Effect of Image Compressibility and Internal Model on Time Perception (Data Collection Forthcoming)

*Maxim Zewe[1], Domenica Bueti[1], Eugenio Piasini[1]

1. International School for Advanced Studies (SISSA)

Natural images differ dramatically in their visual complexity (VC), raising the question of how VC affects cognitive processes that depend on visual input. Specifically, low-level sensory features strongly affect perceived duration (Ma et al., 2024), suggesting that VC influences time perception. However, VC remains poorly defined, encompassing both semantic and structural components. To isolate the latter, studies have argued that complex images contain more information, making them harder to compress (Donderi, 2006). Indeed, extracting information is a potential driving force of time perception (Matthews & Meck, 2016), but the role of compressibility in time perception is underexplored, with few exceptions (e.g., Palumbo et al., 2014). Two main problems are: (1) the compressibility of typical stimuli, such as natural scenes (Ma et al., 2024), is hard to control, and (2) compressibility depends on an observer’ s expectation or internal model of the images, which has thus far been neglected. To overcome these issues, we use synthetic visual textures (SVTs) - binary images with tunable multipoint correlations and compressibility (Victor & Conte, 2012) - and manipulate participants’ internal models via a yet-to-start two-alternatives forced choice task. We generate noisy SVTs of one type (e.g., horizontal stripy patterns), which participants must discriminate from noise. Subsequently, using the same (horizontally striped) stimuli, participants must judge if the images are noise or an SVT of a different type (e.g., block-like texture). This reveals how compressible the images are when the observer’ s internal model is misspecified (square-like) relative to the ground truth (horizontal stripes). We employ this to measure how compressibility affects perceived duration in a reproduction task and hypothesise that more compressible images represent a greater information source, leading to over-reproduction (Matthews & Meck, 2016). This study reveals how structural visual complexity depends on an observer’ s internal model and how this shapes time perception.

Keywords: time perception, compression, visual complexity, internal state