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The interplay of dynamic gaze and emotion on time estimation

Recent studies have shown that timing can be dramatically affected by gaze behavior (e.g., Thones et al., 2016) and emotional facial expressions (e.g., Droit-Volet, et al., 2004). However, the manner in which timing is modulated has not been consistent with results being mixed and interpretations attributed to both attentional and arousal mechanisms (e.g., Gil et al., 2011). Additionally, studies to-date have mainly utilized static images and a small sample of facial expressions, while gaze and emotion are highly complex, variable, and dynamic. In the present study, therefore, we investigated the effects of gaze direction and emotion on the perceived duration of dynamic facial stimuli by using video clips of a male and female actor (Amsterdam Dynamic Facial Expression Set; Van der Schalk et al., 2011). Specifically, we presented angry, happy, fearful, and neutral faces by keeping constant the timing of emotional exposure and varying the gaze (direct or indirect) duration (from 960 to 1680 ms). Twenty-four participants performed a temporal bisection task whose analysis showed a general underestimation of angry, fearful, and neutral faces as compared to happy faces, a result that was independent of gaze direction. This finding is in line with previous studies supporting that the allocation of attention to processing emotion leads to temporal underestimation (e.g., Lui et al., 2011) according to the Attentional Gate Model (AGM; e.g., Zakay & Block, 1995). Conversely, the bisection point for happy faces resulted in an interval overestimation only for the cases that the gaze was direct, a result that could be interpreted as a product of approach-withdrawal attentional mechanisms (Angrilli et al., 1997; Corr, 2013). Additionally, a higher weber ratio for happy faces with direct as opposed to averted gaze was noted, thus indicating a lower temporal sensitivity for directly gazing happy faces. This result seems to support the aforementioned finding on temporal overestimated of happy directly gazing faces, as it could be attributed to the cognitive bias promoted by affiliation behaviors, where the anticipation of a positive event and the preparation to act is linked to dopamine activity (i.e., readiness to move) and the subsequent prolonged experience of the event (Droit-Volet et al., 2009). Together, our results support that apart from the attentional accounts on time modulation in the presence of gaze and emotional signals, the social significance of the stimulus also plays a crucial role in dynamically forming perceived temporal information.

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Metricality and rhythm complexity interactively modulate visual rhythm perceptual learning

Rhythm perception is considered as having a special affinity with the auditory system (Barakat et al., 2015; Grahn, 2012). Yet, recent evidence suggests visual moving stimuli can effectively mediate rhythmic information (Grahn, 2012), while discrimination performance of two-integer-ratio visual rhythms consisting of static visual stimuli can also be enhanced following training with multisensory and visual-only moving stimuli (Paraskevoudi & Vatakis, in preparation). However, it remains unknown whether these improvements would be observed in rhythms of different interval durations that have been found to increase the memory load (Teki & Griffiths, 2014). Here, we aimed to extend previous findings by assessing whether the metricality (metric simple vs. metric complex rhythms) and rhythm complexity (i.e., number of integer ratios) interactively affect post-training performance in a task consisting of static visual rhythms. We, thus, investigated whether multisensory training with moving stimuli (i.e., a moving bar accompanied by filled auditory tones) benefits discrimination of metric simple and complex visual rhythms (i.e., sequences of static circles of changing colors) that consisted of four (Exp.1), three, and two (Exp. 2) interval durations. Experiment 1 showed significant post-training enhancements for metric complex four-integer-ratio visual rhythms only, a finding that was also evident in three- and two-integer-ratio rhythms (Exp. 2). These results are in line with recent evidence suggesting that training on more difficult judgments may improve temporal acuity (De Niear, Koo, & Wallace, 2016). Experiment 2 further demonstrated that the post-training enhancements are limited to three-integer-ratio rhythms and metric-complex rhythms only. Interestingly, contrary to our previous work no significant post-training improvements were observed for two-integer-ratio rhythms. We speculate that this difference results from the use of filled auditory intervals during multisensory training in Exp. 2 as compared to the empty auditory intervals employed in previous studies (Paraskevoudi & Vatakis, in preparation). Taken together, these findings suggest that metricality and rhythm complexity together affect perceptual learning of rhythms. Future studies need to elucidate the differential effects of filled and empty auditory intervals on multisensory rhythm perceptual learning.

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Causality and probability in causal maps

The aim of this research is to bring together philosophy of science and experimental psychology on representing causal knowledge and learning. In the literature cited causal knowledge and causal learning underlie any scientific or naive theory formation. It could be argued that the formation and alteration of any abstract and coherent set of concepts and beliefs could be based on or constrained by a causal learning process (Bonawitz et al. 2006, 2012). We will discuss the theory of causal maps and the critique it has received: is the notion of probability needed for an analysis of the concept of causation in forming a theory of knowledge and learning within the field of cognitive psychology?

In the field of philosophy and psychology during the 20th century the concept of causality moved towards a probabilistic analysis. The last ten years, psychological research in the field of causal models has shown that the developing cognitive system of early childhood seems to be organized with such representations and cognitive mechanisms that can be characterized as causal models of the world and enable children to develop an accurate "causal map" (Gopnik, et al., 2004). These causal models are based on the theory of probability and are computationally implemented in Causal Bayes Networks.

Alison Gopnik and her colleagues (Gopnik et al., 2001, 2004, Gopnik and Schulz, 2007) support that starting out in infancy and early childhood and throughout our adult life, human learning is explained better in terms of theory building and changing. According to Gopnik theory formation and causal representation go hand in hand (Gopnik, 2012). The notion of causality is important, because it helps us to put our experience in order, to predict events, to imagine new possibilities, even ones that will never occur in reality, and to manipulate our environment.

In the past it was supported that children learn by making and testing hypotheses. Contrary to that, Gopnik and her colleagues propose that children behave as probabilistic learners (Gopnik, et al. 2004), that is by making hypotheses and gradually change the probability of each hypothesis to occur under new data, new experiences. They are equipped with a causal learning system, which makes them able to construe hypotheses about how the experience of events captures the causal structure of their relations. Causal maps represent causal relations and are non egocentric, accurate, and can be learned. Experimental data support that children use such representations, which are implemented in Causal Bayes Nets. Children use information about the probability of parameters in a causal network to form a causal map.

Johnson-Laird and his colleagues (Goldvarg, E. & Johnson-Laird, 2000, Frosh, C. and Johnson–Laird, P.N. 2011) are skeptical as of the need of a probabilistic analysis of causality in causal reasoning and modeling (Khemlani, S., Lotstein, M. and Johnson-Laird, P.N., 2014).

It seems that philosophers and cognitive researchers can both benefit from this debate. It also seems promising that a probabilistic approach of the concept of causality has been so fruitful in the field of cognitive development and theory change. In conclusion, it seems possible that the missing link between rational models of inference and theory based conceptual development is a probabilistic notion of causality.

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Self-deception and illusion of fairness in bargaining games

In this presentation, we review the literature in regards to deception and self-deception in bargaining games. Bargaining games such as the Ultimatum (UG) and the Dictator's Game (DG) have been a topic of heated debate in regards to social cognition and behaviour for the last 20 years. In UG (**1**), player A ("proposer") is given an amount of money and asked to choose what percentage to give to player B ("responder"). Then, the other player either accepts the offer or rejects it. If the responder accepts, the amounts are shared as agreed. If the offer is declined, players receive nothing. According to Game Theory, the responder should never decline an offer, no matter how low it might be, because "something is better than nothing" and, therefore, a subgame perfect strategy would be the "no-declining" strategy. Accordingly, since the proposer is aware of the "no-declining" strategy of the responder, offers should be minimal, in order to maximize the proposer's gain. However, when actual individuals are tested in UG, their behaviour is quite different from the one expected by Game Theory. Responders usually decline offers that are less than 30% and proposers tend to make fair offers ranging an average of 40-50%. This phenomenon was initially explained as an adaptive tendency of people for fairness and the rejecting behaviour of the responders was interpreted as altruistic punishment towards an unfair player (**2**). In evolutionary terms, an overly egoistic individual might be dangerous for the group's survival and prosperity. Thus, group members are justified to punish the culprit, even at their own (minimal) expense.

It was suggested that the proposers' behaviour in UG might actually be an elaborate maximizing strategy taking into account all the possible mental mechanisms of the responder that could lead to a rejection. In order to investigate this hypothesis, a new, simplified version of UG, was created (**3**). In DG, player A ("allocator") chooses the amount to offer but player B ("recipient") has no choice but to accept it. This way, rational allocators can just keep all the money for themselves without fearing a rejection by player B. Even so, it has been shown that players tend to offer an average of 20-30% to their counterpart. This was initially thought to be evidence of an inherent fairness principle. However, a multitude of experiments and different manipulations (social distance, imbalanced information, context, monitoring, role assignment method etc.) of both UG and DG have shown that it is easy for players to change their strategy and become more or (more often) less fair, once the conditions allow it (**2, 4**). It is therefore possible that people want to be perceived as fair and will act like it as long as their behaviour is directly and obviously linked to the outcome of the game. This means that people are likely deceiving others and themselves in order to protect their self-perception as fair while at the same time protecting their self-interest.

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Aspects of Performance Spectatorship: "embodied simulation" and "embodied language"

Nowadays, the new field of Neuroaesthetics –introduced by Semir Zeki– along with the discovery of the Mirror Neuron System (MNs) in the brain –by Giacomo Rizzolatti– have enhanced the relations between Art and Neuroscience (Zeki 1999, Rizzolatti 2004). Their findings shed light on issues concerning aesthetic perception by investigating the brain-body physiological correlates of aesthetic experience and action-understanding, both of which are fundamental in theatre perception.

In the late twentieth century, a number of important theatre theorists (H. Blau, J. Feral, Br. McConachie etc) drew attention to the significance of the *sensory element* in the spectator's perception of performance. In their publications they introduced concepts of spectatorship which moved away from *interpretation* towards *sensory* perception and *empathy*. The fact is that theorists of theatre had intuitively stressed the central role that *sensation* plays in spectatorship, at least one decade before neuroscientists begun to investigate aesthetics thoroughly; not to mention Antonin Artaud (1958) who envisioned it more than half a century ago.

Neuroscientist Vittorio Gallese coined the term “embodied simulation” in order to describe the neural activation taking place during the aesthetic response to paintings and sculptures (Galesse 2017). In addition, available neuroimaging evidence seems to suggest that even certain classes of *words* can activate specific sensorimotor areas in the individual’s brain in order to ascribe meaning. Thus, a similar term, such as “embodied language” (Buccino 2016), is employed in order to describe the neural substrates activated during language understanding. In many ways, the above-mentioned findings (visual and auditory stimuli) demonstrate that the performance spectator’s primal perception occurs on a *sensory* level, thus vindicating the assertions of contemporary theatre theorists on spectatorship.

The proposed announcement reviews the above-mentioned neuroimaging data and discusses them in connection to performance spectatorship. The author strongly believes that the time is right for theatre theorists, artists and neuroscientists to form an interdisciplinary research platform on an issue of their common interest: spectatorship. The announcement will also discuss the outcome of a few cases of such a collaboration.