



Language & Cognition

Brain, language & thought

Tutorial

OVERVIEW

Unlike most other areas of cognition, there are no animal models of language. Historically, our study of the neural basis of language relies heavily on patients with brain lesions and more recently, on functional imaging. By examining the way in which language breaks down, we learn how language is organised in the normal brain. Similarly, the study of developmental disorders of language can inform us of the way language normally develops.

Readings

- *Whitney, P. (1998) *The Psychology of Language*. Boston, Houghton Mifflin. Chapters 10, 11 & 12. or
- *Harley (2007) *The Psychology of Language. From Data to Theory*. (3rd Ed.) Hove: Psychology Press. Chapter 4. or
- *Gazzaniga, M.S., Ivry, R.B., & Mangun, G.R. (2002) *Cognitive Neuroscience: The Biology of the Mind*. (2nd Ed.) London: W.W. Norton & Co. Ltd. Chapters 9 and 10.
- McCarthy, R. and Warrington E. (1996) *Cognitive Neuropsychology: A clinical introduction*. Chapters 6, 9 and 10.
- Kolb, B., & Whishaw, I.Q., (2003). *Fundamentals of human neuropsychology* (5th Ed.) New York: Worth Publishers. Chapter 19.
- Pinker, S. (1994) *The Language Instinct*. New York. Morrow. Chapter 10.

Language and Thought

A pervasive view of behaviourists was that thought is silent inner speech. Such a view has some modern proponents, for example, in schizophrenia one theory proposes that “thought insertion” and “auditory hallucinations” are inner speech misattributed to external sources, say aliens, when they are in fact self-generated. Such a view, however, raises a number of interesting questions – is there thought without language? Do infants (i.e. children without language) have thoughts? Do animals? Does the language you speak influence the way you think? The relationship between thought and language has occupied scientific discussions for some time. As you will see some of the debate is open to abuse and borders on being racist and sexist.



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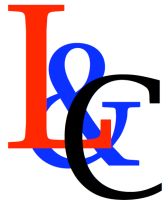
- *Whitney, P. (1998) *The Psychology of Language*. Boston, Houghton Mifflin. Chapter 4.
- Pinker, S. (1994) *The Language Instinct*. New York: Morrow. Chapter 3.
- Gordon, P. (2004) Numerical Cognition Without Words: Evidence from Amazonia. *Science* 306 (5695), 496.
- Pica, P., Lerner, C., Izard, V. and Dehaene, S. (2004) Exact and Approximate Arithmetic in an Amazonian Indigene Group. *Science*, 306, 499-503.
- Gilbert, A.L., Regier, T., Kay, P. and Ivry, R.B. (2006) Whorf hypothesis is supported in the right visual field but not the left. *Proceedings of the National Academy of Sciences*, 103(2), 489-494.

Acquired language disorders

The work of Broca and Dax nearly 150 years ago led to the discovery of the left hemisphere's role in language. Wernicke, Lichtheim and Dejerine contributed further to more specific localisation of function within this hemisphere. The models developed were useful but an oversimplification. Recent work refines the location of lesions relating to some language functions or better describes the deficits associated with specific lesions.

Readings

- Hillis, A. E. (2007). Aphasia: Progress in the last quarter of a century. *Neurology*, 69(2), 200-213.
- Blumstein, S.E., Cooper, W.E., Zurif, E.B. & Caramazza, A. (1977) The perception and production of voice-onset time in aphasia. *Neuropsychologia*, 15(3), 371-383.
- Caplan, D. & Waters, G. (2006). Comprehension disorders in aphasia: the case of sentences that require syntactic analysis. In: *The Handbook of Psycholinguistics*. M.J. Traxler & M.A. Gernsbacher (Eds). (2nd Edition) Elsevier Ltd (pp. 939-966).
- Dick, F., Bates, E., Wulfeck, B., Aydelott Utman, J., Dronkers, N., and Gernsbacher, M.A. (2001) Language deficits, localization, and grammar: Evidence for a distributed model of language breakdown in aphasic patients and neurologically intact individuals, *Psychological Review*, 108, pp. 759-788.



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Price & Mechelli (2005) Reading and reading disturbance. *Current Opinion in Neurobiology* 15:231-238

Leff, A.P., Crewes, H., Plant, G.T., Scott, S.K., Kennard, C., Wise, R.J. (2001) The functional anatomy of single-word reading in patients with hemianopia and pure alexia. *Brain* 124, 510-521.

Abnormal development (disorders and critical periods)

In contrast to adults, children with focal brain lesions do not show the patterns of impairment commonly seen in adults. This could be because the impairment occurs before the end of the critical period for language development or because the brain is able to compensate or recover from the injury (or both). When speech and language fail to develop normally in the absence of a neurological, social or cognitive explanation, we suspect a developmental disorder often with a genetic aetiology.

Readings

Bishop, D.V.M. (1997) *Uncommon Understanding: Development and Disorders of Language Comprehension*. Hove: Psychology Press Ltd. Chapters 2, 3 and 9 (pp.225-239)

*Elman, J.L., Bates, E.A., Johnson, M.H., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1998) *Rethinking Innateness: A Connectionist Perspective on Development*. London: MIT Press. (pp. 301-314).

Bellugi, U., Lichtenberger, L., Jones, W. Lai, Z., & St. George, M. (2000). 1. The neurocognitive profile of Williams Syndrome: a complex pattern of strengths and weaknesses. *Journal of Cognitive Neuroscience*, 12 (Suppl. 1), 7-29.

Skuse, D.H. (1993) Extreme deprivation in early childhood. In: Bishop, D & Mogford, K (Eds.) *Language Development in Exceptional Circumstances*. Hove: Lawrence Erlbaum Associates. (pp.29-46).

Lenneberg, E.H. (1967) *Biological Foundations of Language*. London: John Wiley & Sons. Chapters 4 & 5.

Watkins, K.E., Dronkers, N.F., Vargha-Khadem, F. (2002) Behavioural analysis of an inherited speech and language disorder: comparison with acquired aphasia. *Brain*, 125(Pt 3), 452-464.



Essay Questions or Presentation Topics

1. What is the relationship between language and thought?
2. Describe how the Wernicke-Lichtheim model explains the relative deficits in different types of aphasias.
3. Describe how patients with surface, phonological and deep dyslexia have contributed to our understanding of reading at the neural and the cognitive level.
4. How do we assess brain lateralisation of language? What have such studies told us about the capacity of different brain areas for language processes?
5. Are there critical periods for language development?
6. Compare and contrast the abilities of animals to use language with those of children whose early exposure to language is delayed or limited (i.e. 'wild', deprived/abused, deaf or blind children).
7. Discuss right hemisphere language processing in the context of acquired brain damage, split-brain patients and deaf sign-language users.
8. "Acquired language disorders and developmental disorders of speech and language are caused by more general impairments in cognition (e.g. working memory or intelligence)." Discuss.