

# LEVEL OF ASL KNOWLEDGE: ACCURACY OF DECODING EMOTION IN FACIAL EXPRESSIONS

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Paralanguage has been defined as “the study of those aspects of speech communication that do not pertain to linguistic structure or content, for example, vocal qualifiers, intonation, and body language” (Houston 1984). While body language is not listed here as part of the linguistic

structure, it does contribute to the communicated message. Mehrabian and Ferris (1967) claim that 55 percent of communication is in the face, 38 percent is in tone, and 7 percent is in words. This puts a large emphasis on decoding emotion within others' faces. Decoding emotions in facial expressions provides emotional and social cues in social situations (Custrini and Feldman 1989). Social competence (Custrini and Feldman 1989), gender, and knowledge of American Sign Language (ASL) (Feldman and Goldstein 1996) have been shown to influence accuracy in decoding facial expressions. However, not many other variables have been studied and shown to influence accuracy.

ASL and other signed languages are primarily visual, using hand-shapes, facial expressions, and spatial movement to convey linguistic meaning. Grossman and Kegl (2006) note that "a large part of the grammar of ASL is expressed nonmanually" (2006). ASL utilizes facial expressions to convey linguistic, emotional, and NENG (nonemotional and nongrammatical) information (Grossman and Kegl 2006). Facial expressions are used to denote negation, yes/no questions, *wh*-questions, rhetorical questions, and so forth. Because of this, beginning signers are taught to recognize and produce facial expressions for linguistic information. But as signers increase in ASL proficiency, does this focus on facial expressions also help them increase in emotion-decoding accuracy in facial expressions?

## Knowledge of ASL Does Not Improve Accuracy of Decoding Emotion in Facial Expressions

Gender and social competence are significant in a child's ability to decode emotion in facial expressions (Custrini and Feldman 1989). Boys do not vary significantly in their emotion-decoding accuracy, but the more socially competent girls are, the more accurately they decode

emotion. Social competency is likely gained partially through repeated exposure to social situations and positive reactions from peers. It is possible that students of ASL were socially competent before learning ASL, and their ability to decode emotion comes from their social competence rather than their knowledge of ASL.

Elfenbein and Ambady (2003) argue that while some emotions are recognized cross-culturally, those part of the *in-group*, or those from the same culture as those who were recorded or photographed to show emotion in facial expressions, were significantly more accurate at decoding emotion in the tested facial expressions than those who were not part of the *in-group*. Also, they noticed that the less cultural interaction between the participant decoding the emotion and the people recorded or photographed, the less accurate the participants were at decoding the emotions. This implies that cultural interaction plays a part in accurately decoding emotions. Testing hearing signers from within their own culture may lead to more accurate results (the *in-group* effect) than if the participants were from multiple cultures.

Corina, Bellugi, and Reilly (1999) showed that linguistic facial expressions are primarily mediated by a different hemisphere of the brain than nonlinguistic facial expressions in ASL. Students of beginning and intermediate ASL classes will most likely focus on noticing and producing linguistic facial expressions, rather than emotional and NENG facial expressions. Because these expressions are mediated in different hemispheres of the brain, it is not likely that students of ASL learn to decode emotion in facial expressions in beginning and intermediate courses.

Feldman and Goldstein (1996) tested whether knowledge of ASL among hearing people made a difference in being able to accurately decode emotion in facial expressions. The male hearing signers were not significantly more accurate in decoding emotion in facial expressions.

# Knowledge of ASL Does Improve Accuracy of Decoding Emotion in Facial Expressions

Feldman and Goldstein (1996) supported the results of Custrini and Feldman (1989) in that female participants were more accurate at decoding emotion in facial expressions than their male counterparts. Feldman and Goldstein's results also showed that signers at an intermediate level were significantly more accurate at decoding emotion in facial expressions than non-signers. However, Feldman and Goldstein only tested the difference between signers and non-signers, leaving implications about whether the level of knowledge of ASL made a difference in the accuracy of decoding emotion in facial expressions and whether students of ASL had inclinations towards visual languages and decoding facial expressions before learning ASL.

Ekman et al. (1992) and Izard (1971) conducted studies that demonstrated “consistent evidence of agreement across more than a dozen Western and non-Western literate cultures in the labeling of enjoyment, anger, fear, sadness, disgust and surprise facial expressions” (Ekman et al. 1992). This implies emotions in facial expressions that go beyond cultural boundaries and are referred to as universal emotions. Because ASL has facial expressions for linguistic, emotional, and NENG purposes, students of ASL are learning to watch facial expressions for smaller changes. This may help them in recognizing emotions as they look for patterns and changes in facial expressions.

McCullough and Emmorey (2009:20) concluded, based on other studies regarding signers, that Deaf and hearing signers had enhanced performance in identifying facial features. This implies that those who learn ASL will also enhance their performance with facial features. Since emotions are often focused in facial expressions, this may enhance signers' abilities to accurately decode emotion in facial expressions.

# Methodology

I recruited ASL and non-ASL undergraduate participants from Brigham Young University (BYU). Each participant completed a Qualtrics survey asking them to decode emotion in photographed facial expressions.

## ASL Participants

I contacted the ASL department chair at BYU and asked if I could send a survey to all students currently enrolled in an ASL class. Upon receiving permission, the department secretary then sent my survey to students currently enrolled in ASL 101, 102, 201, or 202. In these courses, students learn how to converse in the language. Because these courses build on each other, students may only take one per semester. ASL 111 and 112 were also being offered, but I chose not to use them because they were new classes offered to students with a wide range of ASL proficiency and thus were out of the scope of my study.

After my survey had been available for a week, I realized that none of the ASL 201 or 202 students had completed my survey. I personally went to all of the ASL 201 and 202 classes and, with permission from the ASL department chair and each professor, announced my survey to each class. For the ASL 201 students, I announced my survey in English. For the ASL 202 students, I announced my survey in ASL. In each of the 200-level classes, I sent the survey link to a volunteer in the class who agreed to send the survey to the rest of the class. This approach brought in ASL 201 and 202 participants.

There were 154 ASL students who responded to my survey. Of these, two did not complete the survey, one had hearing loss, five were non-native English speakers, and five were not in the conversation ASL classes (ASL 101, 102, 201, or 202). The results from these individuals were removed from the study, leaving me with one hundred forty-one participants. Of these one hundred forty-one participants, seventy-one were in ASL 101 (sixty-four female, seven male), thirty-seven were in

ASL 102 (thirty-four female, three male), nine were in ASL 201 (nine female, 0 male), and twenty-four were in ASL 202 (twenty-two female, two male).

Participants were removed from the study if they had hearing loss because I did not want to confound the data with a potential *in-group* effect on those without a hearing loss. Non-native English speakers were removed from the study to remove excess variables. ASL students who were not in the conversation ASL courses were removed from the study because their course number would not accurately reflect the class's ASL proficiency level. Some of the ASL participants had exposure to ASL or the Deaf community before they began ASL classes at BYU, but I am assuming this is not a significant factor because students will generally enroll in the conversation class that approximately reflects their skill level. Hence, for the scope of this study, the course number will be used to determine approximate ASL proficiency.

## Non-ASL Participants

In order to choose non-ASL classes to include in this study, I used Randomizer.org to randomly generate numbers assigned to course names and numbers. I then contacted students in these classes to participate in the study. I initially ended up with a theatre class for theatre majors only, TMA 112: CRV, but decided it could confound my results because theatre students have to understand how to produce facial expressions in such a way that others understand the emotion they are expressing. Upon repeating the process, I ended up with an Exercise Science (EXSC) class, EXSC 365: Sci Bases Sport: Kinesiology and distributed my survey to them with the permission of the professor.

There were fifteen EXSC 365 students who responded to my survey. Of this total, seven had previous exposure to ASL or the Deaf community and one had hearing loss; they were removed from the study, leaving me with seven participants (four female, three male).

I removed participants with previous exposure to ASL or the Deaf community because I didn't want their ASL exposure to potentially influence their emotion-decoding accuracy. Participants were removed from the study if they had hearing loss because I did not want to confound the data with a potential in-group effect on those without a hearing loss.

## Stimuli

With permission, I used the Paul Ekman Group's ER photos in my research. These pictures were displayed in my survey for ten seconds each (Appendix A).

## Procedure

Using the ER photos, I made a Qualtrics survey in which I showed each picture for ten seconds with a timer beneath the picture. Then, the participants were asked to respond to the stimuli by indicating which emotion was being expressed: anger, contempt, disgust, fear, happiness, sadness, or surprise. These emotions constitute the seven universal emotions found by the Paul Ekman Group (Ekman et al. 1992). There were two pictures for each emotion except happiness, which had one picture. The first picture for each emotion was a standard representation. The second picture for each emotion was either a subtler version of the emotion (referred to as "slight") or an alternate version of it. The pictures were shown in a random order to each survey participant.

Following these questions participants were asked demographic questions and ASL-exposure questions. The ASL-exposure questions were to determine how much ASL they had been exposed to (for EXSC students) or what ASL course they were enrolled in (for ASL students).

If a group is 10 percent or more accurate in decoding emotions in facial expressions than another group, it will be considered significantly more accurate. If three or more groups (sequentially

from non-ASL to ASL 202) increase by 10 percent accuracy each, it will be considered a linear relationship. If eight or more emotions have a linear relationship, we will consider there to be a linear relationship between ASL proficiency and accuracy in decoding emotion in facial expressions.

## Analysis

After the participants finished taking my survey, I compiled their results and separated them out by gender and by level of ASL proficiency (ASL class).

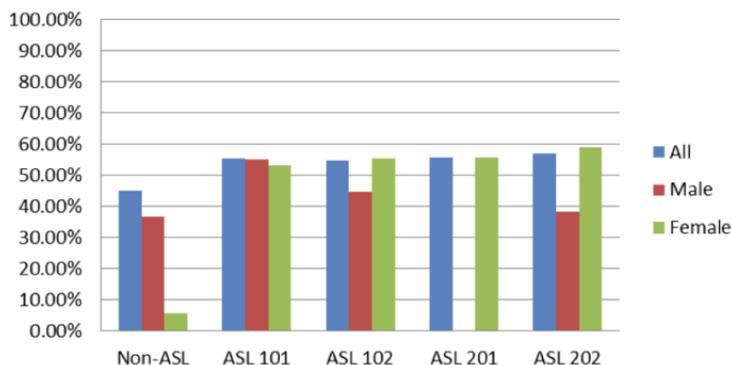
When looking at the accuracy rates of all participants with all emotions, ASL 202 students have the highest rate (57.14 percent) but not by a significant amount (ASL 101 follows with 55.53 percent). All of the “all” percentages were calculated with a weighted average. There were no male participants for ASL 201, so the average reflects the female average. Therefore, we will not be comparing males and females in ASL 201. When gender is taken into consideration, males have higher corresponding accuracy rates for non-ASL (significant) and ASL 101 (non-significant), while females have higher corresponding accuracy rates for ASL 102, 201, and 202 (all are significant) (see Figure 1). Because the combined emotions do not have three sequential groups with an increase in ten percent accuracy each (in all, male, or female), it will not be considered a linear relationship.

Figure 1

As we look at individual emotions, we notice other patterns. For anger, there were two images: anger and anger slight. With anger, we see that females are significantly more accurate than males in all groups except ASL 101, where males are insignificantly more accurate than females (see Figure 2). Because anger does not have three sequential groups with an increase in ten percent accuracy each (in all, male, and female), it will not be considered a linear relationship. For anger slight,

we see a reversed trend. Males are significantly more accurate in all groups except ASL 102, where females are significantly more accurate

## All Emotions



than males (see Figure 3). Because anger slight does not have three sequential groups with an increase in ten percent accuracy each (in all and male), it will not be considered a linear relationship.

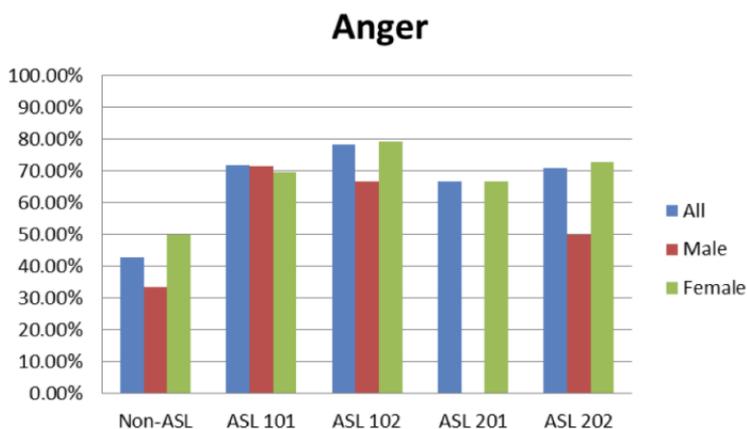


Figure 2

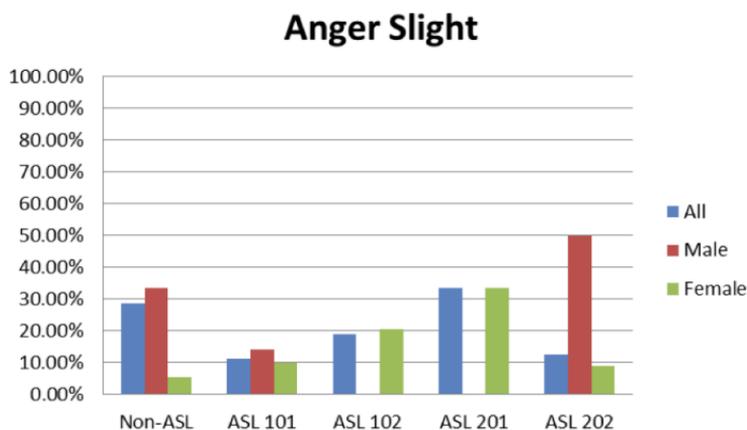


Figure 3

For contempt, there were two images: contempt 1 and contempt 2. For contempt 1, females were more accurate in ASL 101 (insignificant) and ASL 202 (significant), while males were more accurate in non-ASL (significant) and ASL 102 (insignificant) (see Figure 4). Because contempt 1 has three sequential groups with an increase in 10 percent accuracy each (in all, male, and female), it will be considered a linear relationship. For contempt 2, females were significantly more

accurate in ASL 102 and 202, while males were significantly more accurate in non-ASL and ASL 101 (see Figure 5). Because contempt 2 does not have three sequential groups with an increase in ten percent accuracy each (in all and male), it will not be considered a linear relationship.

## Contempt 1

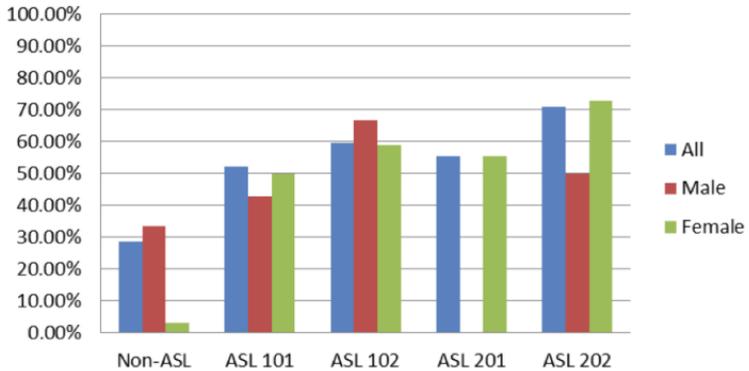


Figure 4

## Contempt 2

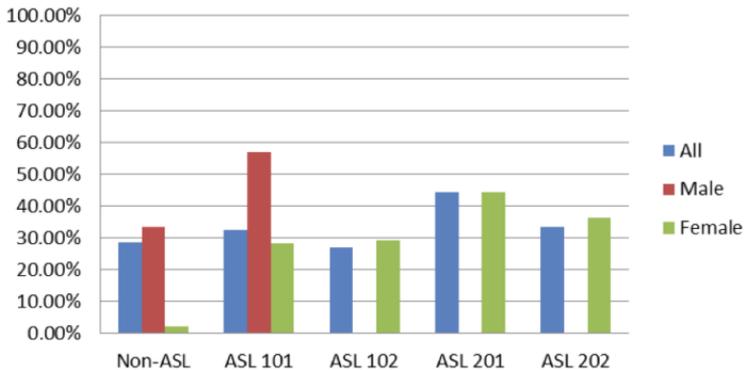


Figure 5

For disgust, there were two images: disgust and disgust slight. For disgust, females were more accurate in ASL 101 (insignificant),

ASL 102 (insignificant), and ASL 202 (significant), while males were significantly more accurate in non-ASL (see Figure 6). Because disgust does not have three sequential groups with an increase in 10 percent accuracy each (in all and male), it will not be considered a linear relationship. For disgust slight, females were significantly more accurate in ASL 101, while males were significantly more accurate in Non-ASL and ASL 202 (see Figure 7). Because disgust slight does not have three sequential groups with an increase in 10 percent accuracy each (in all and male), it will not be considered a linear relationship.

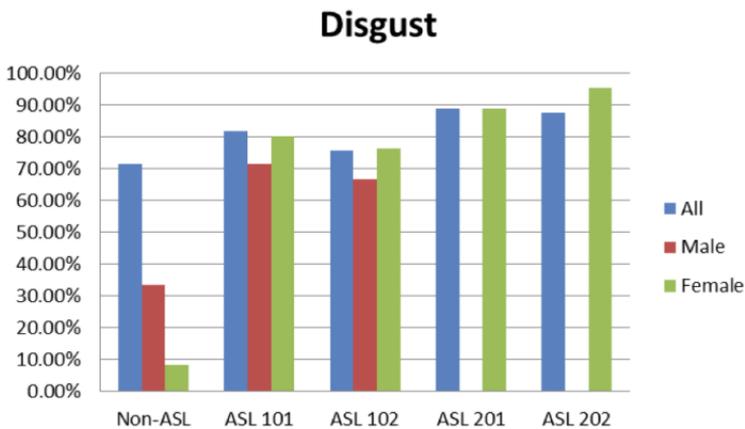


Figure 6

## Disgust Slight

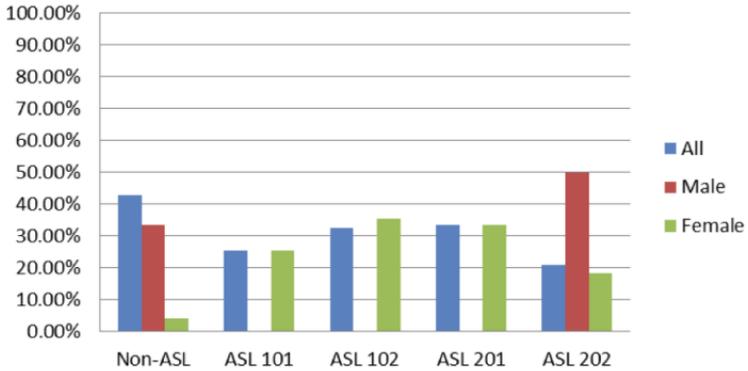


Figure 7

For fear, there were two images: fear and fear slight. For fear, females were significantly more accurate in all categories, while males did not decode any accurately (see Figure 8). Because fear does not have three sequential groups with an increase in 10 percent accuracy each (in all, male, and female), it will not be considered a linear relationship. For fear slight, females were more accurate in non-ASL (insignificant) and ASL 202 (significant), while males were more accurate in ASL 101 (significant) and ASL 102 (insignificant) (see Figure 9). Because fear slight has three sequential groups with an increase in 10 percent accuracy each (in all and female), it will be considered a linear relationship.

## Fear

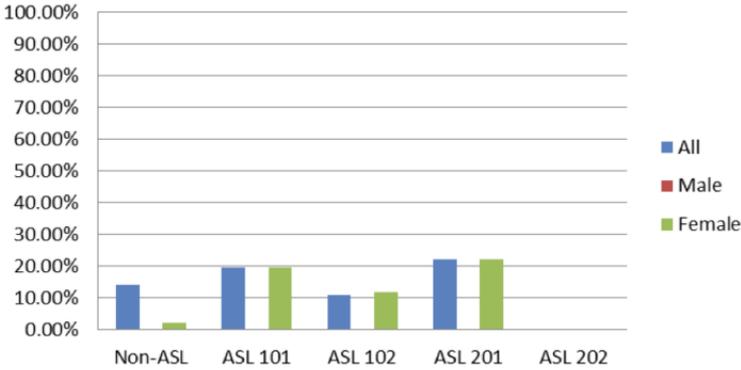


Figure 8

## Fear Slight

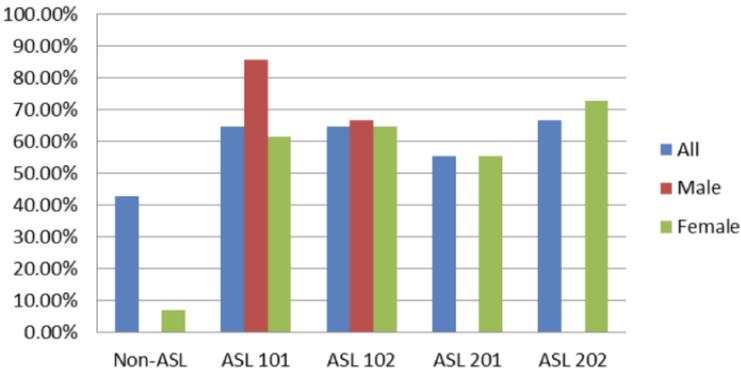


Figure 9

For happiness, there was one image. Males were more accurate in all groups except ASL 202 (non-ASL [significant], ASL 101 [insignificant], and ASL 102 [insignificant]). Both males and females were completely accurate in ASL 202 (see Figure 10). Because happiness does not have three sequential groups with an increase in 10 percent accuracy each (in all, male, and female), it will not be considered a linear relationship.

## Happiness

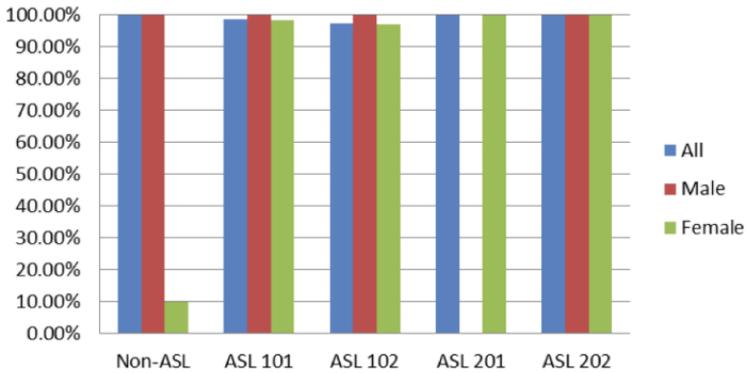


Figure 10

For sadness, there were two images: sadness and sadness slight. For sadness, females were significantly more accurate in ASL 102 and 202, while males were more accurate in non-ASL (significant) and ASL 101 (insignificant) (see Figure 11). Because sadness has three sequential groups with an increase in 10 percent accuracy each (in all and female), it will not be considered a linear relationship. For sadness slight, females were significantly more accurate in ASL 102 and 202, while males were significantly more accurate in non-ASL and ASL 101 (see Figure 12). Because sadness slight does not have three sequential groups with an increase in 10 percent accuracy each (in all, male, and female), it will not be considered a linear relationship.

## Sadness

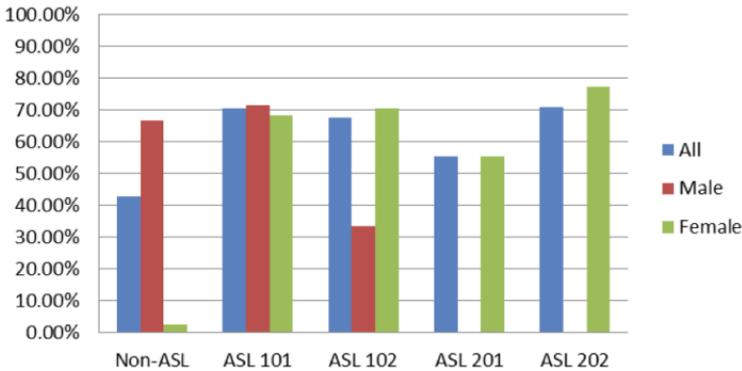


Figure 11

## Sadness Slight

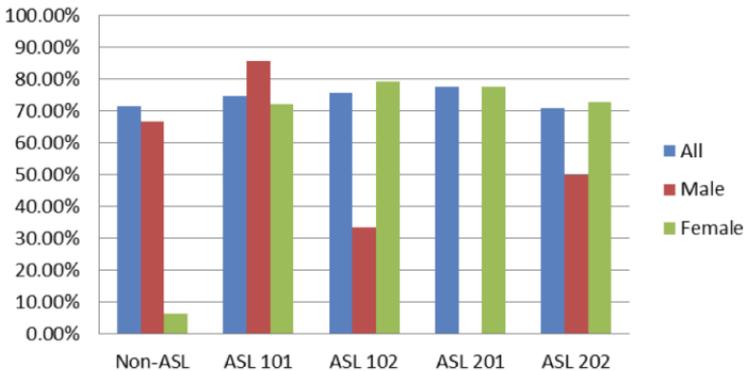


Figure 12

For surprise, there were two images: surprise 1 and surprise 2. For surprise 1, males were more accurate in all groups (non-ASL [significant], ASL 101 [significant], ASL 102 [insignificant], and ASL 202 [significant]) (see Figure 13). Because surprise 1 has three sequential groups with an increase in 10 percent accuracy each (in all, male and female), it will be considered a linear relationship. For surprise 2,

females were more accurate in ASL 101 (insignificant) and ASL 202 (significant), while males were more accurate in Non-ASL (significant) and ASL 102 (insignificant) (see Figure 14). Because surprise 2 does not have three sequential groups with an increase in 10 percent accuracy each (in all and male), it will not be considered a linear relationship.

### Surprise 1

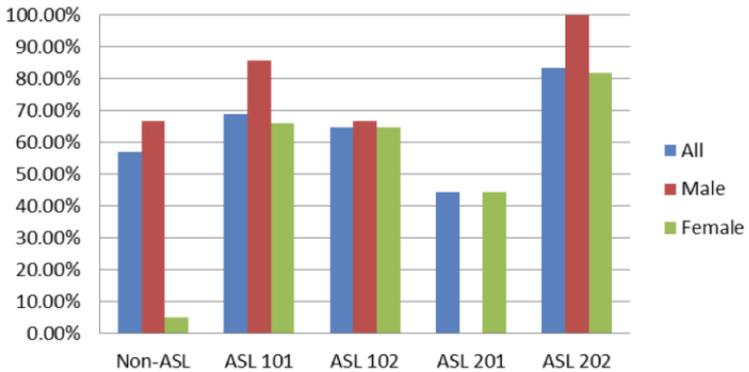


Figure 13

### Surprise 2

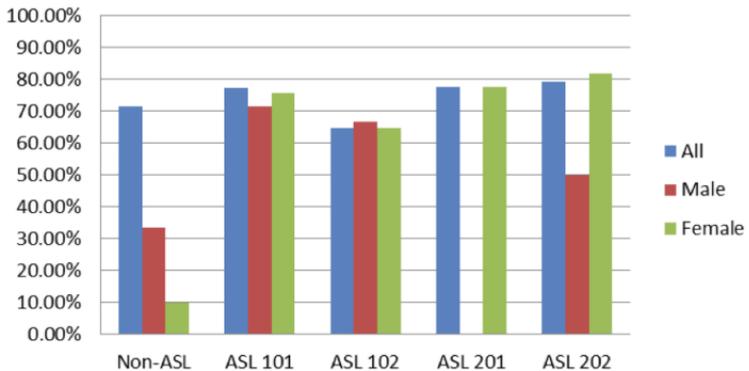


Figure 14

Hence, linear relationships are found in contempt 1, fear slight, sadness, and surprise 1. Non-linear relationships are found in anger, anger slight, contempt 2, disgust, disgust slight, fear, happiness, sadness slight, and surprise 2. The overall relationship among the emotions is also non-linear. Because the total number of linear relationships (Figure 4) is less than our threshold of significance (Figure 8), we will not consider there to be a linear relationship between ASL proficiency and accuracy in decoding emotions in facial expressions.

## Conclusion

Because there were fewer emotions considered to have a linear relationship (Figure 4) than the threshold of significance (Figure 8), we did not consider there to be a linear relationship between ASL proficiency and accuracy in decoding emotions in facial expressions. Hence, the data supports the first argument: knowledge of ASL does not improve accuracy of decoding emotion in facial expressions. The implication of this conclusion is that the level of ASL proficiency may not influence emotion-decoding accuracy. In other words, becoming more proficient at ASL may or may not increase your accuracy in decoding emotions in facial expressions.

There are limitations to this study in regards to its size, available participants, lack of Deaf participants, proficiency-level grouping, and static stimuli. The size and scope of this study was rather small, as I only surveyed BYU undergraduates. I did not have any volunteer male ASL 201 participants, which presented problems in accurately seeing a correlation between emotion-decoding accuracy and level of ASL proficiency. I did not have any Deaf participants to see if in-group was taking effect. I did not have a tested method of determining a participant's ASL proficiency beyond categorizing them by the BYU ASL course they were enrolled in. The pictures I used were of the same subject producing different facial expressions instead of having differ-

ent subjects to produce each facial expression. Also, by using pictures instead of videos, the facial expressions were static instead of dynamic. Since facial expressions are dynamic, this may influence the accuracy levels of the participants.

This research relates to larger issues by determining that learning ASL may not influence your ability to decode paralanguage in facial expressions. However, other areas of paralanguage need to be explored with ASL and other signed languages to be able to generalize this finding.

## Future Work

Due to the limitations of my study and the breadth of the issue, there is much future work to consider.

Reproducing my study on a larger scale with more participants would generate a more likely representation of a larger group that could then be generalized to a wider audience. This data would be relevant in determining whether ASL influences emotion-decoding accuracy in other situations.

Using a more reliable test, such as the Sign Communication Proficiency Interview (SCPI), to determine my participants' ASL proficiency would add credibility to my study. It would allow me to group participants based on their actual proficiency instead of by the class they are enrolled in. However, it would require hiring professional SCPI interviewers to determine the participants' SCPI level.

Using a longitudinal study to monitor individual improvement based on an increase in ASL proficiency would allow researchers to see more clearly how ASL affects individuals over time rather than assuming the participants are the same except for the level of their proficiency. However, this would require extensive time and cooperation from the participants.

Including Deaf participants would show whether the in-group effect was occurring. This would be helpful in determining what effect learning ASL has on decoding emotions in facial expressions from other cultures and would confirm or disagree with the universal-emotions research.

Using a variety of subjects in the stimuli (i.e., the Pictures of Facial Affect [POFA] from the Paul Ekman Group) may influence the emotion-decoding accuracy, as male stimuli may not be equally difficult to accurately decode. Changing the emotions in stimuli would force participants to take in the entire facial expression instead of look for changes in the facial expression of the same stimuli.

Using video clips, rather than pictures, would allow for a dynamic, rather than static, representation of emotion in facial expressions. This would be closer to facial expressions in regular conversations in English and ASL, and would help to determine whether there is a difference between emotion-decoding accuracy in static or dynamic facial expressions.

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