Enhanced visual exploration for real objects compared to pictures during free viewing in the macaque monkey

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The degree to which different animal species perceive pictures as representations of real objects is currently debated. Most research paradigms used to address this question require the animal to learn a task involving real objects and then examine the transfer of learned knowledge to pictures of these objects. Here we examine spontaneous visual exploration behavior in macaque monkeys for three dimensional arbitrary objects and the corresponding pictures. We reasoned that similarities in visual exploration behavior could provide evidence that monkeys are able to understand the representational nature of pictures. We recorded eye-movements of two monkeys (*macaca fascicularis*) during free viewing of LEGO objects and the corresponding pictures of those objects as they entered, remained stationary and were removed from visual field in front of the subjects. In general, while monkey looked considerably longer at objects than pictures, striking similarities in the gaze patterns during the course of stimulus presentations were evident. Visual exploration habituated within single behavioral sessions as well as across daily session for both stimulus types. We also demonstrate differences in terms of spatial gaze patterns, such that the monkeys' gaze focus for individual stimuli could be well predicted by a visual saliency model and exhibited specific similarities between the objects and corresponding pictures. Taken together, this provides evidence for mental correspondence between objects and pictures in macaque monkeys, validating spontaneous visual exploration as a method to examine the question of object-picture perception. On the other hand, the observation that real objects tend to capture the gaze and interest to a much larger degree than pictures suggests that real objects may provide an alternative method for studying neural representation of three dimensional visual forms in animals.

Turn transition detection in aphasic patients: Insights from eye tracking

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Humans are highly competent to manage the smooth and appropriate exchange of speaking turns during face-to-face interaction. Previous research showed that our ability to predict turn transitions mainly relies on the lexico-syntactic content of the conversation and that the intonational contour is neither necessary nor sufficient to predict the next turn transition. In the present study, we compared the timing of gaze shifts in aphasic patients with healthy controls while they watched video vignettes of natural conversations. Turn transitions in a video direct the viewer's gaze behaviour. We expected that aphasic patients who have problems to grasp the lexico-syntactic content would show delayed gaze shifts corresponding to speakership change around the turn transition. We found that the timing of turn related gaze shifts did not differ in aphasic patients. However, aphasic patients adapted their gaze shift strategy. In comparison to healthy viewers, they made significantly more indirect gaze shifts in response to a turn. It seems that aphasic patients try to overcome their uncertainty in turn transition detection by indirect gaze shifts. The cost of this strategy is prolonged time to track the turn transition.

Cortical control of manual dexterity is differentially affected by permanent or transitory inactivation in non-human primates.

Roux C, Fregosi M, Kaeser M, Savidan J, Gindrat AD, Cereghetti A, Buchs J, Rappo N, Rouiller E, Schmidlin E.

The primary motor cortex (M1), in association with premotor cortices, controls complex precision grip needed in manual dexterity via direct projections to the motoneurones located in the ventral horn of the spinal cord. We studied in non-human primates (NHP) under three different conditions, the behavioral consequences of cortical inactivation in a “reach and grasp” drawer task requiring proximo-distal coordination to perform precision grip: i) permanent cortical inactivation of the delimited region of M1 dedicated to the control of intrinsic hand muscles; ii) transient focal inactivation of the area using GABA agonist drug; iii) transient inactivation using particular paradigm of non-invasive repetitive transcranial magnetic stimulation (TMS). The pharmacological intracortical inactivation was performed using a tecapeek grid placed at the dural surface over M1 allowing the penetration of either microelectrodes to elicit finger movements using intracortical microstimulation or a cannula allowing the microinjection of ibotenic acid specifically destroying neurons or muscimol. The non-invasive transient inactivation consisted in TMS of M1 using a theta burst frequency of 600 pulses (rTMS). The “reach and grasp” drawer task consisted for the monkey in the opening of a drawer using the precision grip against adjustable levels of resistance. We continuously measured the grip force (applied on the button of the drawer) and the load force (needed to open the drawer), and the duration of the application of those forces. The comparison of the changes of motor parameters induced by the three types of inactivation of M1 in the same behavioral task showed that focal transient inactivation was comparable to permanent focal inactivation, pronounced decrease of maximal grip and load forces at different levels of resistance, whereas network transient inactivation elicited by rTMS produced slight difference in the duration of the application of the forces.

Perception of co-speech gestures in aphasic patients: an eye movement study

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Introduction: Gesturing, including co-speech gestures, is a crucial part of human communication. The present study aimed to investigate the perception of speech and gestures, and in particular the influence of congruence between speech and gesture on both verbal comprehension and visual exploration. Healthy subjects spend about 88-95% of the time fixating a speaker's face, while only a minority of fixations is directed at gestures. It is unclear whether aphasic patients display a similar pattern.

Method: Twenty aphasic patients and 30 healthy controls watched videos in which speech was either combined with congruent, incongruent, or meaningless gestures. Comprehension was assessed with a decision task, while remote eye-tracking allowed analysis of visual exploration of predefined areas of interest.

Results: Patients displayed a decreased accuracy in incongruent sequences whereas congruence between speech and gesture led to an increase in accuracy. Furthermore, patients fixated significantly less on the face and slightly more on the hands compared to controls.

Conclusion: Co-speech gestures play an important role for aphasic patients as they modulate verbal comprehension. Incongruent gestures evoke significant interference and deteriorate patients' comprehension. In contrast, congruent gestures enhance comprehension in aphasic patients, which might be valuable for clinical and therapeutic purposes.