S3-5-1-5 Computations for value-decision making in nonsocial and social situations: Emulation and extraction of contextual information

Hiroyuki Nakahara 1,2
1 Lab for Int Theor Neurosci, RIKEN BSI, Wako, Japan 2 Dpt Comp Intell & Sys Sci, Tokyo Inst of Tech, Yokohama, Japan

The computational framework of reinforcement learning or temporal difference learning underlies the recent progress in research on neural value-based decision making and characterizes choice behaviors based on associations between 'state' input and 'action' output, through reward outcomes or 'value'. The computations of actual choice behaviors, however, go beyond these associations.We highlight two computational capabilities that must be combined with these associations: emulation and extraction of contextual information. We investigated contextual emulation in a social situation, i.e., emulating the other's value-based decision making. We used human fMRI experiments to examine which brain areas contribute to the emulated-other's reward prediction error (RPE) to update the subject's decision variables. Both the ventromedial prefrontal cortex (vmPFC) and temporoparietal junction (TPJ) contributed to the other's RPE. The TPJ encoded the other's RPE, but not the self RPE. The vmPFC encoded both the other's and the self-RPE, but in different regions; therefore, the vmPFC is particularly suited for influencing the subject's decisions. Thus, the capability to emulate the other can be integrated with the basic form of value-based decision making.We further show, mostly using non-social situations, that information or neural signals beyond current sensory input may greatly improve value-based decision making under the temporal difference learning framework. These signals can enrich input representations for both reward prediction and action selection. Accordingly, they help to achieve better performance in both functions and also make anticipatory preparation and execution possible. These suggest that input constructions by extracting appropriate contextual signals is integral to neural value-based decision-making. This view may resolve some controversial issues in the field, e.g., contextual and salience coding in relation to dopamine activity.
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