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Lie detection and language comprehension

People who can't understand words are better at picking up lies about emotions.

People are usually no better than chance at detecting lies from a liar's demeanour[1,2], even when clues to deceit are evident from facial expression and tone of voice[3]. We suspected that people who are unable to understand words (aphasics) may be better at spotting liars, so we tested their performance as lie detectors. We found that aphasics were significantly better at detecting lies about emotion than people with no language impairment, suggesting that loss of language skills may be associated with a superior ability to detect the truth.

We studied the lie-catching abilities of ten patients who could understand individual words but who suffered severe deficits in comprehending spoken sentences after damage to the left cerebral hemisphere (LH). Their performance was compared with that of ten patients with damage to the right cerebral hemisphere (RH), ten healthy controls (C) and 48 undergraduates from the Massachusetts Institute of Technology (UC). Subjects watched a videotape in which each of ten people was shown twice consecutively: once attempting to conceal powerful negative emotions and once honestly revealing positive emotions. The sequence of the two interviews was random. Behavioural measurement showed that the interviews differed in subtle facial expressions and in pitch changes in the voice[4].

Aphasics were significantly more accurate than controls at detecting lies. The mean of the LH group (0.61; s.d. = 0.10) was higher than that of the RH, C or UC groups (0.44, 0.47 and 0.46 respectively with standard deviations of 0.11, 0.16 and 0.16). An analysis of variance of the three matched groups (LH, RH and C) found a significant difference among groups ($F_{2,26} = 4.33$, $P < 0.03$). A planned contrast analysis comparing the LH group against the others was statistically significant ($F_{1,26} = 12.95$, $P < 0.002$) and the residual variance in the main effect was not significant; *t*-tests comparing the means of all four groups against the value of 5 (the value obtained by chance) revealed that only the LH group scored better than chance ($F = 9.00$, $P < 0.02$).

We then compared the performance of all groups on items where the clues were in facial expression (3 items), in pitch changes in the voice (1 item) or in the face and voice (6 items). LH patients do better when clues are in facial expression but not when they are from the voice alone (Table 1).

Table 1 Success in interpreting lying cues

Group	*Vocal pitch cues only*	*Facial expression cues only*	*Facial and vocal cues*
LH	0.30	0.73	0.60
RH	0.20	0.50	0.45
C	0.20	0.57	0.47
UC	0.32	0.50	0.47

Values represent proportion correctly identifying liars. LH, left-hemisphere-damaged aphasics, mean age 58.4 years, patients at the Massachusetts General Hospital who gave informed consent. Their diagnoses, based on neurological examinations and MRI, were left middle cerebral artery infarct (nine patients) and subarachnoid haemorrhage (one subject). Neuropsychological testing revealed at least low average intellectual and perceptual abilities. Subjects achieved 95% correct (87.5–100% range) on a word-to-picture matching task and 89% correct on a lexical decision task (78–94% range)[9], indicating recognition of single words. However, they performed at near-chance levels on a sentence-to-picture matching task, with an average accuracy of 58% (53–69% range)[10], suggesting severely compromised comprehension of sentences. RH, right-hemisphere-damaged patients, mean age 59.6 years. C, matched controls, mean age 60.2 years. Both RH and C groups had equal numbers of men and women, were matched with the LH patients for education and IQ scores, were patients at the Massachusetts General Hospital, and had given informed consent. UC, undergraduate controls.

Our results support the untested claim that aphasic patients are unusually sensitive to deceitful behaviour[5,6]. Perhaps damage to the circuitry underlying language comprehension results in the growth of compensatory skills in recognizing non-verbal behaviour. All but one of our aphasic patients were tested more than one year post-injury (the one who was tested within a year scored no better than chance). Although we cannot distinguish whether our patients were better lie detectors or simply better at detecting subtle cues to emotion, aphasics' abilities to recognize non-subtle facial expressions have, to our knowledge, never before been shown to be superior to those of controls[7,8]. The superiority of aphasics to normal persons in any task is a rarity.

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Growth factors

Formation of endothelial cell networks

The growth factor VEGF (vascular endothelial growth factor) promotes the formation of blood vessels in a process known as angiogenesis by inducing the proliferation and migration of endothelial cells[1]. We show here that VEGF has another proangiogenic function — it can stimulate the elongation, network formation and branching of non-proliferating endothelial cells in culture that are deprived of oxygen and nutrients. As endothelial cells in tumours are exposed to chronic or intermittent hypoxic conditions[2,3], we propose that autocrine endothelial VEGF contributes to the formation of blood vessels in a tumour and promotes its survival.

Human umbilical-vein endothelial cells (HUVECs) and bovine adrenal cortex capillary endothelial cells were cultured in a sandwich system[4], in which the medium can only reach the cells from the edges of the culture (Fig. 1a). The combined processes of diffusion, consumption of oxygen and nutrients, and production of metabolites establish microenvironmental gradients across the width of the culture, like those that occur in tumours *in vivo*[4–6].

These gradients cause the cells to change shape and to reorganize themselves into networks (Fig. 1b,c). HUVECs at a distance of 0–2 mm from the edge of the sandwich cultures, where nutrients and oxygen are plentiful, retain their homogeneous, intact monolayer configuration (Fig. 1b). The monolayer morphology of HUVECs further in (3–5 mm from the edge) is disrupted and some endothelial networks are evident (data not shown). At the most hypoxic interior of the sandwich, 10–12 mm from the edge, these networks are fully formed (Fig. 1c). Control cultures, which had no top slide