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Autism-Spectrum Disorder
Testing Perceptions of Reality through the Monty Hall Problem

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Senior Honors Thesis (Psychology)
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Visual perception of reality has evolved for fitness and not for perceiving an accurate reality, indicating that typical humans perceive an inaccurate perception of reality. Previous research indicates that other information processing systems may also interact with reality using heuristics. Heuristics are mental-shortcuts that are used to facilitate cognitively effortless interaction with the environment, but they often affect accuracy. Individuals with Autism Spectrum Disorder (ASD) have demonstrated less susceptibility to certain heuristics. The lack of heuristic use may attribute to perceiving an objective reality. The Monty Hall problem (MHP) is a probability reasoning question that elicits heuristics that typically leads to incorrect conclusions in the MHP. The objective of this study is to measure the heuristic use between ASD and non-ASD individuals using the MHP. Results indicate that ASD participants were significantly more likely to solve the MHP correctly and understand the reasoning behind the MHP than non-ASD participants. This could indicate a need to revisit leading ASD theories and theories of perception. The implications of these results could also be used to help diagnose individuals with ASD at an early age. Future research should use imaging techniques to determine brain structures responsible for heuristic use.

Introduction

The goal of perception is purportedly to perceive an objective view of reality. However, according to Hoffman (2009), perceptions are not tailored to an objective view of reality, but towards species-specific user interfaces that guide behaviors based on the species’ needs. Hoffman calls his theory the Interface Theory of Perception. An example that Hoffman (2009) uses is an Australian Jewel Beetle. The male beetle uses a categorization heuristic to locate female beetles, anything golden and dimply. This is not an accurate description of the female beetle, but it works fine for locating the female beetle. But when humans began to litter, beer bottles holding the same characteristics of the beetle’s criteria for a female were compromised. Male beetles began to mate with beer bottles. The beetles did not perceive an accurate reality, but an inaccurate reality based on a heuristic for quick behavior. Hoffman claims that the same perception occurs in humans as well.

An accurate perception may be difficult to imagine, but consider a computer desktop interface as an example. Hoffman (2009) describes that percep-
tion is like a desktop interface. We can interact with the icons, move the icons, and change the color of the icon. The icon is what we perceive. The icon is not the true nature of the file. It would be misguided to say because the icon is blue it must be an accurate reconstruction of the file. But it would also be misguided to say that the icon’s color is useless (Hoffman, 2009). This is a misunderstanding of the use of the icon, and the same misunderstanding can be made with perception. Perception is the result of fitness and not accuracy. Perception does not reconstruct reality in the same way an icon’s color, position, and shape do not reconstruct its file. Icons are created to interact with files in user-friendly ways. Imagine using a computer that did not provide this interface. This computer would not be very popular, user-friendly, or useful. Now imagine if our perception did not have this perceptual interface. Results may not be desirable or useful as well. It would be cognitively tiring to discern the objects in an objective reality considering there are many factors that can create even the slightest difference between two objects at a precise level.

Hoffman demonstrates his theory using computational models. Computational models are computer-generated simulations in which entities are programmed to behave in ways resembling theoretical models. Within this game, Hoffman has two programs compete over three different territories. There are two strategies, the truth interface strategy and the simple interface strategy. The truth interface strategy perceives the exact values of food and water for each territory. The simple interface strategy perceives only one bit of information about the resources. If the food value of a territory is greater than a fixed value, the territory will be highlighted green. If it is lower than the fixed value, it will perceive the territory as red. The simple interface program is attracted to the green territory. Hoffman (2009) demonstrated that simple drives truth to extinction even when the information provided about the territories is minimal and the correlation between food supply and water supply is small. Pressures of evolution do not select for an accurate perception, instead they drive it to extinction (Hoffman, 2009).

What Hoffman does not do well is provide an example of what an accurate perception of reality is. Hoffman explains that our perceptions of reality are inaccurate because we use an interface that hides the complexity of reality and provides us with shortcuts to interact and adapt to our environment. If this interface is what creates this simple and inaccurate perception of reality, then the absence of it might provide an accurate perception of reality. And according to past literature, there may be evidence of individuals who do perceive reality without this interface.

**Autism Spectrum Disorder (ASD)**

Autism Spectrum Disorder individuals may possibly perceive a more accurate reality than non-ASD individuals. ASD is most commonly characterized by frequent deficits in social, emotional and communication skills and persistent repetitive behavior. These symptoms can lead ASD individuals to develop unique ways of learning, interacting and paying attention (Centers for Disease Control and Prevention [CDC], 2015).

**Mindblindness Theory**

Baron-Cohen first proposed the mind-blindness theory (Baron-Cohen, Leslie, & Frith, 1985), otherwise known as Theory of Mind Module (ToMM), which explains that Autism Spectrum Disorder (ASD) individuals lack the ability to project mental awareness in themselves and others. Typical individuals are normally equipped with the abilities described in the ToMM. We attempt to interpret the behavior of others with our own mentalistic terms, attributing meaning to behavior that may be absent of intent (Baron-Cohen, 1997). As a species without claws, sharp teeth, or size, successful competition and even survival were dependent on how well we could infer what the other humans were thinking—we are interpreters by nature.

Now how does this tie with Hoffman’s interface theory of perception? ToMM does not always make correct claims of an individual’s mental state, it is a heuristic. Think of a situation in which you were paranoid about the behavior of a very suspicious unpredictable-looking individual. You may begin to tighten-up, thinking about what this individual could be thinking, possibly of harming you. As it turns out, he or she does nothing and you laugh, shrug it off, and continue with your day. You were wrong in making your assessment of the intentions of the suspicious stranger, but that does not mean it was the wrong precaution to take. Imagine if you went into the situation as calm as possible, not attributing the behavior towards a mental state. You leave yourself vulnerable in a possibly dangerous situation. It would be more rewarding for you to be “safe” rather than “sorry.” Now imagine how an individual with mindblindness might assess the
situation. It might be more accurate to not attribute a mental state or intent to the individual, but it might also lead to a more vulnerable situation.

**Empathizing-Systemizing (E-S) Theory**

Mindblindness theory provided a plausible explanation for ASD individuals’ lack of social and communication skills. However, it does not explain the persistent repetitive behavior commonly seen in ASD. Baron-Cohen also proposed an empathizing-systemizing theory to explain the behavioral characteristics of ASD (Baron-Cohen, Wheelwright, Lawson, Griffin, Ashwin, Billington, & Chakrabarti, 2005). This theory explains that individuals with autism demonstrate delays and deficits in empathizing and superior skill in systemizing (Baron-Cohen, 2009). Missing from Theory of Mind (ToM) was the second component of empathy, the response. He referred to this response as affective empathy (Baron-Cohen, 2009). Baron-Cohen’s measure indicates an individual’s strength in the concept of empathy and concept of systems. A discrepancy between empathizing and systemizing would determine diagnosis for ASD (Baron-Cohen, 2009). Systemizing is the drive to interact, analyze and construct systems. A system is defined as anything that follows a set of rules. He explained that ASD behavior could be inferred from an unintentional lack of interest in empathy and an above average interest in systems. He claimed that to understand a system, an ASD individual engages in repetitive behavior to analyze the nature of the system (Baron-Cohen, 2009). Lack of interest in empathy could explain the lack of communication and social skills. The strength of this theory is that it can explain the social and non-social aspects of ASD. A below average rating in empathy can explain social deficiencies. Above average interest in systems can explain the nonsocial features of ASD. When an individual systemizes it is easier to keep everything constant.

If an objective reality is a reality that is perceived without mental-shortcuts, empathy could distort a veridical perception. Although empathy is very useful to communicate, relate, and socialize with other individuals, it is not always accurate in attributing your emotional states to other individuals. Empathy can be a mental-shortcut for decision making. We do not need to take into account all factors to make a decision, we have a filter (empathy) to give us only the “important” information necessary in making a decision. Another factor to consider is Baron-Cohen’s view of empathizing and systemizing and their independent roles from another. If an individual is strong in empathy, it is possible for the individual to be strong in systemizing as well. I agree. However, it is equally as likely that if an individual is strong in empathy, that individual will be low in systemizing. Baron-Cohen agrees as well. But is it possible that these characteristics are more interdependent than Baron-Cohen believes? Indirect evidence provides some insight. Specifically, lack of a heuristic processing such as empathy, could increase the use of systematic processing. The problem may not be a heightened use of systematic processing, but the lack of a heuristic processing. Thus it may be misleading to compare empathy to systemizing.

Although many theories attempt to explain the behavior and the processes of ASD with different approaches, they make very similar predictions from each theory (some were already mentioned). The most important commonality between these theories is the suggestion that individuals with ASD have some form of abnormal, missing, or altered information processing system. This information processing found in individuals without ASD, has evolved through generations of natural selection. Information processing meant to make communication between individuals more fluent, so that humans can survive and succeed in passing down their genes. Individuals with ASD have a cognitive processing module that is different from individuals without ASD. According to Baron-Cohen (2009), paying attention to detail is important in understanding the system as a whole—but is it necessary? Does it confer evolutionary selective advantage? If passing down our genes were the purpose of our perception, would our perception need to know the exact details of every component of a system? Although it would be very beneficial to know this level of detail, it does not directly help the passing down of our genes. This example is very similar to Hoffman’s (2009) computational model of perceptions and evolution.

**A Proposed Theory of ASD**

Perceptions of reality are shaped and based on the needs of evolution. We see reality based on how the pressures of natural selection formed our perceptions (Hoffman, 2009). Baron-Cohen mentions that the function of systemizing is to predict lawful events, including lawful change, or patterns in data. He describes these observations of data as truth. And according to the E-S theory, one could describe individuals with ASD as being strongly driven to discover the truth (Baron-Cohen, 2009). He
Individuals with ASD can reveal a different perception of reality that is not perceived by individuals without ASD. When using the Empathy quotient (EQ) and Sympathy quotient (SQ) to measure empathy and systemizing, one could misinterpret an individual with ASD’s systemizing ability as above average, when compared to individuals without an ASD. It is widely accepted that individuals with ASD lack some sort of information processing that individuals without ASD have (Baron-Cohen, 1997; Frith, 1989; Baron-Cohen, 2009). The conventional explanation would claim an empathy processing system that is below average, and a systemizing system that is above average. A more consistent claim could be that an above average systemizing mental processing ability results solely from the lack of an empathizing mental processing system, or rather, a heuristic mental processing system. That is, it represents a mental processing system that filters the observable reality to be used to pass down genes. A heuristic processing system would filter for stimuli and information that is salient towards passing down genes. Once this system is abnormal or removed, reality may not be biased towards evolutionary pressures, changing the perception of reality altogether. This theory would mean that the systemizing mental processing system could possibly be universally identical with all populations. The ability to perceive and conceptualize reality with a different filter or without a filter, would instead change the ways we process stimuli. Hoffman (2009) demonstrated that our perceptual interface (sensory system) perceives a reality based on evolutionary pressures. However how would we process the stimuli? A heuristic mental processing system must also be used to understand the stimuli being observed, and it must do so quickly and cognitively effortlessly. This mental processing system is what I would call a *heuristic interface*, and relies heavily on theory provided by Kahneman and Tversky (1973). A heuristic interface is what processes or makes sense of the stimuli that are observed through perceptual interfaces using heuristics. Heuristic are mental shortcuts that are used to create estimations based on information provided by stimuli or past experience. These conclusions can sometimes yield reasonable judgments, but they can also lead to serious misperceptions and errors (Kahneman and Tversky, 1973). Similar to Hoffman’s (2009) perceptual interface, heuristic interfaces are species specific. Take into account the example of the male Australian Jewel Beetle again. The Australian Jewel Beetle has a heuristic interface, not exactly like humans do, but nonetheless a mental processing system that supports its evolutionary pressures. The heuristic interface uses mental shortcuts. For the beetle, a female was anything golden-brown, dimply, and glossy. The beetle sees an object that matches the criteria for a female beetle, a beer bottle. The beetle has made a categorical error. Now imagine if the beetle had no heuristic interface. A female beetle would have extremely discriminate characteristics. Checking off the list of what makes a female beetle would be cognitively tiring and time consuming. In the long run, beetles using veridical perception would be beaten by beetles using the heuristic interface. So where does the heuristic interface fit into the overall reality processing module?

**Measuring Heuristic Processing**

ASD and non-ASD individuals are differentially affected by framing effects in decision making. Framing effect is a cognitive bias in which typical individuals react to the same scenarios differently when the scenarios are presented differently. (Kahneman and Tversky, 1973). De Martino, Harrison, Knafo, Bird, and Dolan (2008) tested framing effects on ASD and non-ASD individuals. Results of this study indicated that ASD individuals were less affected by framing effects than non-ASD individuals. Results were consistent with Baron-Cohen’s empathizing-systemizing theory, in which lack of emotional reaction could be attributed to innate lack of interest in empathy. De Martino et al. (2008) also explained that according to two systems theory (heuristic and systematic mental processes), framing effects are attributed to using affect heuristics, which are the result of heuristic
processing. Lack of use of framing effects would suggest that ASD individuals may not be as susceptible to heuristic processing as non-ASD individuals. Klin (2000) demonstrated that children with ASD were less likely to attribute mental states to animated geometrical shapes than non-ASD children. Non-ASD children described the animated shapes with social attributions such as shy, brave, and bully. ASD children described the shapes by their physical nature and did use as much social attributions (Klin, 2000). What we could be seeing here is that attributing mental states to these shapes is a type of heuristic, and individuals with ASD are less susceptible to these heuristics.

Yet there is little research in measuring probabilistic heuristic use. Most research shows that individuals with ASD are less susceptible to affect heuristics. Heuristics that are attributed to empathy and emotional reaction. Demonstrating lack of probabilistic heuristic use could indicate that the core of ASD would not be a lack of empathy, but instead a lack of heuristic use in general. And the Monty Hall problem (MHP) may be the most appropriate situation in doing so.

**The Monty Hall Problem**

The Monty Hall problem is usually presented as a game show. The host presents three doors. One door has a prize behind it. The other two doors hold nothing. The objective of the game is to attempt to find the door with the prize. The participant is then instructed to select a door. Instead of opening the door that the participant selected immediately, the host opens a door that has nothing behind it. The host then gives the participant the option to either stay with his or her original decision or switch to the remaining closed door. The problem lies in determining which door, if any, provides a better chance of winning the prize. The Monty Hall Problem is a unique scenario because it elicits the user to use intuitive (heuristic) reasoning methods, but to solve the problem correctly, it requires logical (systematic) reasoning methods. The correct answer would be to switch. Most participants tend to stay with their decisions believing that there is no difference in strategies. Humans tend to rely on probabilistic heuristic thinking as an approach to distinguish probability within door selections, albeit incorrectly (Franco-Watkins, Derks, & Dougherty, 2003; Gilovich, Medvec, & Chen, 1995; Herbranson & Schroeder, 2010; Kahneman, Knetsch, & Thaler, 1991; Tubau & Alonso, 2003). Participants believe that after selecting a door, their odds increase because another door is eliminated, which is incorrect.

**Present Study**

The objectives of this project are to measure and compare the use of heuristic processes and systemizing processes within ASD and non-ASD individuals that cannot be readily attributed to empathy. With this procedural set up, we can determine two things: the use of affect heuristics and likelihood judgment heuristics. Use of affect heuristics can be determined if the participant decides to stay instead of switch. This affect heuristic will show the omission effect as demonstrated by Franko-Watkins et al (2003). This effect claims that there is more psychological regret in a bad decision that was based on action than by omission. The likelihood judgment heuristic can also be demonstrated to not be in use if an individual selects to switch and understands why switching is the optimal strategy in the MHP (Franco-Watkins, Derk, & Dougherty, 2003). The likelihood judgment heuristic occurs when an individual believes that when there are two events, for example drawing a white or black bead from a jar, when one event occurs, the opposite event has a higher probability of occurring. This may make sense for this situation, but when applied to the MHP, it can prove counterintuitive (Franco-Watkins, Derk, & Dougherty, 2003). Unlike the omission effect, the likelihood judgment heuristic cannot be readily attributed to affect heuristics.

I hypothesize that individuals with ASD will be more likely to solve the MHP correctly (i.e., choosing to switch doors) than non-ASD individuals. I also hypothesize that individuals with ASD will be more likely to understand why the correct solution is to switch. Because using heuristics is cognitively effortless and quicker than using systematic means of problem solving, I hypothesize that non-ASD individuals will come to a conclusion more readily than ASD individuals.

**Method**

**Participants**

Non-ASD participants. 106 undergraduate students from the University of Hawai‘i at Mānoa participated in the experiment. Participants were contacted through the University of Hawai‘i Sona Systems, a Psychology department participant pool. Participants ranged in age from 18
to 43, with a mean age of 34.83. All participants self-reported that they were not clinically diagnosed with ASD.

**ASD participants.** 105 individuals from the Interactive Autism Network participated in the experiment. Participants ranged in age from 18 to 73, with a mean age of 21.36. All ASD participants were given a clinical diagnosis for ASD, which was necessary to be included within the experiment.

**Stimuli and Measures**

An online questionnaire was created using Qualtrics. The questionnaire consisted of five sections, the certificate of consent section, the inclusion section, the probability question section, the Monty Hall Problem section, and the demographic section. All questionnaires first presented a thorough and concise certificate of informed consent. The consent form provided an overview of the task, expected confidentiality of survey, potential risks and benefits, compensation, and contact information. Consent to participate in the experiment was given when the participant checked the box, “I have read and understand all of the information provided on this form, and I agree to participate.” The inclusion section included a question that asked the participants if he or she has had any experience or knowledge of the Monty Hall Problem or the Three Prisoners game. If the participant selected “yes,” the questionnaire would then ask how much the participant knew about the Monty Hall Problem or Three Prisoners game. This was used to determine if the responses provided by the individual were a result of previous knowledge. The next section was the probability question section. This section included five different simple probability questions. These questions were implemented to determine whether the participant had a sufficient understanding of probability to be able to solve the Monty Hall Problem. Participants were excluded from the final analysis if he or she was unable to solve four of the problems. The next section was the Monty Hall Problem section. This section included the implementation of the Monty Hall Problem, which was influenced by the design of Franco-Watkins et al. (2003) Monty Hall Problem question. The first question introduces the participants to the scenario, “You are a contestant on a game show. An honest game-show host has randomly placed a new car behind one of the three identical doors. There is a goat behind the two other doors. You select door number 3. What is the probability that the car is behind the door number 3?” The participant is then required to select an answer out of the three possible choices, 1/3, 2/3, and 1/2. The correct answer is 1/3, and the participants’ responses are recorded. Response times from when the question was presented to when an answer was selected were also recorded. If a participant did not select the correct answer for this question, his or her responses were excluded from the final analysis. The next question then asks “After you selected door number 3, the host (who knows where the car is) opens up door number 1 to show that the car is not behind that door. He will always show you a door that has a goat behind it, and he will never open up your door or a door that reveals the car. You are now given the choice to stay with your initial door selection (door number 3) or switch to the other door (door number 2) that you did not select and the host did not open. Would you like to: Switch or Stay?”. The participant was then required to decide whether he or she would like to switch or stay. The next question asked what the probability of winning the car is after switching or staying. The participant was required to select either 1/3, 2/3, or 1/2. If the participant selected switch, the correct answer would have been 2/3. If the participant selected stay, the correct answer would have been 1/3. This was used to determine whether the participant understood the probability reasoning. We then asked which decision would provide the best probability of winning the car. This was used to further determine if the participant understood the probability reasoning. The questionnaire then asked why he or she had felt that switching or staying was the best choice for winning the car, or why he or she had felt that both choices provided equal chances of winning the car. This was used to eliminate the chance of guessing from the final results. Solving times were also measured for each question. The last section was the demographics section. This required participants to enter their age, gender, education level, and whether or not they have been clinically diagnosed with ASD. This clinically diagnosed question was primarily used in case a participant recruited as a non-ASD participant was diagnosed with ASD.

**Procedure**

**Non-ASD participants.** Participation in the current research study was advertised using the University of Hawai‘i Sona System. The University of Hawai‘i Sona System is an online application that connects the university students to current ongoing research being conducted at the university, primarily in the Department of
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Psychology. The current study was enrolled in the Sona System under “Game Show Study.” Once a student was enrolled to participate in the Game Show Study, he or she was sent a link to participate in the experiment. The link forwarded the participant to the study measure using the Qualtrics interface. The measure was online, so participants were able to participate from any computer or cellphone with internet access. Once the participants clicked the link, they were taken to the certificate for informed consent. If the certificate was read and understood, the survey would begin.

**ASD participants.** Participation for the online study was advertised by email through the recruitment services of the Interactive Autism Network (IAN). IAN is an online organization established in 2006 to facilitate research that will lead to advancements in understanding and treating autism spectrum disorder. IAN research is governed by the Johns Hopkins Medicine IRB (NA_00002750; PI: Dr. Paul H. Lipkin). If a member was interested, he or she would click a link that was included in the email, which would open another window that led directly to the survey. This survey allowed the participants to enter their email if the participant wanted a $2 gift coupon for RedBox movies.

**Results**

All participants that were included in data analysis understood the beginning probability question of the MHP (i.e., selected the odds of choosing the correct door is 1/3 in the first MHP question.) Solving times were measured from beginning to end of the MHP solving section. Two analyses of unpaired two-tailed t-tests revealed that ASD participants took significantly longer than non-ASD individuals: 1) measuring time from beginning to page submission, \( t(209) = 2.075, p = .039 \); and 2) measuring time from beginning to last click, \( t(209) = 2.323, p = .021 \). Correct response to the MHP (switching) was measured. A chi-square test of independence revealed that ASD participants were significantly more likely to solve the MHP correctly than non-ASD participants, \( \chi^2(1, N = 211) = 6.642, p = .01 \). I also measured whether participants understood why switching was the correct response (indicated by selecting the odds were 2/3 on the next question). Correct responses and response understanding were measured. A chi-square test of independence revealed that ASD participants were more likely to solve the MHP and understand why switching is optimal than non-ASD participants, \( \chi^2(1, N = 211) = 7.172, p < .01 \).

We also had controls to highlight data in which participants could possibly be guessing, or participants did not fully grasp basic probability needed to solve the MHP. This was determined by the 5 preliminary probability questions in the simple probability question section. This was not a direct indication of guessing or lack of knowledge of probability, since all participants understood the beginning probability of the MHP. For safe measures, we excluded any participants who did not solve at least 4 of the 5 preliminary probability questions. Simple probability corrected (SPC) correct responses to the MHP were measured. A chi-square test of independence revealed that ASD and non-ASD responses were not quite significantly different, \( \chi^2(1, N = 185) = 3.151, p = .076 \). SPC correct responses and response understanding was measured. A chi-square test of independence revealed that even with SPC corrections, ASD participants were significantly more likely to solve the MHP correctly and understand why switching is optimal than non-ASD participants, \( \chi^2(1, N = 185) = 4.507, p = .034 \). Solving times were also still significantly different, in which ASD took significantly longer to solve the MHP, \( t(174) = 2.434, p = .016 \).
Discussion

Results provided support for my hypothesis. Results indicated that ASD individuals were not only more likely to select the correct response to the MHP, but also were more likely to understand why their response was correct even when responses were corrected for guessing and lack of knowledge on probability. As indicated earlier, the reason individuals come to incorrect conclusions in the MHP is because individuals attempt to use heuristic means to solve the MHP (Franco-Watkins, Derks, & Dougherty, 2003; Gilovich, Medvec, & Chen, 1995; Herbranson & Schroeder, 2010; Kahneman, Knetsch, & Thaler, 1991; Tubau & Alonso, 2003). Results from this study indicate that individuals with ASD may not be susceptible to using heuristics during the MHP, which may be why they are more likely to solve the MHP than non-ASD individuals. The heuristics that people typically rely on in the MHP are the omission effect and the likelihood judgment heuristic (Franco-Watkins, Derks, & Dougherty, 2003). This is a particularly interesting finding because the likelihood judgment heuristic is not readily attributed to empathy or emotion, instead it is a heuristic attributed to probability reasoning. What this means is that ASD individuals may not only be less susceptible to affect heuristics, but heuristics in general.

Results may also indicate a possible bias that was not previously identified in previous research. Confirmation bias may also be present in participants who select the incorrect response to the MHP. For example, individuals may not recognize the correct response because they only take into account evidence that confirms their assumption that staying or switching provides equal probability for winning the prize. If true, these results may indicate less of a confirmation bias in ASD individuals than non-ASD individuals using solving times. For example, results indicate that non-ASD individuals came to conclusions more readily than ASD individuals. This may be a result of non-ASD participants ignoring disconfirmatory evidence and only acknowledging confirmatory evidence, and ASD participants taking into account both disconfirmatory and confirmatory evidence. This could be why we see significant differences in the solving times between ASD and non-ASD participants because ASD participants take into account evidence that disconfirms their hypothesis. But there were also some ways to improve the methodology of the study.

Limitations

The authenticity of the MHP could be improved. For example, a correct or incorrect conclusion had no effect on whether the participant was going to receive an incentive or not. This is an element that could elicit a stronger susceptibility to heuristic use than with the design that was used in this experiment. Another element missing was an actual game show setting. For example, the experiment took place using an online survey. Having participants participate in the MHP live could change heuristic use in participants.

The Interactive Autism Network also had over 5000 eligible participants for this study. Unfortunately, due to funding, I was only able to provide incentives for 100. Future research attempting to replicate this study should also consider using a larger population, as it can be easily attainable using the Interactive Autism Network.

Applications

One of the greatest applications of these results would be the adoption of heuristic use as a potential criterion for ASD. But a more concrete measure of heuristic use would be more accurate than using the MHP itself to diagnose ASD. For this reason, future research should attempt to use brain imaging techniques to identify the brain structures responsible for a difference in heuristic use between ASD and non-ASD participants. This could create concrete criterion that could increase efforts in early diagnosis, especially in individuals who are not able to communicate such as infants and children.

ASD and Heuristic Interfaces

As mentioned earlier, a heuristic interface is what processes or makes sense of the stimuli that are observed through perceptual interfaces using heuristics. Heuristic are mental-shortcuts that are used to create estimations based on information provided by stimuli or past experience. These conclusions can sometimes yield reasonable judgments, but they can also lead to serious misperceptions and errors (Kahneman and Tversky, 1973). The results indicated that individuals with ASD were significantly more likely to be able to solve the MHP than non-ASD individuals. In this way, we can see that heuristics support natural selection and
the passing down of genes by supporting fitness. Similar to Hoffman’s (2009) theory of perceptual interface, heuristic interfaces create cognitive illusions that do not accurately report information of reality, especially in situations that are unfamiliar or uncertain. In the MHP, heuristic use creates an inaccurate perception of probability between selectable doors. Individuals who use these heuristics may use past experience that is believed to be similar to the MHP, may perceive action as more regrettable than omission, or may look for evidence that only supports their hypothesis of the solution. All of these heuristics techniques speed decision-making. If these heuristics are not used, the situation is seen as novel. An individual would not look for past experience, would not have a negative emotional reaction to action, and would look for evidence that both supports and disconfirms the individual’s hypothesis. This would create a more accurate perception of the scenario, but it will be cognitively taxing and slower. What this research could possibly have demonstrated was that individuals with ASD were not susceptible to these heuristics that are used to speed decision-making through mental-shortcuts. Instead, we see that participants with ASD were more likely to take significantly longer to solve the MHP, possibly indicating that individuals with ASD perceive a more accurate reality.

Although this research supports the hypothesis that ASD individuals perceive a more accurate perception of reality, it may not mean that it is beneficial. Recall the situation of the Australian Jewel Beetle. The beetle uses heuristics to find female beetles quickly. The inaccurate perception program used short-cuts to determine which territories supported life. These heuristics are created for one thing, to pass down genes, to evolve.

This could also explain why individuals with ASD are reported to lack social and communication skills. Communication is essential when looking for a potential mate. There are both explicit and implicit meanings in messages. If a female asks a male to go out to dinner, and the male responds with “I have work,” why do we come to the conclusion that he means he can’t go out to dinner? This may be a situation where we use these heuristics to comprehend meaning when there is no accessible systematic way to comprehend a situation, speeding up how we respond. But sometimes our inferences on the implicit message is incorrect, and we may completely have misinterpreted the cues and message. But if an individual does not use these heuristics to make these inferences, the individual will only use what is presented to derive meaning, making communication more literal, therefore more cognitively effortful and slow, creating the image that the individual lacks social and communication skills.

But of course, more evidence is needed to support the claim that individuals with ASD perceive a more accurate perception of reality because they are less susceptible to heuristic interfaces. There are many other heuristics that have not been tested using an ASD population such as confirmation bias, availability heuristics, and representative heuristics. Demonstrating that individuals with ASD are less susceptible to these heuristics can not only change how we view ASD, but also change the way we view reality itself.

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