Comparing Action Gestures and Classifier Verbs of Motion: Evidence From Australian Sign Language, Taiwan Sign Language, and Nonsigners’ Gestures Without Speech

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Recent research into signed languages indicates that signs may share some properties with gesture, especially in the use of space in classifier constructions. A prediction of this proposal is that there will be similarities in the representation of motion events by sign-naive gesturers and by native signers of unrelated signed languages. This prediction is tested for deaf native signers of Australian Sign Language (Auslan), deaf signers of Taiwan Sign Language (TSL), and hearing nonsigners using the Verbs of Motion Production task from the Test Battery for American Sign Language (ASL) Morphology and Syntax. Results indicate that differences between the responses of nonsigners, Auslan signers, and TSL signers and the expected ASL responses are greatest with handshape units; movement and location units appear to be very similar. Although not definitive, these data are consistent with the claim that classifier constructions are blends of linguistic and gestural elements.

To the extent that classifier signs share properties with gesture, there will be measurable similarities between nonsigners’ gestures and signed language and between signing in unrelated signed languages. The aim of this article is to explore the degree of such similarities between hearing nonsigners, deaf signers of Auslan (Australian Sign Language), and deaf signers of the historically unrelated Taiwan Sign Language (TSL), in the visual-gestural representation of motion events, which typically involves “classifier verbs.” (The analysis of the hand configurations in these constructions as classifiers is problematic [see Schembri, 2003], but we use this widely accepted terminology in this article.) Similarities in the depiction of motion events have previously been reported for adult and child signers of American Sign Language (ASL), a home signer, and hearing nonsigners using gesture without speech (Goldin-Meadow, 2003a, 2003b; Singleton, Goldin-Meadow, & McNeill, 1995; Singleton, Morford, & Goldin-Meadow, 1993; Singleton & Newport, 2004). The present article reports on data from a larger sample of signers and nonsigners than in previous articles and includes data from two unrelated and relatively understudied signed languages, Auslan and TSL. Details of the verbal systems of these two signed languages have previously been reported for Auslan by Johnston (1989, 1991) and Schembri (2001) and for TSL by Smith (W. H. 1989).
Definitions of Language and Gesture

The present study of the representation of motion events in signed language and gesture was guided by research that views gesture not as an extralinguistic feature of face-to-face communication, but as integral to language itself (Kendon, 2004; McNeill, 1992). Evidence for this view comes from research that shows that speech and coverbal gesture interact in face-to-face communication (Kendon, 2004; Kita & Ozyurek, 2003), develop together in first and second language acquisition (Gullberg, 2003; Mayberry & Nicoladis, 2000), share common neurological bases (Kimura, 1993), and may break down together in language disorders (Mayberry & Jaques, 2000) and aphasia (Goodwin, 2000; McNeill & Pedelty, 1995).

From this viewpoint, language may be viewed as an expression of thought by means of two distinct representational systems: Speech tends to be categorical, arbitrary, and conventionalized, but gesture is often synthetic, gradient, and iconic (McNeill & Duncan, 2000). Okrent’s (2002) work drew on the definitions of language and gesture proposed by Kendon (2004) and McNeill (1992). Such definitions recognize a continuum of gesture types from those with the fewest language-like properties, such as gesticulation or coverbal gesture, to those forms that most resemble language, such as emblematic gestures (e.g., the “thumbs up” gesture, or the “goodbye” wave). The latter type of gesture is not considered here. The term gesture in this article refers to the broad range of iconic or mimetic gestures that may be created anew, can cooccur with speech (as gesticulation) or alone, and that “depict concrete aspects of imagery with forms that look like the images they represent” (Okrent, 2002, p. 182). It is these forms that appear to share some properties with classifier verbs of motion in signed languages and that provide the impetus for the present study.

Predictions

The aim of this study was to explore the extent to which signs may share some properties with gesture in the representation of motion, in the hand configurations used to represent referents, and in the use of space. To the extent that signs share properties with gesture in classifier verbs of motion, it was predicted that there will be similarities between native signed language use and the gestures of nonsigners and similarities between signs produced in unrelated signed languages to depict the same motion event.

Similarities between hearing nonsigners’ gestures and signed language use in different deaf communities could in principle be measured in many different ways. In this article, all participants completed the Verbs of Motion Production (VMP) task from the Test Battery for ASL Morphology and Syntax (Supalla et al., n.d.). In this task, participants view a video recording of a short motion event and then describe that motion event using signed language or gesture without speech. The scoring system for the VMP task was used as an operational measure to compare the forms produced by different participant groups (Auslan, TSL, nonsigners). In the VMP task, the response to each item is coded for handshape, location, manner, path, and direction of movement and can then be compared to standard ASL responses provided in the task manuscript. The coding
system also makes it possible for data from all of the
groups to be directly compared. The results can thus be
used as a gauge of the extent of similarities between the
responses of different participant groups. To the extent
that signs share properties with iconic gesture in
classifier constructions, it was expected that the VMP
results for nonsigners would be similar to those for
signers, and that the responses from different groups of
signers would be similar to one another.

Two experiments are reported in this article. Experiment 1 reports VMP task data from a compar-
ison of hearing nonsigners and Auslan signers (hand-
shape results for the Auslan signers were reported in
Schembri et al., 2002). Experiment 2 reports VMP task
data from signers of an unrelated language, TSL.

Experiment 1: Auslan Signers and Hearing
Nonsigners

Method

The Verbs of Motion Production Task. The following
description of the VMP task (and our discussion of
the results) adopts the terminology contained in the
unpublished test manuscript (Supalla et al., n.d.). The
use of this terminology is not intended, however, to
signal that an identical analysis of these components in
signed language or gesture is necessarily appropriate.

Supalla (1982) designed the VMP task as a set of
short, animated films that elicit approximately equal
numbers of examples of several major types of classifier
verbs of motion, with the features of handshape,
manner, path, and direction of movement, and locative
relationship elicited in different combinations. Thus,
given a handshape unit is elicited by several task items,
with these items differing from each other in the
accompanying movement path and direction, manner
of movement, and locative relationship. The aim is to
elicit each component in a carefully controlled variety
of meaningful contexts. There are five practice items,
followed by 120 task items. Within the practice and

Each of the 120 task items involves a single object,
which Supalla (1982) originally referred to as the
central object, moving in specific ways. In one animation
sequence, for example, an ashtray ziggags across a lawn.
In another, a toy airplane hops in a straight line. In
addition, 60 of the task items also involve another
object (the secondary object) that does not move. In one
sequence, for example, a small doll jumps into a
plumbing nut, and in another, a toy tractor moves back-
ward and turns around to face a book.

A variety of toy people, animals, vehicles, and
furniture as well as other objects, such as pencils, rulers,
cups, books, washers, rolls of masking tape, and so on,
are used as props in the VMP animation sequences.
Supalla (1982) carefully selected these props on the
basis of his description of classifier handshape units in
verbs of motion in ASL. The 80-item version of the
VMP task included in the Supalla et al. (n.d.) materials
is designed to elicit four distinct “semantic” classifier
handshapes and five “size and shape specifier” classifier
handshapes, as described in Tables 1 and 2 (for more
discussion of this classification, see Supalla, 1986).

The movement of the central object props in
the animation sequences was selected “on the basis
of morpheme contrasts in movement, form, and direc-
tion” (Supalla, 1982, pp. 69–70). Of the events in the
task, 40 involve only the central object. These events
were designed to elicit the manner of movement units
shown in Table 3. All of these manner units may be
combined simultaneously with the movement path. A
path may be from one locus to another (AB), in a single
locus (A), or moving from one locus to a second and then
on to a third (ABC).

The second group of 40 events involves both a central
object and a secondary object. The secondary object is
placed along the central object’s path of movement so that
there is some contact between the secondary object and
the central object. The contact may occur in the initial,
middle, or final part of the central object’s path of
movement, as shown in Table 3. This is known as location.
The initial, middle, or final part of the movement may
involve one referent in, on, moving around, or moving
through the other referent. This is referred to as position.
These events thus include two objects interacting and
are used to elicit locative units as well as manner of
movement units (Supalla et al., n.d.).

Participants. A total of 50 adults participated in the
study reported here: 25 deaf native or near-native
signers of Auslan (24 had deaf parents, and 1 had an older deaf sibling) and 25 hearing fluent speakers of Australian English (all but one were native speakers) with no knowledge of any signed language. All participants had normal or corrected vision, and all were unaware of the purpose of the study.

The deaf signers were volunteers recruited from the workplace and from personal contacts of the first author and his deaf coresearcher. There were 12 male and 13 female deaf participants (17 participants lived in

<table>
<thead>
<tr>
<th>Referent class</th>
<th>ASL target</th>
<th>Central object</th>
<th>Secondary object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight, vertical</td>
<td>Gvert</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Straight, horizontal</td>
<td>Ghoriz</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Flat, narrow</td>
<td>Hflat</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Flat, wide</td>
<td>Bflat</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Circular</td>
<td>gC</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Cylindrical</td>
<td>bC</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

Total number of SASS units 40 24

Note: Hflat and Bflat refer to the handshapes shown here oriented with the palm downward.

<table>
<thead>
<tr>
<th>Referent class</th>
<th>ASL target</th>
<th>Central object</th>
<th>Secondary object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animate</td>
<td>2legs</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Vehicle</td>
<td>3edge</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Airplane</td>
<td>ILY</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Tree</td>
<td>5+</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Total number of semantic classifier units 40 16

Note: 2legs refers to the handshape shown here with the palm oriented downward.

signers of Auslan (24 had deaf parents, and 1 had an older deaf sibling) and 25 hearing fluent speakers of Australian English (all but one were native speakers) with no knowledge of any signed language. All participants had normal or corrected vision, and all were unaware of the purpose of the study.

The deaf signers were volunteers recruited from the workplace and from personal contacts of the first author and his deaf coresearcher. There were 12 male and 13 female deaf participants (17 participants lived in
Sydney, and 8 lived in Melbourne), ranging in age from 16 to 58 years (mean $5 34.6$ years, $SD$ $11.6$).

The hearing participants were students in psychology at the University of Western Sydney. They comprised 20 introductory psychology students who participated for course credit and 5 other undergraduate and graduate students who volunteered their time. There were 2 male and 23 female hearing participants. The hearing participants ranged in age from 18 to 45 years (mean $24.8$ years, $SD$ $7.7$).

**Equipment.** A subset of the items from the VMP task was used: the block of 5 practice items followed by the first 40 task items. A VHS copy of the original color videotape by Supalla (1982) was played to each participant on a large-screen color television in a quiet, well-lit room. The monitor was positioned approximately 1.5 m from the participant, who was seated during the entire session. Participants’ responses to the instructions were filmed in frontal view via a video camera mounted on a tripod approximately 2 m from the participant.

**Procedure.** Each participant was filmed individually in a single 20-minute session (the data collected from the deaf participants were part of a longer data collection session, but each participant was allowed a short break before responding to the VMP task). Instructions were given by a deaf native signer in Auslan to the deaf participants and in spoken English to the hearing participants. All participants were told that they would see short video clips of toys and other objects moving around by themselves and would be asked to describe what they saw using signed language (for deaf participants) or gesture without speaking (for hearing participants). Data collection from deaf participants was conducted by a deaf native signer with no hearing people present. Data from the hearing participants were collected by hearing experimenters, who instructed the hearing participants to imagine that they were communicating with a deaf person who could not understand spoken English.

Before each video clip was played, all participants were told what the objects were going to be so confusion resulting from the lack of context and the relatively low-grade video quality (arising from the use of a copy of an 1980s video master tape) would be avoided. The deaf participants were asked to describe what the toys in the film clips were doing, and were shown three example responses in Auslan to ensure they produced responses that included a verb of motion (these model responses were part of the Auslan translation of the original ASL instructions on the master videotape). Hearing participants were not shown the Auslan examples to avoid any influences from signed language on their gestured responses but were instead reminded between each clip that their task was to describe in gesture what the toys were doing. This was to prevent them from simply producing gestures that “named” the referents but did not describe the motion event.

**Coding and Analysis.** The 40 task items, but not the initial 5 practice items, were coded using the standard scoring procedure for the VMP task (i.e., the coding was identical to that described by Supalla et al., n.d.). Coding was conducted by the first author, who is fluent in Auslan and an accredited Auslan/English interpreter. Data from three randomly selected participants (12% of the overall data) were also independently coded by a hearing native signer with 92% agreement; the same percentage of the hearing nonsigner data was coded independently by two individuals: a hearing nonnative signer and a hearing native signer. There was 90% agreement with the first coder and 91% with the second.

### Table 3 Number of targets in VMP task for movement and location

<table>
<thead>
<tr>
<th>Movement target (Manner + Path)</th>
<th>Locative targets (Location + Position)</th>
<th>n</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear (AB)</td>
<td>Initial (including initial on, initial in)</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Turn (ABC)</td>
<td>Middle (including middle around, middle in, middle avoid)</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Random (AB)</td>
<td>Final (including final in, final on)</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Pivot (AB)</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Bounce/jump (AB)</td>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Fall (AB/A)</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>80</td>
<td>40</td>
</tr>
</tbody>
</table>

Note: AB represents movement from one locus to another; ABC is movement between three loci; and A is a change of orientation at a single locus.
Each response often included lexical signs or gestures that named the referents in the clip, as well as a classifier verb of motion or action gesture that represented the motion event. Only the latter items were coded. Each participant’s response to each task item was coded for features of handshape, manner and path of movement, and locative (location and position) relationship. For movement and locative units, a difference in either manner or path, or location and position, resulted in that entire target not being considered a match.

We directly compared the responses of Auslan signers and hearing nonsigners by creating a set of Auslan targets for handshape, movement, and locative units. We drew up a list of all the hand configurations, movement types, and locative relationships produced by the Auslan signers for each task item and then used this to produce a percentage match between actual Auslan responses and responses from the hearing nonsigners. For each hearing nonsigner, for each test item, and for each of the handshape, movement, and location units, we noted whether the response matched an actual Auslan response given by any of the Auslan signers. These results potentially ranged from 0 to 100%. For movement units, a figure of 100% represents a match to the target in 40/40 task items. For the 20 task items that contain both central and secondary objects, handshape was coded separately for each object, so a result of 100% represents a match in 60/60 task items (i.e., all 40 items elicited a central object, and 20 of these also elicited a secondary object). For location units, 100% represents a match to the target in 20/20 task items because only 20 items contain a secondary object.

Handshape responses for both the central object and any secondary object in the task item were also coded for their match to the expected ASL handshape, movement, and location targets (see Tables 1, 2, and 3). As listed in Table 3, the set of ASL targets for movements contains seven movement types, and the set of ASL targets for locations contains three locative types.

By these means, a set of three results was produced for each participant to indicate the percentage match to ASL targets for each of the handshape, movement, and locative units. Although we describe the results in terms of percentages and “matches to ASL targets,” this is simply an additional way to identify some overall similarities and differences in the responses and to enable comparison with other published studies that have used the VMP. Results with lower percentages should not be perceived as suggesting that the responses are erroneous in any way but simply an indication that responses differ from the ASL targets.

Results

Two comparisons are relevant for exploring similarities and differences in the components for handshape, movement, and location in hearing and deaf participants. The first is between Auslan signers and hearing nonsigners; the second is between each of these groups and ASL signers (data from Singleton et al., 1993).

Direct Comparisons Between Auslan Signers and Hearing Nonsigners. Responses by hearing nonsigners differ across handshape, movement, and location units in percentage match to Auslan signers’ productions, $F(2, 48) = 71.12, p < .001$. The full pattern of results is set out in Table 4. Pairwise comparisons using Bonferroni adjustment to maintain an $\alpha$ level of .05 indicate that percentage match of hearing nonsigners’ productions to Auslan productions was less for handshape (mean = 44.16) than movement (mean = 77.30) and less for handshape than location (mean = 75.20). Percentage match of gesture to Auslan did not differ for movement and location. Percentage match of hearing nonsigners’ productions to Auslan productions was less than 100% for handshape [$t(24) = -31.45$, $p < .001$], movement [$t(24) = -9.08$, $p < .001$], and location [$t(24) = -6.62$, $p < .001$].

Table 4  Mean and median results (% match to Auslan targets) and standard deviations: Hearing nonsigners

<table>
<thead>
<tr>
<th>Component</th>
<th>Handshape</th>
<th>Movement</th>
<th>Locative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>44.16</td>
<td>77.30</td>
<td>75.20</td>
</tr>
<tr>
<td>Median</td>
<td>45</td>
<td>77.5</td>
<td>80</td>
</tr>
<tr>
<td>SD</td>
<td>8.88</td>
<td>12.50</td>
<td>18.73</td>
</tr>
</tbody>
</table>


The degree of variation in handshapes chosen by the deaf and hearing participants to represent referents was also investigated. The mean number of hand configurations used by each individual for each category of referent was higher for nonsigners than signers, for both size and shape (SASS) (mean for nonsigners = 4.08, SD = 0.6; mean for signers = 3.0, SD = 0.5) and semantic (mean for non-signers = 3.4, SD = 0.2) handshape targets. A 2 (SASS vs. semantic) × 2 (signers vs. nonsigners) analysis of variance indicated that the mean number of handshapes per category was higher for nonsigners than signers \( F(1, 48) = 120.057, p < .001 \), and higher for SASS than semantic handshape targets \( F(1, 48) = 51.329, p < .001 \). There was no significant interaction between handshape type (SASS, semantic) and participant group (signers, nonsigners), \( F(1, 48) = 0.572, p = .453 \). These results show that Auslan signers produced fewer hand configurations per category than nonsigners. Their handshape choices showed that they were more likely to group specific referents into one of the major categories of referent (i.e., vehicles, animates, flat narrow objects, flat wide objects, etc.) than produce a handshape that represented the specific characteristics of a single referent.

**Comparisons With American Sign Language Targets.**

Figure 1 shows mean results on the VMP task for the 25 Auslan signers and the 25 hearing nonsigners, and corresponding data from 8 ASL adult signers (these data were collected by Jenny Singleton and her colleagues and reported in Singleton et al., 1993) are also included. Table 5 presents the mean, median, and standard deviation for each component for the Auslan signers and hearing nonsigners.

Responses from Auslan signers and hearing nonsigners were compared using \( t \) tests or (when data were not normally distributed) the Mann-Whitney U test. Auslan signers had a higher percentage match to expected ASL targets than hearing nonsigners on all three components (handshape, movement, and location). For movement, Auslan signers had a higher match to ASL targets (91.98) than hearing nonsigners (70.00), \( t(29.37) = 7.899, p < .001 \), one tailed. For location, Auslan signers had a higher match to the target responses (95.98) than hearing nonsigners (73.70), Mann-Whitney U \( (N_1 = 25, N_2 = 25) = 41.5, p < .001 \), one tailed. For handshape, Auslan signers had a higher match to ASL targets (mean = 56.74) than hearing nonsigners (mean = 24.46), Mann-Whitney U \( (N_1 = 25, N_2 = 25) = 0, p < .001 \), one tailed. The same difference in handshape between the groups was found using a standard \( t \) test: \( t(48) = 19.545, p < .001 \), one tailed.

**Comparisons With American Sign Language Data From Eight Native Signers.** The hearing nonsigners had a lower percentage match to ASL targets than ASL.

### Table 5 Mean and median results (% match to expected ASL targets) and standard deviations: Auslan signers and hearing nonsigners

<table>
<thead>
<tr>
<th>Component</th>
<th>Handshape</th>
<th>Movement</th>
<th>Locative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>SD</td>
</tr>
<tr>
<td>Auslan signers</td>
<td>56.74</td>
<td>56.7</td>
<td>5.84</td>
</tr>
<tr>
<td>Hearing nonsigners</td>
<td>24.46</td>
<td>25.0</td>
<td>5.84</td>
</tr>
</tbody>
</table>
signers for handshape \( t'(10) = 18.804, p < .001 \), movement \( t'(27) = 5.908, p < .001 \), and location \( t'(27) = 6.377, p < .001 \). The Auslan signers had lower matches to ASL targets than ASL signers for handshape \( t'(10) = 8.255, p < .001 \) but not for movement \( t'(10) = -0.861, p > .05 \) or location \( t'(28) = 1.022, p > .05 \).\(^7\)

Discussion

The results of Experiment 1 indicate that there are some similarities between deaf native Auslan signers, deaf native ASL signers, and the gestures of the hearing participants in the representation of motion events. Responses from the three groups differ clearly in handshape, but not all comparisons involving movement and locative units display significant differences between groups. In movement and location components, the hearing participants produced responses that matched the responses from Auslan signers and the ASL targets in over 70% of all task items. The corresponding figure for match to ASL targets for Auslan participants is higher, over 90% of all task items. When comparing the ASL data from 8 native signers to our Auslan data, we find that the difference between the two groups is not significant for movement and location units.

In terms of movement and locative units, Auslan differed from the ASL targets mostly in the use of lexical signs for some motion types (e.g., the lexical sign ROLL was often preferred to the use of a classifier verb of motion using the target “pivot” movement) and spatial relationships (e.g., constructions using prepositional phrases, such as ON BOX, were sometimes used by some signers rather than a two-handed classifier verb of motion with one handshape placed on top of the other). The hearing participants differed from the Auslan and ASL targets, however, in their decreased tendency to encode movement and locative units accurately. Gesturers sometimes did not show any clear spatial relationship between referents. In response to the clip showing a toy duck moving past a small loop, for example, some gesturers flapped their arms to represent the duck and then traced a circle in space with a G (index finger extended from the fist) handshape, without establishing any clear spatial relationship between the two referents. The signers almost always produced a two-handed classifier construction in which one hand (representing the duck) moved past the other (representing the loop). Gesturers also did not always represent motion types accurately. Some gesturers represented a referent turning or jumping, for example, simply with a linear path between two points in space.

In handshape, there are fewer similarities between all groups. Auslan participants produced a handshape within the expected configuration for the ASL handshape in just over half of all task items. The main differences in SASS handshapes (see Table 1) were in the handshape for circular objects (F was preferred by Auslan signers to gC) and for narrow flat objects (the ASL target H was rarely used by Auslan signers). With semantic handshapes, Auslan signers preferred B (not 3) for vehicles and Y (rather than ILY) for planes. Overall the variety of hand configurations in the Auslan data also was much greater than the ASL targets listed in the VMP manuscript, especially for nonhuman animates (Auslan signers used a flat gO for chickens, for example, preferring the ASL target 2legs handshape for human and animal referents).

The match to ASL targets for the hearing nonsigners is around a quarter of all task items, but there is a much higher match with Auslan targets (44%). Like the Auslan signers, gesturers preferred F for circular objects and B for vehicles. Despite this greater similarity, the responses of nonsigners differed from Auslan signers in the number of different handshapes they used. Nonsigners used more hand configurations per category than signers, especially for SASS handshapes (e.g., straight vertical objects, cylindrical objects, etc.) as compared with semantic handshape targets (e.g., vehicles, trees, etc.). In some cases, the hand configurations produced by nonsigners appeared to be attempts to characterize directly aspects of the specific referent’s appearance, as has been reported elsewhere (Singleton et al., 1993). For example, some hearing participants placed a vertical spread 5 handshape on the back of a palm down S to represent the porcupine. Auslan signers tended to represent this referent with a 2legs handshape, a somewhat less analogic representation. In other cases, however, the nonsigners’ hand configurations appeared minimally iconic. The same hearing participant used an S handshape oriented palm
downward to stand for a toy locomotive, a barrel, and a chicken. Auslan signers preferred a B, bC, and flat gO for these referents. The last two handshapes (as iconic representations of the cylindrical shape of the barrel and the beak of the chicken) more closely resembled some characteristic of the referent than the gestures. Thus, it was not always the case that the hand configurations used by the gesturers were more analogic than the handshapes used by signers.

The similarity between nonsigners and signers in their representation of motion and spatial relationships supports the idea that signed languages may share some properties with gesture in the representation of motion events. The cross-linguistic similarities between ASL and Auslan may also reflect aspects of gestural iconicity, but the two signed languages have had significant language contact. A second source of possible evidence for the claim that signed languages and gesture are similar would thus be a comparison of the expression of motion events in unrelated signed languages. Experiment 2 addressed this second kind of evidence.

Experiment 2: Motion Events in Taiwan Sign Language (TSL)

Method

Participants. Four deaf signers of TSL participated in Experiment 2. All were males and fluent users of TSL. Two participants were native or near-native signers, and one of them had deaf parents; the other had a deaf sibling. The remaining two participants came from hearing families, but acquired TSL early in life. Two of the participants were from the northern part of Taiwan, and two were from the southern region.

Equipment. A longer version (120 task items) of the VMP task was used with the Taiwanese participants, but only data from the first 40 task items are presented here. The experimental setup (television, video camera, room layout, and environmental conditions) was the same as that used in Experiment 1.

Procedure. Data collection was conducted in Taipei by a hearing American psychologist and a hearing Taiwanese colleague who is a fluent user of TSL. For each participant, the long version (120 items) of the VMP task was administered in a single session. The same instructions given in Experiment 1 were given to the Taiwanese participants in TSL, and a similar task procedure was followed.

Coding and Analysis. The coding procedure was as for Experiment 1. As in Experiment 1, the first author coded Experiment 2 data. The data from one randomly selected participant (i.e., 25% of the responses) were coded with the assistance of a deaf native signer, with 95% agreement. TSL data were analyzed for both percentage match to Auslan signers’ and hearing nonsigners’ productions and for percentage match to expected ASL targets. The procedure for the former comparison was as for Experiment 1: for each TSL participant, for each test item, and for handshape, movement, and location units, we noted whether the response matched an actual Auslan response given by any of the Auslan signers. To compare TSL responses with hearing nonsigners, we calculated the percentage matches of hearing nonsigners’ responses to TSL responses by noting whether the nonsigner’s response matched an actual TSL response given by some TSL signers. (TSL responses were adopted as the standard in this comparison of hearing nonsigners with TSL signers to obtain a conservative estimate of the similarities; as a group, hearing nonsigners produce a variety of handshapes, movements, and locations in response to any one test item.)

Results

Table 6 shows percentage match of responses of TSL signers to responses by the Auslan signers. TSL responses have a relatively high percentage match to Auslan responses for movement (94.38) and location (95.00) and a lower (but still large) percentage match for handshape (50.50).

Mean percentage match of hearing nonsigners’ responses to TSL productions differs between handshape, movement, and location components, $F(2, 48) = 166.02, p < .001$. Pairwise comparisons using Bonferroni adjustment to maintain an $\alpha$ level of .05 indicate that the percentage match is lower for handshape (24.52) than movement (72.80) or location...
and that the percentage match does not differ between movement and location. Hearing nonsigners’ productions have a less than 100% match to TSL productions for handshape \[t(24) = -64.17, p < .001\], movement \[t(24) = -10.112, p < .001\], and location \[t(24) = -7.253, p < .001\].

Individual match to expected ASL targets for the TSL participants are shown in Table 7, and the mean percentages are shown in Figure 2. The pattern of results is very similar to that found for Auslan in Experiment 1. Mean percentages are higher for movement (88.13) and location (95.00) than for handshape (38.33). As shown in Table 7, results are also quite consistent across the four TSL participants.

Discussion

Although TSL is unrelated to Auslan and ASL, the responses of TSL signers matched Auslan targets and the expected ASL targets for movement and location in a high proportion of task items. The differences for locative units were mainly caused by TSL responses that consisted of lexical signs rather than classifier verbs of motion. For movement, TSL responses diverged from ASL targets in similar ways to Auslan responses. In one clip, a roll of paper is shown jumping through a roll of tape. The upward movement of the jump, however, is not very marked, and both Auslan and TSL signers usually represented this as a linear motion rather than a jump. Similarly, in another clip a broom is shown moving by itself across the floor. Both groups represented this movement with a pivoting rather than a random motion, possibly because the broom twists from side to side as it moves.

In terms of handshape, TSL responses matched expected ASL responses in 38% of task items and matched Auslan in 50%. More ASL and TSL data would be required to confirm the apparent possibility that there is less overlap between the set of TSL and ASL handshapes than there is between both languages and Auslan. The main differences between TSL and the other two signed languages were in the semantic category of classifier handshapes: TSL signers used a Y handshape to represent human referents, a flat bC for vehicles, an open 8 for trees, and a configuration with the thumb, middle finger, and pinkie extended for planes.

Table 6 Mean and median results (% match to Auslan responses) and standard deviations: TSL signers

<table>
<thead>
<tr>
<th>TSL participant</th>
<th>Handshape</th>
<th>Movement</th>
<th>Locative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>52.0</td>
<td>95</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>63.0</td>
<td>92.5</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>40.0</td>
<td>97.5</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>47.0</td>
<td>92.5</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>50.5</td>
<td>94.38</td>
<td>95</td>
</tr>
<tr>
<td>Median</td>
<td>49.5</td>
<td>93.75</td>
<td>95</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>9.68</td>
<td>2.39</td>
<td>5.77</td>
</tr>
</tbody>
</table>

Table 7 Mean and median results (% match to expected ASL targets) and standard deviations: TSL signers

<table>
<thead>
<tr>
<th>TSL participant</th>
<th>Handshape</th>
<th>Movement</th>
<th>Locative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.0</td>
<td>87.5</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>33.3</td>
<td>87.5</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>46.7</td>
<td>90</td>
<td>90</td>
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<tr>
<td>4</td>
<td>38.3</td>
<td>87.5</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>38.33</td>
<td>88.13</td>
<td>95</td>
</tr>
<tr>
<td>Median</td>
<td>36.65</td>
<td>87.50</td>
<td>95</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>5.96</td>
<td>1.25</td>
<td>5.77</td>
</tr>
</tbody>
</table>

Figure 2 Mean percentage match to Auslan targets and expected ASL targets: TSL signers. (Error bars represent standard deviations.)

General Discussion

The two studies discussed in this article compared data from two historically unrelated signed languages with data from sign-naïve gesturers. Despite the differences discussed above, the parallels between the groups are nonetheless striking and have important implications for our understanding of classifier verbs of motion in signed languages. Across the components of
handshape, movement, and location, the greatest similarities between sign-naïve gestures, Auslan signers, TSL signers, and the expected ASL targets are found in movement and location. Handshape is the component for which there are fewest similarities both with the expected ASL targets and across the productions of the three participant groups.

Interestingly, a similar general pattern of results has been obtained in related studies of deaf children acquiring ASL as a first language, deaf home signer, deaf nonnative signers of ASL, and American hearing nonsigners (Singleton et al., 1993; Singleton & Newport, 2004). Table 8 sets out a comparison between the results of these studies and those in the present study. (Table 8 presents results in terms of percentage matches to the ASL targets, not to the Auslan, TSL, or gesture data described in this article.)

Deaf children aged 6;1 to 10;10 acquiring ASL as a first language from deaf native signing parents have higher matches to ASL targets for movement and locative units than for handshape but are not quite at the same level as the adult signers (Singleton et al., 1993; Singleton & Newport, 2004). This would be expected developmentally because children gradually acquire the motor and cognitive skills necessary for the accurate representation of motion events.

Singleton and Newport (2004) studied later learners of ASL, profoundly deaf adults who were first exposed to ASL after puberty but had used ASL as their primary means of communication for at least 10 years. These data are particularly interesting because the late learner results for movement and locative units are almost identical to our results for nonsigners (i.e., despite more than 10 years of exposure to ASL, their responses for movement and locative units appear to be no more similar to ASL targets than the responses of sign-naïve hearing participants).

Singleton et al. (1993) described a home signer known as David, a profoundly deaf child with limited exposure to ASL, who used a “home sign” system (i.e., a visual-gestural communication system created by himself on the basis of his interactions with his hearing, nonsigning family members). The data were collected from David at age 9;5. David’s results with locative units are comparable to the adult native signers (and higher than those for the late learners), but his percentage match to ASL movement targets shown here is not as high as those for the deaf adults. This may reflect the same developmental timetable we see in the ASL signing children mentioned above. The fact that he had such a high percentage match to ASL locative targets probably reflects his age (he is older than most of the ASL native signing children). Overall, these data fit into the same pattern, with a considerably lower match to ASL movement targets shown here as the home signers appear to be more internally consistent than those reported for nonsigners).

Most interesting of all are the results from American hearing adult nonsigners (data reported by Singleton et al., 1993). Overall, their results for

<table>
<thead>
<tr>
<th>Table 8</th>
<th>Comparison of results (mean % match to expected ASL targets) from studies using the VMP task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handshape</td>
<td>Movement (Mean of manner + path)</td>
</tr>
<tr>
<td>ASL native signer adults&lt;sup&gt;a&lt;/sup&gt; (N = 8)</td>
<td>82</td>
</tr>
<tr>
<td>Auslan native signers&lt;sup&gt;b&lt;/sup&gt; (N = 25)</td>
<td>57</td>
</tr>
<tr>
<td>TSL signers&lt;sup&gt;c&lt;/sup&gt; (N = 4)</td>
<td>38</td>
</tr>
<tr>
<td>ASL native signer children&lt;sup&gt;d&lt;/sup&gt; (N = 8)</td>
<td>68</td>
</tr>
<tr>
<td>Home signer&lt;sup&gt;e&lt;/sup&gt; (David)</td>
<td>49</td>
</tr>
<tr>
<td>ASL late learner adults&lt;sup&gt;d&lt;/sup&gt; (N = 8)</td>
<td>55</td>
</tr>
<tr>
<td>American hearing adult nonsigners&lt;sup&gt;a&lt;/sup&gt; (N = 16)</td>
<td>21.5</td>
</tr>
<tr>
<td>Australian hearing nonsigners&lt;sup&gt;b&lt;/sup&gt; (N = 25)</td>
<td>24.5</td>
</tr>
</tbody>
</table>

<sup>a</sup>Data from Singleton et al., 1993.<br><sup>b</sup>Experiment 1.<br><sup>c</sup>Experiment 2.<br><sup>d</sup>Singleton & Newport, 2004.
handshape (21.5%) and locative units (73%) are very similar to the data obtained from Australian nonsigners in Experiment 1 in the current article, although the figure for movement units (91%) is actually in the same range as those obtained by fluent deaf signers of Auslan, TSL, and ASL. In the Singleton et al. (1993) study, these surprisingly similar results for movement for the American nonsigners and ASL signers are never explicitly explored or explained, despite the fact that the article focused on differences in the degree of systematicity in the visual-gestural representation of motion events between nonsigners, home signers, and native ASL users. In our data, however, some individual gesturers did score a 90% match or higher with Auslan targets for movement. These American results may reflect a smaller sample size than the Australian data (16 vs. 25 participants) or some difference in the coding procedures in the two studies.

In summary, despite some peculiarities, there is a similar overall pattern of results in all groups across these studies, with the percentage of handshape matches to ASL targets lowest for the hearing nonsigners; intermediate for signers of Auslan, TSL, ASL late learners, the home signer, and ASL signing children; and highest for ASL native signers. This indicates that there is relatively little overlap between standard ASL classifier handshapes and iconic hand configurations used by nonsigners, although there is some degree of similarity between ASL and other signed languages.

With movement and locative units, however, the results follow a different pattern. Australian nonsigners and ASL late learners achieved a lower level of matches to ASL targets than American nonsigners, the home signer, and the ASL, TSL, and Auslan signers on movement. For locative units, the Australian and American nonsigners patterned with the ASL later learners at the lower end, and the home signer and adult and child signers of all signed languages showed the most similarity to expected ASL responses.

What accounts for the high degree of similarity in the data from ASL, Auslan, and TSL signers and the general similarity between signed and gestured responses? In relation to the similarity of different signed languages in general, Supalla and Webb (1995) suggested three possible explanations. First, it may be that a sufficient number and variety of signed languages has not yet been studied, and the typological differences found between Navajo and English may exist in signed languages yet to be documented. To date, the most well-described signed languages are those of North America (ASL, Quebec Sign Language) and the European Union (British Sign Language [BSL], Danish Sign Language, Italian Sign Language, etc.). Some of these signed languages are historically related or have been in contact with one another for a considerable period, and thus the similarities so far discovered perhaps should not be surprising.

This is not, however, the case with two of the signed languages described in this article. There is no evidence that Auslan and TSL are historically related in any way. It is clear that Auslan is related historically to BSL (some have argued that BSL and Auslan are in fact dialects of the same signed language; see Johnston, 2003). TSL, in contrast, is thought to be part of the Japanese Sign Language family (Smith, 1989). BSL and Japanese Sign Language appear to be signed languages that have developed completely independently in the deaf communities in these two countries. Moreover, BSL, Auslan, Japanese Sign Language, and TSL have not existed in any sociolinguistic situation in which extensive language contact has been possible. Despite these genetic and areal differences, we have seen that Auslan and TSL use almost identical visual-gestural mechanisms to represent the motion types and spatial relationships elicited by this task. Although it may be true that other, as yet undescribed, signed languages may differ in the representation of motion events much more than do Auslan and TSL, there is still a need to explain why our data from two unrelated signed languages are so similar.

A second possibility discussed by Supalla and Webb (1995) is that all signed languages studied so far are comparatively young languages. Communities of signing deaf people have only recently formed in many parts of the world as a result of social changes such as urbanization and the introduction of public education for deaf children. Schools for the deaf were established in Australia in the middle of the 19th century and in the last decade of the same century in Taiwan. As Newport and Supalla (2000) explained, younger languages (i.e., creole languages) have been argued to have more
structural properties in common than is generally found in older, unrelated languages (Bickerton, 1990). The claim that signed languages such as ASL and BSL are in fact relatively recently emerged creole languages has been made by a number of researchers (Deuchar, 1984; Fischer, 1978, 1996; Ladd & Edwards, 1982). This may also be true of Auslan and TSL, and thus the similarities in classifier verbs of motion that we see here may be the result of recent creolization. If all signed languages described thus far are in fact relatively young languages, it may be that their classifier verb systems will diverge more from one another as they develop longer histories of use (this has already occurred in other areas of their organization; TSL reportedly has a system of auxiliaries for marking person “agreement,” which Auslan lacks). Then again, this may not happen because of the patterns of transmission peculiar to signed languages. The fact that fewer than 5% of deaf signers acquire signed languages from deaf signing parents (Mitchell & Karchmer, 2004), some of whom may not themselves be native signers, may result in some aspects of the language being recreolized by each new generation. Signed languages may never attain the same community-wide multigenerational depth of use that we see in many spoken language communities, so at least some of the processes of language change may be different. This may be part of the explanation for the cross-linguistic similarities we find here.

The third possibility raised by Supalla and Webb (1995) is that the visual-gestural modality may result in more similarity in structure and typology than does the auditory-vocal modality. In spoken languages, a limited range of speech sounds is used to form morphemes, and the relationship between these sounds and their meaning is, for the most part, arbitrary. Although there are effects of iconicity on the grammatical organization of languages in the auditory-vocal modality (Haiman, 1985), there is also a great variety of apparently arbitrary systems of grammaticalization (Newport & Supalla, 2000). Some spoken languages rely on linear word order, some use tonal contrasts, and others use differences in morphological patterning for the same grammatical functions.

In contrast, languages in the visual-gestural medium appear to exploit the available resources in similar ways. All signed languages documented thus far appear to use similar classifier verb constructions for expressing motion events (Schembri, 2003). This may be because there is inherently a great deal more iconicity available in the visual-gestural modality than in the auditory-vocal medium (Woll, 1990). Referents exist in space, so it may be quite natural for loci in space to be used to represent referents. The hands also exist in space and may take on a range of configurations. It is perhaps not surprising that some of these hand configurations will come to be associated with referents of particular shapes.

These types of links between form and meaning in the description of motion events may thus predispose signed language classifier verbs to develop structurally in specific ways. Moreover, these structural predispositions may also explain some of the similarities between the signed language data and the gesture responses found in Experiment 1 because both signed language and gesture can take advantage of the iconic properties of the visual-gestural modality. This is not the first time such parallels between signed language and gesture have been reported in the literature (Brennan, 1993; Kendon, 2004; McNeill, 1992; Singleton et al., 1993; Webb, 1996). Just as cross-linguistic research is revealing surprising similarities among unrelated signed languages (Newport & Supalla, 2000), the relationship between some aspects of signed language grammar (e.g., classifier verbs of motion) and gesture may turn out to be different from what the field had initially anticipated.

Until recently, many researchers in signed language linguistics focused on gathering evidence showing that signed languages are qualitatively different from gestural behavior (Corina et al., 1992; Petitto, 1987; Singleton et al., 1995). This evidence has shown that it is only in signed languages that we see extensive lexicons and complex grammatical organization, features that other uses of the visual-gestural medium lack (Kendon, 2004). Increasingly, however, the assumption that signed languages and gesture are in all respects qualitatively different has come into question (Armstrong, Stokoe, & Wilcox, 1995; Casey, 2003a, 2003b; Cogill, 2003; Cogill-Koez, 2000a, 2000b; Corina, 1999; Emmorey, 1999; Emmorey & Herzig, 2003; Liddell, 2000, 2003a; Liddell & Metzger, 1998; Wilcox, 2004). For example, Petitto (1987) showed that
the developmental pathway of index finger pointing was U shaped (i.e., the use of pointing appears in infants around 9 months of age, disappears around 12 months, and reappears at 18 months of age) as it moved from what she believed to be initially gestural to fully linguistic uses of the index finger point. Recent data, however, suggest that a similar U-shaped developmental pathway occurs in nonsigning hearing children moving from index finger extension to gestural pointing (Masataka, 2003). Thus, differences in the development of gestural and linguistic pointing may not be as great as initially believed.

Similarly, the data presented in this article suggest that significant similarity exists between signed and gestural uses of the visual-gestural modality to depict motion events. In the case of some individual responses, the Auslan, TSL, and gesture data described here do not appear as different as one might expect if a qualitative difference existed between sign and gesture. The nonsigners appear to produce the appropriate signed language (ASL, Auslan, and TSL) use of movement and locative units in these signs in over 70% of all VMP task items. These gestural data appear to raise doubts about the claim that these structures are complex multimorphemic constructions similar to what is found in polysynthetic spoken languages (Supalla, 1982, 1986). Such forms typically require considerable learning by adult second language learners to master. As Newport and Supalla (2000) pointed out, no hearing participants brought into a laboratory and asked to communicate with each other by using sounds unrelated to their spoken languages will spontaneously produce even the beginnings of a language like Navajo or West Greenlandic. The nonsigners described in this and other studies (Singleton et al., 1993), however, begin to make systematic use of movement and locative units to represent the motion of referents in a way that appears similar to signed languages, and their responses on the VMP task resemble those of late learners of ASL who use signed language as their primary means of communication.

These data may be interpreted to provide support for the claim that classifier verbs of motion and location in signed languages, like the use of indicating verbs described by Liddell (2000), represent a blend of morphemic and gestural elements. The hand configurations in the current data appear to be used to refer to categories of objects (rather than specific referents), are more conventionalized than the use of movement and locative units (e.g., they vary from one signed language to another and clearly need to be learned by children or adults acquiring the language), and are not consistently iconic in nature (e.g., the ASL handshape for vehicles does not resemble a typical vehicle). This appears to be less true of the various uses of movement and locative units. It is difficult to judge the degree of conventionalization of these elements because hearing nonsigners with no exposure to a signed language can produce similar forms with over 70% accuracy, and they do not appear to vary from one signed language to another. It is also difficult to assess the degree to which the movement and locative units are categorical and not analogue, although some signed language researchers (Brennan, 1992; Engberg-Pedersen, 1993; Schick, 1990) have posited “analogue” morphemes to account for the fact that classifier constructions can sometimes mimetically represent particular motion events. Certainly, these forms appear to be nonarbitrary in relation to their contextualized meanings. Both the signed and gestured responses appear to express imagistic aspects of thought (i.e., the mental representation of motion events) by means of forms created to conform to that imagery. In fact, the similarities among the signers and “error” patterns briefly mentioned for the nonsigners suggest that signers are able to do this more consistently.

Alternatively, it may be argued that classifier verbs of motion are grammaticalized forms of iconic gestures used by nonsigners (Duncan, 2003; Pfau & Steinbach, 2004; Zeshan, 2003). Despite their iconicity, it has been suggested that the movement and location components of classifier constructions are nevertheless morphemic because it is possible to recognize discrete units of form-meaning pairing (Supalla, 1982). Unlike most uses of gesture, classifier verbs of motion appear to enter into syntagmatic relationships with other signs to form clauses and clause complexes. If classifier constructions are indeed entirely grammaticalized forms of gestures, the data presented here do not, however, suggest that they have moved very far along a grammaticalization pathway. Some of the typical changes associated with grammaticalization include phonological reduction (i.e., the number of phonological
segments decreases), fusion (i.e., phonologically discrete items begin to merge), and the loss of semantic transparency (i.e., the relationship between form and meaning becomes less clear) (Hopper & Traugott, 2003). We see these patterns in the historical change that produced ASL modal verbs from lexical signs that in turn derived from emblematic gestures (Wilcox, 2004).

The responses from the signers and nonsigners in our data do seem to differ in timing. Responses from the signers appear to be faster. This may provide some evidence for the grammaticalization of these forms. (We hope to investigate this aspect of our data in a future study.) We have already seen that the use of handshapes is more categorical in the Auslan responses than in gesture. It is difficult, however, to see how the use of movement and locative units in the Auslan and TSL data are phonologically fused compared to their equivalent gestures or how they are less semantically transparent. In fact, the lower scores for the nonsigners reflect a greater number of responses that were less iconically transparent (i.e., the signers more consistently represented jumping motion with jumping movements than the nonsigners). In many cases, the way signers used movement and location did not appear dramatically different in form from the iconic gestures produced by nonsigners in a no-speech condition, and we do not see much divergence in these forms in the data from unrelated signed languages in this article. This makes their possible grammaticalization quite different from the development of modal verbs in ASL. The peculiar patterns of language transmission in deaf communities mean each generation may partly reconstitute the language. This, coupled with the great capacity of the visual-gestural modality for iconic representation, may mean that some aspects of classifier constructions do not move far from their gestural origins.

Furthermore, in accounts of grammaticalization, it is often recognized that grammaticalized items may coexist synchronically with their source lexical items (Hopper & Traugott, 2003). For example, in modern ASL, the modal CAN exists alongside the lexical sign STRONG (from which it is derived), and both are similar to a gesture for physical strength known to signers and nonsigners alike (the ultimate source of both signs) (Janzen & Shaffer, 2002). Thus, fully grammaticalized uses of classifier verbs of motion may possibly exist synchronically alongside semigrammaticalized and fully gestural elements within signed languages, as suggested by Engberg-Pedersen (1993). Indeed, differing degrees of grammaticalization of the various meaningful units in these constructions may be why a fully morphemic account of classifier verbs of motion has thus far been unable to deal with the many possible sources of meaning in these signs, but this remains an issue for future research.

If we accept the proposal that classifier constructions represent blends of gesture and sign (Liddell, 2003b), the question arises regarding which components of classifier signs are morphemic and which may be gestural. This question clearly requires further research and more empirical investigation beyond the tentative start made in this article (our data need to be complemented by, for example, psycholinguistic investigations of comprehension and on-line processing), but the evidence presented here points the way. In these data, the component that differs most between Auslan and TSL, and between the signed language data and the gesture data, is the handshape unit. Despite some similarities in hand configuration choices (e.g., the nonsigners and Auslan signers both used the V handshape to represent the legs of human and animal referents), those found in gesture without speech do not appear to be used as systematically as the handshape units in Auslan or TSL. Evidence from the analysis of indicating verbs (Liddell, 2000) and from psycholinguistic studies of classifier verbs (Emmorey & Herzig, 2003) appears to support the claim that the handshape unit is a linguistically definable entity, whereas the use of locations in space in such constructions is not.

In the movement and locative components, there was a high degree of similarity between Auslan, TSL, and ASL signers, and gesturers were able to produce responses that resembled signed language choices of movement and locative units with around 70–90% accuracy. Although signers were more similar to one another than to nonsigners, it is not clear from this study if this difference in performance constitutes linguistic knowledge or is related to some other nonlinguistic factor, such as enhanced visual-spatial skills in signers (Emmorey, 2002). It is feasible that the types of enhanced skills for motion processing and spatial memory documented in signed language users...
translate into the higher matches to movement and locative target responses seen here, but this claim requires further investigation.

Conclusion

Data from three different populations using the VMP task from the Supalla et al. (n.d.) Test Battery for American Sign Language Morphology and Syntax have been presented. The high degree of similarity in the data from the different groups is consistent with the claim that classifier verbs in signed languages may be analyzed as blends of linguistic and gestural elements, but it is not definitive. Nevertheless, the data presented in this article indicate that there is a need for all serious scholars of language to rethink assumptions about the relationship between signed languages and gesture and to seek further evidence of the extent to which movement and location in classifier constructions may be grammaticalized gestures or whether they involve blends of linguistic and gestural elements.

Acknowledgment

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Notes

1. Duncan (2003) pointed out, however, that both representational systems can be operative in speech and in gesture (i.e., it is not necessarily the case that every aspect of speech is categorical or that gesture can only be analogic and gradient).

2. The VMP elicits only verbs of motion that use semantic and SASS classifier handshapes. Other types of classifier construction, such as verbs of motion that use body part classifiers or verbs of handling, are not relevant here.

3. The instructions for the hearing and deaf participants were thus slightly different. After some unsuccessful trials in which hearing participants produced only gestures that named the central or secondary objects and did not produce gestural descriptions of the motion event, we introduced instructions that reminded the participants of the nature of the task after each task item. In many cases, this meant that the nonsigners only produced a response with an action gesture, whereas the majority of responses from signers were in the form of clauses including lexical nouns and a verb of motion. It is clear, however, that this difference did not produce higher rates of matches to ASL targets in our nonsigning participants than may have otherwise occurred because our results were almost identical to results obtained in an earlier study of 10 nonsigners reported by Schembri (2001). In the earlier study, nonsigners were specifically instructed to produce both naming and action gestures.

4. The figures for the adult native Auslan and TSL signers differ somewhat from figures earlier reported by Schembri (2001, 2002). In earlier work, the results for handshape and location were scored differently. A match to ASL handshape targets by Schembri (2001, 2002) was scored on the basis of the hand configurations that were reported as possible in ASL in two sources: the ASL test battery manuscript (Supalla et al., n.d.) and Supalla’s (1982, 1986) description of classifier constructions in ASL. This resulted in slightly higher percentages of correct responses for both Auslan and TSL. For the representation of locative relationships between referents, only the simultaneous production of a central object and secondary object on both hands was considered correct by Schembri (2001, 2002). If the locative relationship between central object and secondary object was described sequentially, this was not considered a match to ASL targets. This resulted in slightly lower percentages of correct responses for locative units. To facilitate comparison with the reports in the literature, the results presented here were scored strictly according to the scoring criteria outlined in the ASL test battery manuscript only (Supalla et al., n.d.).

5. These figures on the adult native ASL signers represent their results for all 120 test items, not the first 40 used with the adult native Auslan signers and hearing nonsigners.

6. The t-test degrees of freedom reflect adjustment for unequal variances.

7. The t’ statistic in these comparisons is Welch’s (1938) t, which controls against Type II error in comparisons involving unequal sample size.

8. It is preferable to collect data from deaf signing participants interacting with other deaf signers, rather than with hearing signers, because of the well-documented influences of language contact (e.g., Lucas & Valli, 1992). Nevertheless, we do not feel that failure to follow this practice with the TSL signers necessarily invalidates the data collected. It is quite clear from the interactions on the videotape that the four TSL signers saw
themselves as providing data about their signed language use because the video includes many clear comments about the acceptability of particular classifier constructions.

9. We disagree with Cogill (2003), who rejected morphemic status for the handshape in classifier constructions because some signers accept analogic modifications of particular hand configurations (such as bending one finger in the 2legs handshape to indicate that the referent is limping). As pointed out by Okrent (2002), such gestural modifications of morphemes occur in English when lexical items (such as the word long) may be lengthened to indicate an increase in size or duration (e.g., “that lecture was really loooong”), so it is not clear if this is sufficient reason to reject the analysis of handshapes as morphemic.

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