Articulatory Phonology and Movement in ASL

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Movement

- Few studies have examined sign movement empirically.
- Debate about whether movement is phonologically specified (Hulst, 1995; Uyechi, 1996).
- We examine simple movements toward or away from the body, in different phrase boundary conditions.

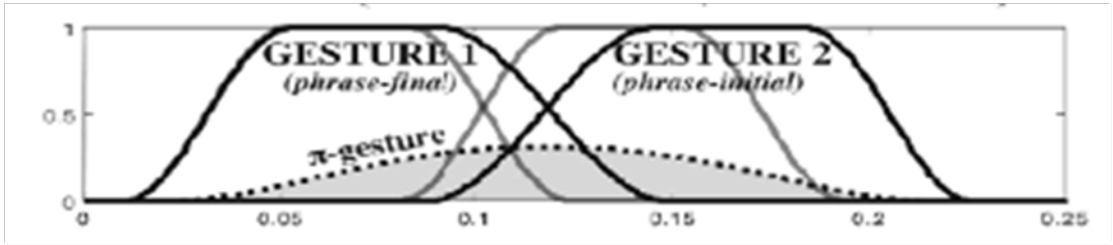
ASL Signs: SICK & WILLING

- SICK has a movement toward the forehead
- WILLING has a movement away from the torso

Articulatory Phonology

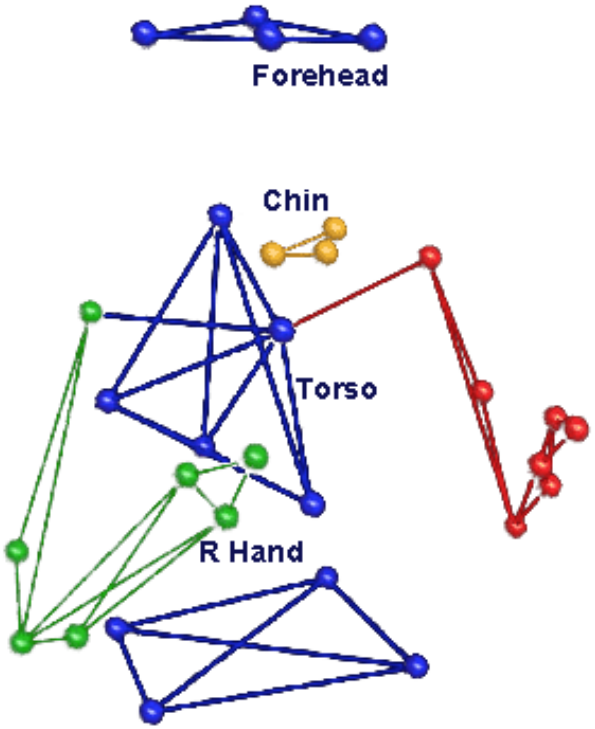
- Suggests that the structural primitives of language are articulatory gestures (Browman & Goldstein, 1992).
- Provides a way to represent the phonological primitives of both sign and speech in terms of broader theories of motor control.
- Task Dynamics is used to implement articulatory phonology computationally (Saltzman & Munhall, 1989).

Prosodic Gestures



- Byrd, Kaun, Saltzman & Narayanan (2000) proposed that prosodic gestures (pi-gestures) occur at phrase boundaries.
- Pi-gestures slow all simultaneously active constriction gestures.
- Like articulatory gestures, pi-gestures also have durations and overlap with vocal tract constriction gestures.

Methods: Data Capture



- A Vicon motion capture system was used to record movements
- 30 light-reflecting markers were attached to the body
- Marker positions were tracked in 3D at 100Hz

Methods: Procedure

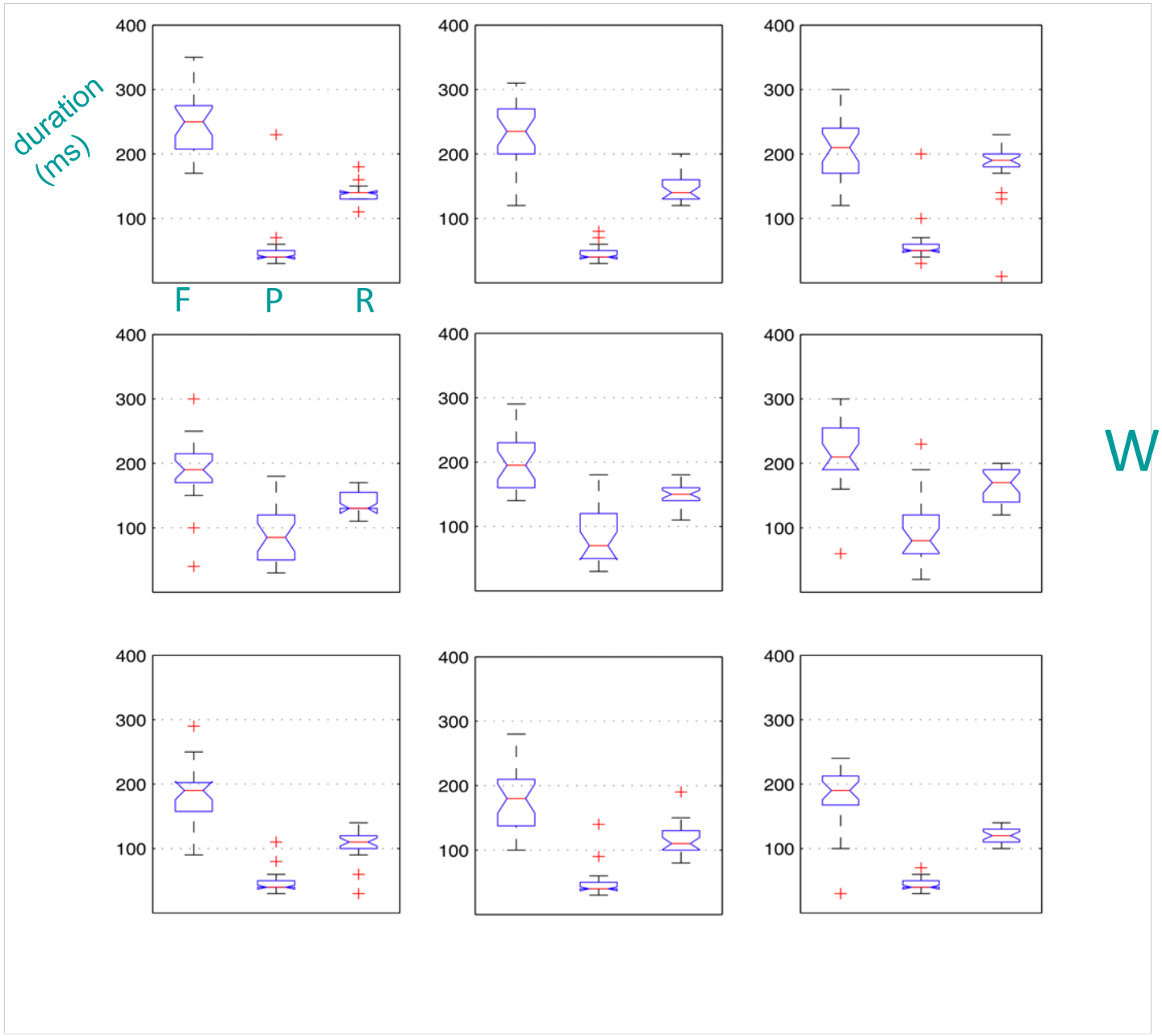
Native Deaf signers (n=3) produced sign sequences with different phrase boundaries.

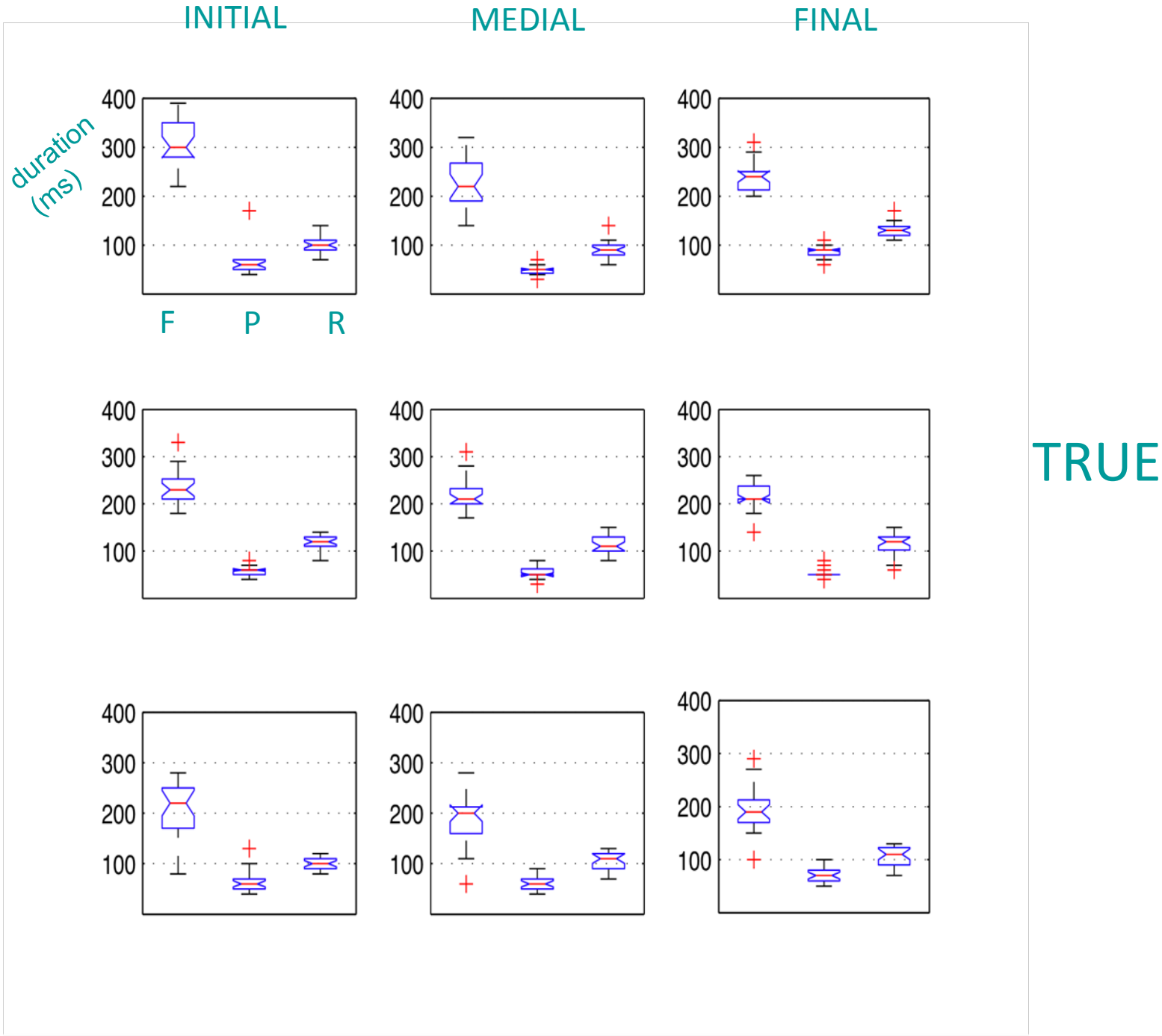
KNOW NIECE? || **WILLING** NOT, STUBBORN.
KNOW NIECE **WILLING** NOT. || STUBBORN.
KNOW NIECE **WILLING**. || NOT STUBBORN.

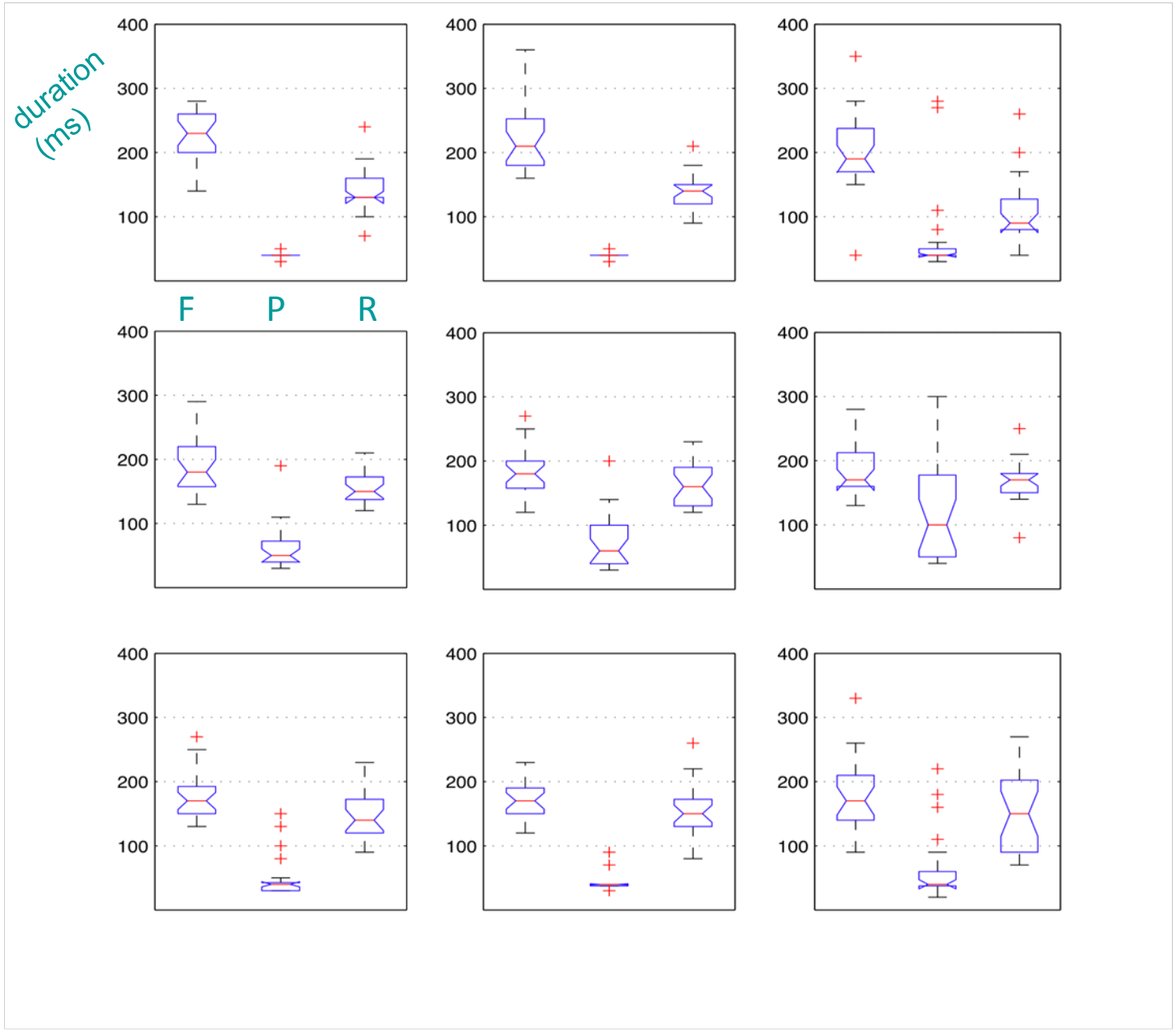
KNOW MOTHER? || **SICK** NOT, HEALTHY OK.
KNOW MOTHER **SICK** NOT. || HEALTHY OK.
KNOW MOTHER **SICK**. || NOT HEALTHY OK.

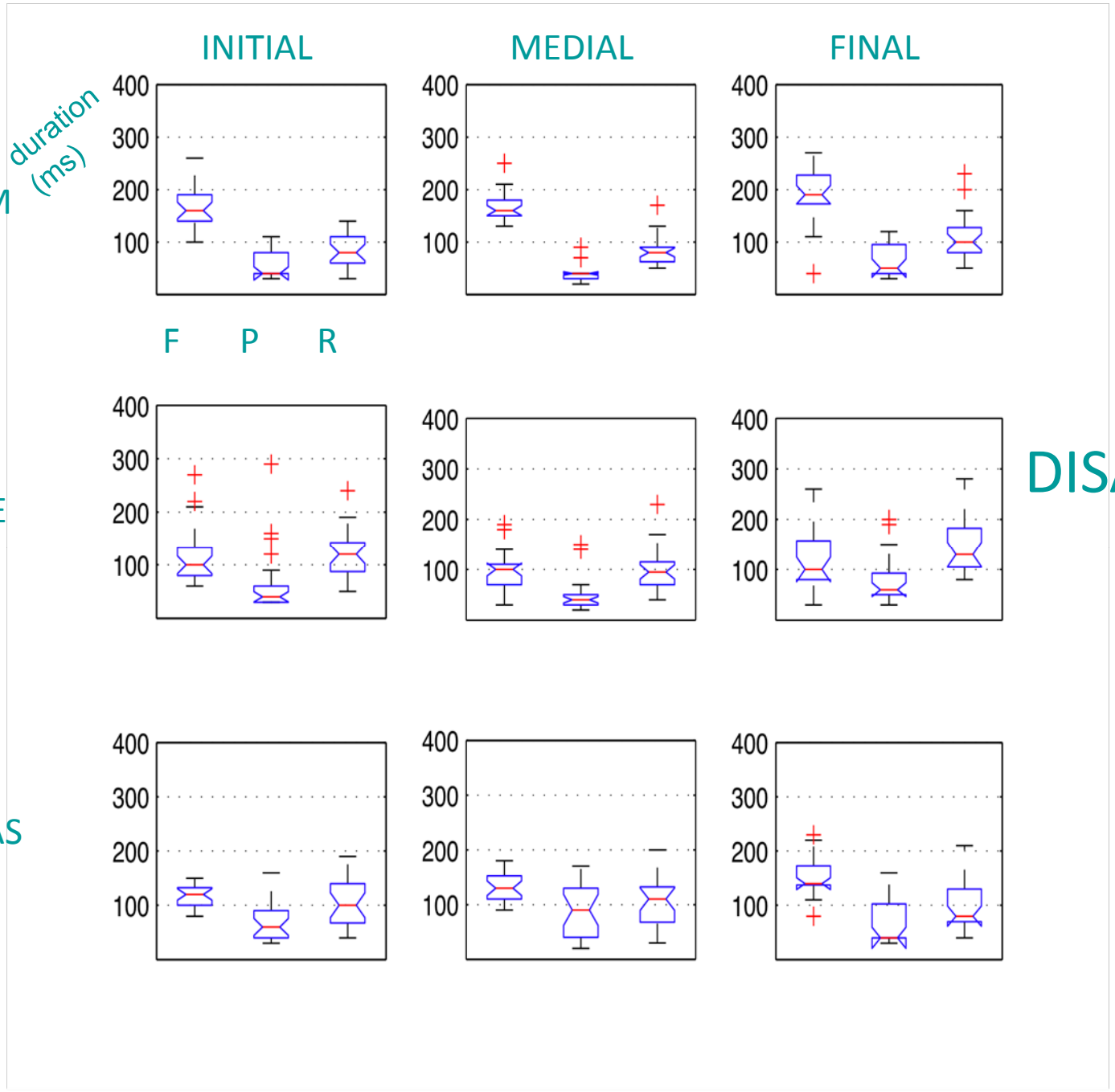
Methods: Analysis

- Marker data were compared for the hand and for markers near the torso, chin or forehead.
- The task variable was defined as the euclidean distance between the hand and the target location.
- Gesture phases (formation, plateau, release) were delimited using tangential velocity thresholds.
- Durations were compared across phrase boundary positions.


INITIAL
MEDIAL
FINAL
AM
TE
AS
duration (ms)
400
300
200
100
F
P
R
WILLING


INITIAL
MEDIAL
FINAL
AM
TE
AS
duration (ms)
400
300
200
100
F
P
R
TRUE


INITIAL
MEDIAL
FINAL
AM
TE
AS
duration (ms)
F
P
R
SICK
400
300
200
100


INITIAL
MEDIAL
FINAL
duration (ms)
AM
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AS
400
300
200
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F
P
R
DISAPPOINTED

Summary

- The *formation* phase was lengthened in phrase-initial position for most signs (WILLING, SICK & TRUE).
- *Release* and *plateau* phases were lengthened in phrase-final position for 2 signs with movements away from the body (WILLING & TRUE).
- The *plateau* phase was lengthened in phrase-final position for SICK (movement toward the body).
- DISAPPOINTED varied more, possibly due to the following sign at the same location.

Discussion

- This is the first study to take instrumented measures of lengthening in American Sign Language.
- Preliminary results suggest that lengthening is partially realized through prolonged sign movements.
- The realization of phrase final lengthening varies, depending on the type of sign movement.

Discussion

- Slowing of phrase-final movement in ASL is consistent with the notion of pi gestures (Byrd & Saltzman, 2003).
- Previous studies have viewed lengthening in ASL as an appended pause (cf. Perlmutter, 1993), but this study has found lengthened movements too.
- The pi gesture is a useful model of phrase final lengthening in ASL because it explains slowed movement as well as movement that is stopped completely.

Future Directions of Research

- Applying these techniques to a broader set of signs and sign movements
- Using similar measures to determine sign boundaries
- Synthesizing signs based on kinematics and task dynamics

Acknowledgments

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