

# The role of talking to oneself in the evolution of language

---

**Marco Mirolli, Domenico Parisi**

Institute of Cognitive Sciences and Technologies,  
National Research Council  
Via San Martino della Battaglia 44, 00185, Rome, Italy  
[marco.mirolli@istc.cnr.it](mailto:marco.mirolli@istc.cnr.it)

# Overview

---

- Language as a cognitive tool
- Computational modelling
- Possible roles of talking to oneself in language evolution (speculations)
- Conclusion

# The adaptive function(s) of language

---

- Not much debate
- Common assumption: Language is for communication
- What else?
- Language is (also) a cognitive tool

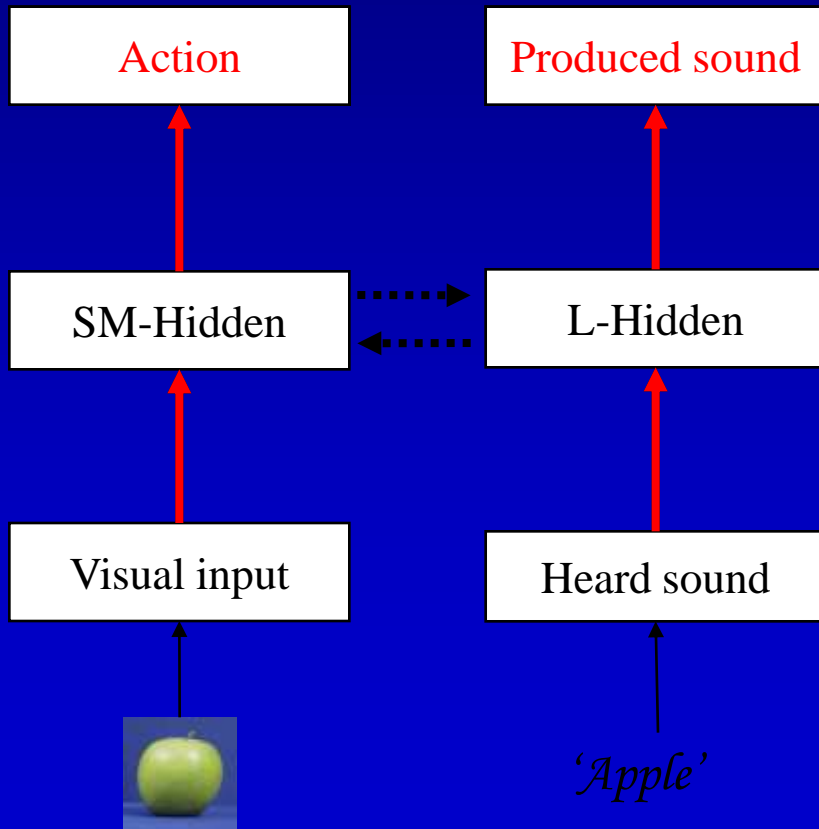
# Language as a cognitive tool

---

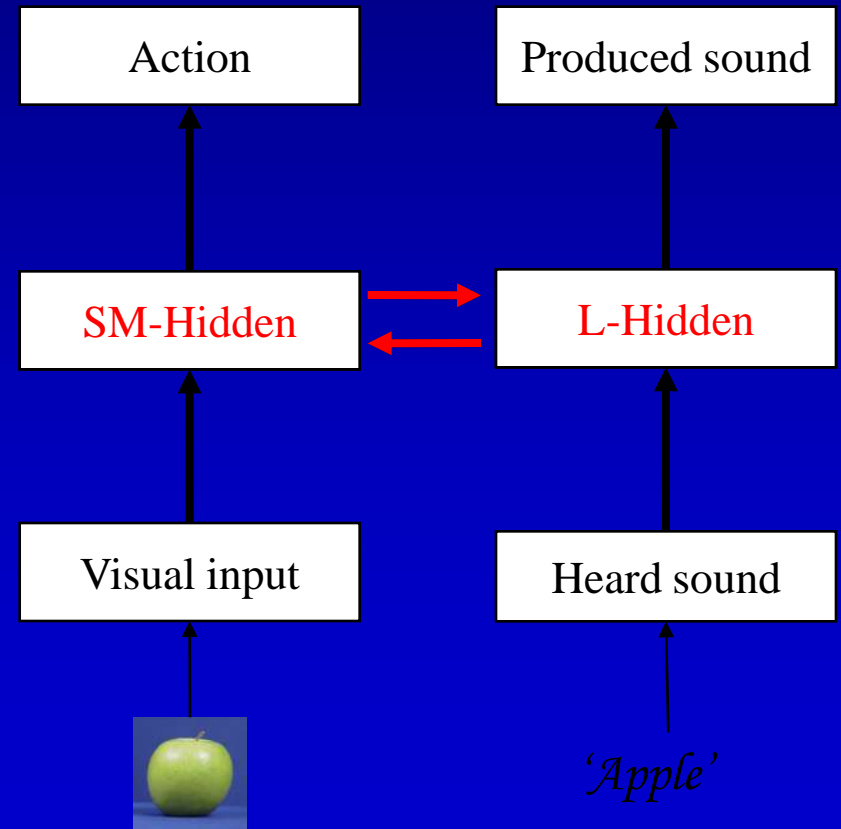
- Empirical evidence:
  - Learning (Waxman & Markow 1995; Lupyan et al. 2007)
  - Memory (Emerson & Miyake 2003; Gruber & Goschke 2004)
  - Abstraction (Gentner 2003, Thompson et al. 1997)
  - Problem-solving (Azmitia 1992; Diaz & Berk 1992)
  - Voluntary control (Diaz & Berk 1992; Boysen et al. 1996)
  - Logico-mathematical thinking (Dehaene 1999)
- Theory (Vygotsky 1934; Dennett 1991; Clark 1998, 2006; Gentner & Goldin-Medow 2003; Mirolli & Parisi in press):
  - Language transforms basic cognitive functions from low-level, animal-like to high-level, properly human ones
  - Children do talk to themselves a lot (Berk 1994)
  - During development private speech gets internalized and becomes inner speech

# Language aids categorization 1

First Stage (0-12 months)



Second Stage (after 12th month)



# Language aids categorization 2



No language



Private Speech



Social language

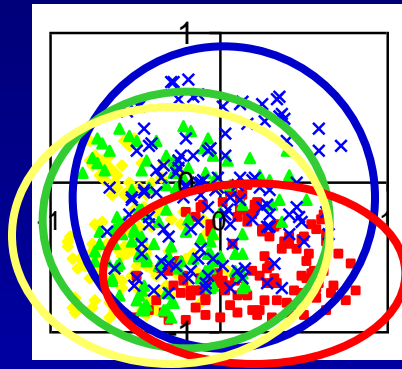


Inner Speech

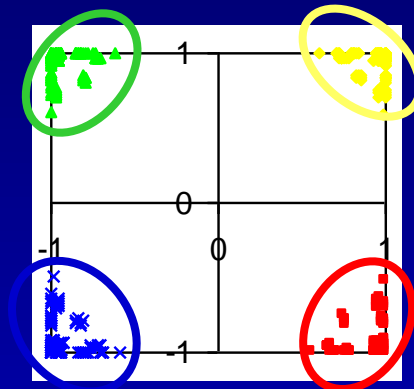


'APPLE'!

# Language aids categorization 3

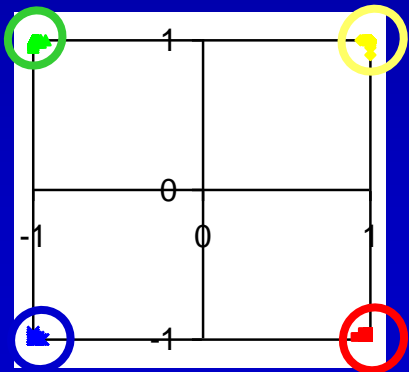


Initial

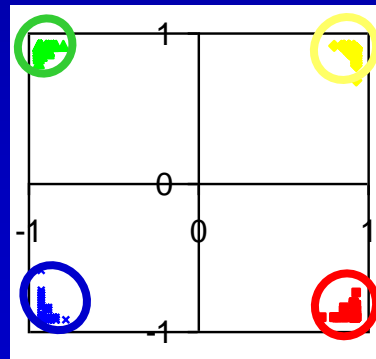


'No language'

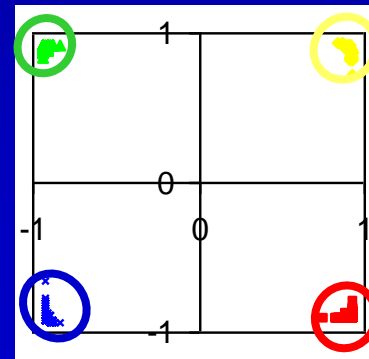
Category learning:  
clouds get small and  
distant from each other



'Social language'



'Private speech'



'Inner speech'

Language makes  
clouds smaller and  
more distant to  
each other!

From Mirolli and Parisi, 2005b; 2006

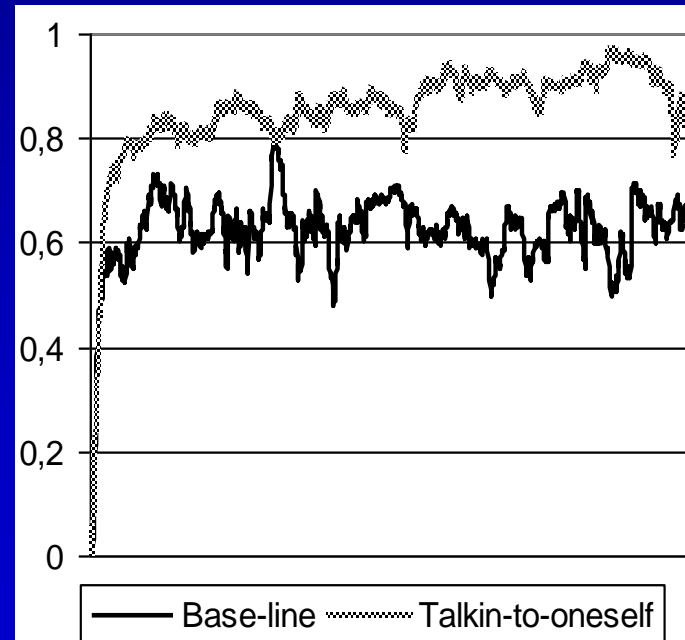
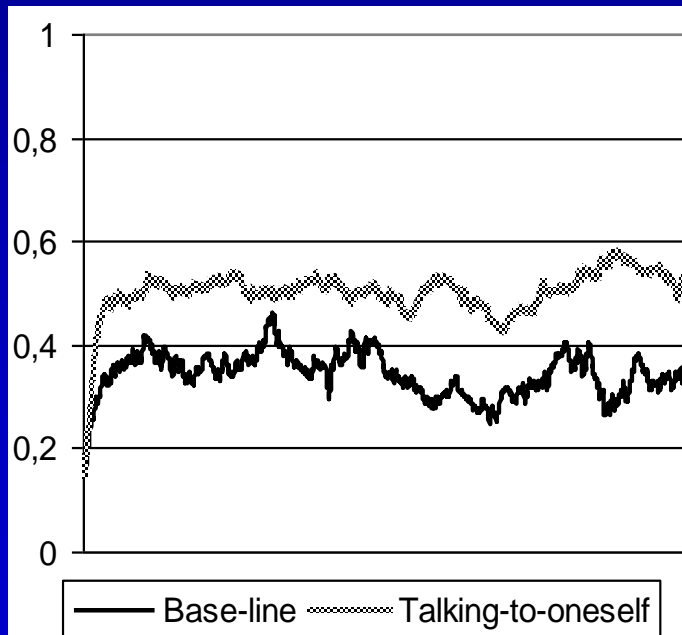
# Language as an aid to memory

Artificial organisms interacting with the environment and between themselves evolve a simple communication system

2 conditions: Base-line vs. Talking-to-oneself (as a memory aid)

**'Language' quality**

**Fitness**



From Mirolli and Parisi, 2005a



# Other relevant computational models

---

- Symbolic theft (Cangelosi & Harnad, 2000; Cangelosi, Greco & Harnad, 2000)
- Category learning (Schyns, 1991; Lupyan, 2005)
- Co-evolution of language and meaning (Steels & Belpaeme, 2005)
- Language reentrance and emergence of case grammar (Steels, 2003)

# Talking to oneself and language evolution

---

- Importance of talking to oneself for human cognition
- We must start asking new questions:
  1. When did the use of language as a cognitive tool begin?
  2. What role, if any, did it play in language evolution itself?
- Possible answers:
  1. Only when language reached its modern, complex form
  2. No role at all
- Computational modelling: even a simple communication system might improve cognition if it is used for oneself
- Hence, a reasonable alternative:
  1. Since its very early evolutionary stages, when language was very different from today's human languages
  2. An exercise: two speculations

# From hand to mouth

---

- Assuming that language evolved in the visuo-gestural mode (Corballis 2002; Arbib 2005), why did it become acoustic?
- Typical answers are all related to communication (broadcasting, freeing of the hands, no need of vision)
- Might the cognitive function have played a role?
- The vocal-auditory channel has 3 key features:
  - Interchangeability: language is the same for the speaker as for the hearer
  - Total feedback: a speaker always hears what she says
  - Specialization: the vocal channel is specialized for speech
- These features make acoustic language more suitable for talking to oneself than visuo-gestural language:
  - It is easier to discover
  - It is more reliable
  - It is easier to internalize

# From contextual to displaced signals

---

- Why don't we find displaced signals in animal communication (apart from bees)?
- Two possible problems:
  - Memory
  - Signal production
- Talking to oneself might help solving both problems:
  - Linguistic memory is easier (more compact information)
  - Linguistic memory frees the other memory system
  - Linguistically memorized signals are ready to be communicated

# Conclusion

---

- Language is not only a communication system but also a powerful cognitive tool
- Even very simple languages (meanings-labels associations) can improve several cognitive functions
- Talking to oneself may have played a significant role in language evolution itself
- Two examples:
  - Transition from gestural to vocal language
  - Transition from contextual to displaced signals
- Important to explore the hypothesis further

# The role of talking to oneself in the evolution of language

**Marco Mirolli, Domenico Parisi**

Institute of Cognitive Sciences and Technologies,  
National Research Council

Via San Martino della Battaglia 44, 00185, Rome, Italy

**[marco.mirolli@istc.cnr.it](mailto:marco.mirolli@istc.cnr.it)**