Neurocognitive Mechanisms of Contextual Adjustments in Cognitive Control

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When routine behavior runs into trouble, "cognitive control" processes are recruited to bring information processing in line with current demands. For instance, encountering an almost-accident on our commute will reinforce our attentional focus on the traffic and away from the radio. How does the brain accomplish this? In this talk, I will present behavioral, neuroimaging, and neuro-stimulation data that delineate the cognitive and neural mechanisms underlying our ability to adapt to changing task demands. Specifically, I will present a "control learning" perspective that views cognitive control as being guided by learning and memory mechanisms, exploiting statistical regularities in our environment to anticipate the need for control. Control learning not only adapts attentional sets to changing demands over time, but it can also directly associate appropriate top-down attentional sets with specific bottom-up cues. This type of learning holds the promise of combining the speed of automatic processing with the flexibility of controlled processing, and could form the basis of novel interventions in clinical conditions that involve impaired cognitive control.

Social signalling as a framework for understanding human non-verbal behaviour

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Face to face social interactions between two people involve a rich exchange of verbal and non-verbal signals, but the cognitive and neural mechanisms supporting dynamic interactions remain poorly understood. This talk will use a social signalling framework to make sense of one particularly social behaviour – imitation – which has been described as a 'social glue' that causes affiliation and liking. However, it is not clear what cognitive and brain mechanisms could link imitation to affiliation. By placing the 'social glue' hypothesis within a signalling framework, it is possible to make specific testable predictions for how and why we imitate. First, to act as social glue, imitation should be produced when another person is watching and can receive the imitation signal. Second, the person watching should change their evaluation of the imitator. I will describe a series of studies which test the first of these predictions in detail, using a behavioural and neuroimaging methods with infants, children, typical adults and adults with autism spectrum condition. The results converge in showing that being watched increases the tendency to imitate, and supports the interpretation of imitation as a signalling behaviour.

Building on this, the second part of this talk describes the new methods available to explore social signalling behaviour in live interactions. Using detailed motion capture together with wavelets analysis, we can track and quantify precise patterns of natural mimicry behaviour and other social cues in two person conversation. Using functional near-infrared spectroscopy, we can record neural signatures of imitating and being imitated while freely-moving attendees are engaged in naturalistic tasks. These new approaches can give deeper insights into the details of social behaviour and allow us to define the neural mechanisms of dynamic social interactions. Applying these methods and interpreting them within the context of a social signalling framework shows how we can turn the idea of 'second person neuroscience' into a concrete reality.

Ecological Language: A Multimodal Approach to Language Learning and Processing

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The human brain has evolved the ability to support communication in complex and dynamic environments. In such environments, language is learned, and mostly used in face-to-face contexts in which processing and learning is based on multiple cues both linguistic and non-linguistic. Yet, our understanding of how language is learnt and processed comes for the most from reductionist approaches in which the multimodal signal is reduced to speech or text. I will introduce our current programme of research that investigates language in real-world settings in which learning and processing are intertwined and the listener/learner has access to – and therefore can take advantage of – the multiple cues provided by the speaker. I will then describe studies that aim at characterising the distribution of the multimodal cues in the language used by caregivers when interacting with their children (mostly 2-3 years old) and provide data concerning how these cues are differentially distributed depending upon whether the child knows the objects being talked about (allowing us to more clearly isolate learning episodes), and whether the objects are present (ostensive vs. non-ostensive). I will then move to a study using EEG addressing the question of how discourse but crucially also the non-linguistic cues modulate predictions about the next word in a sentence. I will conclude discussing the insights we have and (especially) can gain using this real world, more ecologically valid, approach to the study of language.

Contributions

On the limited impact of media source credibility on social judgments based on emotional headlines

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Since news spreads rapidly and reaches millions, the ability to distinguish between credible and less credible media sources may be more crucial than ever. Yet, recent behavioral and electrophysiological evidence suggests that social judgments are primarily based on emotional contents of headlines independent of source credibility. Here we investigate influences of emotional headlines and source credibility on pupil size as a measure of exerted cognitive effort, and on behavioral measures of confidence related to social judgments. Thirty participants read headlines about the social behavior of depicted unfamiliar persons from websites of well-known German news media that are perceived as credible or less credible. Persons paired with emotional headlines were judged more negative or positive than persons associated with neutral headlines, and emotional judgments were faster and made with more confidence than neutral judgments. None of these effects was modulated by source credibility. Pupil dilation during social judgments was reduced for emotional relative to neutral judgments, and less credible sources were associated with larger pupil dilatation relative to credible sources only in response to neutral headlines. These findings complement recent electrophysiological evidence in demonstrating a dominant influence of emotional contents of headlines independent of source credibility. They also shed light on a potential mechanism. Cognitive resources to evaluate the credibility of news may primarily be allocated to neutral, but not to emotional contents.

Voluntary forgetting of outdated information across prolonged delay: Testing theoretical accounts of list-method directed forgetting

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People can purposefully forget information that is irrelevant and no longer needed. In the lab, such forgetting of outdated information is often examined by means of list-method directed forgetting (LMDF). Several accounts have been proposed to explain LMDF, but despite decades of research, there is still no agreement concerning the mechanism(s) mediating it. Here, we used prolonged retention intervals to examine two specific accounts of LMDF, namely mental context change and selective rehearsal. Experiment 1 probed the mental context change account by contrasting LMDF with context-dependent forgetting across two delay intervals. The results showed intact LMDF, but eliminated context-dependent forgetting with longer delay, which is inconsistent with the context-change account. Experiment 2 probed the selective-rehearsal account by contrasting the longevity of LMDF across intentional and incidental encoding. The results showed persistent LMDF for both types of encoding, which indicates that selective rehearsal is not critical for the persistence of LMDF. Together, the findings indicate that context change and selective rehearsal cannot account for persistent LMDF, thus more generally challenging contemporary noninhibitory accounts of LMDF.

Denktraining 2.0: Macht die Trainingsperson den Unterschied?

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Die Denktrainings von K. J. Klauer zur Schulung induktiven Denkens gelten als die empirisch am besten geprüften kognitiven Trainings im deutschsprachigen Raum (Hasselhorn, XXXX). Das Trainingsprogramm „Keiner ist so schlau wie ich" (KISSWI; Klauer, 2007/2009/2011) stellt eine zeitgemäße und ökonomische Version für Kinder im Vorschul- und Schuleintrittsalter dar. Allerdings wurde das KISSWI ursprünglich als Einzeltraining konzipiert. Ein Dissertationsprojekt an der TU Chemnitz untersucht nun, inwieweit dieses Trainingsprogramm auch bei einer Durchführung in Gruppen von ca. zehn Kindern wirksam ist. Die vorliegende Teilstudie überprüft drei Hypothesen: (H1) Das Gruppentraining erzielt im Vergleich zum Einzeltraining ähnlich hohe Effekte auf die kognitiven Fähigkeiten der trainierten Kinder. (H2) Das Gruppentraining erzielt, wenn es von (geschulten) Psychologiestudierenden durchgeführt wird, im Vergleich zu einer Leitung durch Erzieherinnen, ähnlich hohe Effekte. (H3) Das Gruppentraining erzielt vergleichbare Ergebnisse bei Kindern im Vorschul- und Schuleintrittsalter. Die Effekte des Gruppentrainings wurden mit einer Wartekontrollgruppen-Studie im Prä-Post-Design bei Vorschul- und Grundschulkindern der ersten Klasse getestet. Die Vorschul-Stichprobe umfasste 127 Kinder (M=6;3 Jahre). 60 der Kinder wurden von Ihren BezugserzieherInnen aus der Kita trainiert (31 Kinder in der Experimentalgruppe [EG]; 29 Kinder in der Wartekontrollgruppe [WKG]). Die verbleibenden 67 Vorschulkinder (EG=33; WKG=34) wurden von geschulten Master-Studierenden der Psychologie trainiert. In der Grundschul-Stichprobe waren 128 Kinder (M=7;1 Jahre). 59 der Grundschulkinder (EG=29; WKG=30) wurden von ihren betreuenden HorterzieherInnen trainiert und 69 Kinder (EG=36; WKG=33) erhielten das Training von geschulten Master-Studierenden der Psychologie. Die gewonnenen Daten werden aktuell noch analysiert, die Ergebnisse liegen im Januar 2020 vor.

Trait empathy affects expectancy and subsequent neural processing of observed actions

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Accumulating evidence suggests that activity in the anterior cingulate cortex after observed actions reflects an action prediction error rather than, as previously thought, the coding of response accuracy. This process seems to be modulated by trait empathy, but the underlying mechanisms remain to be explored. In this study we aimed to examine these mechanisms further by applying a paradigm in which observer participants' expectations concerning the outcome of the actions of an observed person were modulated by two experimental manipulations. These were true vs. false-belief of the observed person, which we expected to be especially dependent on empathy (as was shown by previous studies on false-belief tasks) as well as task difficulty (easy vs. hard), which we expected to be less dependent on empathy. Empathy and expectation affected event-related-potential amplitudes between 100 and 250 ms after the observed response: less expected events, that is, correct answers in the false-belief condition and incorrect answers in the true-belief condition, led to higher amplitudes compared to more expected events in easy trials, but this effect emerged only for highly empathic individuals. Interestingly, behavioral measures of expectation were similarly affected by empathy, suggesting that empathy helps expectation formation and that these expectations then affect electrophysiological responses.