

Hypothesis of this note	1
Forms of linguistic awareness.....	1
Awareness and core meaning.....	2
Feeling.....	4
Feeling and cohorts in speaking.....	4
Applying these ideas.....	6
Example 1. Speech errors	6
Example 2. Temporal gestures and ego-/allocentric memory.....	6
Example 3. Gestures improving memory	7
Example 4. Aphasia and brain model.....	8
Example 5. Second language	11
Conclusions.....	11
References.....	11

Hypothesis of this note

The origin of language profoundly changed the course of human evolution. I imagine everyone acknowledges this in one way or another. Language had roots in primate evolution but its origin was a unique event that has led us along paths traversed by no other animal. Psychological changes are among them. The hypothesis of this paper is that a special language memory is one major change. When language evolved, it created a new form of memory. We experience it daily as we speak. It is not the usual short-term memory. Neurological insults spare it the impairments the usual memory suffers. Its characteristic is that it is complex, yet extremely fast within a narrow temporal window. To understand its speed, complexity and window, we must consider its properties.

Forms of linguistic awareness

To begin, there are two forms of awareness in language. The new memory integrates them. A sentence, Wundt long ago described, has two aspects. There is a simultaneous awareness and also a sequential awareness, as the bits of the sentence come and go. Simultaneous awareness is present throughout and coincides with the new memory. Successive awareness, while constantly refreshed, has a sense of cohesion that stems from simultaneous awareness. So long as we are speaking this package is flawless. The sequential constantly disappears but the simultaneous is unchanging until it also vanishes when the sentence is done. As long as it is alive it keeps the succession of words together in a cohesive whole. At the end of the sentence, a presumably general-purpose, longer-term memory takes over, and a new sentence can begin.

From a psychological point of view, the sentence is both a simultaneous and a sequential structure. It is simultaneous because at each moment it is present in consciousness as a totality even though the individual subordinate elements may

occasionally disappear from it. It is sequential because the configuration changes from moment to moment in its cognitive condition as individual constituents move into the focus of attention and out again one after another. (Wundt 1970).

Wundt spoke of the “sentence” but it is actually a “growth point” or GP. It need not be a grammatical unit like a sentence. A phenomenological understanding is the proper way to get at it (Merleau-Ponty 1962). Simultaneous awareness is accompanied by a feeling of inhabitation; the speaker inhabiting this memory. It is this we experience and it lets us know we are still in the memory unit. GPs are its content. The successive awareness is more than a succession and is glued together by simultaneous awareness.¹

AWARENESS AND CORE MEANING

Growth points are minimal gesture–speech units, and are products of how language itself began. They were adaptive, especially in family life and the raising of children, not as gesture or as speech, but as units of gesture and speech together. It is of this gesture–speech unit that awareness is simultaneous. Theories differ over the origin of language, but basically there are only three positions. Many today posit gesture-first, an initial language of gesture that speech eventually arose to supplant. In earlier years many held a speech-first view (theories absurdly named bow-wow and yo-heave-ho) but they mercifully have mostly disappeared. The GP takes neither position. It posits *gesture-speech equiprimordiality* (a term coined by Liesbet Quaeghebeur, pers. com.). Gesture imagery with speech is what natural selection chose, acting on gesture–speech units.²

Gestures of course do not always occur. This is itself an aspect of gesture. The underlying reality of gesture is imagery. It is visuoactional imagery, realized in motions typically of the hands, although other parts of the body may also be involved. There is a natural variation in gesture occurrence. Apart from forced suppressions (as in formal contexts), there is a continuum of elaboration. The degree of it is part of the gesture. It parallels a second continuum – the extent to which the gesture adds a communicative “push” to the utterance, what Firbas (1971) called communicative dynamism. At one end, very elaborate gestures (two hands in different roles, reenactment, multiple movements and complexity) participate at the highest levels of communicative dynamism; at the other end, where communicative dynamism is minimal, elaboration tends to toward zero, to no motion at all, yet this is not a lack of gesture. It is the minimum of concrete enactment. To speak of gesture–speech unity we intend a statement that covers all linguistic actions, with all different degrees of elaboration.

The GP is alive from the beginning of the gesture preparation (there is no other reason the hands take their shape than to make the gesture stroke, even though it is not delivered until later). This GP minimal gesture–speech unit stands over the whole, including where, obeying the construction evoked to unpack it, itself lies. If you

¹ Other forms of linguistic awareness exist, such as linguists thinking of verbal forms or someone doing a crossword puzzle. However, simultaneous and successive awareness fit the situation to which the GP also applies, the ordinary use of language in daily social discourse.

² This theory is argued for in numerous places, most extensively in McNeill (2012a), in a blog (McNeill 2012b), in a paper posted on Research Gate (McNeill 2013) and in an exchange on this paper (Lopez-Ozieblo & McNeill 2013).

visualize a suspension bridge with a tower in the middle, cables on either side supporting it, this tower is the GP in its particular place. This is in successive awareness. The cables are its presence over the whole, and this is in simultaneous awareness. The awareness of the sentence is even more than the two layers, simultaneous and successive. They interconnect. The cognitive core, the GP, is over the whole and also is located at a particular point. In this sense the GP, identified with gesture–speech unity, is coextensive with simultaneous awareness. And the GP, located at particular point, is the unity in successive awareness. The GP in this local sense is also called the L-center. The term “gesture–speech unity” accordingly has dual temporal reference, and does so for a purpose. The GP covers the entire utterance including its unpacking into a construction. The unpacking is *of* the GP and depends on it. And the GP is located at a particular place in it where it is experienced successively. The L-center is shown later in Example 2 forming “temporal gestures”.

Built into linguistic memory are the workings of the GP, and it is inherently complex – the differentiation of newsworthy psychological predicates in fields of meaningful equivalents are automatically part of it. All of this is one unit of linguistic memory. While content varies, it has this functional organization. The truism that memory is better in context thus misses the deeper fact that memory is not simply “better” with context; the special linguistic memory does not exist without it. With a decontextualized memory test, this evolved memory is not tapped at all. This conforms to Cowan’s (2001) and Oberauer’s (2007) conceptions of immediate memory as a functional unit.

The gesture phrase displays the span of simultaneous awareness and its temporal window in the record of gesture and speech (the cables). This interval includes all the construction and words that are unpacking the GP. The stroke of the gesture and its synchronous speech are the GP in successive awareness (the tower). Here is an illustration (“and Tweety Bird runs and gets a bowling ball and drops it down the drainpipe”):

(1) “and Tweety Bird runs and gets a bowling
ba[GP & memory window in simultaneous awareness open, successive awareness of individual words
begins ll and \emptyset_{tw} drops
GP in successive awareness opens it down GP in successive awareness closes
the drainpipe]GP & memory window close in simultaneous awareness and change to long term,
successive awareness vacates”

Preparation for the stroke began in the middle of “ball”, in the preceding clause, and retraction ended at the right bracket, the hands reaching a rest position, memory then transferring to a longer-term, less inhabited mode. The span does not always coincide with a linguistic unit, as it did not in this case (the whole gesture phrase and memory window touching two clauses and, in the second clause, the stroke, the meaning-focused part, spanning two constituents).

The gesture phrase, from preparation (left bracket, to the start of the boldface), through the stroke (boldface), to retraction (end of boldface, to right bracket), is the span of simultaneous awareness and linguistic memory. It contains the GP in successive awareness (“it down” plus the imagery-conveying gesture stroke) and the GP’s

unpacking into linguistic form (“...ball and drops/GP/the drainpipe”); the whole “ball and drops it down the drainpipe” is simultaneous awareness in this case.

Sometimes, although not in this example, the hands inch forward on a knee or armrest at the end of retraction, even though they could have stopped where they are. It looks as if simultaneous memory was still active, pushing them forward in a minimal way before it empties. These lingering retractions suggest a linguistic memory that has its own switch-off (also see Example 3, below).

Feeling

Another way to approach linguistic memory is in terms of feeling. This turns out to be the key to its speed. Wm. James (1890) used the term and spoke of its fringes and overtones. He wrote of the feeling of “and” (roughly, more to come) and “but” (contrariness). These are not the systematic *langue* features of the words but a channel into them, via one’s own inhabitation. Feelings apply to gesture–speech unity. Feelings and inhabitation open the very fast winnowing and meshing that fill speech with words and constructions. Using a phenomenological concept, feeling is our sense of being and the shades it takes, an *awareness of one’s own momentary being in language*, inhabiting a gesture–speech unit with all that it contains in both simultaneous and successive senses.

FEELING AND COHORTS IN SPEAKING

With the concepts introduced – awareness, feeling, gesture–speech unity, inhabitation – we can address the mystery of how words and structures, so quickly, pop up during the unpacking of GPs. The information load – all things considered (sounds, words, constructions, gestures) – is high. Hesitations and errors reflect the burden, so it is wrong to say the emergence is flawless, but there is, on the whole, a remarkable speed and accuracy to this memory process. Speaking is the living demonstration of it. I have always regarded this as a great mystery.

A discovery by William Marslen-Wilson (1987), the “cohort effect”, suggests a possible solution. Just as words are recognized, as they are experienced, in a very fast winnowing of a cohort of known words compatible with the sequential left-to-right phonetic input up to that moment (“captain” triggers a cohort of some 7 words up through the “capt-“, all simultaneously active, as experiments show), could not something like this also take place with constructions when speaking? What would be the cohort? Here we turn to Saussure. He considered the synchronic approach a methodological axiom of *langue*. *Langue* is the systematic aspects of language – to see the system of language, in which only differences matter, it is necessary to see *langue* laid out all at once – but could this also be a psycholinguistic axiom? The parts of *langue* a feeling inhabits is the “cohort” on a given occasion. This cohort is not accessed, as is speech input, in strict temporal order but all of the axis of selection alternatives of a given inhabitation are alive and accessible at once (cf. Jakobson 1960).³ For example, a feeling of Making Something

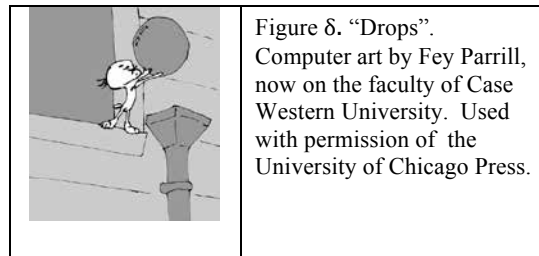
³ Implying another form of linguistic memory, a static memory in which *langue* is available all at once. Such a memory appears to be required logically. While not insignificant, it need not be vast: the

Happen winnows *langue* down to the causative construction with slots for the Agent, Cause, Object and Goal to articulate the GP’s unpacking:

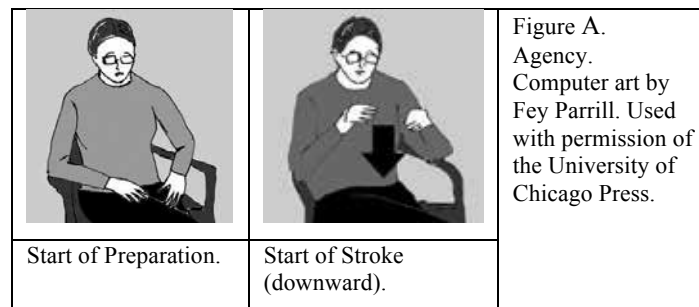
(γ)	Construction:	Agent	Cause	Object	Goal
	Output:	\emptyset_{tw}	<i>drops</i>	<i>it/the b-ball</i>	<i>down the pipe</i>

And words? They are summoned by feelings as well, in productions evoked all at once also (the left-to-right phase coming at the end, in articulation, does not affect memory speed). The cohort effect has been defined for phonetic elements but words are thicker. The concept of a “lemma” applies (Levelt 1989) – feelings attach to lemmas, sound patterns and grammatical potentials (both the axis of selection and the axis of combination) and intentions and presuppositions.

Moreover, constructions and words accessed in these ways work on each other in the winnowing of both, further speeding things. We see this in “it down” – the verb, “drops”, part of the construction, won over alternatives like “thrusts” or “pushes”, because it added something the construction needed but did not have on its own, that in the cartoon story Tweety had released the bowling ball, letting gravity do the rest; “thrust” and “push” contradict this (“release” or “insert” could have survived on this score, but had their own obstacles – three syllables for “releases”, less clarity about the downward direction, and an academic tone).



The gesture was truly novel. The speaker’s hands did not mimic Tweety’s in the cartoon. From the onset, in the midst of saying “ball”, in the preceding clause, the speaker’s hands were arched down, to thrust the ball downward, answering a feeling of agency and summoning a cohort of constructions in which agents can appear (“drops” then opening it to the effects of gravity). Thus the gesture gained immediate access to the cohort of constructions that included caused-motion and helped the verb by carving out a slot for it.



phenomenon of priming implies that favored words and forms recur, highlighting a contextually alive subset of total *langue* and so minimizing the load on this aspect of memory.

Applying these ideas

EXAMPLE 1. SPEECH ERRORS

A cohort will often have more than one construction. Thus the possibility of error arises. Within constructions word errors also occur. Construction error involves simultaneous awareness, word error successive. Spoonerisms are of the successive type (“the queer old dean” for “the dear old queen”, or “you hissed all my mystery lectures” for “you missed all my history lectures”). The same applies on various levels in examples collected by Fromkin (1973) – “Rosa always date shranks” [Rosa always dates shrinks” – disordering past tense], “muddle” [blend of “mud” and “puddle”]. “Omnipotent” is a kind of hybrid of the simultaneous and successive: two words from the same equivalence class in simultaneous awareness blending rather than one surviving in successive awareness (“omnipotent” and “omniscient”).

Errors with constructions entirely in simultaneous awareness also occur. An instance is the “nurturing” example (Dray & McNeill 1990), where a cohort winnowed to a wrong construction, which the speaker rejects:

(α) The fact [that she’s . . .] [she’s nu- uh]

(β) [. . . she’s somehow. . . she’s] [done this nurtur] [ing] [thing and here you]

Brackets are the winnowing gestures – repeated spatial metaphors of rearrangement. The speaker was describing the nurturing actions of a third party that she found cloying and intrusive, and this feeling of uselessness was led her into a cohort. The problem was a mismatch at (α) of the transitive construction to the field of meaningful equivalents. Transitivity means, roughly, that the action has a direct transformative impact via nurturing on the recipient of the action. However, this meaning distorted the idea the speaker wanted to convey – something that would differentiate a field of meaningful equivalents more like *HER OTIOSE ACTS*. Further winnowing led to the slight but successful updating in (β) that separated effect from act.

EXAMPLE 2. TEMPORAL GESTURES AND EGO-/ALLOCENTRIC MEMORY

We also observe gestures winnowing cohorts when the speaker is acting and describing his actions at the same time, trying to keep speech and action together (McNeill 2003). The speaker’s feelings of being outside or inside the action – the feeling of *-ed* and *-ing*, the perfective and imperfective aspects – recruit this cohort. The gestures that winnow it are “temporal gestures”. They appear in the relative timing of speech and action and embody the outside or inside feelings. Extensions of actions with nonfunctional movements are an important clue to what is involved in the construction of temporal gestures. The imperfective view of a picking-up action implies regarding it from its inside and a rocking motion can be added to symbolize the interior of it, inventing a manner of movement (rocking) that is not logically part of it. Or prolonging the end of picking up via an upward hop, which again makes the action seem like it is not over at the moment it is described, also answering an imperfective feeling.

Temporal gestures include “L-centers”. A L-center is the GP where it surfaces in successive awareness, as in “it down” plus the downward stroke. It is an observable surface phenomenon. Inspired by the “P-center,” or perception center (Morton et al. 1976), it is the temporal locus of consciousness concentrated on a particular linguistic–imagistic combination. At the L-center an open and unfinished quality of consciousness exists. The L-center is not always a grammatical unit (“it” and “down” belong to different sentence constituents). It is nevertheless the focus of attention and stands out – the tower – to anchor the simultaneous awareness of the whole in a word or words, in a way that the other words, the “ball and Ø_{tw}/down the drainpipe”, only in successive awareness, do not. It is the point where consciousness feels unfinished, as opposed to the role of pure successive awareness, which is that of finishing consciousness. The L-center linguistic segment(s), like other successive awareness segments, come and go, but unlike the others they also anchor the simultaneous awareness of the sentence to this particular moment of unfinished expectation, and in this way have a simultaneous presence as well.

We see how quickly the linguistic memory process goes. If the feeling is from the outside, the temporal gesture is timed to occur after the verb or satellite, and *-ed* survives. If the feeling is inside, the gesture occurs during or before the verb, and *-ing* survives. More realistically, it is verbs as wholes with their corresponding inflections already attached that form the cohort, temporal gestures and feelings of inside or outside winnowing them down to one appropriately inflected verb. There is a three-sided synchronization: motion in speech and action, plus these linguistically encoded perspectives: all of this in close temporal alignment.

Linguistic compared to environmental spatial memory shows interesting similarities and dissimilarities. Gestures are inherently spatial. They occupy a place in front of the speaker, and can be seen to be oriented around reference points in this space. Gesture–speech unity enables the gestures that winnow cohorts to combine two properties of spatial memory that, in non-linguistic spatial cognition, are typically separated, egocentric spatializations relative to one’s own position and allocentric spatializations relative to landmarks (for ego- and allocentric, see Byrne et al. 2007). Both are in gesture. L-centers are moveable and depending on their location the space is egocentric or allocentric or both. With imperfective aspect the space is egocentric, the L-center placed within the ongoing action. Perfective aspect is indexed with non-progressive verbs, and L-centers of this kind were placed after the action. This space is allocentric: the L-center placed relative to the action’s end as the landmark. In addition, the actions themselves are longer with imperfective aspect, even when the same logical form of action is involved (cf. Vendler 1967). This involves both ego- and allocentric space. Non-functional movements are added to help create the imperfective aspect, and both speech and action timing are adjusted to create the aspectual viewpoint. Again, gesture space is both ego- and allocentric in the same gesture–speech unit.

EXAMPLE 3. GESTURES IMPROVING MEMORY

We can apply this reasoning to a discovery by Goldin-Meadow et al. (2001), that memory for something improves if you talk about something else and perform gestures as you do. Gestures may provide some positive benefit to memory. They increase the materialization

of GPs and may foster enlarged memory functionality. This also may extend to any incidental information floating by in general purpose memory. But there is a second, more direct benefit of gestures within linguistic memory to incidental information in particular. Gesture both possibly enhances the GP but also, by commandeering forgetting, protects incidental information. If linguistic memory changes state not during the 1~2 s span of the memory window but discretely, when the window closes at the end of the gesture phrase, then information can be lost and incidental information in general purpose memory benefit. When there is no gesture memory undergoes less state change, either because the sentence has low communicative dynamism or because no end of a gesture phrase is reached, incidental information receives less benefit. Since incidental information is not in a GP-cycle it does not take part in this state change. So, paradoxically, it is not lost, and as a gesture clears memory of information, more incidental information is retained when there is a gesture than when there is not, and this is the Goldin-Meadow et al. finding. The experiment moreover makes clear that the explanation is because linguistic memory empties promptly when the temporal window closes and is not because of low communicative dynamism. The experiment compared spontaneous non-gestures, those which likely occurred with minimal communicative dynamism, to imposed non-gestures, which would be distributed randomly with respect to communicative dynamism, and found the same reductions of incidental memory. So the effect is uncorrelated with communicative dynamism, which leaves discrete forgetting of linguistic memory at the end of the temporal window as the main factor sparing incidental information.

Looking at the flipside of the effect, if the materialization of GP imagery in gesture encourages a memory state-change, then no gesture should make this change less likely and/or less robust. The contents of the focal task should then be still “in memory.” So, somewhat counter-intuitively, no-gesture trials should show longer-lasting memory for the focal task (and poorer memory for the incidental task, as Goldin-Meadow et al. show). It is not known if this prediction holds, but it is a test of the explanations here of the gestures-benefit effect.

EXAMPLE 4. APHASIA AND BRAIN MODEL

Conceivably two aphasias result in part in impairments of linguistic memory, fluent Wernicke’s and disfluent Broca’s. They would have opposite impairments, Wernicke’s in simultaneous awareness and spared in successive: fluency with disrupted content follows; Broca’s in successive awareness and spared in simultaneous; disfluency follows, but what speech there is showing a totality that is gesture–speech unity. The Wernicke description fits the following patient’s fluent but disjointed and mostly-successive speech (this is his entire narration; data and transcription by Laura Pedelty, MD; quoted with her permission and permission of the University of Chicago Press from McNeill 2005):

a little tooki tooki goin to-it to him
 looki’ on a little little tooki goin’ to him
 it’s a not digga not næ he weduh
 like he’ll get me mema run to-it they had to is
 then he put it sutthing to it takun a jo to-it
 that’s nobody to-it

I mean pawdi di get to-it she got
 got got glasses she could look to-it
 to set something to in to-it to a to a got in to-it
 to a duck to-it
 hit on hit him on nice to him
 then she just sent to 'im
 to ah my knowledge anyway
 she trie to get the little little ah ak it t- t- tush t- t- take it
 the part of the gun ta- take a part of a gun she's tryin' a take up a he got into a puky
 she was trying to be that she was going to take
 to make d- her take the part of the little ton't litle the gar gen to-it little little
 little little like puss to-it
 that's all I tooki
 an' run someplace
 she dropped hi baggage up
 she 'member that she was to-it
 nothin' but a byum that's all
 'n I lef' the whole damn the whole damn
 side look bloorep 'n to-it I use to
 look I look at it way day way took
 I look to-it
 ju' a little ol' toy
 with tappn'
 why he ed take the part of 'im
 an' they give 'im away to 'im
 they gvme him an' they they find out who it was
 it was a no no 'n that was
 bammed up
 an'
 that was all to-it

A Broca's patient in Pedelty's study, in contrast, shows accurate word retrievals but limited successive memory, and with it awareness of the totality that simultaneous awareness captures:

"cat - bird? - 'nd cat - and uh - the uh - she (unintell.) - 'partment an' t* - that (?) - [eh ///] - old
 uh - [mied //] - uh - woman - and uh - [she] - like - er ap - [they ap - #] - cat [/] - [an' uh bird
 /] - [is //] - I uh - [ch- cheows] - [an' down t' t' down]".

The speaker was describing the bowling ball scene. Clearly, she was able to remember many details and gestures occurred at several points, indicated with square brackets, and they convey newsworthy content. Inhabitation of gesture-speech unity was taking place.

In a brain model where the Werinicke's and Broca's differing memories fit, the neurogesture system includes both the right and left sides of the brain in a choreographed operation with the following parts (referring to uninjured brain function):

- The left posterior temporal speech region or Wernicke's area supplies categorial content, not only for comprehension (as classically supposed) but for the creative production of verbal thought.
- This content becomes available to the right hemisphere, which seems particularly adept at creating metaphor and imagery, and at capturing discourse content (McNeill and Pedelty 1995). The right hemisphere could thus play a central role in the creation of growth points. This is plausible since GPs depend on the differentiation of newsworthy content from context, require the simultaneous

presence of linguistic categorial content and imagery (both of which seem to be available in the right hemisphere), and incorporate metaphoricity as a property. Metaphoric gestures, like the so-called “conduit” (Lakoff & Johnson 1980) could be formed there as well. However, gestures themselves arise from the anterior left hemisphere or Broca’s area.

- The prefrontal cortex may play a role in constructing fields of equivalents and psychological predicates, and supplying these contrasts to the right hemisphere, there to be differentiated by GPs. Such a role suggests that language depends on processes that are also crucial for discrimination and choice, for resisting impulsive action, and by extension on moral and social cognition. The prefrontal cortex develops in children slowly, and in fact does not reach a level of synaptic density matching the visual and auditory cortex until about the same age that self-aware agency appears and with it, per hypothesis, GPs differentiated from fields of equivalents.
- Underlying the rhythmicity of speech “pulses” (cf. Duncan 2006) and interactional entrainment (cf. Gill 2007), to which we add GP’s onswitching, following the strong urgings of Lieberman (2002) that subcortical areas were important to the origin of language, we assume a continuous circulation of cerebellum inputs and feedback.
- The results of all this processing (right hemisphere, left posterior hemisphere, frontal cortex, cerebellum) converge on the left anterior hemisphere, specifically Broca’s area, and the thought–language–hand circuits there specialized for the orchestration of actions (such as oral and respiratory movements) under meanings other than those of the actions themselves (chewing, swallowing, breathing) – the essence of speech using vegetative centers.
- Broca’s area may also be the convergence point of two other aspects of the imagery-language dialectic – the generation of further meanings (like “caused-motion,” “expanded noun phrase,” etc.) connected to constructions and intuitions of completeness that provide the “stop orders” to the GP’s dialectic.

All of these – left (front, rear), right, prefrontal – can be called the “language areas” of the brain. The particular anterior left-hemisphere (Broca’s area) specialty is not “language” per se (it draws on many areas) but the ability to use thought, language, and imagery to orchestrate actions under significances.

Typical item-recognition memory and production tests would not tap these other brain regions but discourse, conversation, play, work, and the exigencies of language in daily life, where language originated, would. For this reason, some stroke patients, given decontextualized word memory tests, can flunk badly while continuing to speak fluently. The specific linguistic memory is spared even when the general-purpose memory is impaired. Neurologists tell me that a sparing of speech while decontextualized short-term memory is impaired is a recognized condition; here we explain it. Medical practice would do well to administer tests of specific linguistic memory in order to quantify it. Impairments of different degrees may have unique implications for diagnosis, treatment and prognosis.

Byrne, Becker & Burgess (2007) encompass a range of brain regions in their mathematical model. It would be interesting to try incorporating gesture–speech unity

into it. I don't know what modifications this would entail but the possibility they would be fundamental cannot be ruled out in advance.

EXAMPLE 5. SECOND LANGUAGE

A step to mastery of a new language would be when the student can use the linguistic memory which she has for L1 now in L2. Thinking in a new language is said to be a hallmark of mastery. This seems to require the simultaneous awareness of the sentence in L2. However, there are subtleties. Successive awareness is equally part of thinking, since the GP is also anchored there, not to mention the unpacking, which has its own role in thinking but may have a different learning time-course. Simultaneous memory is filled with GPs, the constructions that unpack them and the feelings that recover those. The result is a sense of inhabiting the new language. Once inhabitation is reached the language in some sense has been "mastered". Successive memory, however, may be incomplete. It depends on vocabulary size and appropriateness. Immersion may do the trick here. It seems that high levels of "mastery" of simultaneous and successive awareness are needed as well to produce the mutual construction-word assistance the "it down" example demonstrated. And equally, the formation of temporal gestures with L-centers needs both kinds of awareness (moreover, languages may differ in what they offer in the way of temporal gestures – I imagine Italian or Turkish and other less-constrained word order languages have more opportunities than languages like English – and this is another dimension of mastery). Finally, with good simultaneous awareness and inhabitation but blocked successive awareness, a sense of a bottleneck arises where the speaker knows what to say but frustratingly not how to say it. "Mastery" in any case is a vague concept, the two awarenesses coming to L2 on their own time scales with their own different aspects of the new language, their interactions yielding a host of mastery points.

Conclusions

Memory is far from passive. It is dynamic, as we see in the constant adjustments of action, speech and perspective, yet is rapid, effortless and mostly free of error. It has the hallmarks of a special memory evolved as part of language. Gesture–speech unity is the content of simultaneous memory, and is accompanied by "feelings" such as that of Making Something Happen. The feelings attach to constructions, here caused-motion, and rapidly winnow cohorts of constructions and the words that fit into them, and in this way offer an account of a mystery of human memory, how words and structures so suddenly emerge in speech.

All this is the evolved special memory of language. It is not the general-purpose short-term memory of non-language that serves all else but is a gift of language itself.

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