Summaries of recently published papers of interest to cognitive scientists. Readers who would like to contribute to this section, by identifying appropriate papers and writing short summaries, should contact the Editor (tics@current-trends.com).

Learning language on-line

Language acquisition research focuses on knowledge representation and its development: the overall question is 'What do children's grammars look like and how are they created?' Trueswell *et al.*[1] approach this question from the adult sentence-processing world and they have formulated a new question: 'How do children use their grammar on-line?' They investigated a familiar item from the processing literature, namely, temporarily ambiguous prepositional phrase (PP) attachment. In the sentence, '*Put the frog on the napkin in the box*', the PP '*on the napkin*' could be interpreted as modifying either the noun phrase (NP) *frog* (specifying the frog's location) or the verb phrase (VP) *put* (specifying the destination of the action). The ambiguity is temporary, and depends on an incremental processing of the sentence; as soon as the second PP ('*in the box*') is reached, it is clear to adult readers that the first PP must indicate the frog's location. Using a head-mounted eye-tracker, Trueswell *et al.* monitored the direction of children's gaze as they performed the actions specified in the spoken target sentences (e.g. as above '*put the frog...*'), using 3-D objects. The results showed that the gaze of five-year-olds does track incrementally with the sentence: they looked first at the frog, then at the napkin, then at the box. These children are also more prone than adults to misinterpreting the first PP (as judged by object of gaze), despite discourse cues to the right interpretation. Moreover, judging by their placing behavior, these children find it very difficult to recover from their errors. In one dramatic example, some children placed the frog first onto the empty napkin and then into the box, effectively treating both PPs as modifying the VP. These exciting results are just the beginning of what appears to be a new approach to language acquisition research.

Reference

1 Trueswell, J.C. *et al.* (1999) The kindergarten-path effect: studying on-line sentence processing in young children. *Cognition* 73, 89–134

Be BOLD

The precise localization of the Blood Oxygenation Level Dependent (BOLD) signal with respect to local neural activity is critical to the accurate interpretation of many functional MRI experiments. The BOLD contrast response to neural activity appears to reflect two components; a small, early decrease, and a later and much larger, increase in blood flow. The vast majority of fMRI experiments measure the larger delayed response that is thought to reflect changes in deoxyhaemoglobin concentration caused by changes in blood flow to an activated brain area. The early dip is much more difficult to measure (as it is much smaller), particularly at low magnetic field strengths. On the basis of optical imaging studies, the early dip has been thought to reflect increases in deoxyhaemoglobin concentration caused by oxidative metabolism immediately following neural activity. However, the nature of this dip has remained controversial, with other experiments suggesting the alternative hypothesis that it is caused by hydrodynamic changes in blood volume occurring prior to flow changes. Now, Vanzetta and Grinvald have resolved this issue by using optical imaging with a novel oxygen-tension-sensitive molecular phosphorescent probe[1]. Changes in intravascular oxygen tension could be reliably detected by measuring changes in phosphorescence following sensory stimulation in the cat brain. The time course of the activity-dependent changes in oxygen tension thus obtained indicate an early deoxygenation following sensory stimulation. Critically, blood-volume changes were delayed by about half a second with respect to changes in the oxygen tension, ruling out the existence of a rapid increase in blood volume. Such an increase would be predicted by the alternative, hydrodynamic model. These results strongly suggest that the early dip therefore does indeed represent oxidative metabolism in neurons or glia. The question of whether this dip is more accurately localized to the site of neural activity than the delayed increase therefore becomes more important. Vanzetta and Grinvald argue, largely on the basis of qualitative data from preliminary fMRI experiments with monkeys, that the early dip is more clearly localized than the delayed response. Future studies should therefore address the question of localization of the different components of the fMRI signal by combining electrophysiological and fMRI measurements. The findings will have potentially important implications for brain imaging studies.

Reference

1 Vanzetta, I. and Grinvald, A. (1999) Increased cortical oxidative metabolism due to sensory stimulation: implications for functional brain imaging. *Science* 286, 1555–1557

In clear and vivid form?

Over a century ago, James suggested that when we pay attention to a particular object the mind takes possession of it in 'clear and vivid form'[1], but what does this mean? In a previous study, Prinzmetal *et al.* briefly presented observers with a test pattern (e.g. a coloured patch) and then a choice of possible patches to match along this dimension[2]. They manipulated the amount of attention that the observer could give to the test patch by introducing a distracting task to be performed concurrently. This distraction did not alter the success of the matching response (i.e. the mean response stayed the same) but it did alter the spread of the responses (i.e. the variance). In other words, the perceived value of the stimulus (its colour, brightness, size, etc.) is not altered by attention but our ability to discriminate between similar patterns is altered. Blaser *et al.* recently complemented this finding by trading-off 'bottom-up' and 'top-down' influences in a perceptual motion task. They devised a stimulus that provides an assay as to which of two colours is more salient to the observer[3]. This comprises a motion sequence in which a red/green striped pattern is alternated with one whose stripes are made up of low- and high-contrast texture. Whichever colour stripe is most salient is matched with the high-contrast stripe and the perceived motion is in this direction. One can then trade-off the bottom-up saliency (which colour stripe is most different in colour from the background) with top-down instructions (e.g. asking the subject to pay attention to the 'red' bars). Paying attention to a given colour did indeed alter the perceived direction of the stimulus and was found to be equivalent to increasing the physical intensity of this colour from 25% to over 100%. How can paying attention not alter the appearance of the stimulus and yet be like altering its physical intensity? The authors suggest that the answer lies in the notion of a salience map, whereby figure/ground decisions and processing priorities are decided. Attention, as well as stimulus intensity, contributes to the salience map, but leaves the actual representation of the stimulus itself unaltered. Thus, perceptual distortions are avoided but we see the object 'clearly and vividly'.

References

1 James, W. (1890) *Principles of Psychology*, MacMillan

2 Prinzmetal, W. *et al.* (1998) Phenomenology of attention: 1. Color, location, orientation, and spatial frequency. *J. Exp. Psychol. Hum. Percept. Perform.* 24, 261–282

3 Blaser, E. *et al.* (1999) Measuring the amplification of attention. *Proc. Natl. Acad. Sci. U. S. A.* 96, 11681–11686

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