

# How NCCpr and NCCae may be NCC-in-disguise: a reminder from the microgenetic stance

Talis Bachmann

University of Tartu, Institute of Public Law and Institute of Psychology,  
Estonia, talis.bachmann@ut.ee /presented by Renate Rutiku/



## The problem

The quest for neural correlates of consciousness (NCC) has been recently caught by a hiccup. It appears that when we use *contrastive analysis* of brain-process data collected in conscious vs unconscious conditions with invariant stimuli not only NCC directly corresponding to conscious experience are extracted, but also **prerequisite** and **aftereffect** (consequent) processes necessarily accompanying the NCC-processes are indicated (NCCpr and NCCae, respectively) (Bachmann, 2009; Aru, Bachmann, Singer, & Melloni, 2012; de Graaf, Hsieh, & Sack, 2012). How to overcome this methodological problem is not so obvious (Miller, 2007). An additional complexity appears because at a closer look, **NCCpr and NCCae also are ambiguous** when we want to interpret them.

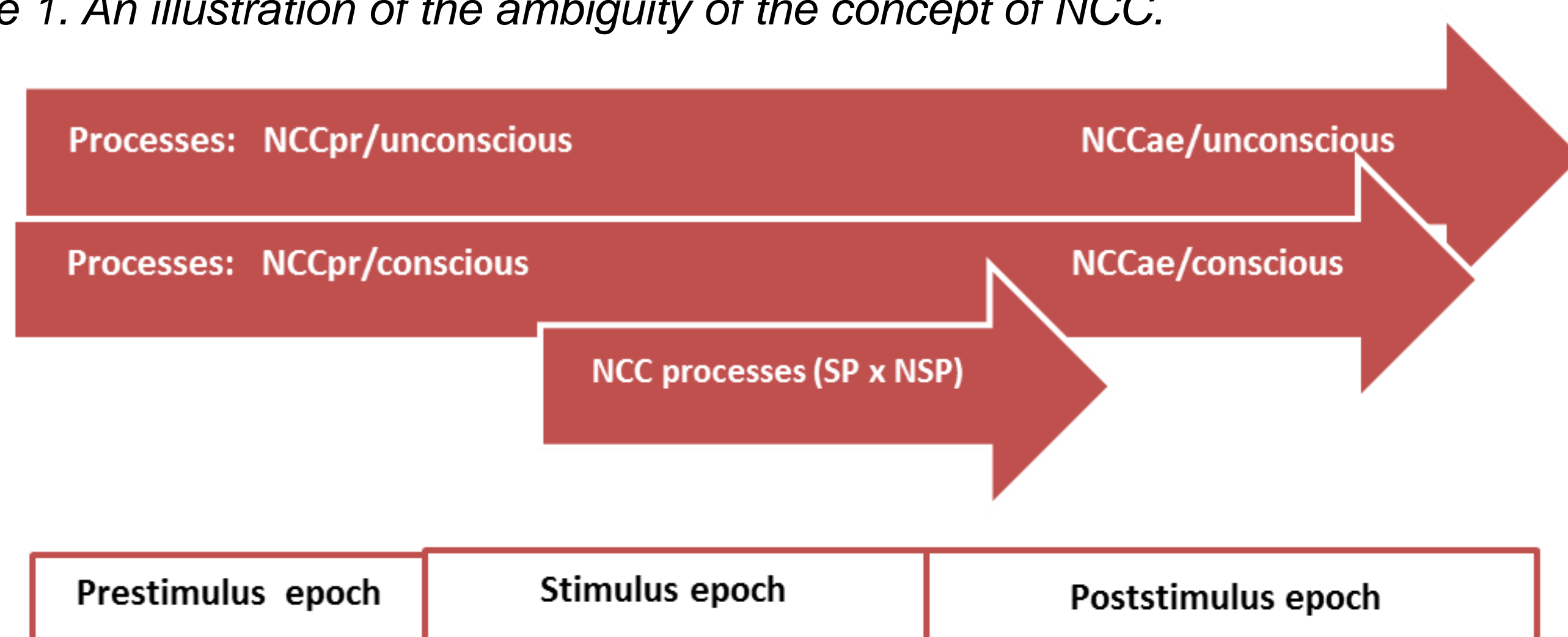
Several complexities hindering further progress can be listed.

1. The NCCpr need not and probably typically do not terminate when NCC proper becomes established. NCCpr becomes a part of NCC – a hidden part – and it is highly complicated to disentangle temporally simultaneous NCC aspects that are added from the aspects that constitute the former NCCpr now present together with the NCC proper. Should we rename the process behind NCCpr as a constituent of NCC as soon as it temporally becomes aligned with NCC or should we accept that NCCpr continues during NCC in parallel as a temporally overlapping, but different activity? Can NCC proper exist without the support from the continued processes formerly marked as NCCpr?

2. The same applies to NCC vs NCCae. NCC need not be and probably are not unitary and a subpart of NCC may continue as NCCae.

3. When reporting about conscious experience subjects base their evaluations on the contents of consciousness. However, they do not report and realistically can not report all the contents present in their phenomenal experience. In the conscious percept, (i) a certain sub-part or aspect spontaneously and *selectively* stands out more conspicuously than some other parts, (ii) the subjects deliberately use certain **critera contents** as the basis of their report and leave the rest of contents for good, and (iii) they use more or less conservative *decision criteria* when reporting the contents (including the possibility that qualitatively same contents are used for report differently depending on how conservative the criterion for ‘aware’ vs ‘unaware’ report, is). These circumstances leave open the possibility that actually **the NCCpr and NCCae are still related to conscious experience**, but subsumed under unconscious conditions because subjects are incapable or unwilling to report the qualitatively different contents from those pre- and after-stages of the full-blown conscious percept. Similarly, experimental instructions of awareness report often set subjects to certain content criteria different from all possible aspects of conscious contents. **NCCpr and NCCae must not be interpreted exclusively as markers of unconscious processes as long as there may be some difference between (1) intuitively adopted or instruction-based selective contents on which the report has to be founded and (2) the remaining part of the varied conscious contents.**

Figure 1. An illustration of the ambiguity of the concept of NCC.



## Microgenetic perspective

In order to deal with the present problem a microgenetic perspective (Bachmann, 2000) combined with the mechanistic approach distinguishing brain systems for contents and levels of consciousness (Bachmann, 1984; Hohwy, 2009; Bachmann & Hudetz, 2014) can be recommended:

- ✓ Conscious percepts develop through several qualitatively different incremental stages characterized by the changing quality of the perceptual contents: **proto-objects** stage of the subjective image → complete, stabilized perceptual image stage with its **differentiated contents** in the analogue format → **conceptually encoded** knowledge stage ( → genesis of a response alternative as a post-perceptual stage)  
**Imperative:** distinguish (i) NCCpr/no-consciousness, (ii) NCCpr as a marker of proto-object consciousness qualitatively different from the analogue-format awareness-response criterion content for NCC, (iii) NCC/conceptual distinguished from NCC/analogue-format.
- ✓ Conscious percepts decay in time through decremental stages by changing into immediate sensory persistence and iconic (echoic) memory and also working memory representations; direct-percept contents and immediate memory-contents differ qualitatively.  
**Imperative:** distinguish (i) various versions of NCC, (ii) NCCae as a vague sensory-memory experience, (iii) NCCae as experienced iconic access, (iv) NCCae as conscious aspect of working memory, (v) NCCae/no-conscious. Distinguish NCC-as-perception vs NCC-as-memory.
- ✓ Before actual stimulus presentation, subjects can consciously experience a spontaneous or expected image of any stimulus, a proto-object entity, or a specific stimulus alternative. Therefore, NCCpr interpreted as NCCpr/no-consciousness can be actually NCCpr/conscious, but different from NCC when the contents criterion for NCC is different. NCC-as-expectancy ≠ NCC-as-actual.  
**Imperative:** distinguish (i) NCCpr/no-consciousness, (ii) NCCpr as a marker of expectancy based generic contents, (iii) NCCpr as a marker of specific expectancy, (iv) NCC-primitive object contents, (v) NCC proper with contents corresponding to criterion contents of response.
- ✓ Conscious perception of a specific stimulus necessarily owes to interaction of two systems – specific content representing systems (SP) and nonspecific systems of modulation (NSP). Neural markers of activity of these systems may differ.  
**Imperative:** distinguish (i) NCC-general invariant to specific contents, (ii) NCC-specific as markers of specific content, (iii) NCC indicative of interaction SP x NSP. (Similarly for NCCpr and NCCae.)

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