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News from the field

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TIME PERCEPTION

Closer to real time with anger

Gil, S. & Droit-Volet, S. (2011). "Time flies in the presence of angry faces"…depending on the temporal task used! *Acta Psychologica*, 136, 354–362.

Facial expressions are considered to be the main expressive component of emotion because they serve a physical and social adaptation function. But how do emotions and others' facial expressions affect our perception of time? Due to the availability of standardized materials for studying emotions, there has been, over the past few years, a significant increase in the amount of scientific work on facial expressions of emotion, and more specifically on their effect on time perception. For the specific case of anger, previous results showed that, compared to neutral faces, seeing angry faces results in a subjective lengthening of time. This effect is explained by the fact that threatening faces generate arousal, which is argued to speed-up the pacemaker component of the internal clock. However, the results showing this lengthening effect of anger have all been based on the use of one procedure, the temporal bisection task. Gil and Droit-Volet recently asked whether this finding could be generalized to other classical temporal tasks, including some involving higher cognitive processes.

These authors examined the potential lengthening of subjective time caused by angry faces with five temporal tasks: bisection, generalization, verbal estimation, production, and reproduction. Three main results can be drawn from this work. Firstly, the authors confirmed with three temporal tasks (bisection, verbal estimation, and production) that angry faces have a strong impact on subjective time. This effect is attributed to the adaptive role of subjective time distortions for human beings: the acceleration of the internal clock's pacemaker is thought to participate in the body's preparation of action (see Droit-Volet & Gil, 2009—*Phil. Trans. R. Soc. B*). Secondly, this subjective lengthening effect doesn't appear in generalization and reproduction tasks, where higher cognitive mechanisms, like memory, make an important contribution to the processing of duration. This specific result highlights the importance of adequately choosing a procedure when approaching a new research topic related to time perception. Finally, the use of these multiple temporal tasks allowed the authors to calculate a relative temporal index, i.e., an overall assessment where subjective time and objective time are compared. Counter-intuitively, the index reveals that, due to the time distortion caused by anger compared to neutral faces, people appeared to be more accurate in their time perception when facing emotional cues.—S.G.

CONSCIOUSNESS

A tale of two invisibilities

Kanai et al. (2010). Subjective discriminability of invisibility: A framework for distinguishing perceptual and attentional failures of awareness. *Consciousness and Cognition*, **10**, 1045–1057.

Exner (1868; reviewed in Breitmeyer & Öğmen, 1984) stumbled on visual masking when he discovered that one light could make another seem less bright, simply by flashing it a little later. Since then, psychologists have invented many tricks for reducing stimulus visibility, and the list keeps on growing (e.g. object-substitution masking, Enns & Di Lollo, Psych Sci 8:135; motion-induced blindness, Bonneh et al., Nature 411:798). Almost every new type of mask is accompanied by an effort to determine where in the visual pathway it takes effect. Such positioning of effect is typically made with respect to anatomy or that of other masking effects. By contrast, Kanai et al. position six of these visibility reductions with respect to conscious access.

Their idea can be simply stated. If observers can confidently discriminate misses from correct rejections, then the target's visibility must have been affected by some mechanism amenable to conscious access.

Kanai et al. tested this idea using decreased contrast, backward masking, flash suppression, dual task, attentional blink, and spatial uncertainty. When each of these paradigms was adjusted to produce comparably poor detection performances, observers were able to confidently discriminate misses from correct rejections only with the latter three. Kanai et al. justifiably ascribe such discrimination to their subjects' self-assessment of attentional fluctuations, and distinguish this *attentional blindness* from the *perceptual blindness* that is implied when observers cannot discriminate misses from false alarms.

Although the *AP&P* community has yet to establish a complete list of masking effects with their relative and anatomical loci, blindnesses at the lower levels seem likely to qualify as perceptual, while those at the higher levels are almost certainly attentional. If you haven't tested your favorite masking paradigm yet, now would be a good time!—J.A.S.

INVERTEBRATE VISION

How jellyfish keep their eyes on the skies

Garm, A., Oskarsson, M., & Nilsson, D.-E. (2011). Box Jellyfish Use Terrestrial Visual Cues for Navigation. Current Biology, 21(9), 798–803.

If you were a box jellyfish (Tripedalia cystophora, to be precise), you would have a strong interest in floating about in a narrow strip of water amidst the roots underneath the canopy of mangrove trees of the Caribbean. You want to be there because your food gathers there in the shafts of light between the roots. If you wander away from the cafeteria, out into the open water a few meters away, you are going to starve. How is a jellyfish going to manage to stay in the right neighborhood with no brain; just a few thousand neurons, distributed in ganglia? The answer is to keep an eye on the canopy. Actually, the jelly keeps four eyes on the skies. All told, they have 24 eyes, 6 in each of 4 structures called "rhopalia". One of these, the "small lens eye" has a circular visual field of about 100 degrees diameter. That is interesting. If you are looking up through the water, refraction will compress the 180 deg world into a 97 degree field (Snell's window) so the eye is well-suited to monitor the terrestrial world above the water. However, this will only work if the eye is pointed straight up and the jellyfish assumes many different orientations in the water. This is where things get really clever. The rhophila is on a stalk and contains a weight like the otoliths in your vestibular system. As a result, when the jelly tilts, the weight continues to point downward, the stalk bends, and the small lens eye continues to point up. It is rather like those weighted toys that return to upright no matter how hard you push or punch them.

So, does this work to keep the jellyfish in place? Garm et al. calculated what the small lens eye could see and concluded that, in principle, a jellyfish could detect the edge of the mangrove canopy from about 8 m out in the bay. If they were 12 m out, their eyes wouldn't help. To test the theory, they put jellies in a transparent pen and positioned them at various distances from the mangroves. When the pen was under the canopy, the jellies just swam about. When it was moved out into open water, however, they swam to the side of the pen closest to the canopy. This preference got weaker as the distance got greater but, as theory predicted, they were still headed in the right direction at 8 m. By 12 m, they were lost. The water is too murky for underwater vision to work and the pen had isolated the beasts from other chemical or tactile cues, so the authors argue that these jellyfish are using only the view from the sky eye to stay at the buffet. Not bad for an animal with no central brain.—J.W.

ATTENTIONAL CAPTURE

The Neural Basis of Distractibility

Kanai, R., Dong, M. Y., Bahrami, B., & Rees, G. (2011). Distractibility in daily life is reflected in the structure and function of human parietal cortex. J Neurosci, 31(18), 6620–6626.

The notion that certain external events in everyday life can capture attention in a purely bottom-up fashion has strong intuitive appeal. However, closer examination of this phenomenon in the laboratory has revealed interactions between top-down and bottom-up forms of attentional control that in turn have been difficult to disentangle. In some cases, findings that appear to reflect purely bottom-up control have been shown to instead reflect subtle forms of top-down control; whereas, in other cases, findings that appear to reflect a lack of bottom-up control have been shown to instead reflect the occurrence and subsequent suppression of such effects by top-down control. Moreover, there has also been growing concern that some of the experimental tasks used to measure attentional capture may lack the ecological validity of real-world objects and events. Studies that can link the distractibility experienced in everyday life with experimental tasks, as well as disentangle the relation between top-down and bottom-up forms of attentional control, while also clarifying how this relation is mediated by control networks in the brain are thus clearly needed. Fortunately, this need has begun to be fulfilled by Kanai et al.'s study. In this study, the Cognitive Failures Questionnaire (CFQ) was first administered to 145 participants. The CFQ measures absent-mindedness and failures of attention in everyday life. These participants then underwent an MRI scan; using a voxel-based morphometry analysis to assess gray matter volume, the researchers found a single significant positive correlation between CFQ distractibility and gray matter volume in the left superior parietal lobe (SPL). In other words, participants who reported greater distractibility on the CFQ tended to have more gray matter in the SPL. Kanai et al. suggested that this positive correlation was consistent with two possible interpretations. On the one hand, this positive correlation may reflect greater bottom-up vulnerability to salient distractors; whereas, on the other hand, this positive correlation may reflect (perhaps counterintuitively) less top-down modulation of distraction after it has occurred. In order to assess these two hypotheses, the researchers applied transcranial magnetic stimulation (TMS) to either the SPL or a control region during the performance of a standard experimental measure of attentional capture. If the positive correlation observed between CFQ distractibility and SPL volume reflected greater vulnerability to distraction, then disruption of SPL functioning via TMS should result in less distraction in the experimental task. However, if the positive correlation observed between CFQ distractibility and SPL volume reflected less top-down modulation of distraction after it occurred, then disruption of SPL functioning via TMS should result in greater distraction in the experimental task. The results supported the latter, top-down modulation, hypothesis. Finally, in a third experiment, the researchers showed that distractibility as measured by the CFQ was positively correlated with distractibility as measured by the standard experimental task. Altogether, these findings provide reassuring evidence that measures of distractibility in everyday life correlate (albeit modestly, $r=.39$) with laboratory-based measures of attentional capture, and they also help shed light on the neural locus of top-down modulation of bottom-up control. Ultimately, these findings suggest that individual differences in distractibility experienced during everyday life may arise not so much because individuals differ in their vulnerability to salient objects and events, but rather because individuals differ in their ability to modulate this distraction in a top-down fashion after it has occurred. One provocative, but ultimately unanswered, question that arises from these findings concerns why greater gray matter volume was found to be associated with less top-down control—B.S.G.

AUTOMATICITY

The Social Side of Stroop

Goldfarb, Aisenberg, & Henik (2011). Think the thought, walk the walk—Social priming reduces the Stroop effect. *Cognition, 118*, 193.

Much of the way we perceive our surroundings and act as we navigate through the world is automatic. When we drive to the grocery store on autopilot, ride a bike effortlessly, or read our grocery list, there is little awareness of how we are accomplishing these feats of perception and action. Over the years, automatic processing has been investigated using the Stroop task (Stroop, 1935) in which participants are presented with color terms (e.g., BLUE) printed in ink colors (e.g., *blue* or *green*) that are either congruent or incongruent with word meaning. When ink color and word meaning mismatch, participants take longer to name the ink color compared to when word ink color and meaning match. This Stroop interference is assumed to reflect the automatic and obligatory reading of the color words.

Goldfarb et al. investigated whether Stroop interference could be modified by simply priming *another* type of automatic process. The concept of dyslexia was primed to determine whether the activation of a social concept that includes difficulty with reading could influence the degree of Stroop interference. Across experiments, participants were asked to engage in the classic Stroop task of identifying the printed ink color of color terms. In the middle of the task, a social priming technique was administered in which a description of a person with dyslexia was introduced and then participants were asked to write briefly about the characteristics of that person. Following the priming manipulation, the Stroop task resumed. Goldfarb et al. found that robust Stroop interference occurred before the priming manipulation, but was eliminated immediately after priming of the social concept of dyslexia. Additional experiments determined that the effects of social priming were specific to the concept of dyslexia (difficulty with reading) and priming of another social concept, such as dyscalculia (difficulty with calculation), did not influence the magnitude of Stroop interference.

Goldfarb et al. concluded that different kinds of automatic processes interact such that the automatic process of reading can be influenced by the activation of a social concept. Behaviors consistent with the social concept of dyslexia, including difficulty with reading, appeared to be automatically activated and readily influenced the automatic operation of reading processes in the Stroop task. These findings suggest that social priming and the activation of social concepts have particularly powerful effects on basic perceptual and cognitive processes.—L.C.N.

MODELS OF ATTENTION

Flexible Attentional Control

Wilder, M. H., Mozer, M. C., & Wickens, C. D. (2011). An integrative, experience-based theory of attentional control. J Vis, 11(2) #8.

Attention is incredibly flexible and selection can operate over features in artificial 'spots and dots' displays to entire objects in real-world scenes. This diverse range of environments poses a problem for formal models of attentional control. Specifically, how can attention be configured to be directed toward color at one time, shape at another, or toward cars at yet another? Various schemes have been proposed for attentional control, ranging from bottom-up salience models to top-down 'endogenous' models. Further, these schemes tend to be applied to results from a particular domain, such as visual search or scene processing.

A recent paper by Wilder et al. attempts to integrate the different flavors of attentional control into a single conceptual framework. Their framework, termed TAsk-Specific and Contextual-scale control (TASC), involves combining different forms of attentional control into a larger control space. Tasks can be classified in terms of their specificity—the degree to which they rely on experience with the specific task. For example, contextual cuing, in which repeated displays come to produce efficient visual search, is high on task specificity; the capture of attention by an irrelevant color singleton would be low on task specificity. Further, tasks differ in the scale of the information relevant for the task, ranging from tasks in which attention is affected primarily by features (e.g., color or shape) to tasks in which attention is affected entire scenes (e.g., contextual cuing).

In the TASC framework, task specificity and context are orthogonal and map out a two-dimensional control space over which attention must operate. Wilder et al. note that different models of attention cover phenomena in one region of the control space; for example, salience-based models work well for explaining tasks with low specificity in which features are relevant. From there, Wilder et al. propose a broader model that encompasses the entire space and can account for relevant behavioral phenomena at different task and conceptual levels. Other attentional models can be viewed as specific versions of TASC that are suited to one region of control space.

Wilder et al. implement TASC as a series of modules that operate independently over an image. Each module computes a saliency map of some aspect of the image, and the independent saliency maps are combined into a larger saliency map that corresponds to the distribution of attention over an image. TASC modules each have a 'patch range' that corresponds to the scale of information relevant to a task. For modules with small patches, the saliency of the module is determined based on local features with a narrow spatial scale. For modules with large patches the saliency of the module is determined over the entire image (not small patches of the image). Each module is also specialized for a task based on learning a target template. Thus, modules capture the control space outlined by the TASC framework.

Simulations using the TASC implementation capture many attentional phenomena including visual search for features and conjunctions and search for objects in real-world scenes. Wilder et al. also generalize their simulations to other phenomena that exist in their control space, including figure-ground assignment and contextual cuing.

This computational framework for attentional control should be useful to attention researchers because of its broad perspective on control. The model points attentional control in useful directions by highlighting different scales over which control can occur and the role learning plays in shaping task-relevant targets. These ideas can be applied to existing empirical results, but they can also provide a foundation for new studies of attentional control.—S.P.V.

SUMMARY STATISTICS

How fast is the extraction of average size?

Whiting BF, Oriet C. (2011). Rapid averaging? Not so fast! Psychonomic Bulletin & Review, 18, 484–489.

Several contemporary models rely on the assumption that observers are able to rapidly extract basic statistical properties of the visual scene. In accordance with this assumption it was found that observers were able to compare the mean size of two groups of heterogeneous circles as easily as they were able to compare the size of two single circles. The fact that this pattern of results was found even when the groups of circles were presented for only 50 msec suggested to many that the processes involved in such calculations are fast, automatic, and preattentive. However, as Whiting and Oriet indicate, prior studies that used such short exposure durations, did not employ backward masks and therefore additional processing of the stimuli may have taken place after their physical offset. Additionally, Whiting and Oriet indicate that a relatively high performance in such tasks can also be achieved if the observers base their judgments on the cumulative mean—the mean size across trials—rather than the mean size of the current trial—trial mean. Thus, in addition to comparing performance under various exposure durations with and without backward masks, the frequency with which each trial mean occurred was also manipulated. Critically, this manipulation of the distribution of trial means resulted in two conditions: in one condition, similar to previous studies, relying on the cumulative mean rather than the trial mean leads to above-chance performance, while in the other condition relying on the cumulative mean results in chance performance. Whiting and Oriet have found that performance in the former condition was indeed above chance, but performance in the latter condition was at chance level, particularly at the short exposure durations with backward masks. This finding suggests that when the visibility of the circles was truly limited by a short exposure duration observers used information from previous trials (i.e., the cumulative mean) to help them determine the average size. Interestingly, the observers relied on the cumulative mean even when the trial mean was never similar to the cumulative mean. This finding is important because it offers an alternative explanation to previous findings of rapid averaging and it suggests that caution should be taken when assuming that such averaging is automatic.—Y.Y.