SIMULTANEITY AS AN EMERGENT PROPERTY OF SIGN LANGUAGES

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One of the defining properties of natural languages is segmenting holistic representations into smaller meaning units that allow to combine them into larger meaning units, leading to compositionality (Kirby et al., 2008). This has been shown to constitute an emergent property of linguistic systems that evolved initially from holistic representations to accommodate the pressures of communicative efficiency during language use and language transmission to new learners (e.g., Kirby et al., 2008; Motamedi et al., 2019; Senghas et al., 2004). One of the evidence for this claim comes from sign language emergence research which has shown the emergence of segmentation out of holistic representations and linear sequencing of these meaning units (Senghas et al., 2004). However, in sign languages, due to the affordances of the visual modality to use multiple articulators and iconicity, meaning units can be organized not only linearly but also simultaneously. In the present study, we investigate if simultaneity, in addition to linearity, is an emergent property of sign languages by comparing the use of simultaneous constructions in LIS (Italian Sign Language) to that of silent gestures used by hearing Italian speakers.

Recent research has shown that LIS signers use simultaneous and iconic constructions (i.e., diagrammatic iconicity) as modality-specific properties to achieve communicative efficiency through clustering related meaning units closer together when they are asked to encode informatively rich events in an interactive task (Slonimska et al., 2020). The study showed that as the events to be communicated became more informationally dense (i.e., contained more semantic information units) LIS signers increased the use of simultaneous constructions as well as information density of these constructions. However, it remained to be explored whether such simultaneity might constitute a general affordance of communication in visual modality rather than a linguistic property that has evolved for greater communicative efficiency. Therefore, here we asked whether hearing participants with no knowledge of any sign language using only their gestures to communicate could recruit multiple articulators and iconicity to represent multiple elements of the event simultaneously to the same extent as signers.

In the present study, we conducted the same experiment as in Slonimska et al. (2020) with 23 Italian speakers with no knowledge of any sign language (12 females, M age = 26.04) using silent gesture to describe the events of varying information density in a director-matcher task. We coded whether movement segments (MS), i.e., segments based on gesture strokes (Kendon, 2004) used by gesturers contained simultaneity, where more than one articulator is used to represent distinct semantic information units. We also coded the information density (i.e., the number of simultaneously represented semantic information units) of these MS. We then compared frequencies and information density of MS with simultaneity in descriptions of silent gesturers and LIS signers (N = 23).

The findings showed that in comparison to signers, silent gesturers used MS with simultaneous constructions less frequently than signers (β = -0.98, CI[-1.23; -0.73], SE = 0.13, z = -7.65, p <.001), even though their use increased in both groups as information density of the pictures they needed to describe increased (Fig.1). Furthermore, when silent gesturers used simultaneous MS they were significantly less informationally dense (β = -0.21, CI[-0.26; -0.17], SE = 0.02, z= -9.16, p <.001). Simultaneous constructions were also qualitatively different in the two groups. Gesturers relied on imagistic iconicity to represent simultaneous aspects of the event (e.g., to hold and caress) in separate movement segments (Fig. 2). In turn, signers relied on diagrammatic iconicity and brought various information units encoded on different articulators together (also relating to the two different referents) in their movement segments (MS 3, 4 and 5).
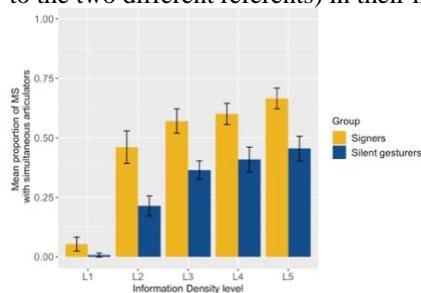

Figure 1. Mean proportions of simultaneous MS out of the total number of MS per trial for silent gesturers and signers when asked to describe events with increasing information density.
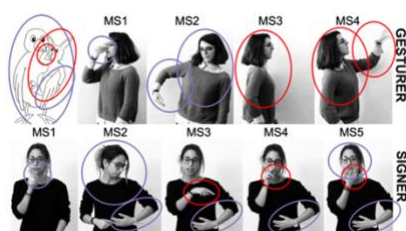

Figure 2. Prototypical encoding sequence for an event from silent gesturers and signers. Colored circles represent semantic information units of different referents (purple circles for the bird, red circles for the bunny).

The present study indicates that not only linear but also simultaneous expressions of segmented meaning units constitute an emergent property in sign languages that potentially evolved for achieving greater communicative efficiency. The findings highlight the role of modality-specific adaptive capabilities in linguistic expression and are relevant for the broader discussion about the multi-modal origins of language.

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