# EXPLORING A RELATIONSHIP BETWEEN INTUITION AND DETECTION OF DISCREPANCIES

An Honors Fellow Thesis

by

TALYA LAZERUS

Submitted to Honors and Undergraduate Research
Texas A&M University
in partial fulfillment of the requirements for the designation as

HONORS UNDERGRADUATE RESEARCH FELLOW

May 2012

Major: Psychology

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Associate Director, Honors and Undergraduate Research: Duncan MacKenzie

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# ABSTRACT

Exploring a Relationship between Intuition and Detection of Discrepancies. (May 2012)

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This paper discusses a possible link between visual discrepancy detection and intuitive processes. Intuitive processes are attributed to the experiential system, which is associated with affect and visual processing. Thus, intuition is predicted to enhance the ability to make connections on other tasks. Furthermore, past research has shown that sensing, the phenomenon in which a person may notice a change but not consciously perceive the change, and seeing, the phenomenon in which a person is consciously aware of a change and visually experiences it, rely on different processes. The sensing phenomenon, which seems related to intuitive processing, supports the conclusion that intuition is involved in detecting visual discrepancies. The literature supports the idea that people who are more intuitive and use more intuitive processes will be more accurate and faster at making connections on other tasks. Additionally, because intuition is affiliated with affect, it is predicted that people will be more accurate and faster when detecting social and emotional discrepancies than when detecting neutral discrepancies.

# DEDICATION

I would like to dedicate this thesis to my oldest sister, Aurit Lazerus. Despite everything you had going on in your life from your surgery to chemotherapy to radiation treatments, during my undergraduate career you were able to support and help me. You offered encouragement, let me bounce off ideas and pushed me to think more in-depth about the concepts with which I wrestled. Thank you for helping me find the words when I could not and for pointing out when I would be needlessly worrying. I am forever thankful and grateful. Thank you for being such an amazing person and an awesome big sister.

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# CHAPTER I

# INTRODUCTION

Psychological interest in intuition has flourished in the past few decades. Many researchers are trying to understand how intuitive processes work and how they influence decision-making processes. Kirkpatrick and Epstein (1992) proposed one of the leading explanations of intuition within the framework of cognitive-experimental self-theory (CEST). According to CEST, intuition is an unconscious, automatic process by which people accumulate and interpret information. The present study explored the relationship intuitive detection of perceptual and social discrepancies and the ability to identify connections on other tasks. Specifically, this investigation examined whether people who score high on the ability to detect discrepancies will score higher on tasks that require connections among concepts. The findings have implications for understanding unconscious processes, how those processes affect people's abilities, and the role that intuition plays in judgment and decision-making. Furthermore, the findings will have implications for other social sciences, such as economics and sociology, in understanding how people come to conclusions.

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This thesis follows the style of *Journal of Personality and Social Psychology*.

Recent dual process theories, including CEST, propose that information is processed by two systems that work in conjunction. The experiential system functions unconsciously, automatically, reactively, and rapidly processes information (Kirkpatrick & Epstein, 1992; Epstein, 2008; Epstein, 1991; Kahneman, 2003; Morewedge, & Kahneman, 2010). It processes information in a manner that is nonverbal, holistic, concrete, effortless and reliant on affect (Epstein, 1990; Epstein, 2008; Kirkpatrick & Epstein, 1992). The experiential system is associated with activation in the limbic system (involved in emotional and sensory processing; Goleman, 1995). In contrast, the analytic system functions relatively consciously, analytically, deliberately, and slowly. It processes information in a manner that is verbal, abstract, logical, effortful and does not rely on emotion. Because the experiential system processes information more quickly than the analytic system, judgments derived from experiential processing occur before judgments that involve analytic processing (Kahneman, 2003). Largely uncontrollable, the experiential system makes minimal demands on cognitive resources (Epstein, 2008).

Intuition is considered a product of the experiential system and thus intuitive reactions are characterized as tacit, automatic, unconscious, fast, and effortless (Epstein, 2008). Intuition does not include experiences in which a person can explain and articulate where his or her beliefs come from (Epstein, 2008). In other words, intuition is knowing without knowing how one knows. Intuition yields separate solutions than analytic thinking does because intuition is thought without analysis and uses implicit information, information that a person is not consciously aware of encoding. Intuition is the ability to make fast, unconscious connections, allowing one to reach conclusions without conscious awareness of how one arrived there. In the intuitive process, the mind acquires information, unconsciously scans and analyzes it, and then connects point A to point B. Without introspection, a person is unaware that this process occurred. I posit that a stable individual difference in intuition exists, such that even in unfamiliar or new domains, an individual's intuitive ability would remain constant.

Currently, there are no well-established tests that measure intuition and intuitive processing. Individual differences in intuition are difficult to determine because measures would need to assess the use of subconscious, implicit thought processes. Tests in development include self-reports, measuring eye movement, and tracking physiological changes (Glöckner & Witteman, 2010). One of the more well-known self-report measures is the Faith in Intuition (FI) scale by Epstein, Pacini, Denes-Raj, and Heier (1996), which evaluates people's reliance on the experiential system and confidence in his or her own intuition. The FI scale may not be a reliable means of assessing individual differences in intuition because the scale only gathers people's confidence and self-usage ratings, rather than actual performance.

I propose that intuitive processing is reflected in the ability to detect perceptual and social discrepancies. Detecting discrepancies involves becoming aware of a change in your environment and can promote safety or social connectivity. Discrepancies can take several forms including perceptual (e.g., noticing the traffic light change from green to yellow) or social (e.g., noticing a brief frown on the face of a friend). It is likely that intuition, and experiential processing more generally, reflects discrepancy detection because the experiential system is often involved in the processing of holistic images. The experiential system has a relatively fast connection to sensory information and responds to concrete nonverbal images (Goleman, 1995; Epstein, 1991). Also, the experiential system typically encodes information as images (Epstein & Pacini, 2001). Further, visualization of events promotes biased choices similar to choices made with experiential processing (Epstein & Pacini, 2001). Also, people make judgments faster and more efficiently when viewing pictures compared to words, suggesting that experiential processing is involved in responses to images (Zajonc, 1980). Together, these findings suggest that experiential processes are critical to formulating reactions to images.

Further evidence suggests that intuition in particular may be relevant to discrepancy detection because people often "feel" or sense a change before being able to verbalize the exact change. Ryan and Cohen (2004) tracked participants' eye movements and discovered that eye movements indicated that participants noticed a change before they could consciously recognize the change (see also Galpin, Underwood, & Chapman, 2008). People also self-report sensing changes before they can identify them. Rensink (2004) found that participants reported that they sensed changes in images before they could report the exact change. The difference between sensing and identifying discrepancies is further supported by neuropsychological findings that identifying a change involves different perceptual and neural processes than sensing a change (Busch, Frund, & Herrmann, 2009). Additionally, behavioral data from a change blindness study indicated that people implicitly detect changes in emotional expressions, suggesting that intuitive processing is involved in this type of discrepancy detection (Khittle, Bauer, & Wall, 2009).

There is also a possibility that discrepancy detection differs for social and nonsocial stimuli, in part because of the highly emotional nature of social stimuli that is likely to involve experiential processing. Specifically, the ability to detect discrepancies might be greater for social stimuli than nonsocial stimuli. Evidence suggests that people generally process social and emotional stimuli more quickly and efficiently than nonsocial neutral stimuli. In one study, participants detected when a change occurred in faces more easily than when a change occurred in house images, but they had trouble localizing which feature changed for the faces compared to houses (Wilford & Wells, 2010). Alpers and Gerdes (2007) found that people perceive emotionally significant visual stimuli prior to neutral stimuli. Emotional expression represents the most complex and important social stimuli that people process. Sato and Yoshikawa (2010) found that emotional significance was more important than facial characteristics for proficient detection of emotional expressions. These findings demonstrate that people process emotionally significant stimuli faster and more adeptly than neutral stimuli, indicating that people might be better able to detect social and emotional discrepancies than neutral discrepancies.

The present study investigated the relationships among individual differences in intuition, as reflected in the ability to detect perceptual and social discrepancies, and performance on tasks that require connections among concepts. Based on previous findings that people sense discrepancies before they can identify the change, I hypothesized: 1) that people using intuitive processing to detect discrepancies will perform better on tasks that require connections among concepts, and 2) social discrepancies will be detected faster and more accurately than nonsocial discrepancies. I will also investigate whether differences exist between the accuracy and speed of identifying changes in the three facial features (mouth, browns, and eyes) and changes in five facial expressions (angry, disgusted, happy, sad, and scared).

This investigation has important implications for understanding what comprises "intuition" and has the potential to identify one skill that is associated with intuitive processing. This study could also help explain how people process both social and perceptual discrepancies as well as lead to a greater understanding of unconscious processes.

# CHAPTER II

# METHODS

## Participants

Participants were 126 undergraduate students (73.8% female, M age = 18.90 years, SD = 2.76, 7.1% were Asian, 0.8% were Black/African American, 19.8% were Hispanic, 69.0% were White, 1.6% represented other ethnic groups, 2 participants were unreported). Participants received course credits for their introductory psychology course. Data from 64 participants was not reported for the Dyads of Triads task and for the Waterloo Gestalt Closure task due to computer error.

## Materials and procedure

*Demographics questionnaire*

Participants reported basic information, including sex, age, current academic standing, ethnicity, current GPA, high school GPA, and ACT and/or SAT score.

*Dyads of Triads*

The Dyads of Triads task (DOT) was used as measure of the ability to make connections among concepts. The DOT task consists of 20 dyads of groups, each group comprised of three words (Bowers, Regehr, Balthazard, & Parker, 1990). One group from each dyad contained three words that were semantically associated with a fourth word that was not presented. This group is “coherent,” in the sense that the words are related. The other group represents an incoherent triad, with the three words not semantically associated with a fourth word. For example, one group included goat, pass, and green and the other group included bird, pipe, and road. Goat, pass, and green are all associated to the word mountain, whereas bird, pipe, and road have no similar associated word. The coherent and incoherent triads were counterbalanced so that they alternated in the left and right positions.

Participants completed 20 trials of the DOT task. Each trial consisted of a dyad and was displayed for twelve seconds. Afterwards, participants were instructed to choose the group that they believed was semantically associated to a fourth word. They also rated their confidence regarding their choice on a scale, ranging from *not very confident* (1) to *very confident* (5), and if able, identified the semantically related word or concept. Figure 1 illustrates an example trial.

*The Waterloo Gestalt Closure Task*

The Waterloo Gestalt Closure Task was also used as a measure of the ability to make connections among concepts. The Waterloo Gestalt Closure Task consists of drawn images that are either meaningful in nature, representing a real object, such as a camel, or meaningless, representing an abstract design, such as a grouping of random lines (Bowers et al., 1990). Each meaningful item was paired with a meaningless item to create a trial set. Participants completed 20 trials of the Waterloo Gestalt Closure task, and each trial was presented for five seconds. Participants were instructed to identify which image represented an actual object. They also rated their confidence regarding their choice on a scale, ranging from *not very confident* (1) to *very confident* (5), and if able, named the object. Figure 2 depicts an example trial.

| A | B |
| --- | --- |
| Bird | Goat |
| Pipe | Pass |
| Road | Green |

*Figure 1.* An example of a DOT word trial.
*Note*. *From* “Intuition in the Context of Discovery” by Bowers et al., 1990, *Cognitive Psychology, 22*

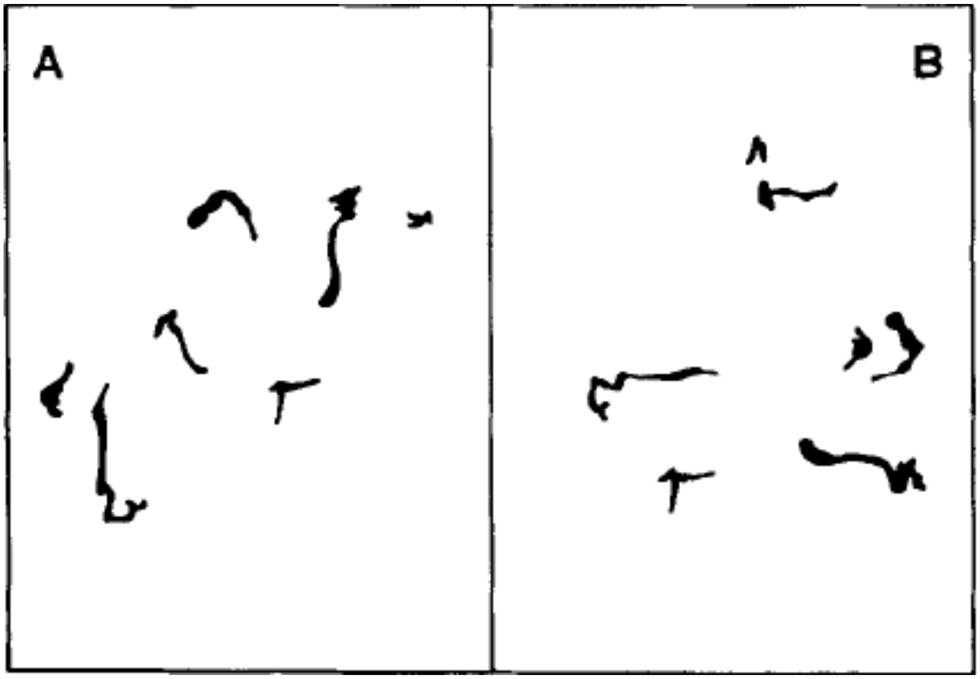


*Figure 2.* An example of a Waterloo Gestalt Closure task trial.
*Note*. *From* “Intuition in the Context of Discovery” by Bowers et al., 1990, *Cognitive Psychology, 22*

*Picture discrimination task*

The picture discrimination task was used to measure of individual differences in intuition, reflected as participants’ ability to detect discrepancies. In the task, images were presented in a flashing sequence, known as a flicker paradigm, in which an original image (A) alternated with its modified version (A’) in a pattern of A, A, A’, A’, A, A, A’, A’, … and so on; the modified version of each image contained only a single change. Each image was shown for 240 milliseconds and automatically forwarded, with an 80 millisecond blank gray field acting as an inter-stimulus interval between image presentations. For each trial, participants pressed the “Z” key when they sensed the change but could not name it. They indicated when they could verbally identify the change by pressing the “M” key. The image sequence continued for 30 seconds or until the participant's pressed the "M" key. Participants also reported the nature of the change for each trial. The order of scenes was randomized for each person, and participants viewed each scene pair only once. Reaction times were measured for both the "Z" key and "M" key responses.

The picture discrimination task included stimuli from Rensink (2004) that depict nonsocial scenes (e.g., a statue; a market scene) and newly created stimuli that depict social images of facial expressions in three-by-three picture grids. For the nonsocial scenes images, modifications either consisted of location, color, or presence of an object within the picture. For the social stimuli, pictures were taken of both a female model and a male model depicting neutral, happy, sad, angry, scared, and disgusted facial expressions. Three facial features (eyes, brows, and mouth) of each emotional expression were manipulated in Adobe Photoshop. The facial features were all individually blended onto the neutral expression of the models. A total of 30 new images were created, 15 per model, with one feature change per emotional expression (e.g. one new image consisted of the female neutral face with happy eyebrows).

The neutral and manipulated images of facial expressions were placed into a three-by-three picture grid (total of nine images). This was done in order to increase the complexity of the trials to match the complexity of the nonsocial trials. Each grid included images of the models, pictures of different people, and nonsocial scenes (e.g. shells in the sand; a tree by a pond). The neutral and manipulated facial expressions were considered the target images, with the neutral expressions being the original images (A) and the manipulated expressions being the modified versions (A'). For example, in the first picture grid, the target image displayed the neutral expression of one of the models. In the second picture grid, a manipulated image of the same model was shown instead of the neutral expression (e.g., a neutral expression of the female model is shown first, then the same neutral expression of the female model with her eyes from the sad expression is shown).

The task consisted of 59 trials. Twenty-three of the trials were nonsocial images, with five of the trials being catch trials with no change. Thirty-six of the trials were the social image picture grids, with 30 of the trials containing models' facial expression changes, three consisting of changes that did not include the models' pictures, and three trials having no changes serving as catch trials. Figures 3 and 4 depict a nonsocial trial and social trial, respectively.

Images were presented on Dell Inspiron 570 desktop computers. Each nonsocial image from the picture discrimination task was at 700 X 500 pixels with a 16-bit color depth. Each social image picture grid from the picture discrimination task was at 700 X 700 pixels with a 16-bit color depth. The individual images in the grid were at 233 X 233 pixels. The experiments were implemented using MediaLab and DirectRT.

Participants were tested on individual computers in cubicles in groups of up to five. Participants first completed the Dyads of Triads task, the Waterloo Gestalt Closure Task, and then the picture discrimination task. They then completed a demographics questionnaire. All measures and tasks took place on the computers and participant responses were recorded by the computers.

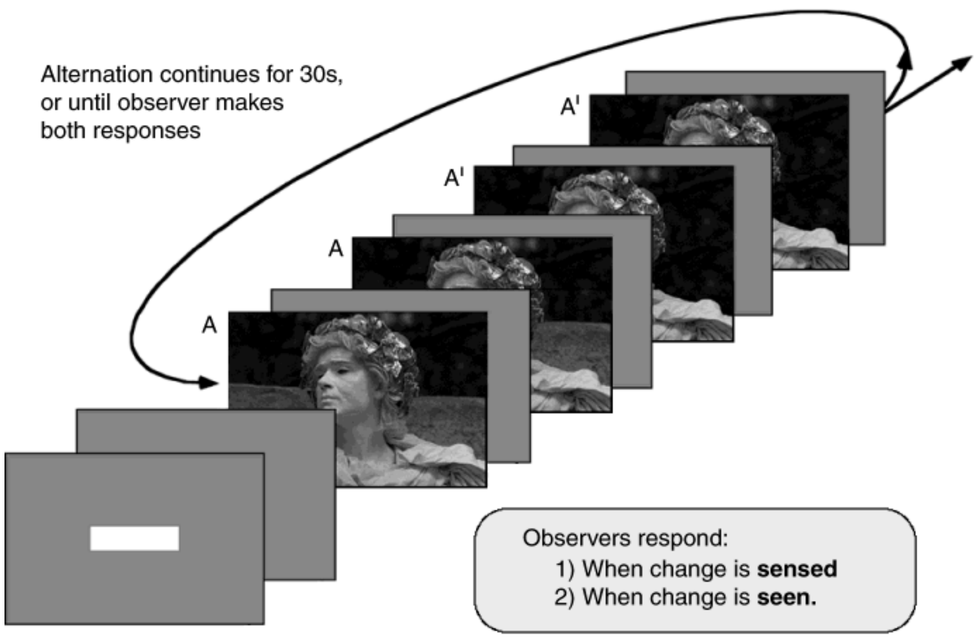


*Figure 3.* An example of a nonsocial image trial sequence in the picture discrimination task.
*Note. From* "Visual Sensing Without Seeing" by Rensink, 2004, *Psychological Science*, 15. p. 28

*Figure 4.* An example of a social image picture grid in the picture discrimination task.

# CHAPTER III

# RESULTS

**Preliminary coding and analysis**

Participants were divided into two groups based on their false alarm rates in the social scene trials. Participants who had a false alarm rate higher than 50% were classified as guessers (19.8%), while all other participants were considered non-guessers (80.2%). Analyses focus only on non-guessers because the results of guessers are not interpretable (Rensink, 2004).

Participants were classified as intuitive or non-intuitive based on performance during the picture discrimination task. Each of the 30 trials were coded as either Alpha or Beta trials (Rensink, 2004). Alpha trials were trials in which the time between the “see” response and the “sense” response was less than 1 second, indicating that little to no sensing had occurred during these trials. Beta trials were trials in which sensing occurred more than 1 second before seeing. Participants who had a low percentage (< 5%) of Beta trials were considered to be non-intuitive (50%), all other participants were considered to be intuitive (50%). Intuition classification was determined by the social scene trials, unless otherwise noted.

**Accuracy and speed of intuitive versus non-intuitive participants**

I first examined whether there were differences in the proportion of changes in the picture discrimination task accurately identified by intuitive versus non-intuitive participants. There were no significant differences in accuracy between intuitive and non-intuitive participants on the social and nonsocial trials, all *p*'s > .232. Participants were equally accurate regardless of whether they sensed changes before seeing them. Intuitive participants (*M* =6.98, *SD* = 1.86) were faster at seeing changes in the nonsocial scenes compared to non-intuitive participants (*M* =7.84, *SD* = 2.07), $t(85) = 2.04$, $p = .045$, $d = 0.44$. There were no significant differences between intuitive and non-intuitive participants in the amount of time taken to see changes in the social scenes.

Next, I explored whether intuitive classification predicted accuracy on other tasks that require connections among concepts. As predicted, participants classified as intuitive were more accurate at identifying the coherent triads in the DOT task (*M* =15.48, *SD* = 1.91) than non-intuitive participants (*M* =14.29, *SD* = 2.05), $t(42) = 1.95$, $p = .058$, $d = 0.60$. Similar results were found for identifying the meaningful items in the Waterloo Gestalt Closure Task, however the effect did not reach statistical significance. Intuitive participants tended to be more accurate at selecting the meaningful images (*M* = 14.48, *SD* = 2.08) than non-intuitive participants (*M* = 13.29, *SD* = 2.82), $t(42) = 1.60$, $p = .11$, $d = 0.49$. Intuitive classification based on nonsocial trials did not relate to accuracy on other tasks, all *p*'s > .18. There were no significant differences in time taken by intuitive and non-intuitive participants to choose which word triads were coherent. There were also no significant differences between intuitive and non-intuitive participants in time spent choosing which images were meaningful.

**Change detection in nonsocial and social trials**

Overall, participants were more accurate at detecting changes in the nonsocial trials (*M* = .74, *SD* = .15) than in the social trials (*M* = .48, *SD* = .19) during the picture discrimination task, $t(109) = 12.37$, $p < .001$, $d = 2.37$. Participants were also faster at sensing changes in the nonsocial trials (*M* = 8.24, *SD* = 4.51) than in the social trials (*M* = 10.71, *SD* = 4.36), $t(64) = 4.72$, $p < .001$, $d = 1.18$. The same was true for seeing changes, with participants seeing changes in nonsocial trials faster (*M* = 7.42, *SD* = 2.00) than in social trials (*M* = 10.16, *SD* = 2.63), $t(108) = 8.88$, $p < .001$, $d = 1.71$.

**Ability to detect changes in facial features**

A repeated measures ANOVA revealed a main effect of facial feature type (brow, eye, mouth) on sensing reaction times, $F(2, 94) = 6.56$, $p = .002$. As shown in Table 1, participants were slower at sensing changes in the brows compared to changes in the eyes, $t(55) = 1.71$, $p = .08$, $d = 0.46$, or the mouth, $t(48) = 3.54$, $p = .001$, $d = 1.02$. Participants were also slower at sensing changes in the eyes compared to changes in the mouth, $t(55) = 1.73$, $p = .09$, $d = 0.47$. Thus, overall, participants were the slowest at sensing changes in the brows and fastest at sensing changes in the mouth.

A similar ANOVA revealed a main effect for facial feature type on seeing reaction times, $F(2, 196) = 13.14$, $p < .001$. As shown in Table 1, participants were again slower at seeing changes in the brows compared to changes in the eyes, $t(100) = 2.23$, $p = .03$, $d = 0.45$, or the mouth, $t(99) = 4.32$, $p < .001$, $d = 0.87$. Participants were also slower at seeing changes in the eyes compared to changes in the mouth, $t(112) = 2.47$, $p = .02$, $d = 0.47$. Thus, again, participants were the slowest at seeing changes in the brows and fastest at seeing changes in the mouth.

Table 1
*Sensing and Seeing Times for Facial Features*

| | Sensing | | Seeing | |
|---|---|---|---|---|
| | *M* | (*SD*) | *M* | (*SD*) |
| Brow | 11.26 | (4.64) | 10.90 | (3.89) |
| Eye | 9.94 | (3.70) | 10.04 | (2.60) |
| Mouth | 7.97 | (3.82) | 9.03 | (2.57) |

A repeated measures ANOVA demonstrated a main effect for facial feature type on the accuracy of identifying changes in faces, $F(2, 236) = 152.52$, $p < .001$. As displayed in Table 2, participants were less accurate at identifying changes in the brows compared to changes in the mouth, $t(118) =13.13$, $p < .001$, $d = 2.42$, or the eyes, $t(118) = 17.17$, $p < .001$, $d = 3.16$. Participants were also less accurate at identifying changes in the mouth compared to changes in the eyes, $t(120) =4.09$, $p < .001$, $d = 0.75$. Altogether, participants were the least accurate at identifying a change when it occurred in the brows and were the most accurate at identifying a change when it occurred in the eyes.

Table 2
*Accuracy of Identifying Changes in Facial Features*

| | *M* | (*SD*) |
|---|---|---|
| Brow | 0.27 | (0.21) |
| Eye | 0.64 | (0.25) |
| Mouth | 0.54 | (0.20) |

I also examined whether intuition impacted detection and accuracy of identifying changes in different facial features. Intuitive participants were faster at sensing changes in the brows ($M$ = 11.46, $SD$ = 4.58) compared to non-intuitive participants ($M$ = 15.44, $SD$ = 6.65), $t(18.97) = 2.14$, $p = .045$, $d = 0.98$**.** There were no significant differences between intuitive and non-intuitive participants in sensing changes in the eyes and in the mouth. There were also no significant differences between intuitive and non-intuitive participants in seeing changes in the different facial features. Intuitive participants ($M$ = 0.59, $SD$ = 0.19) were more accurate at identifying changes that occurred in the mouth compared to non-intuitive participants ($M$ = 0.49, $SD$ = 0.23), $t(94) = 2.16$, $p = .033$, $d$ = 0.45. There were no significant differences in the accuracy of identifying changes occurring in the eyes or brows between the two groups.

**Ability to detect changes in facial expressions**

A repeated measures ANOVA revealed a main effect for facial expression type (angry, disgust, happy, sad, scared) on sensing times, $F(4, 96) = 3.43$, $p = .012$. As shown in Table 3, there was no significant difference in time to sense changes in angry and sad faces, $t(31) = 0.24$, $p = .812$, $d = 0.09$. There were also no significant differences in time to sense changes in disgusted, happy, and scared faces, all $t$'s $\leq 1.48$, all $p$'s $\geq .147$. There were significant differences in sensing changes in angry and sad faces compared to disgusted, happy, and scared faces, all $t$'s $\geq 2.48$, all $p$'s $\leq .018$, with one exception of sensing changes in sad faces compared to scared faces, which was not statistically significant, $t(35) = 1.63$, $p = .112$, $d = 0.55$. Thus, overall, participants were slower at sensing changes in angry and sad faces compared to disgusted, happy, and scared faces.

A repeated measures ANOVA revealed a main effect for facial expression on time to see changes, $F(4, 324) = 12.96$, $p < .001$. As shown in Table 3, there was no significant difference in time to see changes in angry and sad faces, $t(84) = 0.18$, $p = .859$, $d = 0.04$. There were also no significant differences in time to see changes in disgusted, happy, and scared faces, all $t$'s $\leq 1.49$, all $p$'s $\geq .140$. There were significant differences in seeing changes in angry and sad faces compared to disgusted, happy, and scared faces, all $t$'s $\geq 3.35$, all $p$'s $\leq .001$. Thus, overall, participants were slower at seeing changes in angry and sad faces compared to disgusted, happy, and scared faces.

Table 3

*Sensing and Seeing Times for Facial Expressions*

| | Sensing | | Seeing | |
|---|---|---|---|---|
| | *M* | (*SD*) | *M* | (*SD*) |
| Angry | 10.71 | (5.44) | 11.04 | (4.01) |
| Disgust | 7.73 | (2.79) | 9.08 | (3.36) |
| Happy | 8.48 | (3.15) | 9.34 | (2.73) |
| Sad | 10.98 | (4.59) | 11.31 | (4.11) |
| Scared | 8.62 | (4.49) | 8.63 | (2.97) |

A repeated measures ANOVA demonstrated a main effect for facial expression type on the accuracy of identifying changes in the faces, $F(4, 460) = 77.48$, $p < .001$. As displayed in Table 4, there was no significant difference in the accuracy of identifying changes in angry and sad faces, $t(117) = 1.25$ $p = .213$, $d = 0.23$. There were also no significant differences in the accuracy of identifying changes in disgusted, happy, and scared faces, all *t*'s ≤ 0.764, all *p*'s ≥ .446. There were significant differences in the accuracy of identifying changes in angry and sad faces compared to disgusted, happy, and scared faces, all *t*'s ≥ 9.624, all *p's* ≤ .001. Thus, overall, participants were less accurate at identifying changes in angry and sad faces compared to disgusted, happy, and scared faces

Table 4
*Accuracy of Identifying Changes in Facial Expressions*

| | *M* | (*SD*) |
|---|---|---|
| Angry | 0.33 | (0.29) |
| Disgust | 0.59 | (0.26) |
| Happy | 0.60 | (0.22) |
| Sad | 0.30 | (0.25) |
| Scared | 0.61 | (0.20) |

I also examined whether intuition impacted detection and accuracy of identifying changes in the different facial expressions. Intuitive participants were faster at sensing changes in sad faces ($M = 10.72$, $SD = 4.78$) compared to non-intuitive participants ($M = 17.38$, $SD = 5.71$), $t(35) = 2.83$, $p = .008$, $d = 0.96$; however, this is a small sample size. Non-intuitive participants were marginally more likely to sense changes faster in disgust faces ($M = 6.45$, $SD = 4.32$) compared to intuitive participants ($M = 9.06$, $SD = 4.16$), $t(47) = 1.69$, $p = .098$, $d = 0.49$; however, this too was a small sample size. There were also no significant differences between intuitive and non-intuitive participants in seeing changes in the different facial expressions. Intuitive participants were more accurate ($M = 0.69$, $SD = 0.17$) than non-intuitive participants ($M = 0.61$, $SD = 0.24$) at identifying changes that occurred in the happy faces, $t(92) = 1.98$, $p = .051$, $d = 0.41$. There were no significant differences in the accuracy of identifying changes occurring in the other four facial expressions between the two groups.

# CHAPTER IV

# DISCUSSION AND CONCLUSIONS

The present study investigated whether intuitive ability, reflected as detection of visual discrepancies, impacts performance on other tasks that require connections among concepts. This study also examined whether there would be a difference in the detection of discrepancies in various facial features and expressions. Results suggest that intuitive discrepancy detection predicts performance on tasks that require connections among concepts.

**Intuitive processing and ability to connect concepts**

I hypothesized that people who use intuitive processing to detect discrepancies would perform better on tasks that require the connection of concepts than those not using intuitive processing. This was tested by examining the accuracy and speed of discrepancy detection, the ability to identify coherent word sets, and the ability to identify coherent images. The findings were not fully consistent with the hypothesis for detection of discrepancies. Intuitive processing did not predict higher accuracy of detecting discrepancies. Also, a reliance on intuitive processing did not correspond to faster seeing times in the social scene discrepancies, though intuitive processing was associated with faster seeing times in the nonsocial scene discrepancies. The results illustrate that intuitive processing may not enhance accuracy in visual detection tasks and, more generally, that sensing is not crucial for correctly identifying changes.

One explanation for why intuitive processing was related to faster seeing times in nonsocial scenes, though not on the social scenes, may depend on the complexity of the different scene types. The nonsocial trials each consisted of one large image, with many potential change locations, whereas the social trials each consisted of nine images, also with many possible change locations. During the social trials, participants might have been more distracted in their visual search compared to in the nonsocial trials, up to the point that individual differences in intuitive processing would not have been exhibited. The nonsocial images would have less visual interference, thus differences between intuitive and non-intuitive participants might have been evident.

In the DOT task, intuitive participants were more accurate than non-intuitive participants at identifying the coherent triads. Also, while not significant, intuitive participants were more accurate at identifying the meaningful images in the Waterloo Gestalt Closure task compared to non-intuitive participants. There were no significant differences in the amount of time intuitive and non-intuitive participants took to choose which triad was coherent and which image was meaningful.

Detection of discrepancies offers a potentially useful measure of intuitive ability by presenting a way to assess unconscious processes that are usually difficult to evaluate. People sense changes before becoming consciously aware of the changes, indicating that detection of discrepancies involves unconscious processing (Galpin, Underwood, & Chapman, 2008; Ryan & Cohen, 2004). People who sense and see changes faster demonstrate greater reliance on intuitive processing when detecting discrepancies. And while intuitive processing (based on the social task) did not correspond to higher accuracy in the picture discrimination task, it did with the DOT task and Waterloo Gestalt Closure task. Thus, by calculating discrepancy detection times of individuals, the amount of intuitive processing utilized can assess intuitive ability in tasks that require connections among concepts.

Furthermore, intuition can be thought of in terms of a spreading activation model of cognition (Collins & Loftus, 1975; Ross & Bower, 1981). Intuitive processing may activate a wide variety of nodes in a holistic manner, connecting and spreading outward, whereas analytical processing has a narrower range of activation. Similar models have been proposed for creativity (Isen, Daubman, & Nowicki, 1987; Isen, Labroo,& Durlack, 2004). People who are high in intuitive ability are more likely to have a wider variety of connections available and also have connections that are more readily activated than people who are low in intuitive ability, and this difference is likely to be reflected on tasks that require application of wide connections such as a discrepancy detection task. In the DOT task, participants must make connections among concepts. Within the framework of this theory, intuitive participants would have an easier time concluding which triad is coherent compared to non-intuitive participants due to enhanced spreading activation. Intuitive participants would have a greater variety of words connected with each other, as well as having those connections easily triggered, which would increase the chances of them activating the correct node of the corresponding associated word.

Thus, intuitive participants would be more accurate at choosing the coherent triad compared to non-intuitive participants who have limited networks of connection. In the Waterloo Gestalt Closure task, participants must make connections about concepts in a visual manner, matching images with others in their memory. Intuitive participants would have an easier time identifying the meaningful images than non-intuitive participants because intuitive individuals would have a wider variety of images connected to each other, as well as having those connections be more readily accessible. These network characteristics would magnify the number of nodes activated and comparisons made, increasing the likelihood of the intuitive participants activating the correct node and identifying the correct image. Thus, intuitive participants would be more accurate at choosing the meaningful image compared to non-intuitive participants.

**Detection of social and nonsocial discrepancies**

I predicted that participants would detect social discrepancies faster and more accurately than nonsocial discrepancies. This prediction was not observed. Participants detected (sensing and seeing) nonsocial discrepancies faster than social discrepancies and were more accurate at detecting nonsocial discrepancies than social ones. As previously suggested, the higher complexity of the social scenes may have factored into the differences of accuracy and detection times between the social and nonsocial trials. Lowering the complexity of the social scenes, such using a 2X2 grid rather than a 3X3 grid, may be more suitable for comparing and analyzing the accuracy and detection times of social and nonsocial discrepancies. In addition, standardizing the complexity of both types of scenes would be useful in future investigations.

**Change detection of facial features**

I also examined accuracy and detection in relation to the different facial features. Overall, participants were the slowest at sensing changes in the brows and the fastest at sensing changes in the mouth. Paralleling these findings, participants were the slowest at seeing changes in the brows and the fastest at seeing changes in the mouth. Similarly, participants were the least accurate at identifying that a change occurred when it happened in the brows, though they were the most accurate at identifying a change when it occurred in the eyes. Analyzing whether intuitive processing influenced accuracy and speed of detecting facial feature changes revealed that intuitive participants were more accurate at identifying changes in the mouth, as well as faster at sensing changes in the brow, compared to non-intuitive participants. There were no differences in seeing changes in the facial features between intuitive and non-intuitive participants.

The higher accuracy in detecting changes in the eyes compared to the brows and mouth is compatible with previous research that has shown that people attend to the eyes more than the mouth (Davies & Hoffman, 2002). Why, then, were changes in the eyes not sensed and seen quicker than changes in the mouth when changes in the eyes were more accurately identified? Possible reasons for this occurrence are that 1) the mouth covers a larger area than the eyes, and thus is easier to sense and see, and 2) because the eyes were presented without the normal corresponding brow movement, changes in the eyes were harder to detect than in natural facial expressions in which the eyes and brows shift together. The lack of differences in seeing changes in facial features between intuitive and non-intuitive participants suggests that sensing does not facilitate seeing.

**Change detection of facial expressions**

I was also interested in accuracy and detection of the different facial expressions. Participants were slower at detecting (sensing and seeing) changes in angry and sad faces compared to disgusted, happy, and scared faces. They were also less accurate at identifying changes when the changes occurred in angry and sad faces compared to in disgusted, happy, and scared faces. Compared to non-intuitive participants, intuitive participants were faster at sensing changes in sad faces. Intuitive participants were also more accurate at identifying changes in happy faces compared to non-intuitive participants. Interestingly, non-intuitive participants were marginally more likely to sense changes faster in disgusted faces compared to intuitive participants. There were no significant differences in seeing changes in the different facial expressions between intuitive and non-intuitive participants. As previously discussed, this may indicate that sensing does not promote seeing.

Recent research has found that observers detect the change of a male neutral face to a male angry face more rapidly than the change of a male neutral faces to either a fearful or happy male face (Amado, Yildirim, & Turkey, 2011). The present findings indicate an opposing conclusion: a change from a neutral to a happy face is detected faster than a change from a neutral to an angry face. Becker et al. (2012) found similar results in which participants detected a change to a happy more rapidly than a change to an angry face. One caveat of the current study is that in the picture discrimination task, features were individually changed to display the emotional expression, rather than the whole expression being manifested.

An evolutionary perspective may account for the clustering of the responses to angry and sad faces and disgusted, happy, and scared faces. Evolutionarily, emotions have adaptive functions, and emotional expressions are a form of communication, indicating intent, behavior to follow, and potential danger (Greenberg, 2002; Keltner & Gross, 1999). Disgust signals possible contamination, such as in a food source (Teachman, 2006). Aggression and anger warns other members of the group that an attack may occur, whereas fear corresponds with the intention of flight and escape, preparing others to flee (Greenberg, 2002; Nesse & Ellsworth, 2009). Happiness may motivate an individual to remain on his or her current path or indicate friendship; while sadness can prompt calls for help or signal that efforts are ineffective (Nesse & Ellsworth, 2009; Ohman, 2009). Fear and disgusted expressions indicate imminent danger from environmental factors and a happy expression signals safety of the surrounding environment, whereas angry and sad expressions communicate conflict within the social group. Expressions related to external factors might prompt faster reactions than expressions related to conflict within a group.

## Limitations

The present study has several limitations. First, even though the models used are actors and were chosen based on their emotional expressiveness, some may argue that the emotions displayed by the actors are not "true" emotions because the emotions were not elicited in real situations. Also, for the picture discrimination task, because only one facial feature was altered at a time per emotional expression, the results found may not correspond to responses gathered by changing all the facial features. Furthermore, others may question whether the Dyads of Triads task and the picture discrimination task actually measured intuition performance. However, both tasks were designed to have participants make quick, intuitive judgments, and accuracy in both tasks was associated with higher use of intuitive processing. Thus, the Dyads of Triads task and the picture discrimination task most likely measured intuitive performance.

## Conclusions

The findings contribute to the growing body of work that investigates how intuitive processing works and how intuitive processing may be measured. Also, this study begins to tease apart how people respond to quick changes in facial expressions, including which features and which emotions are detected most quickly and accurately.

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