

Perceiving Events and the Format of Time

ESPP 2026 Abstract

In recent years, there has been a significant amount of work devoted to the topic of representational format. This literature has largely developed by looking at research concerning a few domains in perception and cognition, for example, space (Yousif 2022), objects (Quilty-Dunn 2020), numbers (Beck 2012), and emotions (Rivadulla Duro 2026). Despite the variety of domains, the majority of this literature has focused on the distinction between analogue, iconic, and discursive representational formats.

Some have even used these representational format divisions as a means of drawing architectural divisions in the mind by arguing that certain psychological faculties trade in specific representational formats (e.g., Block (2023) on the division between perception and cognition; Quilty-Dunn (2019) on the division between iconic and working memory).

The paper argues that the analogue, iconic, and discursive (AID) distinction fails to capture the variety of representational formats employed in perception, and therefore, these categories cannot be used to distinguish perception from the rest of the cognitive architecture. To do this, I will focus on recent research on event and temporal perception. In order to perceive events that have temporal properties, our perceptual systems use a multitude of different representational formats, some of which fail to fit into either of the AID categories. In giving this argument, I will also develop a general formula for specifying representational format types that does away with drawing analogies between representational formats in cognitive science and the formats of representational artifacts.

Section one lays out the distinction between analogue, iconic, and discursive representational formats, and specifies how behavioural, computational, and neuroscientific evidence is used to identify the representational formats employed in cognition and perception. Adopting the characterization of the AID distinction from Sam Clarke (2022), AID representations are understood in the following way:

Analogue Representations are representations that represent magnitudes in the world in virtue of there being more or less of some property in the representational vehicle (i.e., there is a monotonic relationship between the magnitude of some property of the vehicle and some represented property).

Iconic representations are analogue maps in that (i) the parts of the representation have a map-like structure and the relationships between the parts of the representation correspond with relationships between parts of the represented scene (thereby satisfying a version of the *part principles* (Quilty-Dunn 2016)), and (ii) the properties represented as being instantiated by that representation are encoded via analogue magnitude representations.

Discursive representations are language-like in that the relationships between parts of the representation needn't correspond to relationships between parts of the represented scene, and they can be decomposed into elements referential and predicative components.

If we look to the existing literature on representational format (especially in perception), evidence for representational format has come in three forms: behaviour (e.g., Treisman 1988; Fodor 2007), neuroscience (Nakayama & Martini 2011; Beuhler 2025), and computational models (Beuhler 2025).

In section two, I argue that temporal perception employs representational formats that do not fit the AID categories. Classically, models of temporal perception attempted to explain the perception of time, across timescales and across sensory modalities, by appealing to the operation of a single centralized clock-like mechanism (Creelman 1963; Treisman 1963; Gibbon et al. 1984; Meck et al 2008). According to these models, temporal perception employs a singular analogue format for the representation of duration and temporal order. However, in recent years, these centralized clock models have fallen out of favour and have been replaced with what Viera (2019; 2022) calls *fragmentary models of temporal perception*, according to which temporal perception is underpinned by a range of highly specialized, and dissociable, timekeeping mechanisms.

With the fragmentary model of temporal perception in hand, then the question of how temporal information is encoded in perception is replaced with more specific questions concerning how specific types of temporal information are encoded in perception. This paper uses a particular case to make its point. When we focus on the perception of duration at very short timescales (between 30 – 500ms), we find behavioural, neuroscientific, and computational evidence that perception employs *state dependent network properties* in order to encode this temporal information (Paton & Buonomano 2018). These mechanisms operate in a very specific manner. They encode information about duration in virtue of an evolving subset of active neurons within a population that changes as time progresses. Importantly, on these models there is no distinction between the vehicle that encodes temporal information and non-temporal information related to a specific event (e.g., the same vehicle will encode both duration and pitch information).

I argue that these mechanisms do not satisfy the criteria for iconic representations since they fail to be analogue in nature (thereby not falling into the analogue or iconic categories). Time is not represented by these mechanisms in virtue of the accumulation of any property of the vehicle that corresponds with increasing durations. Rather, it is merely a changing subset of neurons that have no clear ordering. Furthermore, they fail to be discursive since the very same representational vehicle that represents the event (i.e., the sound) also represents the properties attributed to that event (i.e., duration & pitch). These are representations that do not fit within any of the AID categories, and therefore, there is a need to specify a more fine-grained account of representational format.

The paper concludes by drawing out the consequences for attempts to draw architectural distinction between either perception and cognition or iconic and working memory in terms of representational format. The paper also provides a general way of characterizing types of representational format, in terms of extractability / decoding, which can then be used to provide a more encompassing taxonomy of the representational formats found in perception and cognition.