Aspects of aspect[*]

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Performing an action and concurrently describing it creates possibilities for observing how speech and action are synchronized and mutually shape each other. The results to be described show that iconicity is an organizing principle of motion control — actions are performed in relation to speech in such a way as to create an image of the meaning in part. Four English-speaking subjects described their goal-directed actions, step by step, as they assembled a small aquarium. Among the factors observed to have an impact on synchrony are, in speech, perfectivity (*imperfective* or *perfective*) and, in action, the logical form of the action (Vendler's *activities*, *accomplishments* and *achievements*). These factors must be considered jointly. Depending on the logical form, speakers placed the linguistic center ('L-Center') of the description — the satellite or a preposition in the case of activities and accomplishments; the verb itself in the case of achievements — in such a way as to recreate the aspectual viewpoint concurrently encoded in speech. Imperfective aspect was indexed with progressive verbs. L-Centers with this aspect were placed inside or prior to the completion of the action. Perfective aspect was indexed with non-progressive verbs. L-Centers of this kind were placed after the action. In addition, the actions themselves were longer with imperfective aspect, even when the same logical form of action was involved. Non-functional movements were added to goal-directed actions to help create the imperfective aspect, and both speech and action timing were adjusted to create the aspectual viewpoint. These patterns are reminiscent of the perfectivity differences in gesture performance described by S. Duncan (2003) for Mandarin and English. Motor movements adapt to language in a way similar to gestures. Theoretically, there is a three-sided synchrony of two forms of motor action (speech, manual manipulation) and the logical form of the action. The theoretical discussion considers two ramifications: the implications for 'cognitive being' of building aspect into action, which suggests a mechanism of the mutual shaping of speech and action; and the brain organization that might underlie the three-sided synchrony, with emphasis on the role of BA 44 and BA 45 ('mirror neurons'), collectively 'Broca's

Area', in the orchestration of actions under some meaning (actions of gesture, manipulation, and speech); these areas include language but are broader in function than the classical term 'language area' implies.

Keywords: aspect, logical action type, iconicity, gesture, motion control, brain organization

Language is not typically regarded as motor movement or action. Nonetheless, what takes place as we speak is an intricately coordinated ballet of tongue, lips, jaw, vellum, vocal chords, and diaphragm, controlled by neuromotor systems interacting with these moving body parts and unfolding in a closely ordered sequence in time. The performance is intricate and multifaceted enough to be called 'action'. However, it is not a goal-directed action but a meaning-guided one (on multiple levels). One could plausibly argue that these coordinated actions, more than the resulting acoustic signals, are the primary linguistic medium, at least as far as possible evolutionary scenarios are concerned. And concurrently with these movements are other actions in more visible realms — arms, hands and torso — in the form of gestures and instrumental, actual goal-directed actions. The two realms have rarely been considered together; but see Armstrong et al. (1995) for a pioneering discussion. The two control systems of speech and arms/hands may converge in the language areas of the brain, especially BA 44 and BA 45 (Nishitani & Hari, 2000). In view of this possible convergence, these areas are possibly too narrowly labeled 'the language areas' and might be more accurately called the sequence orchestrating areas of the brain under some significance (including goal directed instrumental actions). In this brief paper, I return to experiments I conducted in the 1970s that studied the coordination of speech and goal-directed manual actions (see McNeill, 1980 and 1995 for the original experiments). The aim is to place the experiments within a more up-to-date theoretical context and reveal one way in which the brain uses language to control the timing and the contours of motor action.

Preliminaries

I describe two factors that influence the synchrony of speech and action. First, on the action side, is the logical form of the action, discussed in the first section to follow. Second, on the speech side, is the temporal perspective taken toward

the action; this is discussed in the second section. After these introductory remarks, I give an illustrative example of how speech and action combine; then I present the results of the experiment. Next, I compare these results to gestures associated with aspect in Mandarin and English; and I finish with a discussion in two areas — the implications for how language and gesture affect 'being', and the implications for the brain systems that could produce the kinds of speech-action combinations that we observe.

Logical types of action

To start off, we should take advantage of the classification of actions that Zeno Vendler (1967) introduced. He distinguished activities from accomplishments and achievements.[1] *Activities* are logically unbounded actions, such as HOLDING IT. The moment you hold something, the activity of holding it logically comes into being. *Accomplishments* are actions that have temporal extent but cannot be said to occur until the attainment of a logical endpoint as part of their constitution. An example is PUTTING DOWN ON. Even though you must be holding an object and lowering it to a surface you don't put it down on the surface until a certain defining instant of contact and release. An *achievement* also requires attaining a logical endpoint but consists of nothing else; it is instantaneous, there is no temporally extended run up, only the transition. An example is DROPPING IT (to designate actions as opposed to the verbs referring to them, I write the description in caps). The activity-accomplishment-achievement distinctions are logical contrasts between types of actions, qua actions. Klein (1994) defines *Aktionsart* (action type) as the "inherent temporal features of the lexical content of verbs". Linguistically, the meanings of verbs incorporate the logical content of the actions they refer to. These inherent temporal features combine with other lexical content to constitute the meaning of the verb of motion.[2]

Temporal perspective or aspect

While the logical action type refers to actions qua actions, aspect is a concept applying to language as a system of representations. A verb acquires logical form from the action it refers to and, whatever this is, can have different aspects. Comrie (1976) describes aspect as the temporal perspective taken toward the action. It is important to stress that aspects are not inherent qualities of the actions themselves but are viewpoints highlighted by how language is

used to present the action. This insight can be extended to the relationship of language to the actual motions being performed concurrently by the speaker. The speaker's body tunes to the linguistic perspective and adapts to what is being said concurrently.

Again, there are two kinds (actually more, but two are basic and figure in this essay). A given action may be viewed either perfectively or imperfectively. The *imperfective* aspect is looking at the action from the inside, taking an expanded view of it, as if it were ongoing — "holding it" (inside an activity), "dropping it" (inside an achievement). Different varieties of imperfectivity can be distinguished (progressive, durative, inchoative, etc.). The *perfective* aspect is looking at the action from the outside, as a completed whole. Again, the aspect is possible for either action type — "held it", "dropped it". English lacks a dedicated indicator of perfective aspect and the past tense is often used to show it.

Illustrative example

The example below illustrates one speaker's coordination of speech and motion; we find extra movements and interruptions of movement or speech by which the speaker attempts to keep the two motor realms in synchrony. The synchrony is different depending on the type of action and the aspectual perspective. So there is a three-sided synchronization: motion in the two realms of action, plus the linguistically encoded aspect: all of this is kept in close temporal alignment. The aim of the study here is to discover how this synchrony is achieved (and this is the intended word).

The example occurred while the speaker was assembling a window-type home aquarium and placing the water filter — a tube — inside another part — its container (the subjects were faculty and students at the University of Chicago in the mid-1970s and several are eminent figures in psycholinguistics and developmental psychology — but not in the assembly of aquariums); this is subject WM-W (square brackets mark the boundaries of his movements in relation to the speech; the movements themselves are described in italics). He was told to put the aquarium together and to keep up a running description of his actions as he performed them.

The example illustrates a number of features. First, two of the logical types of action are present: some are 'activities' while others are 'accomplishments'.

Second is the choice of linguistic form. In this choice, the speaker adopts a point of view in verbs marked for the imperfective aspect with the progressive vs.

those apparently perfective with the non-progressive, such as *I'm picking it up* vs. *I've picked the part up*. As we will see, there is evidence that the nonprogressive was used for the perfective aspect.

A third observation is that the speaker attempts to maintain synchrony of speech and action. But speech and action have their own internal clocks, and the flow of either or both is regularly altered to maintain synchrony. This is seen at (3) and (4), for example, where speech was interrupted while the hand opened and grasped the container. Conversely, at (8), downward movement was interrupted and replaced by a symbolic rocking, during which the speaker groped for the appropriate word to refer to the tube and container. At other times action was laboriously elongated in order to line up in time with corresponding parts of the utterance, as in (10) through (13). Similarly, at (5) through (7), the action of dropping the tube into the container was performed in little bursts each timed with a linguistic segment. At (7), the action of dropping was suspended as the speaker sensed that he wouldn't be able to find a word to identify the container (as we see from the elaborated clausal reference to the container that follows, "I'm placing the … tube … the other thing which I'm holding steady with my right hand"). In all of these cases the speaker tried to keep speech and gesture together temporally, and modified action and/or speech to do this. At other times, speech and movement alternated; this was another form of action-speech modification. An example is shown at (2): the subject has picked up the tube in silence and then described what he had done, "I'm picking this up with my left hand", and as he described this action his left hand froze in midair. Thus where language and action were asynchronous, as here, no other action was allowed to occur.

[*well*] […] *I'm picking this up with my left hand* […*and I*] [*'m*]
(1)   (2)   (3)   (4)

(1)   Left hand rises.
(2)   Left hand grasps tube and lifts.
(3)   Right hand opens.
(4)   Right hand grasps container and lifts.

grasping this with my right hand … and holding it […] [*and then I'm plac*] [*ing*] *this*
                                                (5)   (6)   (7)

(5)   Left hand moves tube over container.
(6)   Suspends tube vertically over container.
(7)   Left hand drops tube down partially, an inch.

[…] *I'm placing the … tube … the other thing which I'm holding steady with my right*

(8)

(8)   Rotates tube back and forth.

hand […] [*and*] *I'm* [*just*] *drop*[ ]*ping it in … leaving* [ ] *go with my left hand*
        (9)   (10)   (11)   (12)   (13)

(9)   Left hand drops tube into container.
(10)   Lifts index finger to push down tube.
(11)   Pushes down.
(12)   Maximum extent of the push down.
(13)   Lifts left hand away from tube.

On some occasions there is a non-functional movement added to an action to extend it in time. These added movements are like symbolic extensions of the action. A symbolic extension is also a form of reshaping the action, which occurs when speech and action threaten to fall out of synchrony, particularly when the verb is progressive and the real action is coming to completion too soon. An example from the same speaker is the following double extension:

[…] [*OK I'm…*] [ ] [*picking…this*] … [*up*]
(14)   (15)   (16)(17)   (18)

(14)   Reaches for container
(15)   Picks container up.
(16)   Reaches maximum height.
(17)   *Symbolic extension*: rocks container back and forth.
(18)   *Second symbolic extension* with particle: lifts container a bit higher.

The action of picking up was completed at (15) long before the speech describing it had been reached. When the verb, *picking,* was at last uttered the hand, which had been steady, rocked the container back and forth, and when the particle was reached, at (18), there was the further extension of raising the container higher in the air. Neither movement served any practical purpose. They were motion indexes of an accompanying relevant linguistic segment.

   Such an extension with a nonfunctional movement is an important clue to what is involved in the construction of an aspect. The imperfective view of picking up action implies regarding it from its inside, and the rocking motion symbolized this by a metaphor that can be taken as representing the interior of the action, such as inventing a manner of movement (rocking) that is not logically part of the movement. The second extension prolonged the end of the action via the upward hop, which again made the action seem like it was not over at the moment it was described, also engendering the imperfective perspective on it.

In all of these observations, we should be impressed by the close linkage of speech and action. The two are kept together in an intricately coordinated flow in which speech and action are shaped and reshaped to stay together.
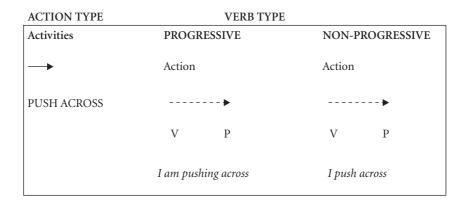
Results of the experiment

The above example is just a brief excerpt from a much longer record by a single speaker. Altogether, descriptions were recorded and analyzed from 4 different subjects. The average results for the durations and relative position of the movements and speech are summarized in Figure 1.

The symbols in Figure 1 designate the Vendlerian categories of the actions occurring frequently enough to be averaged (6 or more examples): → for 'activities,' that is, actions with no logical endpoint (e.g., PUSH); →| for 'accomplishments,' actions with a "terminus which is logically necessary to their being what they are" (Vendler, 1967, p. 101; e.g., PUT DOWN ON); and plain | for instantaneous achievements (e.g., RELEASE).

The panels of Figure 1 are read as follows:

1. The Vendlerian action type and an example in small caps are given at the left of each row.
2. Next and to the right is a diagram of the action in the form of an arrow, a bar, or both. The arrow is meant to represent a temporally extended action, and the bar the temporal locus of the logical endpoint in the case of an accomplishment or achievement. Duration is indicated by the number of dashes in the arrow (each dash is 0.1 s).
3. Beneath this diagram, the letters V and P and the abbreviation Prep represent where, in relation to the action phases, verbs, particles and prepositions, respectively, were uttered during the speaker's performance. The alignments are keyed to onset of the speech segment.
4. Finally, underneath all this, is an example with correct spacing and duration with respect to the flow of the action, insofar as a diagram can show this. The example, *I am pushing across*, represents all activity verbs in the progressive. The spacing of V and P shows that the action started just as the utterance of *pushing* was completed and the particle *across* was uttered while the action took place. The example, *I push*, represents all activity verbs in the non-progressive, and the diagram shows that these verbs were uttered while the action was in progress and the *across* followed the action, uttered after the pushing had come to an end.

ACTION TYPE   VERB TYPE

Activities	PROGRESSIVE	NON-PROGRESSIVE
⟶	Action	Action
PUSH ACROSS	- - - - - - - ▶	- - - - - - - ▶
	V P	V P
	I am pushing across	*I push across*

ACTION TYPE   VERB TYPE

Accomplishments	PROGRESSIVE	NON-PROGRESSIVE
⟶|	Action	Action
PUT DOWN ON	- - - - - - - - - ▶|	- - - - - - - - - ▶|
	V +P Prep	V +P Prep
	I am putting NP down on	*I put NP down on*

ACTION TYPE   VERB TYPE

Achievements	PROGRESSIVE	NON-PROGRESSIVE
|	Action	Action
RELEASE	|	|
	V	V
	I am releasing	*I release*

Figure 1. Coordination of motion with speech by 4 English speakers. Duration of the described action indicated by the number of dashes (1 dash = 0.1 seconds). V is the verb, P is the particle (satellite), and Prep is a preposition.

The non-instantaneous accomplishment example is more complex since a preposition is also involved, but it is read in the same way. In every such case where a preposition was involved, the particle was produced along with the verb and the preposition was delayed — a crucial consideration, as I will describe. (The preposition is not considered to be syntactically a particle, but it is still part of the representation of the action.) When a preposition was not involved, as in *I'm picking up,* the particle was timed with the endpoint of the action.

Coordinated expressions of imperfectivity and perfectivity.

With actions included in the picture, we can see how speakers coordinate action and speech systematically to recreate, on their own, the semantics of perfectivity and imperfectivity. From a motor control point of view, the results show that motions are filtered through the language-thought system where they pick up such control parameters as perfectivity and imperfectivity.

Imperfective aspect

Consider first verbs marked with the progressive for *imperfective aspect.* The rule here seems to be that the verb or particle precedes the end of the action performance. The rule takes different forms depending on the logical form of the action:

1. In → actions (PUSH ACROSS, etc.), which lack intrinsically defined endpoints, the action was described with a verb plus particle (*I'm pushing this across*). The particle occurred in the middle of the performance; said otherwise, the action was extended past the moment when the particle was uttered.
2. In │ actions (RELEASE, etc.), where the achievement is instantaneous, the action was described with a verb such as *release* (there are no particles) that always just preceded the action endpoint; said otherwise, the instantaneous action was not performed until the verb had been uttered.
3. Finally, in →│ actions (PUT DOWN ON, etc.), the accomplishment occurred at the end of a temporally extended process that was also part of the action. Two different descriptions occurred with these actions. In one, exemplified in *I'm pushing this down on*, the particle (*down*) was timed to occur in the middle of the action, just as in the case of → actions, while the preposition (*on*) was synchronized with the accomplishment itself; said otherwise again, the action continued past the verb and particle and as the preposition was uttered the terminus of the action was also reached. In the other pattern,

exemplified in *I'm picking this up,* there was no preposition, and here the particle was held back until the accomplishment. Thus, the preposition or particle marked the crucial endpoint that defines the action as an accomplishment, and when both were included, the temporal order of particle-preposition determined the marking segment. In all these cases the aspect is imperfective, indicated as such by the progressive, and the timing was such that the linguistic references to the action and aspect were all placed temporally *inside* the action.

It is significant that a verb particle or preposition controls the timing of the action and speech combination. According to Talmy (1985), English displays satellite, or particle, framing. In this it is unlike Spanish, for example, where verbs are the framing element. The distinction refers to the sentence component onto which the semantic content of path is mapped. In English, according to Talmy, this component is the particle, not the verb. That satellites appear to be central to English could explain their crucial role in forming the nexus of language and action in our experiment (the necessity of including the preposition to mark endpoints in some non-instantaneous accomplishments suggests that it is not only the satellite that is the focus). It would be valuable to carry out this experiment with speakers of Spanish.

Perfective aspect

Next consider the non-progressive verbs in the figure above. I will argue that these verbs had *perfective aspect* in the experimental context. In general, non-progressive verbs are *mirror images* of progressive verbs. This relationship of non-progressive to progressive, being systematic, suggests that the non-progressive forms were in fact conveying the perfective aspect, the outside view of the action (although this aspect is not officially marked).

4. With → actions (PUSH ACROSS, etc.) the verb (*I push*) was uttered during the action but the particle (*across*) was withheld until the action had been completed.
5. Similarly, with instantaneous accomplishments |, the verb (*I release*) was not uttered until the action had been performed.
6. Finally, with →| actions (PUT DOWN ON, etc.), the verb and particle (*I push down*) were uttered well before the action, which commenced only when the preposition (*on*) was uttered. In the non-progressive case, therefore, no

speech at all was uttered when the subject reached the logical endpoint of the action. The pattern was similar when there was no preposition (*I pick up*); here it was the particle that was withheld until the start of the action. In every case of non-progressive morphology, then, the outside view was taken by the particle, preposition or verb, which in every case was temporally outside the action (outside the endpoints in the accomplishment cases).

Here too the particle emerges as the significant part of the verb in anchoring its temporal relationship to the action and embodies the focus of the temporal perspective.

Timing

Finally, we note that, in the non-instantaneous cases of activities and accomplishments, actions that were described with imperfective progressives *occupied more time* than actions described with perfective non-progressives — 1.30 seconds and 0.85 seconds, respectively.

Summary of actions

To summarize, when actions of each logical type were viewed internally (the imperfective), particles, prepositions or verbs were timed to coincide with the action. This creates an inside 'view' from the vantage point of the particle, verb or preposition in question. The perspective of the speaker is distilled into that particular linguistic segment — a kind of 'L-center', similar to a P-center, but incorporating linguistic information as an integral component of the center. The concept of an 'L-center' can be linked to the idea of a growth point (see McNeill, 2002 for discussion). Doing so adds a dynamic (dialectic) dimension to the placement of the 'L-center' — it would be the point of maximal information focus and the conceptual starting point of the sentence. Such a model implies that perfectivity — the temporal shaping of the action — can be the core meaning or part of the core meaning of an utterance. And it suggests an iconic mechanism for achieving speech-action synchrony. The L-Center and the action combine to create an image of imperfective aspect. The growth point includes the temporal perspective and is actualized in real time as a pattern with action.

Equivalently, when actions were viewed externally (the perfective), the particles, prepositions or verbs were outside the action. This creates an outside 'view' also from the point of view of the particle, verb or preposition.

The morphological contrast of progressive vs. non-progressive marking on the verbs, combined with the logical type of the action, creates in this way *six aspect situations in English* (a language otherwise said to be weak in aspect coding).

Gesture description

The 'gestures' in this experiment were observed in a second condition, in which I induced virtual actions by having the subjects describe how they would carry out a given action or how they would imagine objects of various kinds moving if they manipulated them. The virtual actions and imagined movements were performed after the aquarium assembly task. The virtual action was tying a necktie (all male subjects). The objects and manipulations were: a multiply hinged tong and how it would move when squeezed; two overlapping irregular loops to be pulled apart to see if they formed a knot; a two-dimensional cutout to be folded into a three dimensional figure (the 'cutouts' presented as drawings). The subjects were not informed that gestures were of interest (the data were collected in the mid-1970s — a time when a gesture focus would not have been a particularly plausible guess). Nonetheless, gestures occurred in large numbers. Virtually all were mimicries of appropriate actions. The mimicries, as inferred from their accompanying verbs, were either → activities ("pressing down on") or →| accomplishments ("picking up"), there were no | achievements ("releasing", etc.).

The Vendlerian type of the action mimicked in the gesture determined the temporal location of the verb particle. With activities, the particle was produced at or near the end but always during the gesture. The L-center, in other words, remains within the mimicked action when it is an activity without a logical endpoint. With accomplishments, the particle was timed to be clearly after the action (these were all perfective; there were no progressive verb-accomplishment combinations in the data). The L-center was timed in an accomplishment to occur after the accomplishment itself. Thus it appears that, in imagining actions, the relative timing of gesture and speech, as with actual manipulations, creates conditions that generate aspect. Such relationships suggest that perspective and the logical texture of action affect the speaker's body motion.

The duration of the mimicries of activities was longer than the durations of accomplishments, and this too shows that gestures join with speech to create specific aspectual perspectives.

Overall summary

To summarize both experiments, motor control over action, both imagined and actual, is not independent of the linguistic dimension of aspect; action is kept in a determinate relationship to speech in terms of timing that conforms to the aspectual perspective the speaker is taking. Such an effect implies that action and speech are integrated activity streams converging at some central point in the nervous system.

Susan Duncan's studies of aspect

The linkage of aspect and motion observed in the results above also appear with narrative gestures depicting story-line events in a cartoon stimulus. Susan Duncan (Duncan, 2003) compared the gesture performance of Mandarin Chinese speakers under different aspectual regimes. This was possible since Mandarin provides explicit marking signals for perfective and imperfective aspects, and further distinguishes among the imperfectives between progressive and durative aspects. And gesturally, the same three-way distinction emerges: all gestures had motion event content; those that accompanied perfective verbs were relatively simple and brief; those with verbs marked for the durative were extended in time; and those marked for the progressive had some kind of recurring cyclic feature — related to the manner of motion. The time difference is identical to that between imperfective and perfective activities and accomplishments described actions above, and the agitation feature with some imperfectives in Duncan's data is paralleled by the non-functional actions added to accomplishments with progressive verbs. Moreover, the same gestural distinctions in aspect observed in Chinese performance were also uncovered in English. Armed with these gesture differences linked conveniently by Chinese to explicit aspect markers, Duncan could compare the gestures of English speakers in constructions that signaled different aspects — such as the periphrastic representation of durative aspect in "as he's coming up" and the past tense indication of perfective aspect in "he swallowed it" — and observed very similar gesture effects. The gesture effects — extensions, added motions — are reminiscent of the adjustments of the actions in the experiment described earlier. In this semiotic realm, as in actual actions, aspect induces differential control of motion.

Upshots

For 'being'

To conclude these pieces on aspect I can do no better than quote Merleau-Ponty (1962) for insight into the duality of motion and speech. Gesture is "not an external accompaniment of speech" but "inhabits" it:[3]

> "The link between the word and its living meaning is not an external accompaniment to intellectual processes, the meaning inhabits the word, and language 'is not an external accompaniment to intellectual processes'.[4] We are therefore led to recognize a gestural or existential significance to speech…. Language certainly has inner content, but this is not self-subsistent and self-conscious thought. What then does language express, if it does not express thoughts? It presents or rather it *is* the subject's taking up of a position in the world of his meanings" (Merleau-Ponty, 1962, p. 193; emphasis in the original).

We observe this 'presenting' or, rather, this 'being' of the speaker in his actions as they are taking form and being reshaped in realtime. We observe *body motion adapted to meaning*. This inhabiting is what we observe directly in how the speakers create an image of perfectivity through the combination in time of the L-Center and goal-directed action. It was through inhabiting the viewpoints of perfectivity and the different logical forms of action that the speakers controlled their hand motions.

For the brain

The on-line adjustment of speech to action and vice versa also points to a shared neurological mechanism, plausibly in the area of the brain that seems dedicated to orchestrating movement sequences under some meaning — both movements involved in speech and also movements in gesture and goal-directed action. When lifting up is interrupted to maintain synchrony with the linguistic segment "up", there is a process that can be coordinated within a localized brain mechanism encompassing the classic 'Broca's Area', including BA 44 and the adjacent area believed to house mirror neurons (BA 45), both of which are thought to have evolved from a single source (Rizzolatti & Arbib, 1998). The mechanism could be that the mirror neurons respond to the person's own action, and this provides further input to the speech mechanism and the resulting two-way encoding then keeps the two realms in contact and synchrony. Extrapolating from Duncan's findings with gestures as well as the mimicry gestures in the current study, the same mechanisms could organize

gestures also. The gesture would produce an echo in BA 45 and this be fed back into BA 44 for coordination. In both cases the cover of meaning, including goal-directedness of action, would be the basis for the orchestration of movement in BA 44. The concept of an 'L-Center' as the temporal linchpin that holds speech and action together in turn implies that the two streams of action in BA 44 (speech, manual) are orchestrated in common by the same growth points.[5] Indeed, taking the view assumed at the outset of this discussion, that the primary linguistic medium is coordinated action, the capacity to organize actions via such L-Center growth points could have been an evolutionary selection that made language itself possible.[6, 7]

Notes

* I am grateful to Bennett Bertenthal for comments on this paper.

1. Vendler also distinguished states, but states do not figure in the experiment to be described.

2. Various difficulties arise with the concept of an 'inherent temporal feature' that a full discussion would have to face, but these problems will be ignored here; see Klein's (1994) discussion.

3. I am indebted to Jan Arnold for this passage.

4. Merleau-Ponty's quotation is from Gelb and Goldstein, 1925, p. 158.

5. The growth point concept has been developed to formalize speech-gesture bundles but can be extended to include any orchestrated motor process, including, as here, goal-directed actions.

6. IW, a unique neurological case in which gestures and instrumental actions are dissociated, performs speech coordinated and synchronized gestures normally under conditions where instrumental actions are impossible for him, suggesting a language-thought-hand link in the brain; this link could have been the object of evolutionary selection. Without vision, instrumental actions are impossible for IW because he lacks topokinetic accuracy but he is able to generate spatial representations with morphokinetic accuracy, and this would be within the capability of the hypothetical sequential orchestration area of the brain. For a description of the IW case, see Gallagher et al. (2001). The evolution model suggested by the IW case and other considerations was presented by the author at "Gesture: the Living Medium", First Congress of the International Society for Gesture Studies, The University of Texas, Austin, June 7, 2002.

7. I should make clear that by linking gesture and action to a common source of organization in the brain, I am not saying that gestures are derived from actions; on the contrary, the dissociation of gesture and instrumental action in IW argues that, in the common brain areas

(proposed to be BA 44 and BA 45), they are separate processes that happen to share the same qualities of sequential orchestration under some significance.

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