed. Behavioral theory predicts that because the mother is the source of nourishment (i.e., positive reinforcement) the infant should form an attachment to the mother. However, contrary to behavioral theory, the infant monkey would spend the greatest

amount of time clinging to the cloth mother. When frightened, the infants ran to the cloth surrogate, not, as would be predicted by behavioral theory, the wire mesh mother. Clearly, Harlow's experiments produced important evidence that, contrary to the Standard Model, the primary reinforcement was not necessarily the principal determinant of all behavior.

Theoretical Foundation

Tooby and Cosmides (2005) claimed that evolutionary psychology is a framework whereby the principles and findings of evolutionary biology can be applied in research aimed at understanding the structure of the human mind—the primary research focus of evolutionary psychology. From the perspective of evolutionary psychology, the mind is seen as a collection of information-processing modules, embodied in neural tissue, evolved by natural selection to solve recurrent problems faced by hominids living in the EEA.

According to Tooby and Cosmides (2016) if one is to understand the functional nature of the mind it is important to remember that the psychological mechanisms that constitute its structure did not evolve to solve problems of contemporary humans—they evolved to solve recurrent problems faced by hominids living in the Pleistocene. The programs that evolved did so in response to conditions that were reliably present in the ancestral environment. Some of the recurrent problems faced by hominids living in the EEA included hunting, gathering, avoiding predators, finding a mate, protecting children, navigating the land, and avoiding infectious disease. Predicated on these assumptions, the evolutionary psychologist approaches the study of the mind through a process of reverse engineering. After specifying an adaptive information-processing problem like the avoidance of infectious disease, a task analysis follows in which properties are identified that would be required to solve that problem. This approach allows the

researcher to generate hypotheses about how the mind is structured which are capable of being tested.

Tooby and Cosmides (2016) proposed a number of important postulates underpinning evolutionary psychology. Each anatomical feature of the body evolved to carry-out a specific function. The brain is a computer composed of programs designed by natural selection to extract information from the environment, process that information, and use the output to regulate physiology and generate emotions, cognitions, and behavior, generally aimed at serving inclusive fitness. Thus, manifest behavior is a product of computational operations by uniquely structured computational programs designed by natural selection. In order to understand system output, including emotions, cognitions, and behavior, it is necessary to know the informational input and the nature of the programs that process the input. The collection of programs that constitute the brain evolved in the EEA as a result of specific environmental conditions and selection pressures exerted on ancestral hominids. Each program exists because it yielded emotions, cognitions, and behavior that served inclusive fitness for ancestral hominids. Tooby and Cosmides (2016) explained that natural selection would not have produced a limited number of domain-general programs; rather, the evolutionary process would have produced a large number of very specialized programs. The tendency for numerous domain-specific programs to evolve, each being a solution for a specific adaptive problem, is referred to as the massive modularity hypothesis (Carruthers, 2006; Fodor, 1983). Although there is considerable controversy over the exact nature of modularity, there is consensus on many points, specifically, information encapsulation, domain-specificity, automaticity, and opacity to introspection. Information encapsulation refers to the idea that information-processing within a module is shielded from

outside information flowing into the module and thus, is unaffected by outside information. The Müller-Lyer illusion (Figure 1) is an example of how modular information-processing is

Figure 1. Muller-Lyer Illusion

unaffected by outside information. Awareness that the Müller-Lyer illusion is an illusion and the parallel lines are of equal length does not affect visual processing—the lines continue to appear unequal (Zeman, Obst, Brooks, & Rich, 2013).

In an experiment by Denes-Raj and Epstein (1994) participants were offered a chance to win a dollar by drawing a red jelly bean from one of two jars. One jar contained a greater absolute number of red jelly beans but a smaller percentage (7 in 100), while the other jar contained a smaller absolute number but a higher percentage (1 in 10). Participants claimed to know that their chances of drawing a dollar winning red jelly bean were greater if they drew from the 1 in 10 jar, nevertheless, most participants chose to draw from the 7 in 100 jar. As with the Muller-Lyer illusion, such behavior is likely best explained in terms of modular information encapsulation where the module is shielded from outside information and thus, unaffected by such information (i.e., explicit knowledge that probability of successfully drawing a red jelly bean is greater if selection is made from the 1 in 10 jar). The tendency to go after the greatest absolute number is indicative of a heuristic that yielded a satisficing solution.

Similarly, information encapsulation likely best explains the tendency to react with disease avoidant responses to individuals exhibiting symptoms such as obesity, birthmark, homosexuality, and disability, explicitly known (in a contemporary environment) not to be contagious. Heuristic processes can be circumvented by analytic reason but it does not cancel out

the effects of heuristic processes, that is, we continue to perceive the lines as unequal even though they are explicitly known to be equal. Because of information encapsulation, our conscious analytic knowledge does not penetrate the module which is shielded from such outside information.

Domain-specificity is the idea that each module evolved to solve one specific adaptive problem (Robbins, 2010). Because the process is independent of conscious control, initiated as a function of the processing algorithm upon receipt of informational input, the process is automatic. Opacity to introspection, also referred to as impenetrability, refers to the fact that the process is largely unavailable to conscious awareness or conscious control.

Because all manifest behavior depends on underlying psychological mechanisms the central task of psychological research is the discovery, description, and explication of those mechanisms (Buss, 2015). Because natural selection is the only known causal process capable of producing complex psychological mechanisms, the most efficacious way of identifying, describing, and understanding such mechanisms is to identify their function—what was the specific adaptive problem they evolved to solve. These evolved psychological mechanisms are embodied as neural circuits in the brain, which function as computational programs that process information (Fodor, 1983; Kurzban & Aktips, 2006; Tooby & Cosmides, 2016). Such mechanisms exist in the form they do because they solved a recurrent survival or reproductive problem in the EEA. These psychological mechanisms will accept only specific kinds of informational input and will transform that input through decision rules into emotional, cognitive or behavioral output.

The Behavioral Immune System

Infectious disease imposed significant selection pressure on ancestral populations. According to Fumagalli et al. (2011), infectious disease is perhaps the most important cause of human mortality. They claimed that adaptation to local environments is a crucial factor in determining human genetic variation across geographically diversified populations. For example, among human populations heat adaptation has been correlated with precipitation, temperature, and latitude. Infectious disease imposed significant selection pressure on ancestral populations resulting in a variety of adaptations designed to mitigate fitness costs (Schaller, 2011). The most obvious of these adaptations is the physiological immune system designed to detect and eliminate pathogens which have entered the body. Although the physiological immune system has obvious fitness benefits, it also exacts serious metabolic costs. Sheldon and Verhulst (1996) found that organisms have evolved a large variety of adaptations to fight infectious parasites, all of which require metabolic resources that the organism might have used for some other metabolic purpose. Sheldon and Verhulst argued that it is entirely reasonable to assume that the physiological immune system is very costly to the host. Moreover, the physiological immune system is reactive, prompted to action only after infectious pathogens have entered the body. Because of the high costs associated with the physiological immune system additional fitness benefits would be gained from a proactive immune system, that is, a system that prompted the organism to avoid pathogens before they entered the body (Schaller, 2011). Such a proactive disease avoidance system was proposed by Schaller (2006), calling it the behavioral immune system (BIS). The BIS is a suite of psychological mechanisms that induce adaptive behavioral responses to environmental cues heuristically suggesting the presence of pathogens. When a cue

heuristically indicating a risk of infection is detected, a series of adaptive reactions are initiated which can include emotional, cognitive, and behavioral responses (Schaller, 2011).

The Parasite-Stress Theory of Sociality

Over four decades ago Jerison (1973) proposed the thesis that, when compared with other animals, primates have especially large brains relative to their body size. In recent years a consensus has emerged that the large primate brain evolved because of primate ultrasociality, that is, the primate brain evolved to manage their complex social organization—an explanation which has come to be known as the social brain hypothesis (Dunbar, 2009, 2014). Thornhill and Fincher (2014) who have argued for a more encompassing scope for the BIS claimed their "hypothesis is a parasite-based version of the social brain hypothesis" (p. 258). They argued that as hominids increasingly gained technological mastery over predators and other environmental challenges, pathogens became the most important agents of natural selection, finally, becoming the dominant factor accounting for the evolution of human cognitive and social uniqueness.

Following Schaller (2006), Thornhill and Fincher (2014) maintained that the BIS is fundamental to their hypothesis that parasite-stress was paramount in the evolution of social life for both human and non-human animals, a position which they called "the parasite-stress theory of sociality" (p. 62). According to these researchers, the BIS is commonly characterized in the current literature as human adaptations functionally designed to avoid contact with pathogens. They insist, however, that the BIS should be seen in a broader perspective. The BIS is a combination of both cognitive, emotional, and behavioral aspects including a predilection for association with in-group members thereby reducing potential for contact with foreign or novel pathogens (i.e., a type pathogen not previously encountered and thus, a type for which antibodies would not have evolved among in-group members). Mate choice can also play an important role

in reducing the probability of contact with novel pathogens and increased defenses against pathogens threating offspring. Food preferences, preparation, and cooking are all means of controlling pathogens as is spicing which kills or inhibits pathogens (Billing & Sherman, 1998; Wrangham, 2009). Personality traits such as restricted versus unrestricted sexual behavior, openness, introversion and, gregariousness have all been linked to geographical pathogen loading (Thornhill, Fincher, Murray, & Schaller, 2010). Association with non-human animals linked with zoonotic (i.e., an animal disease that can be transmitted to humans) versus non-zoonotic disease loading (Thornhill et al., 2010). During periods of sickness or down-regulation of the physiological immune system, pregnant women in their first-trimester exhibit a significantly increased attraction toward in-group members and a commensurate aversion directed toward out-group members (Navarrete, Fessler, & Eng, 2007). Social acquisition of commensal and mutualistic microbes and other organisms that regulate BIS recognition and response to safe versus hostile non-self-entities in the body (Thornhill & Fincher, 2014). Preferences for natal habitat (philopatry) and avoidance of foreign people who may harbor pathogens for which no defense has evolved (Thornhill & Fincher, 2014).

The parasite-stress theory of sociality postulates that parasite-stress is central to the evolution of social life. The core thesis of the parasite-stress theory is that "the mind includes adaptations that regulate social behavior to optimize disease avoidance" (Fessler, Clark, & Clint, 2016, p. 1034). In the EEA out-group members constituted a critical source of novel pathogens. The level of pathogen threat posed by out-groups varied with the particular ecology inhabited. Accordingly, heuristic cues suggesting the virulence and density of socially transmitted pathogens in a particular ecology would be a determinate of selection driven by BIS mechanisms which regulate the degree to which in-group members preferentially assort with their own group

and avoid, often with significant hostility, contact with out-group members. Taken as a whole, such BIS outputs can produce a wide range of sociocultural behavioral phenomena including the relative strength of family ties (Fincher & Thornhill, 2012), religiosity (Terrizzi, Clay, & Shook, 2014), being socially liberal or conservative (Feinberg, Antonenko, Willer, Horberg, & John, 2014), and collectivistic versus individualistic (Fincher, Thornhill, Murray, & Schaller, 2008).

Host-Pathogen Coevolution and Local Immunity

There is a perpetual geographically localized arms race across the entire range of hosts and pathogens where adaptation is followed by counteradaptation (Thornhill & Fincher, 2014). An important consequence of the pathogen versus host localization of the evolutionary arms race is that the host defenses are typically only effective against local pathogens and not against other species evolving in other regions. This implies that novel pathogens associated with out-groups are more likely to be indefensible. Moreover, out-group members pose the additional risk of not complying with local norms which typically are aimed at avoiding pathogen risks. The medical anthropologist Horacio Fabrega (1997) claimed that in preindustrial societies the objective of virtually all social rules was the avoidance of infection disease—a claim that clearly supports the core thesis of parasite-stress theory. Thus, social non-conformity (i.e., failure to follow normative rules) would have resulted in decreased inclusive fitness.

Assortative sociality refers to the mating of individuals having more traits in common than would be likely in random pairing (Fincher & Thornhill, 2012). Assortative sociality is characterized by (1) philopatry—a reluctance to venture from location of nativity, (2) ethnocentrism—a belief in the superiority of one's own ingroup and, (3) xenophobia—a belief in the inferiority and avoidance of out-groups (Fincher & Thornhill, 2012; Thornhill & Fincher, 2014). These characteristics are described as preferences or values consistent with assortative

sociality, evolved to motivate the avoidance of novel pathogens vectored by out-group members. Moreover, foreigners are more likely to behave in ways that are maladaptive for local conditions. The evolution of culture can yield indigenous norms and practices successful at reducing disease-causing pathogens such as personal hygiene, patterns of food preparation and storage, diet and, sexual behavior (Navarrete et al., 2007). Cultural differentiation may likely correlate with infectious disease risk and thereby, activate BIS mechanisms in the presence of out-group members.

Philopatry is a tendency of in-group members to remain or return to their birthplace for breeding and nascence—the opposite of dispersal. Philopatry is a way of reducing associations with foreign conspecifics who are likely vectors for novel pathogens and unlikely to observe local norms. Xenophobia is aversion directed toward out-group members who are, once again, likely vectors for novel pathogens and likely to violate in-group norms. Antipathy toward new ways, ideas, and values is called neophobia and is a constituent factor of xenophobia and functions in the same way as xenophobia. Ethnocentrism is favoritism directed toward in-group members, which includes nepotism (favoritism is shown especially toward relatives or friends). Ethnocentrism establishes a defensive boundary against out-group members (Navarrete, 2012; Navarrete & Fessler, 2006).

In a study exploring the relationship between intergroup attitudes and disease, a link was found between an increased perceived vulnerability to disease and ethnocentric attitudes (Navarrete et al., 2007). Because pregnancy is a time of increased vulnerability to infection for both mother and fetus, BIS mechanisms show a corresponding increase in prophylaxis. Because the mother's immunological system is half foreign to the developing fetus, a number of her immune responses shut-down in order to protect the developing fetus leaving both mother and

fetus with increased vulnerability to infectious pathogens. Moreover, this problem is exacerbated because in the early stages the developing embryo is especially vulnerable. However, as development progresses pathogenic dangers decrease. Given these circumstances, Navarrete et al. (2007) predicted that during the initial stage of pregnancy in-group attraction and out-group aversion would increase for expectant mothers. Their findings from a cross-sectional study show that pregnant women in their first trimester exhibit a significantly increased attraction toward in-group members and a commensurate aversion directed toward out-group members. These findings point to a link between ethnocentrism and BIS mechanisms. Accordingly, Thornhill and Fincher (2014) claimed that ethnocentrism secures a prophylactic assemblage of in-group members that guard against out-group members as possible vectors of infectious disease.

Terrizzi, Shook, and Ventis (2012) established a link between religious conservativism and the BIS. They claimed that BIS mechanisms are activated in proximity to likely sources of pathogen contamination. A likely source of contamination is conspecifics, especially out-group members. As suggested above, out-group members are more likely to be a source of novel pathogens and to violate social norms. For this reason, Schaller and Duncan (2007) claimed that BIS theory predicts a preference for in-group members and aversion for out-group members. As also suggested above, an increased sense of vulnerability to disease has been correlated with prejudice, xenophobia, and ethnocentrism (Navarrete & Fessler, 2006; Terrizzi, Shook, & Ventis, 2010). One way the BIS might work, claimed Terrizzi et al. (2012), is by prompting individuals to endorse a socially conservative value system (e.g., social dominance orientation, political conservativism, right-wing authoritarianism, et cetera). Such values typically manifest as out-group avoidance, in-group exclusivity (i.e., clannishness) and, strict adherence to social norms—values which were likely adaptive in the EEA. These findings suggest that more than

induce negative attitudes directed toward out-groups, the BIS apparently fosters the social values that underpin such attitudes.

Thornhill, Fincher, and Aran (2009) established that disease load (historic prevalence of disease) predicts conservative social values. According to these researchers, geographically separate social groups vary in terms of their position on the autocracy-democracy values continuum. This disparity has traditionally been explained in terms of economic development. Lipset (1960) argued that the emergence of democracy is likely best explained as a product of economic development, while autocracy is the result of poor economic conditions. Although Thornhill et al. did not entirely reject the idea of economic factors being partially responsible, they suggested a different frame of reference, offering both an ultimate (i.e., evolutionary) and a proximate explanation. They hypothesized that geographical differences in autocracy-democracy values are a result of psychological adaptations that functioned in the EEA to address local levels of infectious disease. As a result of their testing and consistent with their hypothesis they found that autocracy, conservatism, collectivism, women's sexual restrictiveness, women's subordination relative to men are values that positively covary and correlate positively with local disease loading. These researchers claimed that the psychology of ethnocentrism and xenophobia links autocracy-democracy values with threat management of infectious disease. Additionally, Thornhill et al. found that the inverse of each of the above values (i.e., democracy, individualism, women's rights, et cetera) are positively correlated with geography associated with low pathogen loading.

Terrizzi et al. (2012) hypothesized that religious conservativism or other religious views that expect strict compliance with creeds, doctrine, traditions, and intolerance for alternative views is likely linked with the BIS. Religious conservativism functions as a socially conservative

value system, motivating the faithful to submit to norms that promote in-group unity and out-group repudiation. Religiosity has long been positively linked with stigmatization, discrimination, prejudice and, related concepts and attitudes directed toward out-group members. Allport and Kramer (1946) found that White people who self-reported being religious were found to be more prejudice toward Black people compared with White people claiming no religious preference. In more recent studies Terrizzi et al. (2010) found that both religious fundamentalism and religious orthodoxy predicted prejudice toward out-group members (viz. homosexuals).

While the authors of the parasite-stress theory of sociality have offered an elegant and compelling hypothesis, the theory does have its detractors. Fessler et al. (2016) have objected that parasite-stress theory presupposes an EEA in which interaction between groups was relatively rare. Moreover, it is assumed that there was sufficient geographical separation between groups to allow discrete pathogens to evolve independently in these distinct groups. Antibodies would have developed to counter a particular group's distinct pathogens. However, claimed Fessler and his colleagues, archeological evidence suggests that there was long-distance trade between groups during the Paleolithic period. Such conjectures notwithstanding, there is evidence supporting the contention that across human populations phenotypic diversity may be the result of local adaptive processes (Fumagalli et al., 2011).

The Emotion of Disgust

Among psychologists, the emotion of disgust is now widely agreed to have evolved to motivate the avoidance of contact with infectious pathogens (Tybur, Lieberman, Kurzban, & DeScioli, 2013). However, historically there has been significant disagreement in the explanation of disgust. The anthropologist Mary Douglas (2005) claimed that disgust is a cultural construct.

She argued that abnormal objects or behavior deviating from the normal social order must be rejected to protect the social order. Freud saw disgust as a learned reaction formation which could be directed toward any object (Curtis, de Barra, & Aunger, 2011). The philosopher Aurel Kolnai claimed that disgust was a product of excess, the indulgence of one's appetites, indifference to quality, and a desire for death (Kolnai, Korsmeyer, & Smith, 2004).

Although, research on disgust, understood in terms of its disease avoidance function, has increased significantly in recent years, nevertheless, according to Tybur et al. (2013), disgust still lacks a theoretical framework, capable of providing a comprehensive functional analysis. Tybur et al. offer such a framework based on evolutionary theory, which features two levels of analysis, viz., evolved function and information processing. As mentioned above, there is a consensus that the function of disgust is to motivate the avoidance of contact with infectious pathogens. However, Tybur et al. suggested that beyond motivating pathogen avoidance, disgust was co-opted by evolutionary processes to perform the additional functions of regulating moral behavior and mate choice. For each evolved function, these authors posited distinct information processing modules that integrate function-relevant information and account for the trade-offs required of each disgust sub-system. According to Tybur et al. (2013) at least three types of information processing modules are required to avoid pathogens: (a) perceptual module(s) capable of detecting heuristic cues suggesting the presence of pathogens, (b) intermediate module(s) capable of integrating the probability of infectious pathogens with other factors likely to influence the intensity of disgust and outputting the information, and (c) modules(s) that will initiate processes specific to disease avoidance response.

Consistent with evolutionary logic, it is likely that perceptual modules capable of reliably detecting heuristic cues for pathogens were favored by natural selection (Tybur et al., 2013). As

an example of a heuristic cue, consider color. Because of the effect that infectious pathogens can have on flesh, both dead and alive, color is a reliable way to determine whether meat is suitable for food. Moreover, various diseases and wounds can manifest on the skin as redness or some other atypical coloration having which can disqualify a person as a mating partner or some other social relationships. Atypical coloration is of particular relevance to the current study given the rich assortment of colors characteristic of significant tattooing and the proclivity of humans to commit Type I errors (i.e., assuming an infectious threat when none is present).

It should be apparent that Tybur et al. (2013) are describing a pathogen disgust system that is very similar to the BIS described by Schaller and his colleagues (Schaller, 2006; Schaller & Duncan, 2007; Schaller & Park, 2011). Schaller (2014) claimed that although the BIS is closely associated with disgust, it is not the case that disgust is always and necessarily implicated in behavioral defense against infectious pathogens. Schaller claimed that disgust is characteristically evinced by sensory cues, heuristically connoting a risk of infection. For example, the sight or smell of vomit will typically evoke the experience of disgust; such responses are characterized by Schaller as reactive. For reactive cases, disgust is claimed to be merely concomitant and not a proximate cause. Additionally, even when no perceptual cues are apparent, individuals are often aware of latent cues. Schaller offers as an example the linking of the BIS with conformist behavior reported by Murray and Schaller (2012), who found a link between conformity with local cultural norms and controlling the spread of infectious disease. Based on his research in medical anthropology, Fabrega (1997) claimed that in preindustrial societies virtually all social rules were aimed at avoiding infection. Accordingly, social conformity (i.e., following normative rules) would have resulted in increased inclusive fitness.

Disease avoidant behavior not caused by the direct perception of heuristic cues, but rather behavior resulting from a response to latent cues, Schaller (2014) described as proactive.

The evolutionary psychologists Tooby and Cosmides (2005) explained that the architecture of the mind is an integrated set of domain-specific modules (i.e., computational information-processing programs embodied in neural tissue) which evolved to solve recurrent problems faced by hominids living in an ancestral environment. Given this characterization of the mind, they claimed that emotions can be understood as a type of superordinate program evolved to coordinate subprograms. Ancestral hominids faced a number of different adaptive problems throughout their evolutionary history, including predator evasion, obtaining adequate nutrients, finding an appropriate mate, finding suitable shelter, and avoiding infectious pathogens. Solving a particular type of problem typically required activation of a constellation of modules. For example, obtaining adequate nutrients would require navigational programs to locate food, perceptual programs in order to recognize and distinguish edible from inedible food, physiological programs to activate saliva production and other digestive materials—all such processes requiring subtle coordination to produce a specific adaptive result. The emotions were designed by natural selection to organize interactions among different domain-specific modules to function congruously when addressing recurrent situations encountered throughout evolutionary history. Each situation requiring a certain subset of behavior-regulating algorithms to function compatibly in order to direct bodily systems and behavior adaptively through that type of problematic situation. For the overall system to function harmoniously a superordinate program (i.e., emotion) is required, first, to recognize that two types of situation responses are incompatible, that is, cannot be simultaneously activated and/or carried out. For example, digesting food is not compatible with fleeing a predator—maximum blood resources would be

directed to the muscles and cardiopulmonary system while being denied to the digestive system. A second superordinate program is required to organize and engage appropriate modules for the priority situation (fleeing a predator), while simultaneously disengaging or prohibiting engagement of modules associated with a subordinate situation (digesting food).

As noted above, avoidance of infectious pathogens was a recurrent problem faced by hominids living in an ancestral environment. Organisms more capable of avoiding infection would have a fitness advantage over organisms less capable. Given this understanding of function, it becomes possible to construct a model of the kind of system required to execute such a function (Lieberman & Patrick, 2014). A superordinate emotion information-processing program would likely include perceptual subroutines for the detection of infectious cues, signal detection analysis subroutines capable of estimating the probability that a particular type situation is actually occurring, and subroutines that determine which and to what degree psychological and physiological processes will be activated.

There are numerous psychological heuristics (i.e., subroutines, algorithms) subject to activation by a superordinate emotion information-processing program (Lieberman & Patrick, 2014). However, the particular programs that actually get activated by emotions depend on the particular recurrent situations actually faced and what kinds of functions evolved that led to reproductive fitness in ancestral environments. Thus, according to Lieberman and Patrick, from an evolutionary perspective, part of the definition of emotion would have to include a description of the forms of cognition subject to activation or deactivation by superordinate emotion algorithms. In the case of pathogen disgust, one must ask if there are goals and decision strategies, et cetera that have increased inclusive fitness.

Contrary to the evolutionary perspective offered by Tooby and Cosmides (2005), for the majority of social psychologists, emotion is defined as a particular introspective experience; is associated with a certain facial expression, and is of brief duration (Lieberman & Patrick, 2014). An evolutionary conception of disgust does not see facial expression, introspective experience, or duration as essential or defining characteristics of disgust, but rather as accidental qualities which are only contingently associated with the emotion.

The rationale suggested by Schaller and Duncan (2007) for subsumption of disgust under the BIS lacks plausibility unless the construct of disgust is reduced to only the processes necessary for fostering the experience and the associated physiological response (Lieberman & Patrick, 2014). If disgust is to be construed in the narrow sense supported by Schaller and Duncan then the broad approach to emotion suggested by Tooby and Cosmides (2005) must be rejected. If, on the other hand, the conception of emotion proposed by Tooby and Cosmides is accepted then pathogen disgust and the BIS are essentially the same construct.

Schaller (2014) argued that because disgust is so closely associated with the BIS one might be tempted to assume that arousal of disgust is consistently related to all types of disease avoidance behaviors. Additionally, one might also be tempted to assume that on occasions when disgust does accompany disease avoidant behavior, the disgust is the cause of the behavior. However, claimed Schaller, both of these assumptions are likely untrue. He argued that even if disgust is aroused in response to the perception of disease connoting objects, it does not follow that disgust is the cause of that reactive response. Schaller insists that motor responses take precedence over emotions.

Notwithstanding the fact that disgust might be aroused in response to perceptual cues connoting pathogens, Schaller (2014) claimed nevertheless, it would be fallacious to conclude

that disgust was a proximal cause of a disease avoidant response. What is more, even when disgust is not aroused in response to perceptual cues, still, disgust might have been a remote cause of the response. To illustrate this point, Schaller reviewed a study by Ryan, Oaten, Stevenson, and Case (2012) which manipulated risk of infectious disease, while measuring degrees of disgust and avoidance of contact. They found a strong effect for both behavioral avoidance and disgust. However, the behavioral avoidance effect was significantly stronger than the disgust effect—contrary to what would be expected if disgust were a proximal cause of avoidant behavior. From these results, Schaller surmised that disgust is probably not a proximal cause of disease avoidant behavior, but rather a concomitant event.

Contrary to Schaller (2014), Lieberman and Patrick (2014) maintained that their term "pathogen disgust" and the "behavioral immune system" of Schaller, both refer to the same psychological adaptation (p. 244). That is to say, they are computationally and functionally the same pathogen disgust system detailed by Tybur and colleagues (Tybur, Lieberman, & Griskevicius, 2009; Tybur, Lieberman, Kurzban, & DeScioli, 2013). Moreover, both constructs are measured using essentially the same concepts—the Perceived Vulnerability to Disease scale (Duncan, Schaller, & Park, 2009b) and the pathogen disgust scale of the TDDS are strongly correlated (Tybur et al., 2009). Lieberman and Patrick claimed the only difference between the two is how they define emotion.

Tattooing

Although tattooing is an ancient practice, common across many cultures, nevertheless, for most of the history of Western culture tattooed people have been stigmatized and seen as undesirables. Tattooing was disparaged as a barbaric practice by Greek and Roman writers alike and is forbidden in both the Koran and the Bible (Sperry, 1991). Long considered taboo in

American culture (Sanders, 1988), tattoos enjoyed some faddish popularity among sailors and the upper class in the late nineteenth and early twentieth century. However, by the 1920's tattoos were associated with social undesirables, criminals, and the mentally ill (Ferguson-Rayport, Griffith, & Straus, 1955). More recently, tattoos have enjoyed a popular resurgence, especially among young people. It has now become something of a platitude to say that tattoos are more widely accepted in mainstream popular culture (Armstrong, 2005; Gardyn & Whelan, 2001; Laumann & Derick, 2006). Notwithstanding an increased incidence, it does not follow that tattoos are now positively regarded by mainstream culture (Degelman & Price, 2002).

Although there have been remarkably few studies examining attitudes toward people with tattoos, and despite a purported increase in public acceptance, the consensus among researchers that have done work in this area is that attitudes toward people with tattoos are more negative than people without tattoos. However, because most of the studies that have been done are correlational, it is difficult to determine directionality (Bekhor, Bekhor, & Gandrabur, 1995; Stuppy, Armstrong, & Casals-Ariet, 1998). One exception is a study by Degelman and Price (2002) who found that a model exhibiting a tattoo was rated more negatively than the same model when seen without a tattoo. They reported their findings to be consistent for both men and women and for participants with and without tattoos. These findings are consistent with an evolutionary model which is based on an assumption that such reactions are automatic and unconscious in contrast to the Standard Model which is based on the assumption that such reactions are culturally learned. Moreover, the negative findings of Degelman and Price are consistent with results reported by other researchers. Bekhor, Bekhor, & Gandrabur (1995) surveyed employers in the hospitality, retail, beauty, and office sectors to assess their attitudes about prospective employees with tattoos. They found a significant bias against the employment

of people with visible tattoos, less than 30% of those surveyed said they would hire a person with a tattoo. Based on a survey of 195 tattooed respondents, Dickson, Dukes, Smith, and Strapko (2014) reported a positive correlation between the number of tattoos and the level of stigma. Another study examined undergraduate students' attitudes toward women with tattoos (Hawkes, Senn, & Thorn, 2004). Findings indicate more negative attitudes for both men and women toward women with tattoos than without tattoos. Resenhoeft, Villa, and Wiseman (2008) found that respondents' perception of a tattooed model was more negative than the same model when seen in a non-tattooed condition. A study by Seiter and Hatch (2005) examined the effects of tattooing on perceived credibility and attractiveness. Respondents were shown a photograph of either a male or female model in either a tattooed or a non-tattooed condition. Analysis indicated that while attractiveness ratings were unaffected, credibility ratings were found to be significantly lower for both males and females. Swami and Furnham (2007) found that tattooed women were rated as less physically attractive, more sexually promiscuous, and heavier drinkers than untattooed women, with increasingly negative ratings as the number of tattoos increased.

Bell (1999) made the distinction between "people who have tattoos and tattooed people" (p. 55). Those who have tattoos typically have only one or two and in places where they can be easily concealed with clothing. Tattooed people, on the other hand, characteristically have many brightly colored and imprudent tattoos in obvious places. Bell claimed that tattooed people have made a decision to go beyond a point of no return, entirely accepting marginalization.

The Construct of Stigma

From his analysis of the Classical Roman novel Satyricon by Petronius (trans. 1930) and other classical works, C. P. Jones (1987) concluded that the original Greek and Roman use of the word stigma referred exclusively to what is meant in contemporary English by the word "tattoo"

to the exclusion of other forms of marking. The mention of ink, claimed Jones, was conclusive for the determination of tattooing since this was done in antiquity in the same way it is done today, by piercing the skin with a needle wet with ink. The word stigma carried with it a sense of derision and moral or social failing consistent with its contemporary use. Goffman (1963) reports that the term stigma is used to designate "an attribute that is deeply discrediting" (p. 3). In the Mines discussion of ink, needles, and the inscription on the slave's forehead seems to be clear evidence that he was referring to only one kind of punishment, namely, tattooing (C. P. Jones, 1987).

If the primary function of the BIS is the avoidance of contagious disease, then one adaptive response is likely to be a negative attitude bias toward individuals exhibiting heuristic cues for contagion. That is, an avoidance function for contagion would predict a negative attitude bias toward individuals exhibiting heuristic cues for contagion and thus, consistent with the negative attitude bias toward people with tattoos reported by Degelman and Price (2002) and other researchers, as per above. Negative attitudes (i.e., stigmatization, prejudice) toward people with tattoos can be reasonably interpreted as an a priori argument that such negative attitudes are a manifestation of BIS mechanisms and represent an indication that tattoos heuristically signal contagion.

Goffman (1963) characterized three separate categories of stigmatized individuals. First, there are what Goffman called "abominations of the body"—abnormalities of the body such as leg amputation. Second, were "blemishes of individual character" such as "unnatural passions, treacherous and rigid beliefs, dishonesty, homosexuality and mental disorders". Finally said Goffman "there are the tribal stigma of race, nation, and religion" (p. 4). Cottrell and Neuberg (2005) claimed that Goffman's classification suggests that specific forms of prejudice are likely

based on discrete psychological processes. Stigma directed toward ethnic and national out-groups has been linked with underlying motivational processes to protect the self (e.g., Fein and Spencer, as cited in Park, Van Leeuwen, & Chochorelou, 2013a). Research focused on stigma directed toward individuals with character flaws—what Goffman called "blemishes of individual character"—has been linked with underlying processes associated with perception of controllability wherein the stigmatized person is seen as being responsible for their condition (e.g., Sidanius and Pratto, as cited in Park et al., 2013a).

Though not entirely un-researched, stigma associated with atypical morphology—"abominations of the body"—has not been well explicated (Park et al., 2013a). Although it has been noted that repellent appearance associated with bodily disfigurement has been linked with stigma, heretofore no one has offered a cogent explanation for why bodily disfigurement should be stigmatized. Park et al. suggested that a popular explanation has been that people are socialized to negatively value people with disabilities. Although socialization cannot be entirely excluded as part of the explanation, it does beg the question what prompted the negative evaluation in the first place; what is it about disability that is bothering, that is, why should people be bothered by someone whose physical appearance is not consistent with normal standards. Indeed, this criticism can be levied against all of Goffman's categories, in that, he offers no explanation for why anyone is stigmatized, he simply points out that some classes of people are stigmatized.

A more compelling conceptualization of stigma was proposed by Kurzban and Leary (2001) who argued that the main focus should be placed on the process by which individuals come to be stigmatized. They postulated that stigma is a product of several distinct psychological systems evolved to manage specific problems of sociality recurrent in the EEA. Specifically,

they conjectured that Homo sapiens evolved adaptations designed to govern social contacts, including avoidance of individuals heuristically signaling cues for infectious disease. Park et al. (2013a) explained that people are not explicitly conscious of the disease threat, nor is their response necessarily a conscious one, although it can be. The idea is that people have evolved psychological mechanisms which are automatically and frequently unconscious triggers for stigmatic reactions.

The most efficacious way of identifying, describing, and understanding psychological mechanisms is to identify their function—what was the specific adaptive problem they evolved to solve which, in this case, was the threat of infectious disease. According to Buss (2015), an evolved psychological mechanism is a set of processes carried out inside the organism. Such mechanisms exist in the form they do because they solved a recurrent survival or reproductive problem in EEA. Tooby and Cosmides (2016) explained that these evolved psychological mechanisms are embodied as neural circuits in the brain, which function as computational programs that process information. They will accept only specific kinds of informational input and will transform that input through decision rules (i.e., algorithms or heuristics) to behavioral or cognitive output.

The model of stigma proposed by Kurzban and Leary (2001) is supported by more recent research (e.g., Neuberg & Schaller, 2016; Oaten et al., 2011; Tybur & Lieberman, 2016). Oaten et al. (2011) offer a model of stigmatization based on disease avoidance similar to that of Kurzban and Leary. They began with the assumption that many infectious diseases offer imperfect cues suggesting their presence. Consistent with error management theory this type of ambivalence selects for a disease avoidance system biased toward false positives, indicating a risk of infection when none is present (Haselton & Buss, 2000). Conspecifics are constantly

being (automatically and unconsciously) monitored for signs of infectious disease. Oaten et al. divide their model into three functionally distinct components. The first component is emotive and reflexive. For example, cues signaling infectious pathogens will often evoke the emotion of disgust, as in cases of rotting flesh or bodily fluids, which prompt the affected person to avoid such substances. Reactions prompted by disgust are frequently reflexive, that is, occurring automatically and unconsciously. The second component of the Oaten et al. model is cognitive, again, typically automatic and unconscious. The basis of this component is a representation of bodily forms acquired passively over the life experience of the individual, that is, the individual's experiential acquisition of a prototypical representation of the standard human bodily form. This representation is used as a template against which conspecifics are compared for the purpose of detecting deviations from normal morphology. Deviations are typically read as disease cues. The third component is also cognitive, but unlike the second, it is generally accessible to consciousness. This component functions to monitor and access output from the first and second components and to activate responses mechanisms based on output assessment.

Tybur and Lieberman (2016) discuss more recent developments in the area of adaptations linking disease avoidance with sociality. Their focus is mainly on a conjectured model of information processing. Moreover, their model is consistent with a credible disease avoidant explanation of stigmatization, prejudice, stereotyping, and discrimination. They claimed that the information processing system underlying disease avoidance is likely to be responsible for integrating a complex of components. They offer a conjectural model of how such a system might be structured. On their model, perceptual input (olfactory, vision, etc.) heuristically suggestive of pathogens is gathered from the environment. This assortment of heuristic cues is then integrated by a mechanism, Tybur and Lieberman characterized as "a pathogen presence

estimator" (p. 7) which engenders a representation of the probability that pathogens are present. They cautioned, however, that the likelihood of pathogen presence is not the only relevant factor regulating pathogen avoidance. If pathogen presence was the only relevant factor then such behaviors as child care, copulating, and eating would have to be avoided if the presence of pathogens is indicated. Thus, cost/benefit trade-offs are frequently necessary, that is, the likelihood of infection must be balanced against factors such as kinship, current nutrient condition, sexual value, et cetera.

This evolutionary perspective provides an ultimate explanation for stigma. The distinction between ultimate and proximate explanation is crucial to an understanding of the contemporary evolutionary paradigm (Scott-Phillips, Dickins, & West, 2011). Ultimate explanations offer an account of why a behavior exists, for example, why human beings stigmatize other human beings. Following evolutionary theory, the question is what problem did stigmatic behavior evolve to serve. The ultimate explanation cannot be that offered by Goffman (1963), one person stigmatizes another because "they have an attribute that is deeply discrediting." Indeed, Goffman's explanation is not even a proximate explanation under the Scott-Phillips et al. (2011) definition which specifies that proximate explanations are concerned with the mechanisms that underpin the behavior. As defined in this research, stigmatization is understood as a cognitive, emotional, or behavioral manifestation of a negative attitude toward the stigmatized person. Given this understanding, Goffman's thesis is circular and therefore incapable of explaining anything. An example of a proximate explanation for why person α stigmatizes person β would be something like because person β has a foreign appearance, a large port wine stain birthmark, or because β has an obvious disability such as leg amputation. Nevertheless, there is still the lingering question why would α stigmatizes β because β has a port

wine stain birthmark. It should be apparent that the foregoing examples are not ultimate explanations—an ultimate explanation would have to account for why stigmatization is part of the cross-cultural cognitive behavioral repertoire of human beings. Why do people behave this way, what function does such behavior serve? Kurzban and Leary (2001) argued that the function stigmatization evolved to serve was avoidance of conspecifics exhibiting heuristic cues signaling infectious disease which can carry devastating fitness costs. Stigma was undoubtedly adaptive in the EEA. Thus, Kurzban and Leary have provided an ultimate explanation for stigma.

Despite their recent surge in popularity, tattooed people are still widely stigmatized (Larsen et al., 2014; C. R. Martin & Cairns, 2015). Following Yang et al. (2007) and consistent with the Standard Model, Larsen et al. (2014) claimed that the principal characteristic of stigma is that the stigmatized person has an attribute signifying their lack of conformity with cultural norms. These researchers contend that "stigma does not occur within an individual but within a context and depends on the norms [to which] a person finds themselves subject" (p. 8). Larsen et al. reported that Atkinson (2004) exhibited images to Westerners of body modifications of tribal peoples without complaint but did receive complaints when Westerners were presented comparable images of Western peoples. Larsen et al. maintained this discrepancy in complaints to be a confirmation of the thesis that our norms, meanings, and associations about our skin are culturally bound. The Larsen et al. claim, however, seems logically tenuous not having excluded obvious alternative explanations, such as a distinction between in-group and out-group. The participants see "tribal peoples" as other. The Atkinson study could have profitably included a reversal of the study where the attitudes of tribal peoples were also included. The Larsen et al. (2014) claim that "the principle characteristic of stigma is that the stigmatized person has an attribute signifying their lack of conformity with cultural norms" is consistent with the Standard

Model for which one must assume that stigma is culturally bound and associatively learned as a function of enculturation. That is, they seem to be saying that people learn by virtue of cultural associations with stigmatized members of their group who are unwilling to conform to cultural norms. While such a claim might have some limited veracity, as in the case of voluntary disfigurements, it does not seem to be universally true, nor, a fortiori, the principal characteristic of stigma. Given that the elderly are frequently stigmatized (Duncan & Schaller, 2009a) it is difficult to see in old age a "lack of conformity with cultural norms." Their claim that "stigma does not occur within an individual but within a context" is difficult to understand. As indicated above, the term stigma refers to a negative attitude one person (or group) holds toward another. Given this sense, stigma would occur within an individual and be directed toward another individual, the context is a social relationship. That stigma depends on the social norms, again, seems suspect, especially in light of an important thesis of this paper, namely, that stigmatization, although culturally moderated, is neurologically hardwired and better explained as an evolutionary adaptation designed as a threat-management mechanism for the avoidance of infectious disease. Indeed, as explained above, the characterization of stigma offered by Goffman (1963), and consistent with other Standard Model theorists, that stigma is "an attribute that is deeply discrediting" is no explanation at all. What causes the attribute to be deeply discrediting? Moreover, obesity, homosexuality, physical disability, and mental illness have all been the object of stigmatization, nevertheless, much of contemporary World culture has ostensibly accepted these conditions without stigmatization or prejudice, that is, a substantial portion of the population seems to claim that stigmatizing or prejudicial behavior is inappropriate and ought not to be practiced. Pryor and his colleagues (Pryor et al., 2004) maintained that a defining feature of stigma is avoidance, yet, consistent with contemporary norms of popular

culture mentioned just above, reaction to stigmatized groups or individuals is not always avoidant, negative, or discrediting.

Dual-Purpose Reasoning

Naughton and Vanable (2012) reported that research findings indicate considerable variance in the effort people are willing to expend in order to control their prejudicial behavior whether that behavior is based on internal motivations (i.e., it is personally important not to behave in a prejudicial manner) or on external motivations (i.e., a desire to avoid social censure). There is also research showing that people may have contemporaneous negative and positive attitudes toward the same person or group (Kleck, 1969). Moreover, a significant discrepancy is routinely found between explicit self-report measures and implicit measures (Greenwald & Banaji, 1995; Johnson, Petty, Briñol, & See, 2016; Pinkston, 2015). Typically research exploring prejudicial attitudes has used self-report measures (Wilson & Scior, 2014). However, self-report measures are prone to bias effects due to difficulties with introspection and impression management (Mosca, Dentale, Lauriola, & Leone, 2016). In order to avoid such difficulties, an implicit measure such as the IAT is now frequently used. Predictably there is often a low correlation between explicit and implicit measures suggesting that explicit attitudes are often in conflict with implicit attitudes (J. S. T. Evans & Frankish, 2009). The point being made here is that ambivalent attitudes often exists toward stigmatized people and such disparity calls for an explanation.

In recent years several psychologists in the area of rationality and cognitive processing have proposed a variety of dual-process theories of cognition. Although differences do exist, there is a common core of strongly correlated features shared by these two-system theories which are summarized in the dichotomies in Table 1, a revised version of tables in Mugg (2016),

Carruthers (2014), and J. Evans and Stanovich (2013). The features shown in Table 1, should not be seen as defining or essential features, but rather as correlations (J. Evans & Stanovich, 2013).

The central idea of dual-process theories is that there are two qualitatively different types of cognitive processing which implies two different types of reasoning and therefore, two different ways of making decisions (J. Evans, 2014). Heuristic reasoning is unconscious, automatic, rapid, and evolutionarily primitive, while analytic reasoning is conscious, deliberative, slow, and evolutionarily more recent. Heuristic reasoning entails searching for a good enough solution, what Simon (1955) called a satisficing solution. A solution to an adaptive problem recurrently faced by hominids (and likely more primitive genera) living in an ancestral environment. For example, evading a predator requires a rapid solution, under such circumstances, there would be little time to analyze large amounts of environmental information looking for an optimal solution. Unlike heuristic reasoning, analytical reasoning is slow, conscious, reflective, and deliberate, requiring large amounts of working memory. It is analytic cognition that permits humans to do hypothetical reasoning.

Table 1. Heuristic versus Analytic Reasoning

Heuristic Processes	Analytic Processes
Fast	Slow
Parallel	Sequential
Heuristic-based	Rule-based
Automatic	Controlled, Volitional
Implicit	Explicit
Evolutionarily ancient	Evolutionarily recent
Pragmatic reasoning	Abstract reasoning
Not easily altered (hardwired)	Malleable (social learning)

Independent of normative beliefs	Influenced by normative belief
Satisficing solutions	Optimal solutions

In research dating back nearly two decades, Pryor and his colleagues (Pryor, Reeder, & Landau, 1999; Pryor et al., 2004) proposed an explanation for ambivalent attitudes toward objects of stigma based on a dual-process model of reasoning. More recent research by Naughton and Vanable (2012) has used Pryor et al. as a foundation for similar dual-process research. In a classic study of ambivalence conducted by Kleck (as cited in Landau, Solomon, Pyszczynski, & Greenberg, 2007), participants verbally reported their experience of working with disabled people as being very positive. Verbal reports notwithstanding, nonverbal behavior suggested anxiety and avoidance. Helb and Kleck (2000) conjectured that verbal reports were a product of a deliberate effort to conform to social norms of treating the disabled non-prejudicially, while nonverbal behavior was the result of an automatic and unconscious negative disposition to avoid or reject disabled persons. In their analysis, Helb and Kleck were suggesting a dual-process model.

Pryor et al. (2004) proposed a more fully articulated dual-purpose model which covered a wide range of stigmatizing conditions. These researchers suggested that in their model the "reflexive system" (i.e., heuristic) is a function of either "instinctive" or "spontaneous" reactions (p. 437). Instinctive reactions are associated with evolved adaptive modular responses and related to neural mechanisms; spontaneous reactions are best thought of as conditioned responses acquired through associative learning. While sharing assumptions with Pryor et al., including a firm grounding in the Standard Model, Naughton and Vanable (2012) explain stigma directed towards individuals infected with HIV as the result of a number of underlying social factors including symbolic associations of HIV with homosexuality and IV drug use and contamination myths (e.g., HIV is spread through contact with some object touched by an HIV infected person).

This Standard Model approach is to some degree in conflict with the "instinctual" reaction described above. Although the Standard Model does not necessarily exclude instincts, as a general theory, it is at variance with this kind of explanation (cf. James (1890/1962) with Watson (1924)). Veracity of the current study requires the presupposition that stigma is a generic construct, characterizing a disease management reaction to pathogen cues—stigma is a psychological reaction to the perception of individuals manifesting cues suggesting infectious disease.

Consistent with the early studies of Kleck, (1966, 1969, as cited in Pryor et al., 2004) Naughton and Vanable (2012) reported that prior stigma research has relied predominantly on self-report measures. According to these researchers, despite low scores (i.e., positive attitudes) on self-report measures, people will still ordinarily show negative attitudes toward stigmatized individuals when implicit measures are used that are known to access evolved heuristics which automatically trigger stigmatic reactions. They claimed the veracity of a self-report measure is problematic because such measures are likely to produce socially appropriate rather than veridical responses, whether the individual is conscious of their negative attitude or not. Thus, the dual-process analysis of stigma introduced by Pryor and more recently endorsed by Naughten and Vanable postulates that responses to stigmatized persons are motivated by both heuristic and analytic cognition. Heuristic cognition is triggered automatically and is essentially a negative response (Carruthers, 2014). The negative nature of heuristic cognition is predicted by its hypothesized function as a disease recognition and avoidance mechanism. Analytic cognition is best understood as conscious reasoning engaged when there is a need for deliberate reflective problem-solving.

Theories of Signal Detection and Error Management

One likely explanation for an increased number of false positive identifications is that until modern scientific advances such as the microscope and germ theory, disease-causing pathogens were not only invisible but entirely unknown (Murray & Schaller, 2012). Consequently, because it would be impossible to directly detect the presence of pathogens in others, the BIS has evolved to respond to indirect cues (Schaller, 2011). According to signal detection theory heuristic cues are diagnostic for pathogen carriers, but only on the basis of a broad statistical probability, both false positives and false negatives are often the result—a situation characterized as a signal detection problem (Kurzban & Aktips, 2006; Miller & Maner, 2012; Nesse, 2005). For signal detection problems, error management theory proposes the utility of cognitive biases in which psychological mechanisms evolved to be predictably biased under conditions of uncertainty, as in the case of a signal detection problem when heuristic cues are difficult to interpret causing the BIS to be prone to false identifications (Haselton & Buss, 2000). When a signal detection problem occurs error management theory predicts that a bias will develop to minimize the type of error with the greatest cost in fitness which, in this case, would be false negatives—falsely assuming an infectious person to be healthy. A bias toward minimizing this type of error will necessarily entail a significant increase in errors of the opposite type. Because identifying a person as healthy when in fact they are infected would tend to be extremely costly in terms of fitness, the BIS evolved to err in the direction of false positives—identifying someone as infected when they are not (Haselton, Nettle, & Andrews, 2005). This means that the BIS is especially sensitive to even slight deviations from normal morphology.

Given this extreme sensitivity, the BIS is biased toward overperceiving individuals exhibiting heuristic cues for pathogens (Miller & Maner, 2012). A large variety of diseases manifest as abnormalities on the body such as lesions, rashes, or discolorations. However, the meaning of such symptoms is often difficult to interpret because they can vary significantly across individuals and different types of disease. The same pathogen may manifest as different symptoms in different individuals. Moreover, because pathogens can evolve so quickly, symptoms can also show considerable variability as well. Accordingly, there is no finite set of conditions to which the BIS is responsive because there is no finite set of conditions associated with infectious disease (Schaller, 2011). In order to avoid high-cost false-negative errors, the BIS must be hypersensitive to an exceedingly wide variety of heuristic cues potentially indicating infectious pathogens. Consistent with this thinking, Kurzban and Leary (2001) argued that the BIS has a very lenient threshold for identifying cues as signaling infectious disease. A lenient threshold for BIS triggers tends to support the speculation that voluntary disfigurement is among this group of triggers. Moreover, the tendency to overgeneralize cues as indications of infectious disease increases with an increase in perceived vulnerability to disease (Zebrowitz & Rhodes, 2004). As detailed below, a number of studies have been conducted in recent years demonstrating a natural proclivity to overgeneralize a wide variety of non-pathogenic cues as BIS triggers.

Park, Faulkner, and Schaller (2003) found that individuals with increased perceived vulnerability to disease also showed increased cognitive associations linking physical disability with contagious disease. The essential factor governing the construct of physical disability is not disability per se but perceptible atypical morphology. Indeed, the word “disability” is likely not the best descriptor for the pertinent heuristic activator. A more appropriate word would probably

be “disfigurement” because a person might well have disfigurement which would trigger a BIS reaction (e.g., facial birthmark; Ryan, Oaten, Stevenson, & Case, 2012) without being disabled.

Following evolutionary logic, Park et al. (2003) maintained that given the high cost of association with diseased individuals, being able to quickly identify and avoid such individuals would have been adaptive, notwithstanding a high rate of false positives. Moreover, consistent with error management theory the BIS is biased to process a large variety of ambivalent cues, only some of which being veridically associated with contagious disease, nevertheless, an avoidant response to all cues would have been adaptive. These researchers conjectured that the same cues would likely activate avoidance mechanisms among contemporary populations. Disease avoidance mechanisms, like most evolved mechanisms, operate heuristically, that is, automatically and unconsciously, yielding a satisficing solution.

Studies in Overperception

Because many disfigurements are the result of causes other than contagious disease, this would tend to cause a signal-detection problem (Park et al. 2003). As indicated above, the BIS would be biased toward false positives. Thus, the system would have a tendency to be over-inclusive, identifying and responding to many non-contagious conditions as pathogenic—again, the essential factor being a perceptible disfigurement. Park et al. (2003) concluded that a significant variety of visually unusual, but non-contagious cues will trigger disease avoidance mechanisms. Their thinking is consistent with the current study hypothesis that perception of tattooed people will trigger BIS mechanisms.

Schaller, Park, and Faulkner (2003) found that among individuals having undergone a European socialization which emphasizes germ contamination as the cause of disease transmission, high perceived vulnerability to disease predicted increased associations linking

disabled persons implicitly with infectious disease. Duncan and Schaller (2009a) tested the hypothesis that under increased perceived vulnerability to disease implicit negative attitudes toward older adults would increase. Their research was designed to assess the extent to which participants were likely to implicitly associate infectious disease with older people. They found that, relative to younger adults, older people were significantly more likely to be associated with disease-connoting concepts.

Park, Schaller, and Crandall (2007) assumed that humans have evolved disease-avoidance mechanisms that are particularly sensitive to visual cues. However, because most pathogens are microscopic in size they are not readily visible. Notwithstanding and perhaps because of this limitation, individuals are keenly sensitive to indirect cues such as disfigurements including lesions, rashes, discoloration, and other abnormal morphology. Again, because the link between ambivalent cues and the presence of infectious pathogens is so tenuous, a signal detection problem results, producing an inferential bias to identify a wide variety of cues as an indication of disease. These findings are consistent with the conjecture that perception of tattooed people will trigger disease avoidance module(s), especially under conditions of increased disease salience. In view of this analysis, Park, Schaller, and Crandall investigated the possibility that obesity might implicitly activate disease-avoidance mechanisms. They found that, under disease salience, the perception of obesity tended to activate BIS mechanisms, initiating implicit feelings of antipathy toward obese people.

As discussed above, the emotion of disgust is widely believed to be closely associated with the BIS (Lieberman & Patrick, 2014; Neuberg & Schaller, 2016; Schaller, 2014; Terrizzi, Shook, & McDaniel, 2013; Tybur et al., 2013). Disgust evolved to motivate people to avoid various materials such as rotting meat, vomit, feces, and other bodily fluids, thereby avoiding

contamination by dangerous pathogens reliably associated with such materials. The research of Terrizzi, Shook, and McDaniel (2013) focused on increased sensitivity to disgust as correlated with social conservatism and prejudicial attitudes toward homosexuals. They found that disgust sensitivity was positively correlated with socially conservative values. Moreover, an experimentally manipulated increase in disgust sensitivity predicted an increase in conservative prejudicial attitudes toward contact with homosexuals (see also Golec de Zavala, Waldzus, & Cypryanska, 2014; Terrizzi et al., 2010). Ryan, Oaten, Stevenson, and Case (2012) tested participant reactions to three experimental conditions: influenza, facial birthmark, and healthy control. As a cover story to obscure the real aim of the study participants were told they would be testing "imitation training." Participants viewed video clips of confederates in which one was made up to appear as if he had influenza, a second appeared to have a birthmark on his face, and a third healthy control. Confederates modeled behaviors using props (towel, harmonica, or snorkel and mask). The behavior followed a fixed order ranging from no contact to contact with hand followed by head then face and finally oral contact. Participants were manipulated to believe the test room and props were the same ones recently used by confederates. They were asked to imitate the behavior they observed, with the stipulation they were under no obligation to imitate a behavior that made them feel uncomfortable. Ryan et al. predicted that influenza and birthmark conditions would generally produce the same reactions of facial expressions of disgust and avoidance of contact with props, while the healthy control would not elicit similar expressions of disgust or avoidance behavior. Their predictions were confirmed by research findings. However, reactions seemed to be implicit, that is, automatic and unconscious. When asked at the end of the study, participants reported their belief that influenza was contagious and lethal, while birthmarks were neither. Nevertheless, they responded to both conditions in

essentially the same manner. These findings support the general contention that a wide range of symptoms will activate a disease avoidance module, which is primed to detect "disease-like" cues regardless of their veracity (Kurzban & Leary, 2001; Park, Faulkner, & Schaller, 2003).

Summary

For most of the first half of the twentieth century, the social and behavioral sciences were based on a conceptual framework based on the assumption that the human mind had very few or no innate capacities for the regulation of behavior and thus human behavior was believed to be highly malleable; basically all behavior was learned behavior. Evolutionary psychology represents a paradigm shift in the conceptual foundation of psychology away from the Standard Model. From the perspective of evolutionary psychology, the human mind is no longer seen as a blank slate onto which associative learning scripts are superimposed or impressed into (Buss, 2016). For evolutionary psychology the mind is a computer comprised of a suite of information-processing mechanisms, embodied in neural tissue, that is the cause of all psychological activity, regulating the physiology of the body and initiating all behavior (Tooby & Cosmides, 2016). Like the other bodily organs all of which evolved to serve a particular function, the brain evolved to serve a computational function. The programs that comprise the mind are those that evolved to solve survival and reproductive problems reliably recurring in the ancestral environment. One such problem was defending against the threat of infectious disease. The physiological immune system evolved to cope with infectious parasites after they had invaded the body. The behavioral immune system evolved as a defense against infectious organisms before they entered the body.

Thornhill and Fincher (2014) argued that as hominids increasingly gained technological mastery over predators and other environmental challenges, pathogens became the most important agents of natural selection, finally, becoming the dominant factor accounting for the

evolution of human cognitive and social uniqueness, a hypothesis which they called the parasite-stress theory of sociality. The BIS is typically characterized as adaptations functionally designed to avoid contact with pathogens. Thornhill and Fincher insist that the BIS should be seen in a broader perspective. Their core thesis is that the mind is equipped with adaptations that govern social behavior to minimize pathogen threat (Fessler et al., 2016, p. 1034).

According to Thornhill and Fincher (2014), there is a perpetual geographically localized arms race across the entire range of hosts and pathogens where adaptation is followed by counteradaptation. A significant consequence of this arms race is that the host defenses are typically only effective against local pathogens and not against other species evolving in other regions. This implies that novel pathogens associated with out-groups are more likely to be indefensible. Assortative sociality refers to the mating of individuals that have more traits in common than would be likely in a random pairing which can include social practices such as philopatry, ethnocentrism, and xenophobia—characteristics evolved to motivate the avoidance of novel pathogens vectored by out-group members.

Tybur et al. (2013) describe a pathogen disgust system that is very similar to the BIS described by Schaller and his colleagues (Schaller, 2006; Schaller & Duncan, 2007; Schaller & Park, 2011). There is now a consensus among psychologists that the emotion of disgust is an adaptation that evolved to motivate the avoidance of contact with infectious pathogens (Tybur, Lieberman, Kurzban, & DeScioli, 2013). It is not clear at this time whether the disgust system should be seen as describing the same set of phenomena as the BIS or whether the disgust system is simply a component of the BIS.

Although tattooing has seen a popular resurgence it does not follow that tattoos are now positively regarded by mainstream culture (Degelman & Price, 2002). Recent research suggests

that tattooing is viewed negatively and is stigmatized as much today as it generally has been in the past. Kurzban and Leary (2001) argued that the main focus of stigma should be placed on the process by which individuals come to be stigmatized. They postulated that stigma is a product of several distinct psychological systems evolved to manage specific problems of sociality recurrent in the EEA.

There is research showing that people may have contemporaneous negative and positive attitudes toward the same person or group (Kleck, 1969). Moreover, a significant discrepancy is routinely found between explicit self-report measures and implicit measures (Greenwald & Banaji, 1995; Johnson et al., 2016; Pinkston, 2015). A number of researchers have suggested a dual-process theory of cognition. The central idea is that there are two qualitatively different types of cognitive processing which implies two different types of reasoning and therefore, two different ways of making decisions (J. Evans, 2014). Heuristic reasoning is unconscious, automatic, rapid, and evolutionarily primitive, while analytic reasoning is conscious, deliberative, slow, and evolutionarily more recent. Pryor et al. (2004) suggested that heuristic reasoning is a function of more primitive brain mechanisms while analytic reasoning is the product of more recent evolution. Heuristic cognition is triggered automatically and is essentially a negative response (Carruthers, 2014). The negative nature of heuristic cognition is predicted by its hypothesized function as a disease recognition and avoidance mechanism. Analytic cognition in the context of stigmatization is best understood as a product of social pressure to conform to social norms.

Chapter 3: Research Method

The behavioral immune system (BIS) is a suite of psychological mechanisms, the purpose of which is to manage threat associated with infectious disease (Schaller & Duncan, 2007). The BIS is designed to identify and avoid pathogens before they enter the body—reacting to the perception of heuristic cues, typically manifesting as anomalous morphology in conspecifics. However, because heuristic cues are frequently ambivalent and thus, difficult to process, the BIS is biased to overperceive cues as signaling an infectious threat often when none is present (Miller & Maner, 2012). Because conspecifics were the most likely source of contagion a number of adaptive mechanisms evolved to exclude from social interaction conspecifics heuristically signaling a potential source of infectious disease (Kurzban & Leary, 2001; Neuberg & Schaller, 2016; Park, van Leeuwen, & Chochorelou, 2013b). Stigmatization, prejudice, xenophobia, and ethnocentrism are examples of behavior thought to function as socially exclusionary mechanisms. A variety of non-contagious conditions have been identified as BIS triggers including obesity (Park, Schaller, & Crandall, 2007), facial birthmarks (Ackerman et al., 2009), aging (Duncan & Schaller, 2009a), physical disability (Park, Faulkner, & Schaller, 2003) and foreign appearance resulting in xenophobia (Faulkner et al., 2004). These examples of overperception are also examples of stigmatization.

Although a number of non-infectious conditions are known to activate the BIS, there is a gap in the research literature for which a range of non-infectious conditions suspected of being BIS triggers had not been investigated until the present study. This range of non-infectious conditions has been described as voluntary disfigurement (Graham, 2015). The construct of voluntary disfigurement picks out a set of intentionally administered body modifications, including tattooing, scarification, piercing, and face painting (e.g., war paint and clown faces).

The problem that is addressed in the current study is a hypothesized link between disease avoidant-socially exclusionary behavior (e.g., stigma) and perception of tattooed people (Neuberg et al., 2011; Neuberg & Schaller, 2016). More specifically, the problem can be analyzed as follows: first, whether stigma is best explained as learned behavior or as evolved adaptive behavior based on a threat management system, namely, the BIS and second, whether the perception of tattooed people will activate a BIS response. If the perception of tattooed people acts as a BIS trigger, then tattoo stigma is likely best construed as a BIS mechanism and, thus, best explained as an evolved adaptation designed to avoid conspecifics heuristically signaling a threat of infectious disease.

The purpose of this quasi-experimental study was to determine whether the perception of significant tattooing will cause a BIS reaction. If significant tattooing serves as a heuristic cue for infectious disease, then the perception of tattooed people should activate disease-relevant concepts into working memory. A secondary aim of the research was to increase understanding of the psychological mechanism of stigmatization and its function from the perspective of evolutionary psychology.

In the remainder of the chapter, the research question and hypotheses are reviewed, indicating their alignment with the problem and purpose. The research design and method are described and justified showing their alignment and appropriateness given the research problem and purpose. This section includes an explanation of why the particular design and method were chosen. In the materials and instruments section, a full description of measurement instruments including data supporting their reliability and validity are presented. Other items in this chapter include a description of the target population, selection method and the number of participants.

Operational definitions of research variables, data collection procedures, assumptions, limitations, delimitations, and ethical assurances are described and explained in this chapter.

Research Question

Q1. Will participants implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Q2. Will participants who report having tattoos themselves implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Q3. Will participants who self-report either a neutral or positive attitude toward tattooed people implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Hypotheses

$H1_0$. Participants do not implicitly associate disease connoting concepts with the perception of tattooed people.

$H1_a$. Participants implicitly associate disease connoting concepts with the perception of tattooed people.

$H2_0$. Participants who report having tattoos themselves will not implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people.

$H2_a$. Participants who report having tattoos themselves will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people.

$H3_0$. Participants who self-report either a neutral or positive attitude toward tattooed people will not implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people.

$H3_a$. Participants who self-report either a neutral or positive attitude toward tattooed people will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people.

Research Methods and Design

Because infectious disease can exact such a high-cost in fitness and can manifest in such a wide range of symptoms, disease detection, and avoidance mechanisms were likely designed to be extremely sensitive to pathogenic cues (Schaller, 2016). It is hypothesized that the disease avoidance system will not differentiate between voluntary and involuntary disfigurement. Just as obesity, old age, birthmarks, physical disabilities, and other disfigurements are read as pathogenic cues, it is hypothesized that significant tattooing will also trigger BIS mechanisms.

Because BIS mechanisms, like other psychological mechanisms, are believed to be modular in nature and, thus, to operate automatically and unconsciously, BIS induced attitudes will likely be unavailable to introspective self-report. For this reason, it was necessary to use an indirect research method capable of circumventing the opaque nature of implicit attitudes and the frequently cited problem of socially desirable responding associated with self-report measures (Latkin et al., 2016; Paunonen & LeBel, 2012). The most commonly used measures of implicit attitudes are those based on response latency (Wittenbrink & Schwarz, 2007).

The Implicit Association Test (IAT; Greenwald et al., 1998) is an implicit measure based on the assumption that tasks are easier (i.e., more accurate and faster) when they reflect cognitive associations that are familiar and well-rehearsed as compared with associations that are unfamiliar and incongruous with familiar and well-rehearsed associations (Rudman, 2011).

To some extent, fixed associations, are, undoubtedly, a product of social learning. Nevertheless, it seems unlikely that humans living in small social groups—bands consisting of

25-200 individuals (Cosmides & Tooby, 2013)—"learned" to stigmatize old people (Duncan & Schaller, 2009a) with whom they had life-long ties and typically kinship. Consistent with the Standard Model, this would imply the incredulous thesis that adults learned to stigmatize their parents (for some unexplained motive) and taught their children to do so as well.

Stigmatic behavior is best explained as the output of psychological mechanisms operating automatically and unconsciously (Kurzban & Leary, 2001). That is, the modular hypothesis has greater predictive and explanatory power than the Standard Model and social learning theory (e.g., Goffman, 1963; Skinner, 2009/1974). Indeed, in the case of stigmatization, social learning theory has no explanatory power at all. Although it can account for the transmission of a behavioral attribute from one generation to the next (e.g., stigmatizing old people), it cannot account for the origination of the behavior. Why would such a (culture-bound) practice have begun in the first place? From the perspective of evolutionary psychology, the practice evolved as a socially exclusionary adaptive solution to a recurring threat to fitness encountered in the EEA, namely, avoidance of conspecifics heuristically signaling a risk of infectious disease. Even though stigmatization is, perhaps, no longer adaptive in the contemporary environment, it persists, nevertheless, as a psychological fossil.

As suggested above, a variety of non-contagious conditions have been identified as BIS triggers including obesity, facial birthmarks, aging, physical disability and others characterized by Miller and Maner (2012) as cases of overperception of heuristic cues. The current study is similar to much of the recent BIS research focused on issues related to overperception (Ackerman et al., 2009; Duncan & Schaller, 2009a; Miller & Maner, 2012; Park et al., 2003; Park, Schaller, & Crandall, 2007; Ryan, Oaten, Stevenson, & Case, 2012). This study served as a test of whether significant tattooing is similarly a trigger for BIS reactions.

Park et al. (2007) conducted two studies in which they tested whether obesity would activate BIS mechanisms. Two variables were used in the first study (a) chronic concern about pathogens and (b) stigma toward obese people. Chronic concern about pathogens was measured using a 10-item subscale of the Perceived Vulnerability to Disease (PVD) scale, $\alpha = .78$ (Faulkner, Schaller, & Duncan, 2004). Stigma directed toward obese people was measured using the Anti-Fat Attitudes (AFA) scale, $\alpha = .82$ (Crandall, 1994). A positive correlation was found between PVD subscale and stigma toward fat people supporting their primary hypothesis that people who feel more vulnerable to disease also hold increased stigma toward obese people.

In the second study, Park et al. (2007) conjectured that if obesity is perceived as a heuristic cue for infectious disease, then the perception of obesity ought to trigger disease-relevant cognitions. To test this hypothesis, their experiment manipulated the salience of disease. Participants completed two variations of the IAT that determined the degree to which disease connoting semantic constructs were implicitly linked with obese people relative to non-obese people. Although two versions of the test were administered, only one is germane to the current research. In the relevant version, participants were asked to watch a slideshow depicting images of infectious disease after which they completed a fat-disease version to the IAT. Participants judged whether stimulus words connoted either health or disease and whether persons in photos were either fat or thin. Results showed associations linking fat people with disease supporting their hypothesis that obesity is perceived as a heuristic cue for infectious disease.

In research focusing on people with physical disability, Park et al. (2003) offered a disease avoidance model that linked pathogen avoidance with prejudicial attitudes (i.e., stigmatization) toward people with physical disability. They claimed the primary value of the model is that it suggests a number of hypotheses about variables that likely moderate prejudice

directed toward physically disabled people. Such variables include differences in concerns or beliefs about disease such as sensitivity to disgust and wariness of disease. According to these researchers, such conditions predict cognitive associations linking physical disability with contagious disease. These associations were measured using the IAT. Results showed that individuals warier of circumstances in which pathogens were more likely to be transmitted also showed stronger cognitive associations between disability and disease ($r = .38$, $p = .043$).

Because the Park et al. (2003) design was successful in testing hypotheses similar to the current study, it is offered as a rationale for using a similar design for this research. Additionally, as is apparent from the Park et al. studies (Park, Faulkner, & Schaller, 2003; Park, Schaller, & Crandall, 2007) and several other studies focusing on overperception of infection, as cited above, much about this area of research is already known. Previous research in this area using a quantitative approach focusing on the interaction of variables, in lieu of a holistic or qualitative approach, has proven very productive (e.g., Ackerman et al., 2009; Duncan & Schaller, 2009a; Miller & Maner, 2012; Park et al., 2003; Park, Schaller, & Crandall, 2007; Ryan, Oaten, Stevenson, & Case, 2012). In like manner, this research adopted a quantitative analytic design, concentrating on interactions between variables, specifically, the association between perception of significant tattooing and disease connoting concepts. The independent variable is significant tattooing in a condition of being either present or absent in photographs of research models; it is predicted that manipulation of this variable will yield a corresponding variation in disease connoting concepts activation into working memory. Moreover, the implicit association between disease connoting concepts into active memory and significant tattooing phenomenon was approached from a top-down perspective, beginning with the general principle that stigma directed toward tattooed people is caused by an evolved socially exclusionary mechanism the

function of which is to prompt avoidance of contact with conspecifics exhibiting heuristic cues suggesting infectious disease. In much the same manner as participants in Park et al. (2007) judged whether stimulus words connoted either health or disease and whether persons in photos were either fat or thin, this study tested whether participants associate either health or disease words with photos of tattooed or non-tattooed persons.

It is assumed that research design refers to a logical procedure that will produce evidence (i.e., research data) that enables the researcher to give relatively unambiguously answers to the research questions (de Vaus, 2001). The research method is the procedure used to collect the evidence. For this study it was hypothesized that perception of tattooed people will cause a BIS reaction similar to those found in the case of acne (Papadopoulos et al., 2000), obesity (Park, Schaller, & Crandall, 2007), facial birthmarks (Ackerman et al., 2009), aging (Duncan & Schaller, 2009a), and physical disability (Park, Faulkner, & Schaller, 2003). Thus, the central research question addressed in this study was whether or not the perception of tattooed people will activate disease connoting cognitions. Park et al. (2007) found that obesity is perceived as a heuristic cue for infectious disease because it triggered disease-relevant cognitions. Similarly, it was predicted that if significant tattooing is perceived as a heuristic cue for infectious disease, then the perception of significant tattooing would also trigger disease-relevant cognitions. Thus, to answer the research question it was necessary to determine whether there is a statistically significant correlation between perception of tattooed people and the activation of disease connoting cognitions. Because activation of disease connoting cognitions is a mechanism of the BIS (Park et al., 2007), it follows that if the perception of tattooed people activates disease connoting cognitions, then it can be reasonably inferred that tattooing is a heuristic cue signaling

the possibility of infectious disease. A finding that would justify a rejection of the first null hypothesis.

The method that was used to measure associations between disease connoting cognitions and the perception of tattooed people was the Implicit Association Test (IAT; Greenwald, Nosek, & Banaji, 2003). If stigma toward tattooed people is, largely, an unconscious and automatic response activated by underlying psychological mechanisms associated with the avoidance of infectious disease, then the methodology used in this study was an effective means of testing the research hypothesis.

Population

Project Implicit hosted the study and recruited participants from the World Wide Web, with the limitation that participants were all U.S. Citizens between the ages of 18 and 65. The sample (n = 328) included 231 female and 93 males with a mean age (M = 31) years. Religious preferences included Catholic 26.5%; Protestant 29.6; Jewish 1.8%; Other religions 10.6%; no religious preference 29%, and no response 2.4%.

An assumption of the study was that stigmatization and other mechanisms of the BIS are products of evolution by natural selection and are therefore universal and permanent (i.e., hardwired) adaptations of human mental architecture (Carruthers, 2009). Given the universal and permanent nature of such adaptations, it was inferred that virtually any population of human participants would have served equally well for the current research. Although avoidant attitudes directed toward tattooed people may be moderated by sociocultural factors, nevertheless it was assumed that a proclivity for such attitudes is a species-typical characteristic. For this reason, it was predicted that an implicit negative or avoidant attitude directed toward tattooed people will be statistically apparent for any population of human beings.

Sample

As indicated above the population was a cross-section of U.S. citizens between the ages of 18 and 65 years, who voluntarily visited the Project Implicit Website. The volunteers were randomly assigned to one of the Project Implicit research pool studies that were currently in progress. The sample size was (n = 328).

Materials/Instruments

Because attitudes are psychological constructs, unavailable to direct observation, measuring them is always an inferential process (Rudman, 2011), raising the question how best to measure them. The present study concerned stigmatizing attitudes toward tattooed people. Measurement of such attitudes has typically been approached with self-report measures. However, for several reasons, self-report measures have been judged unsatisfactory. For example, the frequently cited problem of social desirability bias (Paunonen & LeBel, 2012). Even leaving aside desirability bias, because attitudes are often implicit (i.e., automatic and unconscious) participants are frequently unaware of attitudes motivating their behavior and are, therefore, unable to accurately report implicit attitudes even if an accurate report was their intention. For these reasons, a self-report measure was rejected for this study. Given the unconscious and automatic nature of implicit attitudes, associated with BIS mechanisms, it was concluded that an implicit measure would be singularly appropriate for this research.

To test the research hypotheses a quasi-experiment was conducted, using a computer-based reaction-time test, specifically, the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) which measured the extent to which health or disease exemplar words were implicitly associated with photographs of tattooed as compared with non-tattooed people. Because the IAT represents a procedural methodology for measuring a variety of implicit

cognitions rather than an individual construct, there is no particular version of the test to be validated (Lane, Banaji, Nosek, & Greenwald, 2007). Notwithstanding the general nature of the IAT, one study which examined a diverse sample of implicit measures for internal consistency reported reasonable reliability for the IAT (Cronbach's alpha = 0.78; Cunningham, Preacher, & Banaji, 2001). Nosek, Greenwald, and Banaji (2007) claimed that although the IAT has been extensively used in a wide variety of procedural variations, it has consistently shown a satisfactory reliability. In a meta-analysis Hofmann, Gawronski, Gschwendner, Le, and Schmitt (2005) found the IAT acceptable, averaging .79 across 50 studies. They found that much of the variance for each IAT could be ascribed to measurement error. Although somewhat unusual for latency-based measures, the IAT has demonstrated good internal consistency (Nosek et al., 2007). Greenwald and Nosek (2001) reported (alphas or split-half correlations) internal consistency estimates to range from .7 to .9. Schmukle and Egloff (2004) conducted extensive tests for internal consistency and test-retest reliability; they reported finding the IAT shows stable test-retest reliability across studies (median r = .56).

Gawronski (2002) conducted a study that tested the discriminate and convergent validity of two prejudice-related IATs. Using a sample (n = 61) of German students, the studies examined the validity of implicit prejudice relative to explicit measures of prejudice. The studies examined as attitude objects German versus Asian and German versus Turkish people in terms of positive versus negative evaluations. Test results confirmed convergent validity of both IATs. Specifically, individual implicit prejudice toward Turkish people was significantly correlated with explicit prejudice toward Turks. In a similar manner, individual implicit prejudice toward Asians was significantly correlated with explicit prejudice toward Asians. Moreover, the discriminate validity of the two tests was confirmed by the absence of a significant relationship

between implicit Asian scores and explicit Turkish scores and vice versa. Accordingly, these findings confirm the assumption that the IAT is a valid measure of associations relevant to prejudice. What is more, the combination of discriminate and convergent validity establishes the construct validity of the IAT as a measure of associative strength.

Because of the closed-end nature of the research questions, an experimental design was initially considered. However, since the IAT does not permit random assignment of participants a quasi-experimental design was ultimately necessitated. The IAT is an instrument that was developed specifically to access implicit attitudes activated automatically and unconsciously by attitude objects (Meissner & Rothermund, 2015). Thus, the IAT is capable of measuring implicit attitudes largely opaque to introspective reflection. This type of test is based on the principle that human tasks can be performed more efficiently (i.e., faster, and more accurately) when such tasks are the product of evolved heuristic adaptations or associative learning, as opposed to when tasks conflict with such practiced associations (Rudman, 2011).

Operational Definition of Variables

Tattooing. The independent variable in the study will be a photographic presentation of significant tattooing. The construct of tattooing will be manipulated by presenting a series of photographs of both tattooed and non-tattooed models. The construct of significant tattooing will be operationalized as a correlation between disease and health connoting concepts as they are associated with photographs of tattooed and non-tattooed people measured by the Implicit Association Test (IAT; Greenwald et al., 1998). The IAT measures the intensity of associations between target objects (photographs of tattooed and non-tattooed people) and attitudinal valuations (e.g., health versus disease; Project Implicit, 2011). The association between target objects and attitudinal valuations yields an interval measurement. IAT effects are calculated by

subtracting reaction time results of "tattooed or diseased" and "non-tattooed or health" from the results of "tattooed or health" and "non-tattooed or disease." IAT effects are computed such that a higher score indicates an increased facility responding when tattooed is paired with disease and non-tattooed is paired with health (Rudman, 2011, p. 31). Positive scores are associated with Disease and Tattooed; negative scores are associated with Disease and Non-tattooed.

The IAT Effect: The dependent variable is the IAT effect which is based on latencies for the two different classification tasks— an association of infectious disease with tattooing and with non-tattooing. To calculate IAT effect size the D statistic scoring algorithm was used (Greenwald et al., 2003). For this calculation, all congruent and incongruent trials are collapsed, after which the difference between congruent and incongruent trials are calculated. This difference is divided by the pooled standard deviation, yielding a D statistic for each participant. The value of D provides an estimate of the significance of the IAT effect: According to Rudman (2011) D statistics of .15, .35, and .60 imply small, medium, and large effect sizes, in the same order—a higher score indicates a stronger association between disease and tattooing relative to disease and non-tattooing. From this perspective, stigma is understood as a function of the relative speed with which participants match congruent word pairs (e.g., tattooed models paired with disease words) and incongruent word pairs (e.g., tattooed models paired with health words; Denenny, Bentley, & Schiffman, 2014). Thus, a person who associates disease with a tattooed person will respond quicker and more accurately when tattoos are paired with disease as opposed to when tattoos are paired with health.

Data Collection, Processing, and Analysis

For behavioral and social science research, attitude measurement has typically been based on explicit self-report (Wittenbrink & Schwarz, 2007). When a person's attitude about some

matter is sought the principle way to gain such information has been to ask the person to report their attitude. However, social science researchers have long suspected the veracity of self-report measures because respondents may be either unwilling or unable to give an unbiased report of their attitudes (DeMaio, 1984). Unlike the self-report, implicit measures assess attitudes that are the result of automatic and unconscious processes initiated by exposure to an attitude object (Wittenbrink, 2007). Because of their automatic and unconscious nature, such processes are not within the agent's control for purposes of image management or self-presentation. Consequently, measures of implicit attitudes are not vulnerable to agent bias.

IAT Terminology

Before laying out the specific details of the IAT data collection process, a brief digression explaining IAT terminology and assumptions will likely be helpful. An attitude refers to a psychological disposition either to evaluate an object negatively or positively (Eagly & Chaiken, 1993; Rudman, 2011). An attitude object is anything that can be evaluated, including the self, persons, issues, situations, physical objects, and a variety of other things. Asking a person how they would evaluate something or how they feel about something is to use an explicit measure. However, to infer how a person feels about something based on their behavior is to use an indirect (or implicit) measure. As an example, measuring how quickly an interaction is broken-off or how far away one person chooses to sit from another, can be used as an indirect or implicit measure of an attitude toward one person relative to another. Response latencies (i.e., the speed at which a task is performed) are implicit measures. An implicit attitude is an association between an object and a negative or positive evaluation of that object that is automatically activated when the attitude object is presented to consciousness (Fazio, 1990).

Tattoo-Disease IAT

The IAT requires the subject to identify stimuli as belonging to one of four categories by pressing one of two designated computer keys (Meissner & Rothermund, 2015). The four categories are composed of two opposed attitude objects, also known as, the target categories; and two attribute categories. For this study, the target categories were photographs of tattooed models and photographs of non-tattooed models, exemplars of this category were comprised of 20 photographs evenly divided between five men and five women, each model being shown in both a tattooed and non-tattooed condition. That is, duplicate copies of the model's photograph will be made. One of the copies was photoshopped to appear as though the model has significant tattooing while the other copy will show no tattooing (Figures 2 and 3). Thus, the photoshopping process yielded two identical photographs, with the exception, that one copy showed tattooing while the other copy showed no tattooing—there were 20 unique photographs in all. The attributes were "health" and "disease," exemplars consisted of five words connoting health (healthy, hygienic, nutritious, strong, well) and five words connoting disease (contagious, epidemic, illness, infectious, sickness). To assure category applicability stimulus words were

Figure 2. Tattooed Model

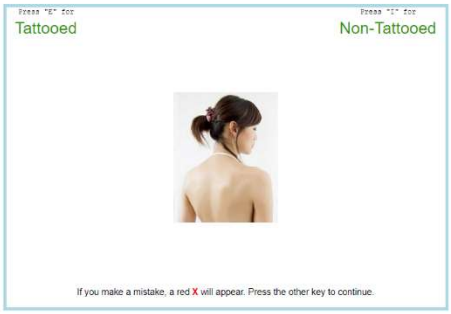
Figure 3. Non-Tattooed Model

tested by Park (2005) using a group of 55 students who provided ratings for a set of words. The words were rated on how much they connoted disease or health. On the basis of these ratings, the health and disease exemplar words listed above were selected for the Disease-Tattoo IAT.

The Disease-Tattoo IAT designed for this study consisted of seven blocks, with blocks 3-4 and 6-7 producing the critical data (Nosek, Greenwald, & Banaji, 2005). Again, the target category was photographs of "tattooed" and "non-tattooed" models and the attribute category was "health" and "disease" connoting words. The following seven-step outline of the Disease-Tattoo IAT design used in this research was derived from Nosek et al. (2005); Rudman (2011); and Lane et al. (2007).

In the first block, participants practice sorting photographs of models that appeared in the middle of the computer screen (Figure 4). Selections were made using the left index finger to strike computer key "e" to categorize the model as tattooed and the right index finger to strike

Figure 4. Model categorization choice.



computer key "i" to categorize the model as not tattooed. The word "tattooed" was displayed in the upper left corner of the screen and the words "not tattooed" was displayed in the upper right corner as reminders of the required response. Block 1 consisted of 20 trials sorting photographs of models. If stimulus items were incorrectly categorized, a red "X" appeared below the stimulus

item indicating that an error had been made. The participant was obliged to correct the error by hitting the correct key before proceeding to the next item.

In the second block, the same type of sorting task was repeated for the attributes “health”

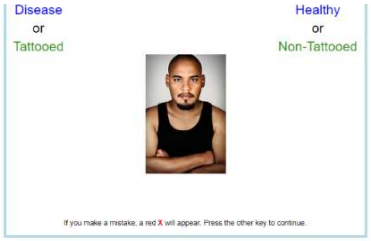
Figure 5. Word categorization choice

and “disease.” Attribute exemplars appeared in the middle of the computer screen (see Figure 5). Selections were made using the left index finger to strike computer key “e” to categorize a disease attribute exemplar word and the right index finger to strike computer key “i” to categorize a health attribute exemplar word. The reminder word “disease” will appear in the upper left corner of the screen, and the reminder word “healthy” will appear in the upper right corner. If the exemplar word “hygienic” appears in the middle of the screen, then a correct response would be sticking the computer key “i” on the right side of the keyboard. Block 2 consisted of 20 trials sorting health/disease exemplar words.

As indicated above, blocks 3-4 and 6-7 produced the critical data. In these blocks, use was made of all four of the categories (i.e., tattooed, non-tattooed, health, and disease), thus,

these two sets were double categorization tasks (see Figure 6). In the third block, the on-screen reminder in the upper left corner was “Disease” paired with “Tattooed”. The right side showed “Healthy” paired with “Non-tattooed”. If a photograph of a tattooed model or a word that

Figure 6. Double categorization choice



exemplified disease was seen in the middle of the screen, then the correct response was the “e” or left-hand key indicating “disease + tattooed.” Block 3 consisted of 20 trials sorting both tattooed and non-tattooed photographs of models and exemplars of health and disease words.

In the fourth block, “non-tattooed” was paired with “disease,” and “tattooed” was paired with “health.” The on-screen reminder in the upper left corner read “non-tattooed + disease” and on the upper right read “tattooed + health.” If a photograph of a tattooed model or a word that exemplified health was shown in the middle of the screen, then the correct response was the “i” or right-hand key indicating “tattooed + health.” Block 4 consisted of 40 trials sorting photographs of models and exemplars of health or disease words.

The fifth block was a single category “health-disease” practice block that reversed the response keys used in the second block in order to eliminate any practice effects (Rudman, 2011). As in block two, attribute exemplars appeared in the middle of the computer screen. Selections were made using computer keys “e” and “i” as described above. The reminder word “health” appeared in the upper left corner of the screen and the reminder word “disease” appeared in the upper right corner. If the exemplar word “hygienic” appeared in the middle of the screen, then the correct response was sticking computer key “e” indicating a health exemplar.

Nosek et al. (2005) observed that performance in the B3 and B4 pairing tended to interfere with the B6 and B7 pairing. However, using 40 trials in B5 rather than 20 trials significantly reduced the interference. Therefore, Block 5 consisted of 40 trials sorting health/disease exemplar words.

Block sixth was a reversal of block three. In this step, the on-screen reminder in the upper left corner was "non-tattooed" paired with "disease". The right side showed "tattooed" paired with "health". If a photograph of a tattooed model or a health exemplar was seen in the middle of the screen, then the correct response was the "i" key indicating "tattooed + health." Block 6 consisted of 20 trials sorting photographs of models and health or disease exemplars.

Block seven was a reversal of block four. For this step tattooed shared, a response with disease and non-tattooed was paired with health. The on-screen reminder in the upper left corner read "tattooed + disease" and on the right was "non-tattooed + health." If a photograph of a tattooed model or a disease exemplar was shown in the middle of the screen, then the correct response was the "e" key indicating "tattooed + disease." Block 7 consisted of 40 trials sorting photographs of models and health or disease exemplars.

Assumptions

The target population for the Tattoo-Disease IAT study was a cross-section of adults (18 to 65 years of age) who were also United States citizens. The sample (n = 328) was recruited through the Project Implicit website. All participants signed an agreement to participate voluntarily. It was assumed that the Project Implicit sample was representative of the United States population. An additional assumption was that stigmatization and other mechanisms of the BIS are products of evolution by natural selection and are therefore universal and permanent (i.e., hardwired) adaptations of human mental architecture. Given the universal nature of such adaptations, it is further assumed that virtually any population of human participants would have

served equally well for this research. Although avoidant attitudes directed toward tattooed people may be moderated by sociocultural factors (e.g., BIS sensitivity is moderated by perceived vulnerability to disease, (Park et al., 2007)), nevertheless it was assumed that a proclivity for such attitudes is a characteristic feature of human mental life. For this reason, it was predicted that an implicit negative or avoidant attitude directed toward tattooed people will be statistically apparent for any population of human beings. It is also assumed that participants would take the IAT test seriously making a sober attempt to avoid dishonest or misleading responses.

It is further assumed that the IAT is a valid and reliable measure. Because the IAT represents a procedural methodology for measuring a variety of implicit cognitions rather than an individual construct, there is no particular iteration of the test to be validated (Lane, Banaji, Nosek, & Greenwald, 2007). Notwithstanding the general nature of the IAT, one study which examined a diverse sample of implicit measures for internal consistency reported reasonable reliability for the IAT (Cronbach's alpha = 0.78; Cunningham, Preacher, & Banaji, 2001). Nosek, Greenwald, and Banaji (2007) claimed that although the IAT has been extensively used in a wide variety of procedural variations, nevertheless, it has consistently shown a satisfactory reliability. In a meta-analysis Hofmann, Gawronski, Gschwendner, Le, and Schmitt (2005) found the IAT acceptable, averaging .79 across 50 studies. They found that much of the variance for each IAT could be ascribed to measurement error. Although somewhat unusual for latency-based measures, the IAT has demonstrated good internal consistency (Nosek et al., 2007). Greenwald and Nosek (2001) reported (alphas or split-half correlations) internal consistency estimates to range from .7 to .9. Schmukle and Egloff (2004) have conducted extensive tests for internal consistency and test-retest reliability; they reported finding the IAT shows stable test-retest reliability across studies (median r = .56).

Gawronski (2002) conducted a study that tested the discriminate and convergent validity of two prejudice-related IATs. Using a sample (n = 61) of German students, the studies examined the validity of implicit prejudice relative to explicit measures of prejudice. The studies examined as attitude objects German versus Asian and German versus Turkish people in terms of positive versus negative evaluations. Test results confirmed the convergent validity of both IATs. Specifically, individual implicit prejudice toward Turkish people was significantly correlated with explicit prejudice toward Turks. In a similar manner, individual implicit prejudice toward Asians was significantly correlated with explicit prejudice toward Asians. Moreover, the discriminate validity of the two tests was confirmed by the absence of a significant relationship between implicit Asian scores and explicit Turkish scores and vice versa. Accordingly, these findings confirm the assumption that the IAT is a valid measure of associations relevant to prejudice. What is more, the combination of discriminate and convergent validity establishes the construct validity of the IAT as a measure of associative strength. Finally, it is assumed that the values obtained from participants responses consist of independent observations and have not been influenced by other study participants.

Limitations

Because the study focused exclusively on the stigmatization of tattooed people, there was a possibility that disease salience might cause or increase antipathy toward any out-group regardless of whether or not they exhibit atypical morphology. However, antipathy toward all out-groups would not necessarily be a disconfirmation of the basic thesis of the BIS. Another limitation was the possible effect that being a tattooed participant (as opposed to being non-tattooed) could have on participant response. It was assumed that implicit attitudes toward tattooed people are the product of unconscious and automatic processes and therefore being a

tattooed person should not affect their implicit attitudes toward other tattooed people. This thesis was strongly supported by the research findings.

Delimitations

Although stigmatization directed toward tattooed people is well documented (e.g., Dickson, Dukes, Smith, & Strapko, 2014; C. P. Jones, 1987; B. A. Martin & Dula, 2010), and stigmatization has been linked with the BIS (e.g., Kurzban & Leary, 2001; Oaten et al., 2011; Park et al., 2013a), to date, no research has explored a possible causal link between the BIS and tattooing. It was a hypothesized link between the BIS and tattooing that was the primary focus of this study. The research paradigm that structured the study was that of evolutionary psychology. According to evolutionary theory, all manifest behavior is the product of psychological mechanisms (Buss, 2015). Thus, stigmatization is the product of such underlying psychological mechanisms. These underlying mechanisms are understood as evolved information-processing devices that regulate behavior and the physiology of the body. Evolutionary psychology rejects what Tooby and Cosmides (2016) described as the Standard Social Science Model according to which the mind is a blank slate and essentially all behavior, including stigmatization and prejudice, are the product of associative learning. For evolutionary psychologists, stigmatization and prejudice are evolved adaptations serving inclusive fitness.

Ethical Assurances

When using human (or non-human) participants in a research study, it is imperative to comply with ethical standards. The APA Code is designed to prevent or minimize harm to research participants, including harm caused by deception unless the deception is a critical aspect of the research design. Researchers must also avoid conflicts of interest that possibly result in

research bias. Moreover, subject debriefing must be conducted accurately and as soon as practicable following subject participation.

Following the APA Ethics Code (2016) participants were informed that participation in the study was voluntary and that they had the right to withdraw at any time without negative consequences. Additionally, participants were informed about the purpose of the study, the procedures that were followed, the expected duration of their participation, potential risks or discomforts, and potential benefits. Participants were also be informed about incentives and that their personal information would be held in strict confidence. Finally, participants were given researcher's contact information regarding the research and their rights. This information was included in a consent form which was electronically signed prior to subject participation in the research. As part of the consent form, participants were informed that there are no particular risks or rewards anticipated pursuant to their participation in the research.

Summary

The chapter details primary research topics including the BIS, stigmatization, and voluntary disfigurement. Using a quantitative quasi-experimental approach, the study examined a hypothesized link between disease avoidant-socially exclusionary behavior and perception of tattooed people. The independent variable was photographic presentations of tattooed and non-tattooed models. The dependent variable was the IAT effect.

The purpose of the study was to examine whether the perception of tattooed people will cause a BIS reaction. Research data were collected using a standardized measure—a Tattoo/Disease version of the IAT designed to identify and measure an association between perception of tattooed people and BIS response.

Chapter 4: Findings

The purpose of this quasi-experimental study was to examine a hypostasized implicit relationship between tattooing, stigmatization, and infectious disease. The instrument used to examine the hypostasized relationship was The Implicit Association Test (IAT; Greenwald et al., 1998). This research focused on a threat-management construal of the psychology of stigma and stigmatization (Smith & Hughes, 2014). It was conjectured that stigmatization of tattooed people is best explained by the hypothesis that perception of tattooing on people heuristically signals a threat of infectious disease. Major researchers have almost universally regarded stigmatization as a product of social learning (Crocker et al., 1998; Goffman, 1963; N. Jones & Corrigan, 2014). However, the tendency to stigmatize conspecifics seems to be a universal human behavior. Moreover, the object of stigmatization also seems to be near ubiquitous (e.g., disfigurements, mental illness, obesity, old age, et cetera). Neither of the foregoing characteristics is easily explained by associative learning. It is hypothesized that stigmatization is best explained from the perspective of evolutionary psychology because being able to identify and avoid carriers of infectious disease would afford a fitness advantage. Consequently, stigmatization is best construed as an evolved adaptation aimed at managing threats associated with sociality, especially the threat of infectious contagion (Neuberg et al., 2011; Neuberg & Schaller, 2016; Smith & Hughes, 2014). The behavioral immune system (BIS; Schaller, 2006) is a suite of psychological mechanisms designed to proactively resist pathogenic threats before they enter the body. Because infectious pathogens are microscopic, and, thus, not directly perceptible, people tend to be acutely sensitive to heuristic cues reliably correlated with infection such as rashes, lesions, discolorations and atypical morphology in general (Park et al., 2007). However, because such cues are inherently ambiguous, inference errors are common. Moreover, because failure to identify and avoid a source of infection carries an excessive cost in fitness, the system is biased

to overperceive cues as signaling infection even when none is present (Miller & Maner, 2012). Thus, the BIS evolved to err in the direction of false positives—a tendency to misidentify healthy people as contagious (Haselton, Nettle, & Andrews, 2005). This means that the BIS is acutely sensitive to even slight deviations in normal morphology. The central hypothesis of this study is that voluntary disfigurements, specifically tattooing, is typically experienced and reacted to (albeit unconsciously and automatically) as a heuristic cue signaling an infectious threat, that is, a case of BIS overperception. The primary purpose of this study was to answer the following research question: Will participants implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people?

Because the hypothesized association between tattoos and infectious disease was thought to be implicit, such an association predicted two additional hypotheses. First, participants who self-report either a neutral or positive attitude toward tattooed people will, nevertheless, still implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. A second prediction was that participants who report having tattoos themselves will still implicitly associate tattooing with infectious disease. This chapter will be organized around the research design and method; validity and reliability of the data collection process; statistical analysis of the data; results of the data analysis as they apply to the research hypotheses.

Validity and Reliability of the Data

Because the IAT represents a procedural methodology for measuring a variety of implicit cognitions rather than an individual construct, there is no particular iteration of the test to be validated (Lane, Banaji, Nosek, & Greenwald, 2007). Notwithstanding the general nature of the IAT, one study which examined a diverse sample of implicit measures for internal consistency

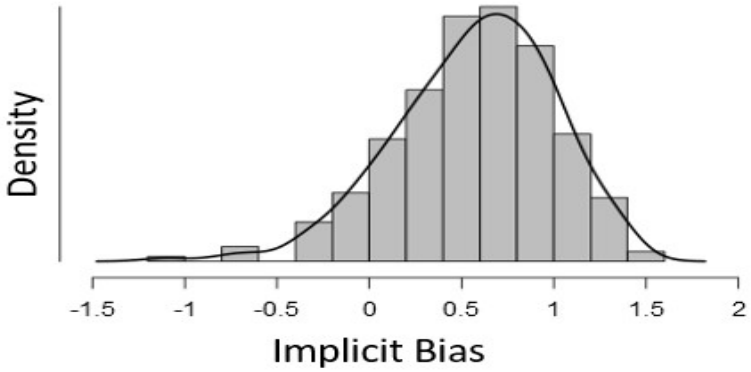
reported reasonable reliability for the IAT (Cronbach's alpha = 0.78; Cunningham, Preacher, & Banaji, 2001). Nosek, Greenwald, and Banaji (2007) claimed that although the IAT has been extensively used in a wide variety of procedural variations, it has consistently shown a satisfactory reliability. In a meta-analysis Hofmann, Gawronski, Gschwendner, Le, and Schmitt (2005) found the IAT acceptable, averaging .79 across 50 studies. They found that much of the variance for each IAT could be ascribed to measurement error. Although somewhat unusual for latency-based measures, the IAT has demonstrated good internal consistency (Nosek et al., 2007). Greenwald and Nosek (2001) reported (alphas or split-half correlations) internal consistency estimates to range from .7 to .9. Schmukle and Egloff (2004) conducted extensive tests for internal consistency and test-retest reliability; they reported finding the IAT shows stable test-retest reliability across studies (median r = .56). Gawronski (2002) conducted a study that tested the discriminate and convergent validity of two prejudice-related IATs. Using a sample (n = 61) of German students, the studies examined the validity of implicit prejudice relative to explicit measures of prejudice. The studies examined as attitude objects German versus Asian and German versus Turkish people in terms of positive versus negative evaluations. Test results confirmed convergent validity of both IATs. The IAT is now reported to be the most well-validated of all implicit attitude measures (Kaiyuan, Brian, & Anthony, 2014).

Results

The problem addressed in this study is whether stigma is best explained as a product of social learning and is thus, culture-bound or whether stigma, although moderated by cultural factors, is best understood as an evolved adaptation the function of which is threat management. The purpose of this quasi-experimental study was to determine whether the perception of significant tattooing will cause a behavioral immune system reaction, specifically, stigmatization

of tattooed people. The instrument used to assess the hypothesized link between tattooing and infectious disease was The Implicit Association Test (IAT; Greenwald et al., 1998). The IAT effect is based on a comparison of latencies for two different classification tasks, specifically, tattooing–disease associations and non-tattooing–disease associations. To calculate the IAT effect size the D statistic scoring algorithm recommended by the test developers was used (Greenwald et al., 2003). For this calculation, all congruent and incongruent trials were collapsed, after which the difference between congruent and incongruent trials was calculated. This difference was divided by the pooled standard deviation, yielding a D statistic for each participant. The value of D provides an estimate of the significance of the IAT effect: According to Rudman (2011) D statistics of .15, .35, and .60 imply small, medium, and large effect sizes, in the same order—a higher score indicates a stronger association between disease and tattooing relative to disease and non-tattooing. Because 55 participants (16.8%) had error rates deemed too high, their data were excluded from the analysis. The D statistic mean is M = 0.58 (SD = 0.43), Cohen's d = 1.33, 95%CId = [1.17, 1.49] and is considered a large effect size, as is apparent in the histogram (figure 7). The possible range of scores is -1.10 to 1.45.

Figure 7. Histogram, IAT Frequency



Participant Demographics

Participants (n = 328) volunteered between November 2, 2015, and November 6, 2017, at the Project Implicit website, https://implicit.harvard.edu/implicit/takeatest.html. Included in the sample were 232 participants that identified as female (70.7%) and 95 participants that identified as male (29.0%), 0 participants identified as "another gender", and 1 participant did not indicate their gender (0.3%). The average age of participants was 30.9 years (SD = 13.9). Age distribution included 77 participants under 20 years old (23.5%), 116 participants were in their 20's (35.4%), 53 participants were in their 30's (16.2%), 37 participants were in their 40's (11.3%), 27 participants were in their 50's (8.2%), 15 participants were in their 60's (4.6%), 3 participants were in their 70's (0.9%). Participant ethnicity and race included 68 participants identified as Hispanic/Latino (20.7%), 224 participants identified as Not Hispanic or Latino (68.3%), 21 participants reported not knowing their ethnicity (6.4%), and 15 participants did not indicate their ethnicity (4.6%). 2 participants identified as American Indian/Alaska Native (0.6%), 9 participants identified as East Asian (2.7%), 12 participants identified as South Asian (3.7%), 3 participant identified as Native Hawaiian or Pacific Islander (0.9%), 45 participants

identified as Black or African American (13.7%), 184 participants identified as White (56.1%), 5 participants identified as More than One Race: Black/White (1.5%), 28 participants identified as More than One Race: Other (8.5%), 38 participants identified as Other or Unknown (11.6%), and 2 participants did not indicate their race (0.6%).

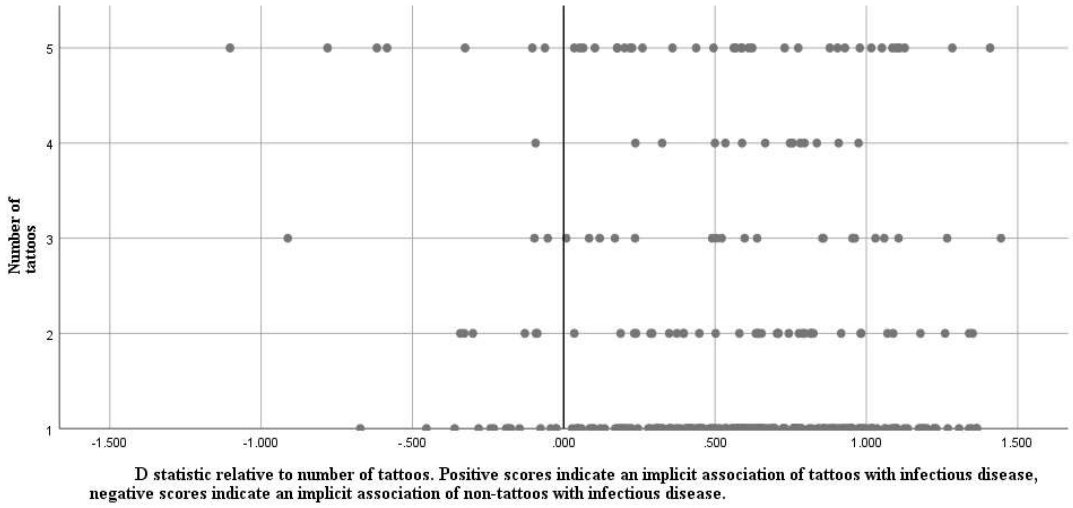
Research Question/Hypothesis 1

The first research question asks whether participants will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. As indicated in the histogram above (figure 7), the D statistic mean M = 0.58 (SD = 0.43), Cohen's d = 1.33, 95%CId = [1.17, 1.49] is considered a large effect size. Hypothesis 1 states that participants will implicitly associate disease connoting concepts with the perception of tattooed people. Thus, consistent with hypothesis 1 there was a statistically robust tendency for participants to implicitly associate disease connoting concepts with the perception of tattooed people—90.2% of participants registered positive scores where positive scores indicate participant association of tattooing with infectious disease. A paired samples t-test was conducted which demonstrated that the Tattoo-Disease IAT effects differed from zero. The congruent-incongruent computed difference yielded a paired difference of (M = .09), t (3.435); r =.531, $p < .05$. On the basis of these findings the first null hypothesis was rejected. The t-test requires that one assume that the dependent variable (i.e., D statistic) is measured using a continuous scale and this condition was satisfied. Participants responding to the Project Implicit website were randomly assigned to one of the various IAT's being run by Project Implicit at the time. Since respondents to Project Implicit who volunteered for this study come from all over the United States there is little chance they might influence one another. It can be further assumed that the U.S. population is normally distributed and of equal variance.

Research Question/hypothesis 2

The second research question asks whether participants who report having tattoos themselves will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. To test hypothesis 2 which states that participants who report having tattoos themselves will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people—a scatter plot was produced as a preliminary comparison between explicit attitudes as compared with implicit attitudes. Participants who both report having tattoos and those reporting no tattooing indicate a strong tendency to implicitly associate tattooing with infectious disease, as is apparent in the right half of the scatter plot (Figure 8). Read the scatter plot as follows, 1 = no tattoos (63%); 2 = 1 tattoo (12.8%); 3 = 2 tattoos (6.7%); 4 = 3 tattoos (4.3%), and 5 = 4 or more tattoos (12.2%). A total of 37% of respondents reported having tattoos. A statistically significant majority of those participants reporting 4 or more tattoos (i.e., line 5, Figure 8) still indicated an implicit attitude associating tattooing and infectious disease. Thus, consistent with hypothesis 2 there was a statistically robust tendency for participants with tattoos to implicitly associate disease connoting concepts with the perception of other tattooed people.

Figure 8. Tattoos Scatter Plot

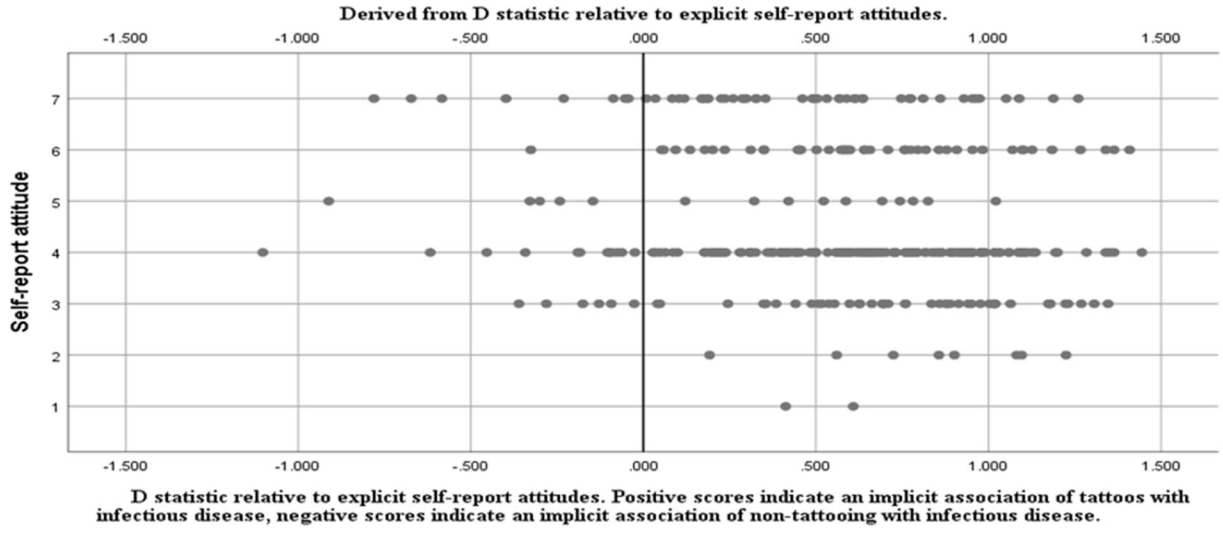


Among participants that self-reported having tattoos, there was a significant difference between the overall average IAT score and zero such that participants that self-reported having tattoos also had an implicit bias more strongly associating disease and tattooing relative to disease and non-tattooing. The average IAT score is 0.52 (SD = 0.48), $t(106) = 11.23$, $p < .01$, Cohen's d = 1.09, 95%CId = [0.84, 1.32]. This is a large effect. Moreover there was not a significant difference in implicit bias between participants who reported having at least one tattoo (M = .61, SD = .39) and participants who reported having no tattoos (M = .52, SD = .48), $F(1, 270) = 1.65$, $p = .10$, Cohen's d = 0.21, 95%CId = [-.04, .45]. A Pearson correlation coefficient was used to test the second null hypothesis (viz., that subjects who reported having tattoos themselves will not implicitly associate disease connoting concepts with the perception of other tattooed people compared with non-tattooed people). The Pearson correlation indicated a weak negative correlation between the two variables, $r = -.128$, $n = 326$, $p < .05$. There was also not a significant correlation between the number of tattoos a participant reported having and their implicit bias, $r(272) = -.12$, $p = .05$, 95%CIr = [-.24, .00].

Research Question/hypothesis 3

The third research question asks whether participants who self-report either a neutral or positive attitude toward tattooed people implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. Hypothesis 3 states that participants who report having either a neutral or positive attitude toward tattooed people will hold an implicit attitude associating tattooing with infectious disease. A scatter plot was produced as a preliminary indication of explicit attitudes as compared with implicit attitudes (Figure 9). Attitudes toward tattooed people as depicted in the scatter plot reflect a response to the question "How would you describe your general attitude toward tattooed people?" 1 = Strongly negative; 2 = Moderately negative; 3 = Slightly negative; 4 = Neither negative or positive; 5 = Slightly positive; 6 = Moderately positive; 7 = Strongly positive.

Figure 9. Attitude Scatter Plot



The scatter plot above (Figure 9) shows that an overwhelming majority of participants associate tattooing with infectious disease (90.2% of the sample). Note the right half of the scatterplot is

associated with positive D scores which links tattooing with infectious disease. Among participants that self-reported either a neutral or positive attitude toward people with tattoos, there was a significant difference between the overall average IAT score and zero such that participants that self-reported a favorable attitude toward tattooed people also had an implicit bias strongly associating tattoos and disease relative to non-tattoos and disease. The average IAT score was 0.53 (SD = 0.43), $t(223) = 18.65$, $p < .01$ Cohen's $d = 1.24$, 95%CId = [1.07, 1.42], indicating a large effect.

As a further confirmation of hypothesis 3, a Pearson product-moment correlation coefficient was calculated. Results suggest a weak negative correlation between the two variables, $r = -.171$, $n = 324$, $p < .01$. From these findings it is concluded that there is not a significant correlation between explicit self-report attitudes toward tattooed people and implicit attitudes associating tattooing and infectious disease. This research suggests that despite explicit neutral or positive attitudes toward tattooed people the vast majority of those tested have a strong inclination to perceive tattooing on people as a heuristic cue signaling infectious disease.

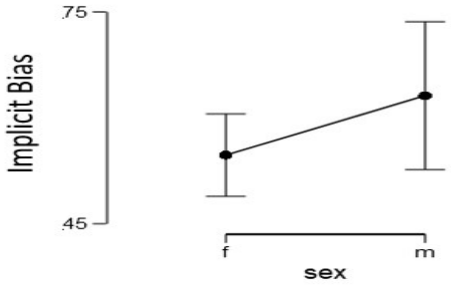
Review of assumptions is the same for both hypothesis 2 and 3 since both made use of the Pearson product-moment correlation for which it is assumed that the dependent variable (i.e., D statistic) is measured using a continuous scale, (i.e., at the interval or ratio level), this condition was satisfied. Additionally, it was assumed that D statistics are a function of related pairs, that is to say, each participant must supply a score on both variables X and variables Y. This condition was satisfied as was made apparent on Number of Tattoos scatter plot (figure 8). Participants responding to the Project Implicit web cite were randomly assigned to one of the various IAT's being run by Project Implicit at the time. Since respondents to Project Implicit come from all over the world, although limited to U.S. citizens for this study, there can be little

chance that respondents had any influence on one another. It can be further assumed that the U.S. population from which the sample (n = 328) was taken are normally distributed and of equal variance.

Relationship between Demographic Factors and Implicit Bias

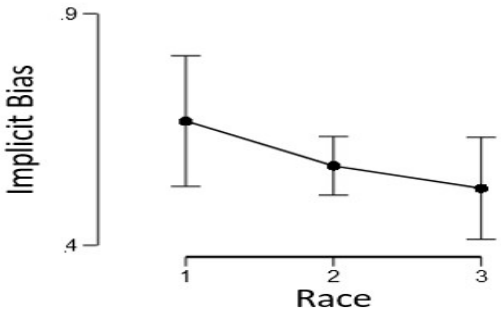
There is no statistical difference in implicit bias based on gender, $t(271) = 1.47$, $p = .14$, Cohen's $d = 0.09$, 95%CId = [-.03, .21] (Figure 10).

Figure 10. Sex and Implicit Bias.



Because there were not enough participants in each racial group to test all differences, participants were grouped into three categories: White, Black, and Another Race. Using these categories, there is not a significant difference in implicit bias based on race, $F(2, 270) = 1.41$, $p = .25$, $\eta^2_p = .01$, 95% $\eta^2_p = [.00, .04]$ (Figure 11).

Figure 11. Race and Implicit Bias



Implicit bias scores by demographic variables. Higher positive scores imply stronger association between tattooed people and disease relative to non-tattooed people and disease. *D* statistics of .15, .35, and .60 imply small, medium, and large effect sizes, in the same order. A strong effect is indicate for all categories except South Asian and Mixed race both having a very small sample size but still indicating a medium effect size (Table 2).

Table 2.

	Sample Size	Mean *D* Statistic	Standard Deviation
		Gender	
Male	79	0.63	0.47
Female	194	0.55	0.41
Other	N/A	N/A	N/A
		Ethnicity	
Hispanic or Latino	50	.49	.48
Not Hispanic or Latino	197	.59	.42
Other/Unknown	13	.58	.38
		Implicit Bias and Race	
American Indian/Alaskan Native	N/A	N/A	N/A
East Asian	6	.71	.42
South Asian	9	.36	.60
Native Hawaiian/Pacific Islander	2	.98	.13
Black or African American	37	.67	.42
White	162	.57	.41
More than one race – Black/White	5	.40	.40
More than one race – Other	24	.51	.44
Other/Unknown	27	.55	.50

Evaluation of the Findings

Making use of an evolutionary frame of reference, this research focused on a threat-management construal of the psychology of stigmatization (Schaller & Neuberg, 2012). The research questions assessed the relationship between significant tattooing and infectious disease with stigmatization being a defensive/avoidant response to the perception of tattooing as a heuristic cue signaling infectious disease. The research findings revealed a statistically significant implicit psychological association between tattooing and infectious disease. This implicit association between tattooing and disease was unaffected by participant self-reports of having either neutral or positive attitudes toward tattooed people, nor was the association affected by the fact that participants themselves had tattooing.

The first research question asks whether participants will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. The association between tattooing and infectious disease was measured using the Implicit Association Test (IAT; Greenwald et al., 1998) with results indicating a strong effect size that is interpreted as a strong tendency for participants to implicitly associate disease connoting concepts with perception of tattooed people—90.2% of participants indicated an implicit association between perception of tattooed people and infectious disease compared with an association between non-tattooed people and infectious disease.

The second research question is concerned with whether participants that report having tattoos themselves implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. Although intuitively it may seem that tattooed people would be favorably disposed toward other people with tattooing, nevertheless, results indicate that tattooed people have an implicit bias more strongly associating tattooing

with disease relative to non-tattooing with disease. Thus, even people with significant tattooing still have an implicit tendency to stigmatize other tattooed people. Such a discrepancy between coexisting negative and positive attitudes has been reported by numerous researchers (e.g., Greenwald & Banaji, 1995; Johnson et al., 2016; Pinkston, 2015). Such ambivalent attitudes are probably best interpreted in terms of a dual-process theory. J. Evans and Stanovich (2013) and numerous other researchers have proposed that two qualitatively different systems of cognitive processing are operative in humans. Evans and Stanovich claimed that heuristic (i.e., implicit) processes are unconscious, automatic, rapid and evolutionarily primitive while analytic (i.e., explicit) processes are conscious, deliberative, slow, and evolutionarily recent. Sometimes the two systems operate harmoniously and sometimes they are in conflict (Carruthers, 2009; Mithen, 1998).

The third research question asks whether participants that self-report either a neutral or positive attitude toward tattooed people still implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. The research findings indicated that participants who reported a favorable attitude toward tattooed people also indicated an implicit bias more strongly associating disease with tattooing relative to disease and non-tattooing. Again, these antithetical attitudes are likely best interpreted as a conflict between heuristic and analytic cognitive processing (J. Evans, 2008; J. Evans & Stanovich, 2013).

Summary

The purpose of this research was to examine a hypothesized implicit relationship between tattooing, stigmatization, and infectious disease. This study aimed at answering three basic research questions concerned with the hypothesized implicit relationship. The instrument used to answer the research questions was The Implicit Association Test (IAT, Greenwald et al., 1998).

The IAT has shown strong validity and reliability. The first question asked if participants would implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. Results of the IAT indicated that participants have a statistically robust tendency to associate disease connoting concepts with the perception of tattooed people. The D statistic which reflects the effect size of the IAT was M = 0.58 which is considered a large effect size. Thus, a clear confirmation of the first hypothesis which states that participants implicitly associated disease connoting concepts with the perception of tattooed people. The null hypothesis was rejected.

The second research question asked whether participants who report having tattoos themselves will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. The study findings indicated little difference between participants with tattooing and those indicating no tattooing. A substantial majority of all participants showed a strong tendency to implicitly associate tattooing with infectious disease indicating little difference between participants with and participants without tattooing. Participants who self-reported tattooing showed an implicit bias more strongly associating disease and tattooing relative to disease and non-tattooing. For participants self-reporting tattoos the IAT D statistic was M = 0.52 which is considered a large effect size. The null hypothesis was rejected.

The third research question considered asks if participants who self-report either a neutral or positive attitude toward tattooed people will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. Regardless of self-report claims findings indicate that an overwhelming majority of participants associate tattooing with infectious. Otherwise stated, explicated attitudes, whether favorable or unfavorable,

apparently have little or no effect on implicit attitudes. For participants self-reporting favorable attitudes (i.e., other than negative) the IAT D statistic was M = 0.52 which is considered a large effect size. Again, the null hypothesis was rejected. It is postulated that a dual-process theory of cognition best explains the ambivalence between implicit and explicit attitudes.

Chapter 5: Implications, Recommendations, and Conclusions

The problem addressed in this study is a hypothesized link between disease avoidant-socially exclusionary behavior (i.e., stigmatization) and perception of tattooed people (Neuberg et al., 2011; Neuberg & Schaller, 2016). More specifically, the problem can be analyzed in terms of the following questions. First, whether stigma is best explained as culturally bound learned behavior (Crocker et al., 1998; Goffman, 1963; E. E. Jones et al., 1984) or part of an evolved adaptive threat management system—the behavioral immune system (BIS; Schaller & Duncan, 2007) although likely moderated by a combination of cultural influences and local ecological conditions. Second, will the perception of tattooed people activate a BIS response such as stigma or disgust. It was hypothesized that if the perception of tattooed people acts as a BIS trigger, then tattoo stigma is likely best construed as a BIS mechanism and, thus, best explained as an evolved adaptation designed to avoid conspecifics heuristically signaling a threat of infectious disease.

The purpose of this study was to determine whether the perception of significant tattooing would cause a BIS reaction. Participants were recruited by Project Implicit (Greenwald et al., 2011), a non-profit international collaboration among researchers who are interested in implicit social cognition. Project Implicit agreed to run the Tattoo/Disease IAT designed for this study which explored a hypothesized implicit psychological association between perception of tattooing and infectious disease, that is to say, an association characterized by a more efficient (i.e., faster and more accurate) response latency when tattoo stimuli is paired with disease connoting stimulus words. Results of the IAT indicated that a significant percentage (90.2%) of the sample implicitly associated perception of tattooing with infectious disease. Limitations of the study included a skewed gender distribution (231 females versus 93 males); the sample was limited to US citizens and age range excluded participants under the age of 18 years and over the

age of 65, the mean age was (M = 31) years. The remainder of the chapter will focus on research design; validity and reliability of the IAT test instrument and data collection process; statistical analysis of the data, and results of data analysis as it relates to the research hypotheses.

Beyond exploring a hypothesized link between tattooing and infectious disease, the study also sought to answer two additional questions. First, will people with tattoos associate tattooing with infectious disease. In other words, will being tattooed oneself have any effect on one's implicit attitude toward other tattooed people—will there be a significant difference in the D statistic (i.e., IAT effect) between participants with tattooing and non-tattooed participants. Second, will participants who report a positive or neutral attitude toward tattooed people still associate tattooing with infectious disease.

Implications

The first research question asked whether participants will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. Results of the study indicated a strong implicit association between perception of tattooing and disease connoting concepts. Therefore, the first null hypothesis of the study was rejected (viz., that participants do not implicitly associate disease connoting concepts with the perception of tattooed people). The IAT effect is based on the difference between latencies for the two classification tasks. To calculate IAT effect size the *D* statistic scoring algorithm recommended by the test developers Greenwald et al. (2003) was used. For this calculation, all congruent and incongruent trials were collapsed, after which the difference between congruent and incongruent trials was calculated. This difference was divided by the pooled standard deviation, yielding a *D* statistic for each participant. The *D* statistic provides an estimate of the significance of the IAT effect: According to Rudman (2011) *D* statistics of .15, .35, and .60 imply small, medium, and

large effect sizes, in the same order. Thus, the *D* statistic mean (M =.58) of the study has a large effect size. Positive scores reflected an implicit association between tattooing and infectious disease, while negative scores reflected an association between non-tattooing and infectious disease. Consistent with first hypothesis there was a strong tendency for participants to implicitly associate disease connoting concepts with the perception of tattooed people—90.2% of participants registered positive scores. A paired samples t-test was conducted which demonstrated that the Tattoo-Disease IAT effects differed from zero. The congruent-incongruent computed difference yielded a paired difference of (M = .09), t (3.435); r =.531, $p < .05$. It was assumed that an implicit association of the perception of tattooed people with disease connoting concepts could reasonably be interpreted to mean that significant tattooing serves as a heuristic (i.e., subliminal) cue signaling a danger of infectious disease. Tattoo stigma is believed to be a psychobehavioral manifestation of a negative attitude which functions as a socially exclusionary mechanism aimed at the avoidance of conspecifics heuristically signaling infectious disease.

The second research question asks whether participants who reported having tattoos themselves will also implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. A Pearson correlation coefficient was used to test the second null hypothesis (viz., that participants who reported having tattoos themselves will not implicitly associate disease connoting concepts with the perception of other tattooed people compared with non-tattooed people). The Pearson correlation indicated a weak negative correlation between the two variables, r = -.128, n = 326, $p < .05$. From these findings, it was concluded that no significant relationship exists between having tattoos and the association of disease with tattooed people. Thus, despite having one or more tattoos participants evinced a

strong tendency to associate tattooing with infectious disease. Thus, the second null hypothesis was rejected.

The finding that even people with extensive tattooing will, nevertheless, still implicitly associate tattooing with infectious disease is predicted by and, thus, best explained in terms of the modular theory of the mind. As detailed above, information encapsulation refers to the idea that information-processing within a module is shielded from outside information flowing into the module and thus, is unaffected by outside information In this case the conscious knowledge that one has tattooing and explicitly places a positive value on having them is unaffected by the modular processing of heuristic cues suggesting infectious disease. The Müller-Lyer illusion (Figure 1) was offered above as an example of how modular information-processing is unaffected by outside information. Awareness that the Müller-Lyer illusion is an illusion and the parallel lines are of equal length does not affect visual processing—the lines continue to appear unequal (Zeman, Obst, Brooks, & Rich, 2013).

In test runs of the Tattoo-Disease IAT heavily tattooed participants universally expressed incredulity with their results which indicated that they associated tattooing with disease. It is apparent that explicit attitudes produce one type of cognition and behavior while implicit attitudes can produce different cognitions and behavior. In a study by Green et al. (2007) implicit race bias was tested to determine whether racial bias predicts level of care administered to patients. Physicians reported no explicit preference for white patients compared with black patients. However, the IAT indicated an implicit preference favoring white over black patients. As physician bias toward blacks increased the level of care decreased. Study findings suggest that physicians' implicit bias may contribute to racial disparities in medical treatment.

Stanovich (2004) details a number of situations where a person's behavior appears to be wholly inconsistent with cultural norms and general expectations, including situations in which a young girl, with serious facial disfigurement, is mocked and chided with remarks like "That is the ugliest girl I have ever seen" and "How on earth did you get that ugly?" (p. 31). Stanovich cites cases of rape in which the victim's spouse is incapable of sympathizing with his injured partner. Often the spouse is aware that his reaction is wholly inappropriate but feels he is incapable of suppressing his reaction. Such a conflict in response tendencies is a very common phenomenon. Stanovich claimed that such inconsistency is like having two minds in conflict.

According to Jonathan Evans and Frankish (2009) in recent years a significant body of research has emerged exploring the idea that the mind has a dual nature. These authors explained that although there is a variety of dual-process theories, the general consensus is that there are two distinct mechanisms used to process the same information often yielding antithetical results. Dual-process theories, they claimed, are frequently explained in terms of an implicit (heuristic) System 1component which is automatic, unconscious, rapid, heavily contextualized, inflexible, and making little demand on working memory; a second component characterized as an explicit (analytic) System 2 which is conscious, decontextualized, effortful, slow, controlled, which makes significant demands on working memory. System 1 is thought to be shared with other animals while System 2 is believed to be uniquely human. System 2 is associated with deductive and hypothetical reasoning. When a tattooed person is perceived both systems can react, System 1 outputting an unconscious disease avoidant response including stigma and disgust reactions and System 2 making a rational judgment about the meaning of the body ink and how one ought to behave. It should be noted that to what extent implicit bias can be consciously overridden is not clear. Research in this area would be a likely next step for future research.

The third research question asks whether participants who self-report either a neutral or positive attitude toward tattooed people will implicitly associate disease connoting concepts with the perception of tattooed people compared with non-tattooed people. The third null hypothesis states that participants who reported having either a neutral or positive attitude toward tattooed people will not implicitly associate disease connoting concepts with the perception of tattooed people compared to non-tattooed people. To test the third null hypothesis a Pearson correlation coefficient was calculated. Results suggested a weak negative correlation between the two variables, $r = -.171$, $n = 324$, $p < .01$. When queried about their explicit attitude toward tattooed people 18.5% of the sample reported a negative attitude; 46.3% reported neither a positive nor a negative attitude; 34.5% reported a positive attitude and 1.2% of the sample did not report (n =328). Thus, a total of 80.3% reported a positive or neutral attitude. These percentages are compared with 90.2% of the sample implicitly associating tattooing with infectious disease. Based upon these findings, the third null hypothesis was rejected.

Less than 20% of the sample reported unfavorable attitudes toward tattooed people, nevertheless, 90% of the sample showed an implicit bias associating tattooing with disease. As noted above, attitudinal ambivalence is a relatively common phenomenon. The situation here with self-reported explicit attitudes conflicting with implicit IAT findings is, like hypothesis two, probably best explained in terms of dual-process cognition.

It was assumed that stigmatization and other BIS mechanisms are products of evolution by natural selection and are therefore universal and permanent (i.e., hardwired) adaptations of the human mental architecture (Carruthers, 2009). Given the universal and permanent nature of such adaptations, it was surmised that virtually any population of human participants would have served equally well for the current research. Although avoidant attitudes directed toward tattooed

people may be moderated by sociocultural factors, nevertheless, it was assumed that a proclivity for such attitudes is a species-typical characteristic. For this reason, it was predicted that an implicit negative or avoidant attitude directed toward tattooed people will be statistically apparent for any population of human beings. This assumption notwithstanding, as indicated above, limitations of the study include a significantly skewed sex distribution with 231 females and 93 males. Moreover, the research sample was limited to U.S. citizens between the ages of 18 to 65 years.

Recommendations for Future Research

It was assumed that implicit attitudes toward tattooed people are a product of unconscious and automatic socially exclusionary disease avoidant adaptive processes and therefore being a tattooed person should not affect that person's implicit attitudes toward other tattooed people, which is to say, the fact that one has tattoos may have a significant effect on the tattooed individual's explicit attitude; nevertheless, being tattooed should have no bearing on their implicit attitude toward other tattooed people. This is, of course, exactly what the findings of this study indicated. However, such findings, notwithstanding, a very puzzling question is suggested, specifically, why, in the popular culture, do so many people choose to be tattooed. Acne (Papadopoulos et al., 2000), obesity (Park, Schaller, & Crandall, 2007), facial birthmarks (Ackerman et al., 2009), aging (Duncan & Schaller, 2009a), and physical disability (Park, Faulkner, & Schaller, 2003) have all been shown to be cases of BIS overperception in the same way that the current findings have supported the thesis that tattooing is associated with infectious disease and, thus, also a case of BIS overperception. There is a difference, however, because unlike tattooing, acne, obesity, and disability are not seen as desirable by a relatively large segment of the popular culture. These ratiocinations might form the basis of an objection to the

cogency of the central thesis of this study or form the basis of an alternative interpretation of the data. However, because these processes are not entirely understood no compelling alternative interpretation is apparent at this time. Although, the question of why people choose to be tattooed has received some attention, the question might form the basis of future tattoo research.

The purpose of the study was to explore a conjectured link between stigmatization, tattooing, and infectious disease. The central problem addressed in the study was a hypothesized relationship between disease avoidant-socially exclusionary behavior (viz., stigmatization) and perception of tattooed people (Neuberg et al., 2011; Neuberg & Schaller, 2016). The study also sought to determine if having tattoos would influence a subject's implicit attitude toward other tattooed people. Additionally, the study sought to determine if explicit self-report of one's attitude toward tattooed people was positively correlated with implicit attitudes. Each of the foregoing issues was addressed in the study. Robust findings indicated that participants are prone to associate perception of tattooing with infectious disease. Moreover, participants with tattooing are no less prone to associate tattooing with infectious disease than participants who are not tattooed. Finally, participants who report having positive or neutral attitudes toward tattooed people are no less prone to associate tattooing with infectious disease than participants who report negative attitudes toward tattooed people.

The results of this study are both consistent with and were predicted by evolutionary psychology, the general framework used for this study. Thus, because evolutionary psychology predicts that atypical morphology will trigger BIS mechanisms this research serves as a confirmation of the general assumptions of evolutionary psychology and more particularly BIS theory (Cosmides & Tooby, 2013; Schaller & Neuberg, 2012). Additionally, this research is consistent with previous similar research in the area of the disease avoidant behavior (e.g.,

Ackerman et al., 2009; Duncan & Schaller, 2009a; Papadopoulos et al., 2000; Park et al., 2003; Park et al., 2007).

Galbarczyk and Ziomkiewicz (2017) conducted a study in which photos of models were rated in either a tattooed or non-tattooed condition. Woman participants rated the tattooed model as healthier than non-tattooed version, a finding which superficially appears to conflict with the findings of this study. However, because the Galbarczyk and Ziomkiewicz findings were based on an explicit self-report measure, their findings are consistent with results of the current study. As is noted above, self-report and IAT measures often conflict. Green et al. (2007), using an IAT measure, tested whether physicians would show an implicit race bias in the treatment of white versus black patients. Physician participants were randomly assigned either a black or white vignette patient. Participants reported no explicit preference for white versus black patients. However, IAT results revealed that white patients received a statistically significant higher level of care than black patients. This example is typical of IAT research where explicit and implicit attitudes frequently conflict.

Given the results of this study future research might further test the construct of voluntary disfigurement (e.g., body scaring, piercing, and "face painting") which evolutionary psychology predicts would be likely triggers for BIS reactions. Additionally, future research might improve upon this study by expanding the sample to include a more nearly equal distribution in sex. Age distribution might also be expanded to include minors and seniors. Moreover, the sample might also be broadened to include participants from other cultures and diverse locations—Project Implicit attracts participants from all locations served by the World Wide Web. A logical next step might be an alternative test to confirm the findings of the current research. Another test that could prove useful in understanding the social nature of tattooing would be an exploration of the

effects of proximity. Specifically, how one is assessed socially when seen in relatively close proximity to a tattooed person.

This study was designed to answer three specific questions, to wit, will participants implicitly associate tattoos with disease; will the fact that a participant has tattoos have a significant effect on their attitude toward other tattooed people, and will participants who report having an explicit neutral or positive attitude tattooed people implicitly associate tattooing with disease. Each of these questions was unambiguously answered by the study. First, study findings indicated that a significant majority of participants do tend to associate tattooing with disease. Second, participants having tattoos themselves associate tattooing with disease in essentially the same way as non-tattooed participants, that is, study results indicated no significant difference between participants with tattooing and participants without tattooing. Finally, even though only 18.5% of participants indicated a negative attitude toward tattooed people, nevertheless, 90.2% of participants indicated that they implicitly associated tattooing with disease.

This study supports the distinction between implicit (i.e., unconscious and automatic) and explicit (i.e., what an individual consciously believes their attitude to be) attitudes. In spite of what an individual might explicitly believe, IAT research has shown that implicit attitudes operating unconsciously and automatically can have profound effects on behavior.

Conclusion

The findings of this study revealed that perception of tattooed people serves as a heuristic cue for pathogen infection and is, thus, implicitly associated with infectious disease. The research also indicated that neither being tattooed nor expressing an explicit neutral or positive attitude toward tattooed people has an effect on the implicit association between tattooing and infectious disease. With the addition of tattooing to the catalog of cues previously determined to

connote infectious disease, this research complements other research supporting the general thesis of the behavioral immune system. Based on the findings of this study, together with previous BIS research, it is evident that a broad variety of perceptual cues are likely to activate socially exclusionary mechanisms (e.g., stigmatization) which evolved to effect avoidance of a potential threat of infectious disease. This research suggests that stigma is best construed as an evolved adaptation aimed at managing threats associated with sociality, especially the threat of infectious contagion (Neuberg et al., 2011; Neuberg & Schaller, 2016). This finding implies positive implications for the general understanding of stigmatization.

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