The Embodiment of Language in Cognitive Systems

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Language $\Leftrightarrow$ Cognition

- Language is not an independent, amodal capability (vs. Fodor, Chomsky)
  - But symbol-symbol phenomena are important (e.g. Landauer, T., & Dumais’s LSA)
- Language relativism hypothesis (Worf)
  - Colour cognition: e.g. Regier et al. 2005
- Language, Cognition & Action
  - Neural basis of verbs and actions (Cappa & Perani 2003; Pulvermuller et al. 2004)
  - From hands to mouth (Corballis 2003; Rizzolatti & Arbib 1998)
Grounding Language in Cognitive Systems

- **Cognitive science studies**
  - Spatial language: Cangelosi et al. 2005; Coventry & Garrod 2004

- **Artificial cognitive systems research**
  - Sensorimotor bases of language in embodied agents: Cangelosi & Parisi 2004; FET ECAGENTS
  - Grounding language in cognitive robots: Harnad 1990; Roy 2005; Cangelosi & Riga 2006; Dominey 2005; Steels et al. 2004; COGSYS ROBOT-CUB
  - Perception/language multi-modal integration: MAGICSTER; PACO-PLUS
R&D Impact

• Scientific impact
  – Understanding developmental (and evolutionary) origins or language
  – Integration of language and cognition
  – Language learning/rehabilitation

• Technological application domains
  – Human-Robot Interaction/Communication (e.g. service/household robotics)
  – Autonomous cognitive systems (e.g. aerospace robots)
  – Multi-modal Interfaces
  – Multi-sensor fusion systems
Long Term R&D Goals

- Current limits of grounded approaches
  - Small scale lexicons
  - Need for realistic human-computer communication
  - Integration of grounding and symbolic approaches

- Future (long-term) R&D goals
  - Social emergence of *human-level* languages in groups of autonomous cognitive systems
  - Architectures for autonomous design of *human-like* conversational systems
  - Bottom-up emergence of symbol-symbol relationships (developmental and phylogenetic implications)
  - Multi-modal integration and sensor fusion (gestures, speech, non-verbal communication)
Achievable R&D goals in F.P. VII

• Inter-disciplinary integration of European researchers in language and cognition (NoE)
  – Robotics, AI, Psychology (language development, embodied cognition), Linguistics (cognitive linguists), Multimedia
  – Strengthen collaboration with extra-EU community

• IPs themes
  – Imitation, action and language
  – Integration of grounding and symbolic approaches
  – Language emergence in embodied cognitive systems
  – Multi-modal/sensor integration

• STREPs topics
  – Language/cognition integration in specific linguistic domains (e.g. spatial language); vision & language; action repertoires; abstract concepts grounding