PUTTING THE BUDDHISM/SCIENCE DIALOGUE ON A NEW FOOTING

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Theoretical Views on the Nature of Spontaneous Thought: Neural Bases and Connections with Phenomenology and Meditation Practice

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Kalina Christoff, PhD

Christoff explained that the unusual context of this meeting had led her to a decision to "open up myself as a scientist to you, partly as an opportunity for witnessing what science really is." Thus her talk covered not only the findings she would normally present, but also a view of her personal path as a scientist, including how professional constraints around the need to publish affected her research decisions and the serendipity of interactions with colleagues opened new directions of thought.

Christoff grew up in Bulgaria where her formative experiences included summers spent wandering in orchards, an interest in analyzing her dreams, and research as a student into insight problem solving that involved thinking out loud. She did her masters in cognitive science in Bulgaria and then her PhD at Stanford University.

She still wanted to study thoughts but the closest she could get to it, other than studying working memory, was the relational integration involved in complex problem solving. Using fMRI scans, she identified activity in the rostrolateral prefrontal cortex (RLPFC) that occurred during problem solving that involved integrating two relations but not in simpler problems. For several years she became fascinated with understanding the functions of this brain region. Around the same time, in the late 90s, researchers became aware of the default network and the fact that brain activity during rest is systematic and not random noise. Recognizing that the resting state was not a good baseline for cognitive tests, she began recording fMRI scans of the simplest possible cognitive tasks in search of a better baseline test. Comparing these scans to the resting state, she was surprised to find reliable activation of the RLPFC during rest that was more pronounced than during complex reasoning. She began to explore the possibility that this region was involved in spontaneous thought processes, described as stimulus-independent or task-unrelated thought.

In an experiment where she tried to modulate the activity of her own RLPFC in the scanner, she had little success doing mental tasks that involved complex relational integration, but—inspired by the data on resting—she found significant activation when she observed her own thoughts passively. A colleague's comment that this passive observation sounded like meditation sparked her interest in research on meditation, although she does not practice it herself.

In an article in *Psychological Bulletin* titled "The Restless Mind," her UBC colleagues Jonathan Schooler and Jonathan Smallwood introduced the term "mind wandering" for stimulus-independent or task-unrelated thought in a deliberate attempt to raise the visibility of such research for mainstream psychology and lay audiences. The earlier influence of behaviorism, and the difficulty of creating task-oriented experiments to study task-unrelated thought, had led to the assumption that this mode of thought could not be measured and therefore was outside the realm of science. The recent awareness of the default network has also contributed to acceptance of spontaneous thought as a valid subject for study.

Continuing with the idea of the need to appeal to scientific respectability at the same time as advancing her own research agenda, Christoff designed an experiment using experience-sampling thought probes, along with other more conventional behavioral and

fMRI measures, to confirm the value of thought probes in studying mind wandering during attentional lapses in the sustained attention to response task. The study also revealed the activation of several executive regions as well as the default network, which it was decided—strategically—to include but de-emphasize in publication.

Most significantly for Christoff's own purposes, the study had shown a surprising inverse relationship between RLPFC activation and subjects' meta-awareness of how their attention was focused. She reasoned that this might indicate differences in types of meta-awareness, distinguishing meta-awareness of processes such as task relationships, intuition, or confidence from meta-awareness of content. Zachary Irving suggested that the effect might result from split attention between the sustained attention to response task and the reported mind wandering, and Clifford Saron added a distinction between obliviously "zoning out" and the more split attention involved in multi-tasking. Christoff responded that this would be an opportunity for micro-phenomenology to add clarification to the thought probe technique.

Christoff then reported on some more theoretical work on mind wandering that she was engaged in with Zachary Irving and Evan Thompson. The current literature has a definitive view of mind wandering as task-unrelated or stimulus-independent thought, with only rare mention of a dynamic process, which Christoff sees as the most essential aspect of spontaneous thought. Focusing on the dynamics and the metaphor of wandering, she defined spontaneous thought as thought that moves relatively freely due to absence of strong constraints on its contents and its transitions from one mental state to another. As a definition of mental state, she offered: a transient cognitive or emotional state of the organism that can be described in terms of its contents and the relation that the subject bears to those contents—for example, perceiving, believing, fearing, imagining or remembering. Based on his own experience, David McMahan added the concept of narrative, which Christoff agreed captured the dynamic aspect. She also noted the value of the metaphors from Buddhist texts describing awareness that Michael Sheehy had introduced in his presentation, and how metaphors of movement such as a bird's flight captured the dynamic nature of the experience.

Christoff presented a graph mapping the conceptual space relating different types of thought on two axes: deliberate, effortful constraints involving executive functions and cognitive control, versus automatic, effortless constraints. Automatic constraints include affective salience, motivational intensity, habits, and implicit skills. Within the relatively automatic category of spontaneous thought, she placed creative thinking further than mind-wandering on the deliberate axis, and goal-directed thought further still. Rumination and obsessive thought are examples of strongly automatic thought that does not involve deliberateness or executive control. The novel distinction of this schema is the idea that automatic constraints outside of executive mechanisms operate on thought and make it non-spontaneous. This also throws light on the challenges of phenomenology, because first-person study of automatic constraints would only be possible with significant training.

Cortland Dahl suggested that the perceptual decoupling that occurs in some types of thought might be a relevant dimension of constraint. He also noted that many styles of meditation practice work with meta-awareness of the dynamic nature of spontaneous thoughts. Christoff related this to her chapter in *Hypnosis and Meditation*, "Increasing Cognitive-Emotional Flexibility with Meditation and Hypnosis," which offered

theoretical speculation on how meditation involving meta-awareness might weaken the associative links between thoughts so that they become less automatic and more spontaneous. Francisca Cho suggested that another automatic constraint might be the underlying narrative or interpretive, dispositional lens that people have about their identity and relationship to the world. Christoff made a point of distinguishing aspects of this that might be classified as habits from the semantic memory that serves as a model of one's world, which she saw as important but very difficult to see in momentary instantiations of unfolding thoughts. Saron added the possibility of considering personality as an automatic constraint.

Continuing with her presentation, Christoff offered her wish list for outcomes from the science/Buddhism dialogue, noting that the current meeting had already made significant progress on the first:

- Developing novel experimental procedures and improving theoretical models and ontologies of mental processes, especially the stream of consciousness.
- Extending the scientific method in general, and in particular to better handle spontaneous processes and experience.

She observed that "the scientific method is overdue for some foundational work. Since Francis Bacon no one has done much on that."

- Putting the science/humanities dialogue on a new footing.

She described this as the elephant in the room, and more necessary in fundamental ways than a new footing for the science/Buddhism dialogue, though the latter might serve as a conduit for a rapprochement between science and the humanities. She saw the humanities' claims to plurality of perspectives in contrast with science's claims to objectivity as the primary disconnect and source of animosity. Martijn van Beek offered the concept of adequacy as a way of resolving the problem of plural narratives: recognizing that adequacy is always situated in context rather than making claims to universal validity. David Germano observed that practices of interpretation and the concept of the hermeneutical circle, as well as the growing role of data analysis in the humanities, were areas that might offer common ground with science. He also suggested possibilities for more deeply engaged pragmatic collaboration between science and humanities. Michael Sheehy remarked on two further aspects of collaboration beyond the interpretive where the humanities can make a significant contribution to science: the priorities for study and contextual factors of an experimental environment, and the hybrid approach where theoretical models are abstracted from existing data sets and then inform future experiments. Cortland Dahl commented that many such collaborations were already taking place in his own laboratory, and in the example that Christoff had given of her work with Thompson and Irving. Saron and Michael Lifshitz introduced the field within humanities known as critical neuroscience, which critiques the ways in which neuroscience information is constructed, taken up by other cultural forces such as media, and then informs how we think of ourselves as human beings.

Christoff noted the need for a new field of neuro-ethics, which related to the final item on her wish list:

- Incorporating some Buddhist values into Western values, such as ethical responsibility for the effect of one's creations, and our relationship to nature.

She saw the inclusion of ethics in science as in some ways antithetical to Western values, and hoped that the science/Buddhism dialogue could serve as a platform to inform a shift in this thinking.