



Figure 1. Loulis signing THAT while interacting.

ABSTRACT

Familiarity affects nonverbal and verbal conversational behaviors in humans. Infant chimpanzees Washoe, Tatu, Dar, and Loulis acquired signs of American Sign Language (ASL) in a conversational context from either humans or other chimpanzees. As adults, their conversational responses are contingent on the conversational partner. In this study, the chimpanzees responded with individual patterns to the familiarity of the human conversational partner, yet they all most often interacted with signers regardless of the level of familiarity. The chimpanzees were sensitive to the familiarity and signing ability of the conversational partner. When the chimpanzees were treated as conversational partners, they responded in patterns that resemble humans.

INTRODUCTION

Human Research:

- The success of a conversation is dependent on many aspects of the interaction including:
- familiarity of the conversational partner
 - using a shared language

Familiarity between conversational partners can increase the number and length of conversations, and comprehension between partners. Conversely, unfamiliarity can inhibit conversations, especially in children. Furthermore, when partners share a language, conversations are more successful.^{18,24,26,29,31,32,33}

As infant chimpanzees Washoe, Tatu, and Dar were reared by humans in a cross-fostering laboratory at the University of Nevada-Reno,^{13,15,16} The cross-fostering environment was modeled after a typical human rearing environment. However, caregivers integrated American Sign Language (ASL) into the procedure so that the chimpanzees were immersed in a sign language environment much like a human child is immersed in a speech environment. The cross-fosterlings paralleled children in their acquisition and use of signs and phrases.¹⁷ When Washoe was about 14 years old she adopted a 10-month-old son, Loulis. To determine whether Washoe would teach signs to an infant without human intervention, human signing was prohibited around Loulis. In the 5-year period of signing restriction, Loulis learned 51 signs.^{9,10} Like the cross-fostered chimpanzees, the growth pattern of Loulis’ phrases paralleled that of human children.¹¹

As adults, all four chimpanzees currently reside at the Chimpanzee and Human Communication Institute (CHCI) at Central Washington University (CWU) in Ellensburg, Washington. Treated as conversational partners, caregivers use ASL in all interactions with the chimpanzees. Systematic manipulations of these conversations show the chimpanzees initiate and maintain conversations.^{4,22} The chimpanzees also are responsive to differences in familiarity of signing partners. King systematically presented familiar caregivers and unfamiliar human visitors to the chimpanzees at CHCI. Even though neither group was allowed to interact or make eye contact with the chimpanzees during trials, the chimpanzees signed more to the familiar caregivers during trials.²⁵ These findings beg further investigation as to how human familiarity and sign usage affects the chimpanzees’ responsiveness in a conversational context.

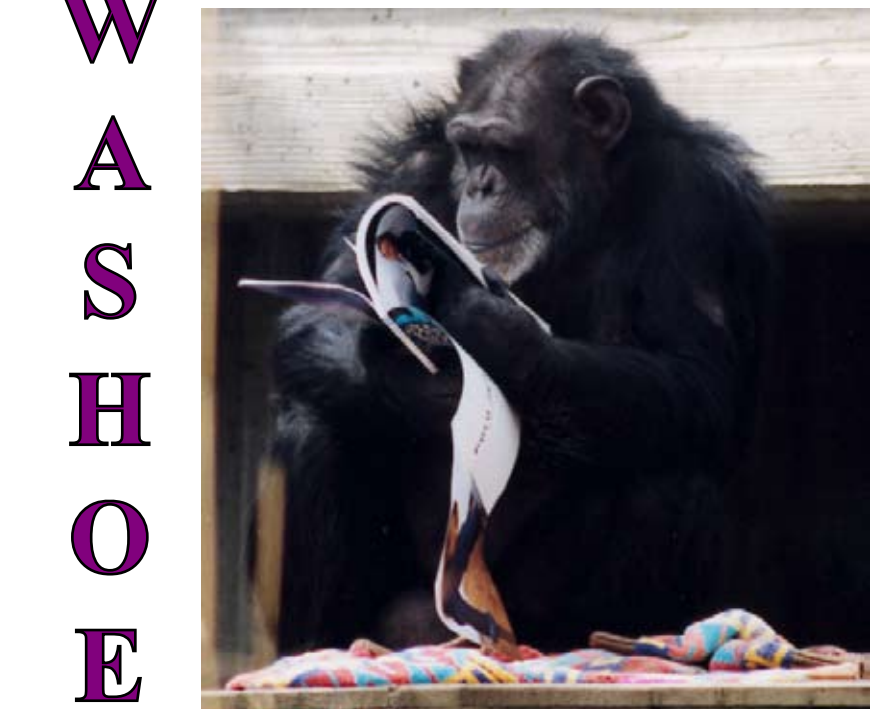
Research Objective:

This study tested the chimpanzees’ responses to familiar versus unfamiliar and signing versus non-signing human conversational partners.

Hypotheses:

- We predicted that the four chimpanzees would engage in more conversational behaviors with familiar-signers, as measured by eight statistically tested dependent variables.
- In addition, the chimpanzees were expected to engage in fewer conversational behaviors with the two types of nonsigners, due to a lack of a shared language.

CHIMPANZEE PARTICIPANTS



41-year-old female



28-year-old male



31-year-old female



30-year-old male

HUMAN PARTICIPANTS (CONDITIONS*)

Familiar-signers (FS): Chimpanzee caregiver staff members that were active ASL users.

Familiar-nonsigners (FN): Entry-level interns and volunteers that 1) did not know any ASL or 2) knew ASL but had never used ASL when interacting with the chimpanzees.

Unfamiliar-signers (US): Advanced ASL users who had never before been exposed to the chimpanzees.

Unfamiliar-nonsigners (UN): Never before been exposed to the chimpanzees and had no knowledge of ASL.

*Note. N = 20 in each of the conditions.

METHODS

The human participant (N = 80) sat in a chair positioned by the chimpanzee enclosures for a 4-min trial. A large glass window separated the human and chimpanzees. Four stationary video cameras videotaped the trial. Please see Figure 2 for a diagram of the trial site. Each chimpanzee was free to interact or not with the human participant. From the videotapes of each trial (21.33 hr), reliable coders (>85% inter-observer reliability) transcribed all of the chimpanzees’ and partners’ signs. The transcriptions were then used to calculate the frequencies of the variables that appear in Table 1. These variables are collectively referred to as conversational behaviors in the results and discussion.

SIGNING CHIMPANZEES’ (PAN TROGLODYTES) INTERACTIONS WITH FAMILIAR AND UNFAMILIAR SIGNERS AND NON-SIGNERS

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RESULTS

ANOVA Analyses:

- As a group, the chimpanzees responded with significantly more nonverbal behaviors in the familiar versus unfamiliar conditions ($F(1, 9) = 10.397, p = .048$).
- None of the other variables were significant using this analysis.
- Visual inspection of the raw frequencies revealed strong individual differences for all dependent variables. Wide individual variation within conditions can result in the repeated measures ANOVA error term becoming too large to achieve statistical significance.

Summary of Individual Chi-square Analyses:

- Tatu and Dar used the most conversational behaviors with familiar-signers.
 - This pattern was consistent for all eight dependent variables, although some dependent variables were not statistically significant.
- Washoe and Loulis used the most conversational behaviors with unfamiliar-signers.
 - This pattern was significant for both Washoe and Loulis for frequency of utterance responses, total signs, and turns.
 - For Washoe, frequency of initiations also followed this pattern with statistical significance.
- Frequency data and results of 2x2 chi-square analyses appear in the graphed figures below.

Table 1. Operational Definitions of the Dependent Variables

Variable	Definition
Trial participation frequency	The total number of trials in each condition that a chimpanzee directly signed at least once to the human participant. Participation was counted for each chimpanzee.
Utterance response frequency	The total number of signed utterances each chimpanzee made in each condition.
Total sign frequency	The total number of signs that each chimpanzee signed in each condition, excluding reiterations.
Overall vocabulary items	The number of different glosses each chimpanzee used in each condition.
Nonverbal response frequency	The total number of nonverbal responses each chimpanzee used in each condition.
Conversation frequency	The total number of conversations in each condition in which a chimpanzee participated. Conversation participation was counted for each chimp.
Initiation frequency	The total number of conversations each chimpanzee initiated in each condition.
Turn frequency	The total number of signed or nonverbal responses each chimpanzee made during a conversation in each condition.

Note. All dependent variables were calculated to reflect a group total as well as individual chimpanzee totals.

Excerpts From Interactions During Trials

Signs appear in capital letters. Forward slash indicates an utterance boundary. Reiterations are indicated by an "x" following a sign.

Trial 71
51:15 US play face, head bob
51:16 Washoe HURRY/
51:19 US HI/
51:20 Washoe SHOE GIMME/
51:23 US ME FRIEND ME/
51:26 Washoe HURRY/
51:27 US YOU ME FRIEND YOU ME FRIEND/

Trial 31
35:10 US show mask
35:14 Loulis HURRY-THATx HURRY THATx/
35:20 US HI/
35:22 Loulis knuckle taps glass THATx FOOD THATx HURRY-THAT FOODx HURRY-THAT THAT THAT-HURRY THATx THATx HURRY-THATx HURRY HURRY-THATx THATx CHASEx/
35:30 US HI/
35:33 US YOU HUNGRY YOU HUNGRY YOU/

Trial 41
44:03 Tatu knocks on window
44:04 FS HEAR WHAT/ WHAT YOU WANT/ blows kisses to Tatu
44:07 Tatu GIMME/ LOTION GO-THERE GO-THEREx/
44:12 FS WANT LOTION WHAT LOTION WHERE LOTION FINISHED SORRY CAN'T/

-----Break in conversation-----
44:33 FS THAT WHAT/
44:36 Tatu CHEESE/
44:37 FS CHEESE NO YOU NOT EAT CHEESE/

Trial 79
50:05 FS MASK/ WHERE DAR/
50:11 Dar MASK CHASEx/
50:13 FS CHASE/ YOU CHASE YOU/ PLAY/
50:20 Dar SHOEx/
50:21 FS SHOE/
50:22 Dar knuckle taps window, they play
50:26 FS THAT MY SHOE/ tap on glass with shoe, they play tickle
50:31 Dar back hand thump glass lightly in play, SHOEx SHOEx/

Washoe Loulis Tatu Dar

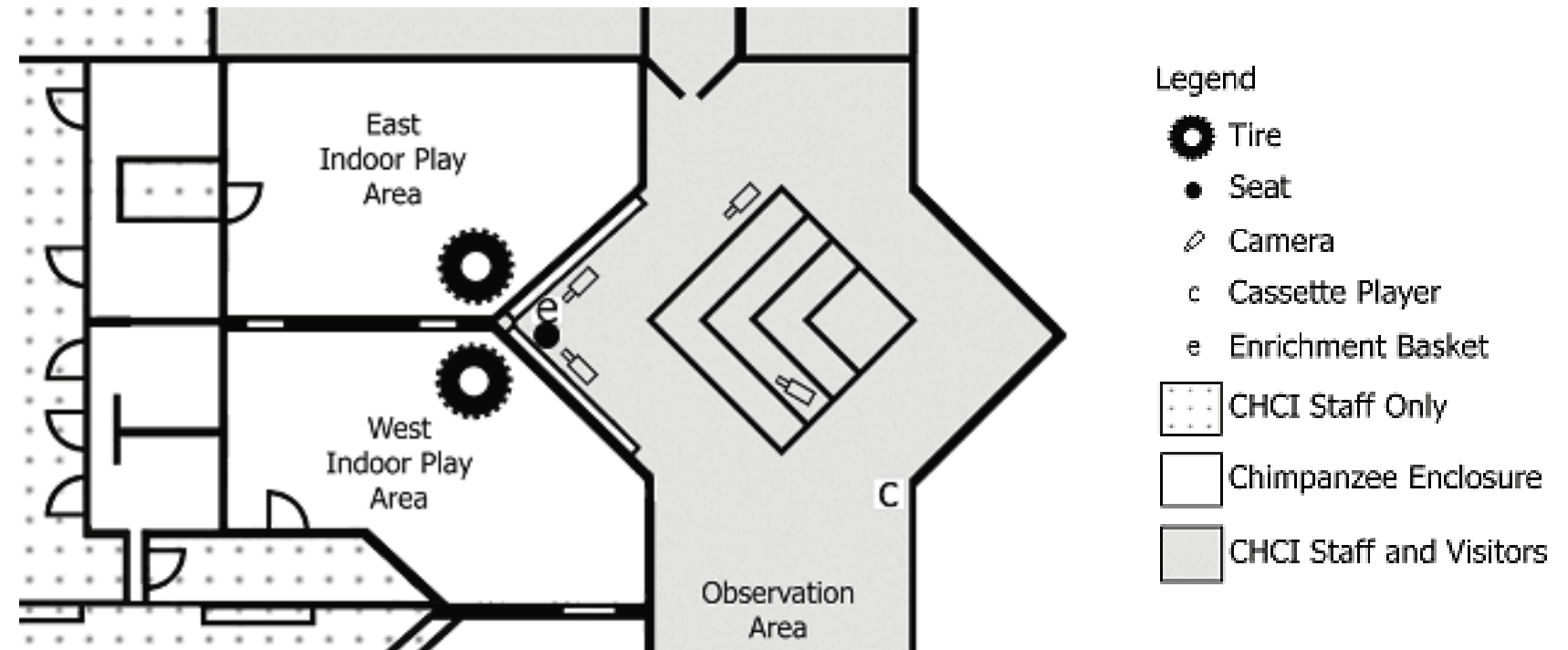
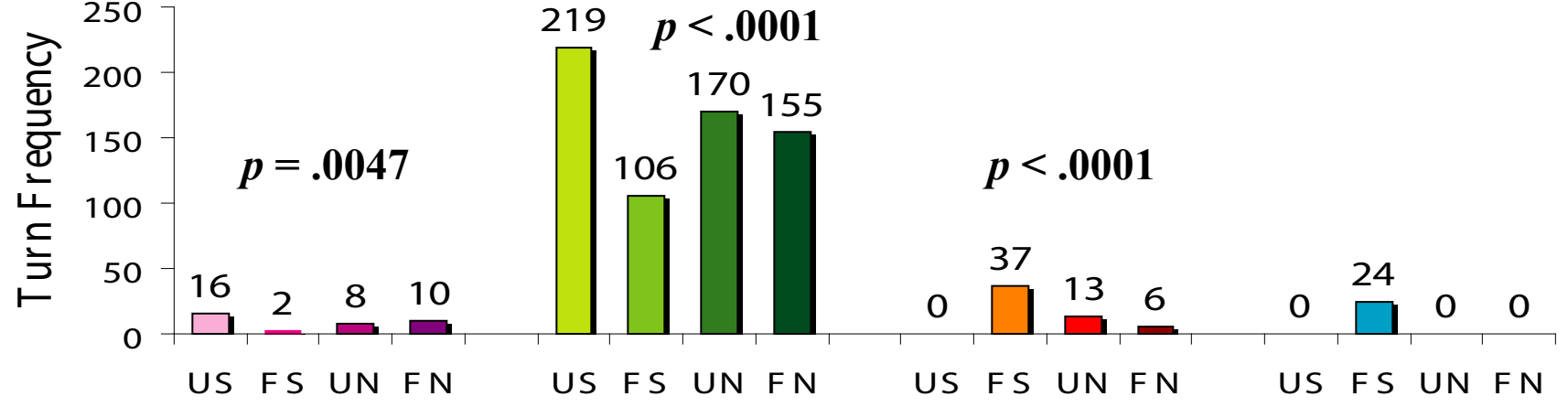
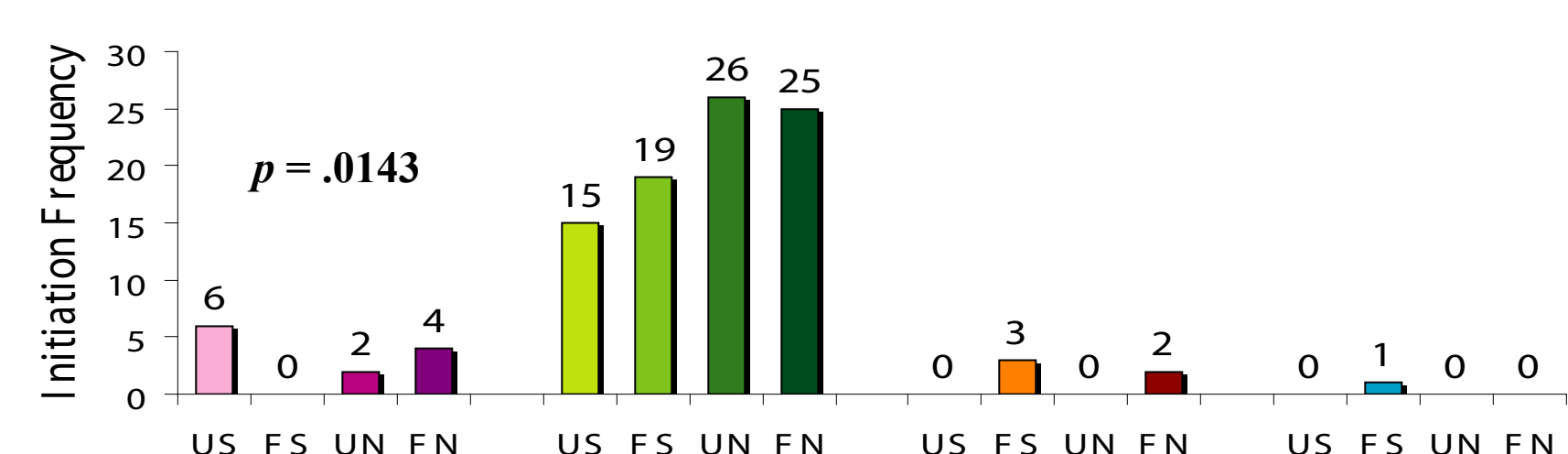
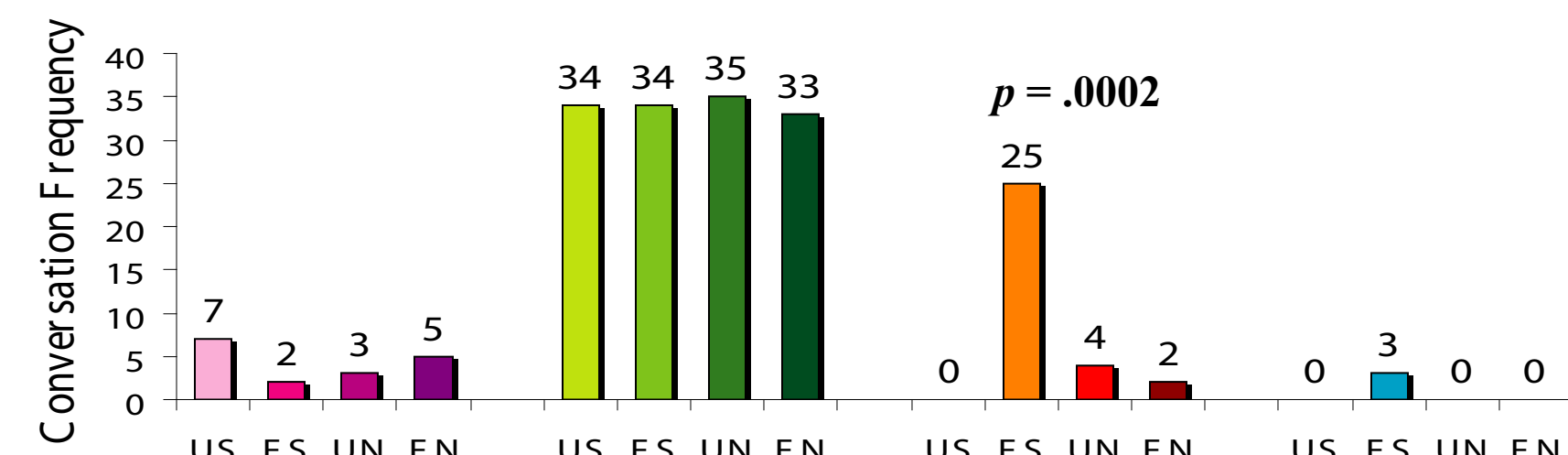
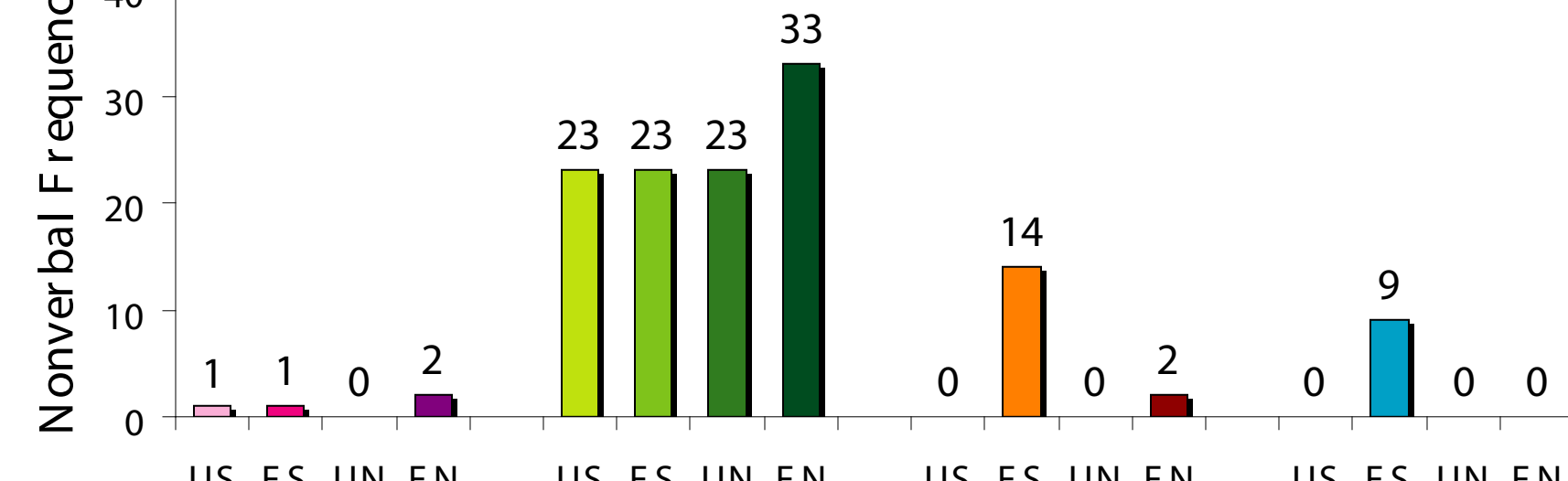
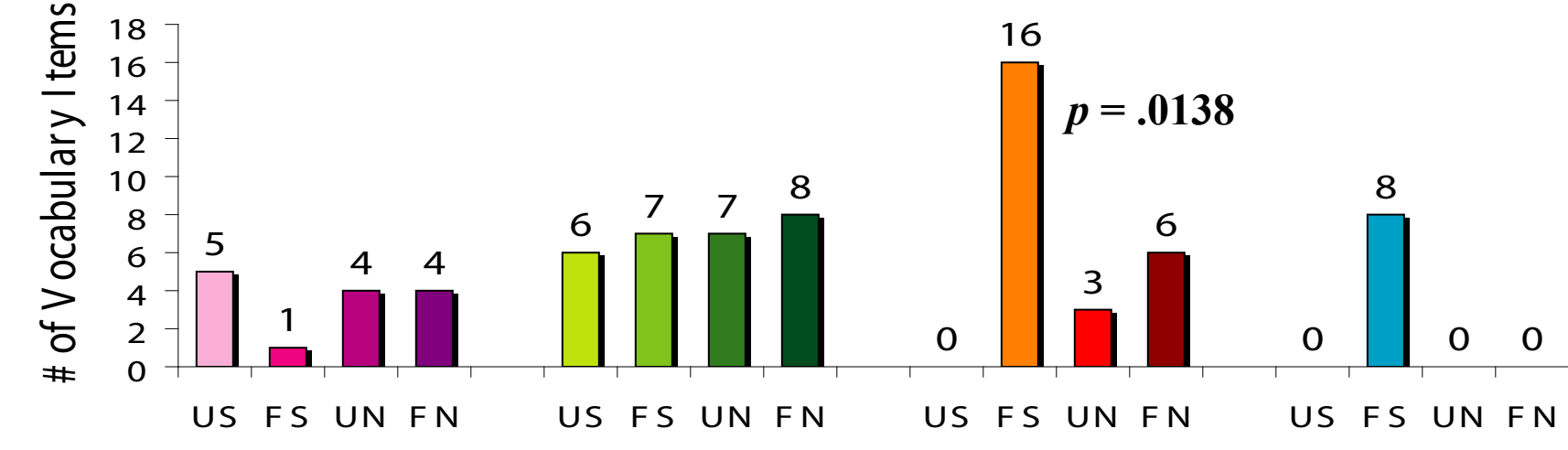
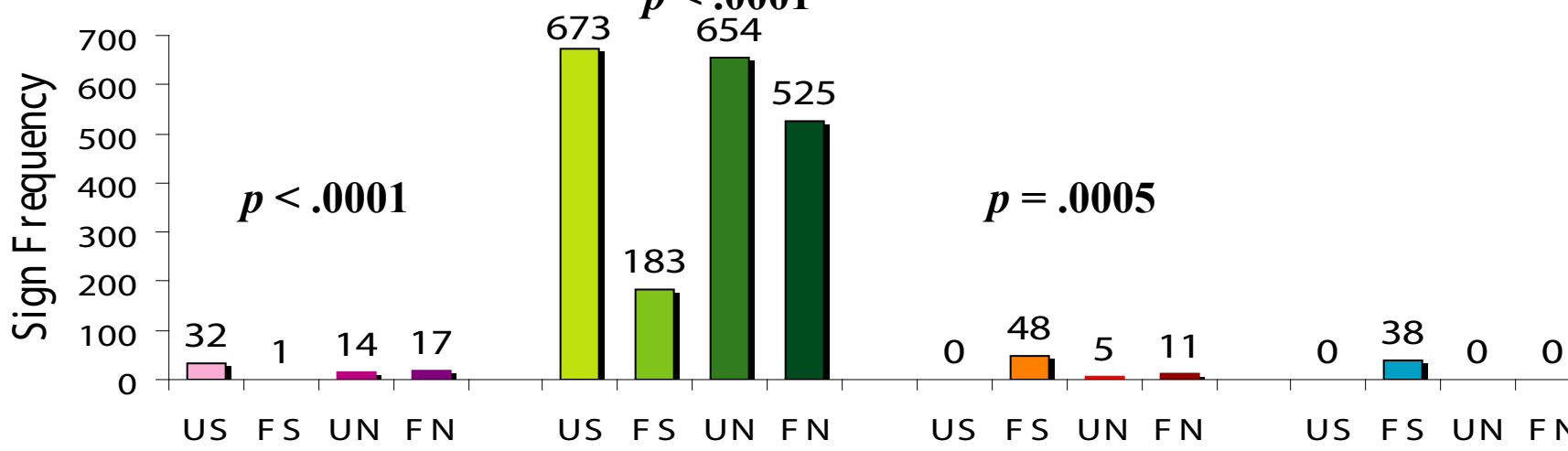
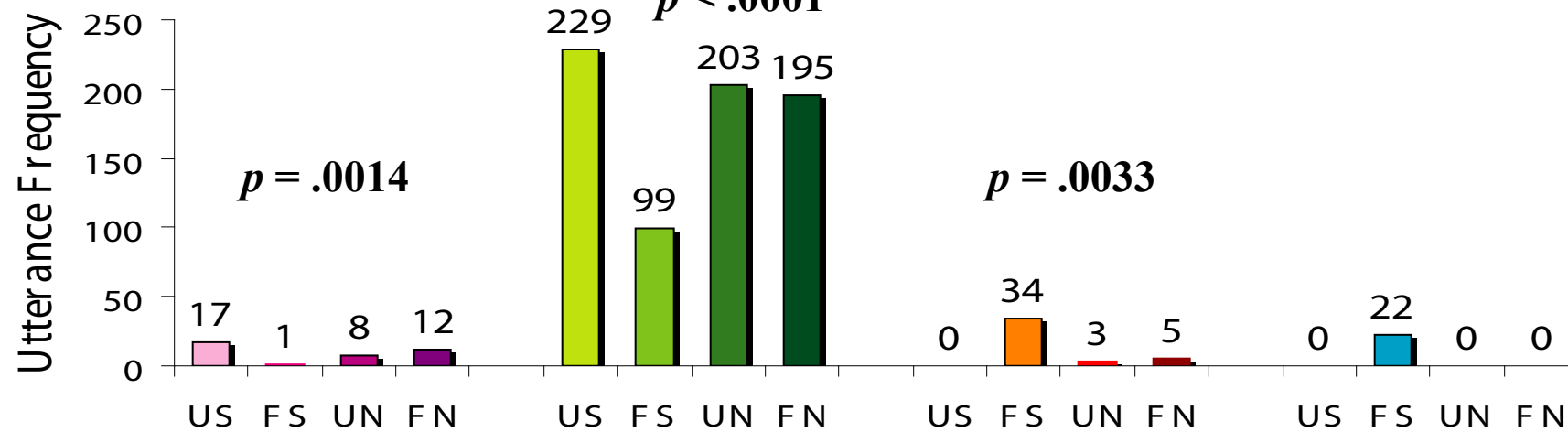
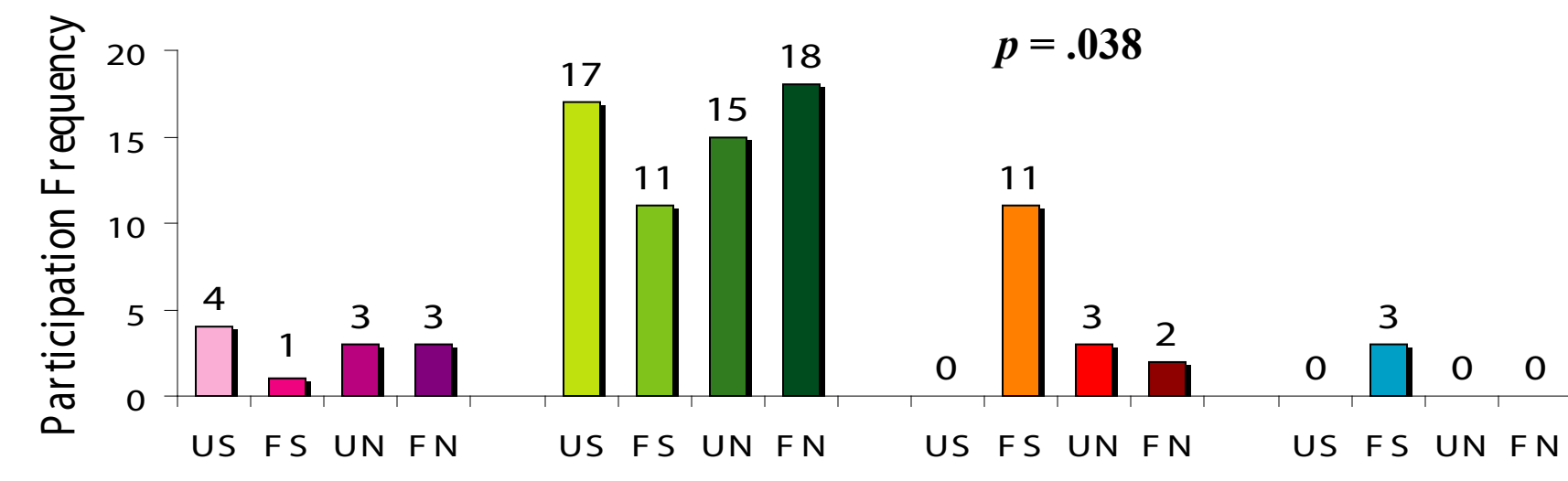


Figure 2. Diagram of trial site.

DISCUSSION

The conversational behavior of Tatu, Dar, Washoe, and Loulis was contingent on both the familiarity of and use of sign by the human conversational partner. Conversational partners must adjust to the individual differences in the partner. For example if language skills vary, then the partners must adjust to this difference. Appropriate adjustments are part of conversational skill.

Response to Familiar and Unfamiliar Partners:

All of the chimpanzees used significantly more nonverbal behaviors with familiars than with unfamiliar partners. Although nonverbal responses lacked a signing component, they still functioned as turns in conversations, such as head nodding in response to the conversational partners’ statements.⁸ Furthermore, Birdwhistell found that 65% of the meaning in a conversation resulted from nonverbal communication.³ Thus, nonverbal responses are a predominant component of conversations.

Other signing chimpanzees and children have different responses to familiar versus unfamiliar conversational partners. Interactions of three deaf signing children and three signing chimpanzees with a familiar teacher versus a stranger, showed that both the children and chimpanzees articulated signs less clearly with their peers than with the familiar teacher and the stranger.²⁰ Both chimpanzees and children show sensitivity to the familiarity of the conversational partner.

Response to Signers:

All four chimpanzees responded with more conversational behaviors to signers than nonsigners. Thus, the chimpanzees were sensitive to the partners’ conversational skill and responded in appropriate ways. Even in the early stages of the cross-fostering project new research assistants who were novice signers reported that Washoe slowed down her signing for them.¹⁴ Successful face-to-face interactions involve the orchestration of pragmatics, including appropriate adjustments to the conversational partner, as well as syntax and semantics. Recent studies of communicative competence in humans examine behaviors as they occur in interactions and explore pragmatic and contextual appropriateness in the conversations of human adults and children.^{1,5,6,7,12,19,27} The use of a natural language like ASL allows us to explore the chimpanzees’ language behaviors in a naturally occurring social context much like that of humans.

Individual Temperament and Individual Response Patterns:

Patterns of conversational response in young children are not solely mediated by characteristics of the partner; they are also influenced by individual temperament. Differences in individual temperament often yield different or even opposing patterns of response in a single condition.^{2,23,30}

Washoe and Loulis:

Washoe and Loulis had the most conversational behaviors with unfamiliar partners. Their pattern was like sociable children who were more talkative and interactive with unfamiliar peers and adults versus with familiar peers and adults.^{23,30} Additionally, sociable children spent more time engaged in conversations as a whole than did shy children.²

Tatu and Dar:

Tatu’s conversational behaviors increased with all familiar partners and she used the most with the familiar-signers. Dar only responded to familiar-signers. These responses were like those of shy children. Shy children’s verbal participation decreased with exposure to unfamiliar partners. Yet the verbal participation of the shy and sociable children was equal when they engaged in conversations with familiar partners.²

Does dominance play a role in conversation participation?

The chimpanzees at CHCI hold individual and specific social ranks within the group’s hierarchy. Loulis is second only to Washoe in the dominance hierarchy at CHCI, followed by Tatu, then Dar.^{21,28} If dominance were truly influential in trial participation, it would be reasonable to predict that the other chimpanzees would interact with the human participant in trials where Loulis was absent from the seats of interaction. Of the 19 trials in which Loulis did not participate, 14 resulted in participation by the others. Dar’s participation was inversely correlated with Loulis’ participation. Tatu participated in half of her total trials when Loulis was not occupying the seat of interaction and Washoe in one-fourth. Washoe was the only chimpanzee that attempted to and displaced Loulis from the seat of interaction.

Conclusions and Overall Significance:

- All 4 chimpanzees responded more to signers than to nonsigners, thus the response patterns were heavily affected by the human participant’s use of sign.
- Tatu and Dar responded the most to familiar-signers.
- Washoe and Loulis responded the most to unfamiliar-signers.
- Temperament and dominance may have an important influence on each chimpanzee’s conversational behavior.
- Signing and speaking children show similar patterns of response.
- Differing responses to familiarity show that it is important to recognize and acknowledge individual differences, especially in captive situations where humans are ultimately responsible for each individual chimpanzee’s psychological well-being and longevity.
- Using rigorous methodologies that allow the chimpanzees to demonstrate their behaviors in a context appropriate situation, sign language studies of chimpanzees have demonstrated conversational competence & remarkable similarities between human & chimpanzee behaviors.

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