EXPERT MEEETING ON FACE PERCEPTION :

SCIENTIFIC REPORT

Summary

The meeting was intended to bring together a panel of experts working on various aspects of face perception and memory. This field ranges from basic neuroscience to social psychology and calls upon multiple methodologies and concepts. One of the goals of the meeting was, for the first time, to bring together researchers with different theoretical interests and background, as well as methodological resources, but all sharing a common interest :clarifying how we perceive and categorize people based on their faces. The presentations were of top quality, and most interestingly, the small size of the meeting allowed participants to interact freely and to present new data. The discussions at the meeting were stimulating, and we do not have any doubts that it will lead to fruitful collaborations among participants, with a high publication potential (see below).

Scientific content and discussion at the event

There are several reasons why face perception attracts the interest of many researchers coming from different backgrounds, and is yet poorly understood. All these reasons were illustrated in the communications of the experts at the meeting. The face is undoubtedly a special type of stimulus, whose basic structure is shared by many animal species and which has a long evolutionary history, tracing back to the first appearance of a primitive mouth organ about 500 million years ago (McNeill, 1998). This has led a number of authors to suggest that the structure of the human face must be encrypted in the genome (e.g. Farah et al., 2000), such that the newborn would already posses a somewhat crude representation of the face. The meeting was opened by a presentation by **Francesca Simion**, who leads on the few laboratories in the world testing face preference and face recognition at birth. Her research has challenged this view, showing that biological constraints leading to face preference at birth were more loosely defined than a basic face stimulus. The presentation also showed that after 3 months of visual experience, the human baby appears to possess a representation of the human face. Yet, the mechanisms subtending face perception and memory undergo a very long developmental course, being fully matured only after puberty (Carey, 1992). The human brain is able to

encode and recognize hundreds of faces (Bruce & Young, 1998). This raises the question of the nature of face representations guiding perception in adults. Presentations by **Gillian Rhodes** and **Jean-Yves Baudouin** directly addressed this question of the nature of the nature of face representation in adults using behavioral methods. Gillian Rhodes summed up the evidence showing that faces would be represented in memory in a multi-dimensional framework, or a face-space (e.g. Valentine, 1991). That is, each individual face that has been perceived could be conceptualized as a point in a multidimensional space, the dimensions being local or configural (e.g. length of nose, darkness of eyes …). This framework would account for a number of empirical observations, such as the fact that caricatures (which are exaggerated versions of an individual face, located further away from the norm or prototype) are recognized better than veridical faces (Rhodes et al., 1987). Recent studies using adaptation methods presented by Pr. Rhodes have supported the view that the face space would be organized around a norm or prototype. Furthermore, she showed that distinct norms might be extracted for upright and inverted faces. This was further illustrated by Baudouin's research, who showed that different patterns of eye movement scanning are applied to upright and inverted faces in normal adult populations, but not in brain-damaged and schizophrenic patients. The presentation by **Roberto Caldara** was also aimed at clarifying the nature of face representations in normal populations and patients, but using different methods : neural network simulations on the one hand, and response classification (Bubbles ; Gosselin & Schyns, 2001) on the other hand. One of the most interesting finding reported by Caldara was the dissociation between the face representations used by normal subjects and a brain-damaged patient unable to recognize faces. This patient was relying mostly on the mouth rather than the eyes to recognize face stimuli.

The notion of face-space was further developed by **Thomas Vetter**, who introduced a computational framework for modeling the variability of human faces. The ability to encode and recognize hundreds of faces is even more impressive when one considers that the perception of the faces constantly change, such that it is never the same visual image that needs to be matched to an internal representation, i.e. recognized. These changes are due to modifications in viewing conditions (the direction of light source, distance, occlusion, etc … Loftus & Harley, 2005) and changes to the observer and/or face stimulus itself (viewpoint). The model introduced by Pr. Vetter compensates for large variations across pose, ranging from frontal to

profile views, and across a wide range of illuminations. It has the advantage of providing a face-space based on image analysis (i.e. how much faces differ physically), and provide a mean to test the validity of internal representations by experiments in psychophysics. The approach could also generate multiple face images across different viewpoints, which may be particularly useful for researchers in this area.

The face stimulus does not undergo only modifications that should be discarded such as illumination or viewpoint changes, but also short-term (dynamic) modifications such as expression or eye gaze direction, and long-term transformations such as aging for instance. In adults, faces indeed convey a great deal of information that is biologically relevant (adaptive) for many animal species, and play an even more critical role in humans for social communication. Our visual system must be able to pick up cues to classify faces according to these changes (i.e. inferring the mood of an observer from his/her facial expression), and yet at the same time generalize by ignoring these changes (e.g. recognizing the same person across changes of age and expression). This raises the question of whether there are separate representations for identity and other categorizations such as expression, which was the focus of **Andy Calder's** presentation. Using principle component analysis of face images (Hancock et al., 1996), Pr Calder showed how identity and expression shared a larger part of their representations and mechanisms that what is commonly assumed.

Besides the presentation of T. Vetter, the second day of the meeting was dominated by approaches at the neural level. The face processing system occupies a large distributed network of areas in the human brain, mainly in the occipital and temporal lobe, but also at the junction with parietal cortex, and in the frontal lobe (Haxby et al., 2000). For instance, in several areas of the infero-temporal cortex of the monkey brain, up to 20% of the neurons appear to be tuned to process face stimuli exclusively (Perrett et al., 1982). **David Perrett** presented exciting, unpublished, single-cell data recording from the monkey infero-temporal cortex, showing how representations of faces can be anticipated in neural populations. During the perception of a movie (i.e. a face rotating left from right , at a given point in time the populations of cells discharge maximally to the particular view of a face stimulus that is going to appear, not to the view that is currently presented. This was the first illustration of how research on face perception can evolve towards dynamic

aspects of face perception, and this should lead to multiple applications for research in human face processing. **Bruno Rossion** presented human data, showing how neuroimaging combined with studies of brain-damaged patients can greatly enhance our knowledge about the functional neuro-anatomy of the human brain. The fact that small brain lesions may lead to massive and selective deficits in face recognition is another testimony to the complexity of the face processing system.

The timing and the dynamic aspects of face processing were addressed by several speakers, including **Jim Tanaka**, **Tiffany Ito** and **Philippe Schyns**, reporting human electrophysiological data. Philippe Schyns combined the response classification method with electrophysiology to address the question of the emergence of face representations in an unbiased way (i.e. what information is extracted first on a face stimulus, and at which latency ?). These methods may potentially open new perspectives for research on the speed at which our beliefs (stereotypes, prejudice) influence the categorization of faces. Along these lines, Tiffany Ito's work shows that perceptual processes occurring within the first 250 milliseconds following the sight of a face predict stereotype activation, whereas Jim Tanaka's interest were more focused on how we build face memory, using electrophysiological measures. Along the lines of research on introduced by T. Ito, **Kurt Hugenberg** presented data showing that social categorization (i.e. perceiving other-race faces) modulates how facial expressions are perceived. **Olivier Corneille**'s presentation also focused on how social categorization, by gender and race, distorts our encoding and memories of faces.

Every single presentation provoked numerous questions and discussions, and the atmosphere was particularly positive among participants. A synthesis and general discussion took place on the last day of the meeting. There was sufficient overlap between the interest of the speakers, as illustrated by the questions summed up above (how are faces represented ; what is the speed at which the percept activate face representations and how can they be influenced …), and yet a tremendous amount of diversity in the methods and the concepts used, to create an excellent and stimulating atmosphere. An interesting aspect that is worth to be mentioned is that most if not all speakers presented their most recent, most often unpublished data, something that would almost never happen in a larger conference.

A recurrent theme was the question of the nature of face representation. This was addressed directly by a number of speakers interested in the 'veridical'

representation of faces (G. Rhodes, J.-Y Baudouin, T. Vetter, R. Caldara). However, it was particularly interesting to note that a large part of the work presented in this meeting illustrated how our face representation are distorted, i.e. anticipating our percepts (D. Perrett), reflecting our past experience (adaptation : G. Rhodes; memory : J ; Tanaka), our categorization (O. Corneille), and our stereotypes (T. Ito ; K. Hugenberg), or following pathology (R. Caldara, B. Rossion, J.-Y. Baudouin).

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Assessment of the results and impact of the event on the future direction of the field

All participants expressed their genuine satisfaction at taking part at this meeting, which should have a great impact on the future directions taken by this field. In recent conference meetings on face processing (i.e. symposia) it appeared that the field became polarized around big theoretical debates, with extreme positions taken by different authors and little dialog (e.g. innateness of the face processing system, modularity …; see Kanwisher, 2000; Tarr & Gauthier, 2000). These themes were not much discussed here, where there was a genuine will to clarify important questions without forcing a strong theoretical point of view, and more generally move forward towards an understanding of how faces are perceived and represented by human

observers. This meeting will also lead to the reinforcement of existing collaborations between participants, and most interestingly the development of numerous collaborations. Several projects will be developed or are already on their way, involving among others Corneille/Rossion (how social representations modulate the perception of other-race faces), Corneille/Tanaka (atypicality biases in likeness judgments of faces), Hugenberg/Corneille (emotion as a moderator of the race categorization of faces), Corneille/Rhodes (attractiveness in a multidimensional face space) Rossion-Schyns (electrophysiological correlates of face categorization); Rossion-Perrett (Human electrophysiological recordings of face moving presentations), Rossion-Vetter (validation of physical face space), Rossion-Rhodes-Tanaka (characterization of representations in prosopagnosic patients using face-space and MDS methods), Rossion-Simion (recognition of faces through spatial frequencies in newborns). There will also be a sharing of stimuli (e.g. face-space) and methodological/technical expertise. At the conceptual level, the meeting was a great and unique opportunity for social psychologists to increase their knowledge about psychophysical and computational work on face stimuli, which will undoubtedly improve their research, and for neurocognitive scientists to learn more how important it is to take into account how our social knowledge and motives may influence basic face perception and encoding phenomena..