The Mystery of Motivation

Peter Ford Dominey: The tip of the language iceberg

Issue: Not just how we got to language but also
“What motivated us to communicate in more and more detail?

Tomasello: From Instrumental to Declarative Communication

Learning from Sign Language

Wendy Sandler: Viva la différence: Sign language and spoken language in language evolution

Karen Emmorey: The neurobiology of sign language and the mirror system hypothesis
**A Bridge from Action to Syntax**

**ASL: American Sign Language**

The use of **signing space** to represent observed/imagined space

![Diagram showing signing space: HOUSE located here and BIKE Located here](image)

The bike is near the house

Adapted from slide supplied by Karen Emmorey

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**Sign Language: A Wealth of Effectors**

Carol Padden says:

“It’s hard to appreciate how fast signers can get if you are not already a signer.”

From Wendy Sandler

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*extracted text*
**Spatial attention & signing space**

Almor, Smith, Bonilha, Fridriksson, and Rorden (2007): Using fMRI, they found that reading pairs of sentences (visual coding of speech!) with repeated names elicited more activation than pronouns in the middle and inferior temporal gyri and intraparietal sulcus.

They suggest that the latter activation is related to **spatial attention and perceptual integration**.

We suggest that this may relate to the use of signing space.

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**A Model of Visual Scene Description: SemRep and Template Construction Grammar**

![Diagram](image)
Learning from Linguistics

a) Acquisition of Language
b) Grammaticalization

Holger Diessel: Where does language come from? Some reflections on the role of deictic gestures and demonstratives in the evolution of language

Linking demonstratives as a syntactic category to the physical action of pointing (Again: language is multi-modal)

Pointing is a crucial human gesture for sharing information that is not seen in nonhuman primates in the wild

As Diessel observes: Demonstratives “constitute a unique class of expressions that speakers of all languages use in combination with pointing gestures to establish joint attention, a cognitive … [process essential for] imitation. They are used not only to direct the interlocutors’ attention to concrete entities in the outside world, … but also to organize the information flow in discourse, which in turn leads to their development into grammatical markers.

Language acquisition: The gestural use of demonstratives provides a powerful mechanism for the child to engage in verbal activities with a limited vocabulary. With age, language becomes more independent from gesture and situational cues though demonstratives continue to play an important role even in adult language.

Grammaticalization: Demonstratives in the emergence of grammar – strengthens relevance of grammaticalization to MSH since Diessel argues that demonstratives have to be kept separate from both content words and function words.
**Learning from Apraxia and Aphasia**

Mariella Pazzaglia: Action and language grounding in the sensorimotor cortex

Alena Stasenko, Frank E. Garcea, and Bradford Z. Mahon: What happens to the motor theory of perception when the motor system is damaged?

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**A Conceptual Model for Apraxia**

*(Rothi, Ochipa, and Heilman, 1991)*

An action may be imitated via the

- *indirect route* in which mirror neurons (in the *input praxicon*) activate known motor schemas (the *output praxicon*) or
- *direct route* in which the action is imitated as an assemblage of meaningless gestures

The right-hand side should be augmented by an *action buffer*
“The Wrong Way Round”

Rothi et al.:

★ Using the Patterson-Shewell model of language (word repetition) to inspire a model of praxis (imitating an action)

Our enterprise:

★ To understand language through an evolutionary account grounded in praxis.

But we did not evolve to make meaningless gestures

Hypotheses:

★ The direct route evolved so that familiar *tweaks* (small intransitive movements that are frequent components of many actions) could be used to adjust a known action to better match an observed novel action

★ yielding much faster adaptation than trial-and-error learning in a vastly larger motor search space

★ The direct route was later exapted for novel gesture imitation

The direct route is, in evolutionary terms, more sophisticated than the indirect route

★ the passage from the common ancestor with monkeys to humans involves the ability to dissociate (some) motions from explicit goals
The Theory of Tweaks

A Key Change of Perspective

Not direct path or indirect path

But direct path and indirect path

New clinical studies are needed to probe the integration of the 2 routes
Hartmann, Goldenberg et al. (2005): “It takes the whole brain to make a cup of coffee.”

Subjects were asked to prepare coffee with a drip coffee maker and fix a cassette recorder, tasks which differentially involve retrieval of functional knowledge from semantic memory, inference of function from structure, and solution of multi-step problems.

**Aphasic left brain damaged patients:**
- Difficulties with making coffee were correlated with aphasia and with defective retrieval of functional knowledge from semantic memory.
- Coffee making showed strong correlations to tests of verbal abilities and to non-verbal tests of functional knowledge, suggesting that these associations reflect the difficulties in retrieving script-like instructions for use from semantic memory.

**Right brain damaged patients:**
- Particular difficulty in keeping track of multi-step mechanical problems which were stressed more by the cassette recorder task, despite the flawless performance of these patients when asked to demonstrate the use of single tool-object pairs like key and padlock.
- Fixing the recorder depended less on scripts and more on trial and error [and working memory to keep track of progress] than on retrieval of instructions.

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**Learning from Archeology & Anthropology**

Benoît Dubreuil and Christopher Stuart Henshilwood: Archeology and the language-ready brain

Chris Sinha: Niche construction, too, unifies praxis and symbolization
Linking the Evolution of Tool Use and Language: A Preliminary Hypothesis

The Oldowan was limited to simple imitation and communication with a limited repertoire of vocal and manual gestures akin to those of great apes.

The early Acheulean was transitional between simple and complex imitation, with the transfer of skills being limited in depth of hierarchy; these protohumans communicated with a limited repertoire of gestures not much larger than those of a group of great apes.

The late Acheulean was the period in which complex imitation was consolidated and communication gained an open-ended semantics through the conscious use of pantomime, with increasingly rich memory structures holding hierarchical plans for both praxis and communication.

From 200 kya to 50 kya (more or less)

Homo sapiens emerged around 200 kya and was the first species of Homo with a language-ready brain.

However, it took more than 100,000 years for the developing power of protolanguage to yield the first true languages with their consequent impact on the acceleration of cultural evolution.

Sinha agrees but Dubreil & Hinshelwood want to push language back much further.
Symbolic use of pigments

Archeologists at Blombos found the remains of what appears to be two toolkits for creating ochre pigments, located very close together and dated to 100,000 years ago. Ochre is used by people as pigment in all parts of the world.

The abalone shell Tk2-S1 in situ before excavation with an ochre covered grindstone on the shell lip. Note the red color of the ochre on the shell. Five fragments of pigment dated between 400 - 260 kya show traces of use.

Dubreil & Hinshelwood: “If pigment use is an archaeological indication of symbolic behavior … and indirectly of language [danger!], then the origin of these abilities, traditionally attributed to Homo sapiens has to be considered more ancient than commonly accepted.” Fascinating data but note that sudden jump to “language.”

Counter-claim: Protolanguage would suffice for the relevant social interactions.

Needed: A cognitive archeology in which to locate language

Ongoing issue: What can we learn about language from traces of objects?

a) We try to infer behavior

b) What then of the communication that might have made it (or its transfer) possible?

Editors:
Sophie A. de Beaune, Université Lyon III
Frederick L. Coolidge, University of Colorado, Colorado Springs
Thomas Wynn, University of Colorado, Colorado Springs
A musical origins theory

But What About Music?

The (Extended) Mirror System Hypothesis: a path from praxic use of the hands via communicative gestures, pantomime, protosign and protolanguage

What is missing includes:
- A concern with prosody and the musical aspects and linkages of language

A promising observation: Embodied language evolves in time so that the necessary brain mechanisms are in place to adjust tempo and its variation

The Mirror System Hypothesis: Language is a multimodal system
- it evolved via many stages,
- much of what we now think of as essential to language is post-biological

A Possible Corollary for Discussion: To place music in evolutionary perspective we must view it as a multimodal system in which movement of body and voice are intertwined
- it evolved via “protodance” as much as “protosong”,
- much of what we now think of as essential to music is post-biological
### Darwin on "Language" in The Descent of Man (1871)

1. **A greater development of proto-human cognition**
   - Counter-point: an expanding spiral between protolanguage and cognition

2. **The evolution of vocal imitation** used largely "in producing true musical cadences, that is in singing". He suggests that sexual selection played a crucial role – that the capacity to imitate vocally evolved analogously in humans and birds.
   - Counter-point: sexual dimorphism is strong in birdsong, weak in human language

3. **Meaningful words would then emerge** via “the imitation and modification, aided by signs and gestures, of various natural sounds, the voices of other animals, and man’s own instinctive cries”
   - Counter-point: The semantic range here is far narrower than that offered by pantomime.

### Tecumseh Fitch and Musical/Prosodic Protolanguage

Fitch offers a modernized version of Darwin’s theory which he sums up as

**Phonology First**

His theory disagrees with mine on two counts:

- He argues that protolanguage evolved in the vocal domain
- He argues that the initial “musical” protolanguage was without meaning

but agrees on one count

- He sees meaning as initially being holistic, associated with phonological patterns, with words emerging from protowords via something like the “Wray-Kirby mechanism”

By contrast I argue for

**Semantics First**

- pantomime without phonology – then suggest that conventionalization (faster/less ambiguity) led to motor patterns whose fractionation yielded both phonology (duality of patterning) and the passage from protowords to words
Where did Human Song Come From?

At least six species have evolved vocal learning in the context of “song”
- including parrots, songbirds, whales, seals, hummingbirds
- … and humans

Fitch: Since it is “easy” to evolve a song system, it makes sense to hypothesize a musical protolanguage in the vocal modality

Arbib: Since both manual dexterity and language are unique to humans, it may be the coupling of hand and voice that gave humans the faculty of speech where other creatures have only song.
Alternatives for debate:
- a songlike system and a protosign system emerged independently and then came to reinforce each other;
- evolution of the human articulatory apparatus was greatly facilitated by the emergence of protosign which then catalyzed the emergence of protospeech

In any case, we can learn from songbirds
### Current Controversies and the Challenges of Multi-Disciplinary Research

- Isn’t it time we abandoned the idea of an innate UG?
- What are the Key Processes that made language emergence, acquisition and use in conversation possible?
- Was the path to speech indirect?
- Is a “words alone” approach viable for evolinguistics?
- Is there an approach to grammar that fits well to the study of brain mechanisms?
- How can niche construction illuminate processes that formed the language-ready (culture-ready/cognition-ready) brain?

- Praxis and Communication
- Social Interaction
- Comparative Neuroanatomy
- Genetics
- Psycho- and Neurolinguistics
- Computer Modeling
- Historical Linguistics
- Language Acquisition
- Emotion and Motivation
- Sign Language
- Apraxia and Aphasia
- Archeology & Anthropology
- … and Many More