Role of Visual Stimuli in Final Seconds of Decision-making

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Abstract:

Visual stimulus can drive immediate appropriate actions. This is evident in digital communications. People spend less than 2 seconds viewing a visual content on their screen before moving to the next. Even the click-through-rates of these communications, for example, a display ad is abysmally low at 0.46%. Hence, there is a need for creating effective call-to-action[2] visual communication. This study takes the scenario of e-commerce to develop the theory of final seconds of decision making. First, key elements in the composition of visual communication in the form of product tile[3] are identified for the brand. Then timelines and neurological stages in comprehending the elements are elaborated. The identified elements are category need, emotional motifs, and brand fitness indicator. These elements drive the shift from one stage to another in the final seconds of decision-making process. Stages being approach /avoidance within the first 300-450ms, proceeding to liking followed by 'wanting' from 350-1450ms finally leading to an action by 1.7-1.8s. Breaking down the final seconds that matter, allows us to understand the speed at which the stimulus is comprehended, diverse neurological processes involved when comprehending an action-oriented visual stimulus and the construction of an optimal visual stimulus.

Keywords: final seconds; decision making; approach; avoidance; liking; wanting.

Introduction

Visual cues play a significant role in guiding actions. An action can be influenced by studying brain processes triggered by the visual stimuli presented in the final seconds of decision-making. This has been researched in the field of sports, such as cricket, tennis, baseball etc. to explain the stages of decision-making in the player's brain before hitting the ball (Land & Tatler, 2009). The study of visual reaction times by Mcleod (1987) suggests that in cricket, batsmen cannot modify their stroke in the last 200ms of the approaching ball. This finding explains the success of slow balling strategy where the batsmen is deceived by the unexpected turn of the ball when it hits the ground towards the end of the trajectory (Regan, 1992).

Studying the final seconds of decision-making also has a significant role in developing better strategies in the digital world. On Netflix, users spend ~1.8 seconds considering each title (Nelson, 2016). Similarly on Facebook, people spend ~1.7 seconds with a piece of content on their news feed (Facebook IQ, 2016). According to a 2018 data set drawn from Google's ad network the average click-through-rate of a display ad plummeted to just 0.46% from 44% in 1994 (Hwang, 2020). These numbers emphasize the need to better understand how the brain processes a visual stimulus to drive a call-to-action within the duration of ~2 seconds. In this paper, an ideal step-by-step neurological response elicited by the visual stimulus in the context of e-commerce brands trying to increase their conversion is proposed. Here, the visual stimulus at focus is the product tile.

Final Seconds of Decision Making

The product tile can be thought of as the final mile of advertisement in the purchase decision journey. This is an underutilized medium consisting of the product against a white background. In nature, advertising one's genetic superiority through "grotesque exaggeration of these displays", for example the tail of peacocks and birds of paradise, is an elemental part of the process of mate selection (Ramachandran & Hirstein, 1999). Evolutionary psychologist Geoffrey Miller (2001) illustrates three traits that describe the selection criteria used by females of a species for mate selection: females prefer (i) "high ranking males capable of protecting offspring from other males", for a brand this translates to *category need*, (ii) "new male from outside the group to keep the genetic pool diverse", this is equivalent to the *brand fitness indicator* that allows a brand to have a distinct occupancy in the minds of the consumer and (iii) "male 'friends' that have groomed the female a lot and have been kind to her offspring", this translates to *emotional motifs*, i.e., the emotional highs, rewards, emotional trigger at the point of purchase and past experience with the brand or product. Thus, taking inspiration from the animal kingdom we state that the visual imagery of the product should be a composition of category need, brand fitness indicator and emotional motifs.

Next, we elaborate the processing of a visual stimulus (as summarized in Figure 1). A visual stimulus can be non-consciously perceived in as little as 30-100ms (Trafton, 2014) through the retinal ganglion cell axons projecting to the superior colliculus. Responses to emotional visual stimuli can travel in less than one-tenth of a second from the superior colliculus in the brain stem to the frontal cortex. A reflex is generated via the premotor neurons in the frontal cortex for motor control of the muscles of the eyeballs, to generate micro-saccades and/or produce head movements. Emotion is consciously experienced at this point. Parallelly, the visual stimulus, processed through the LGN, begins as a raw response in the occipital cortex. Only through sensory integration and feedback does the response evolve into a state of focus, in about 100-200ms

[2] Prompting an immediate response (e.g., *buy now* or *click here*).
[3] The display image of a product on an e-commerce platform.

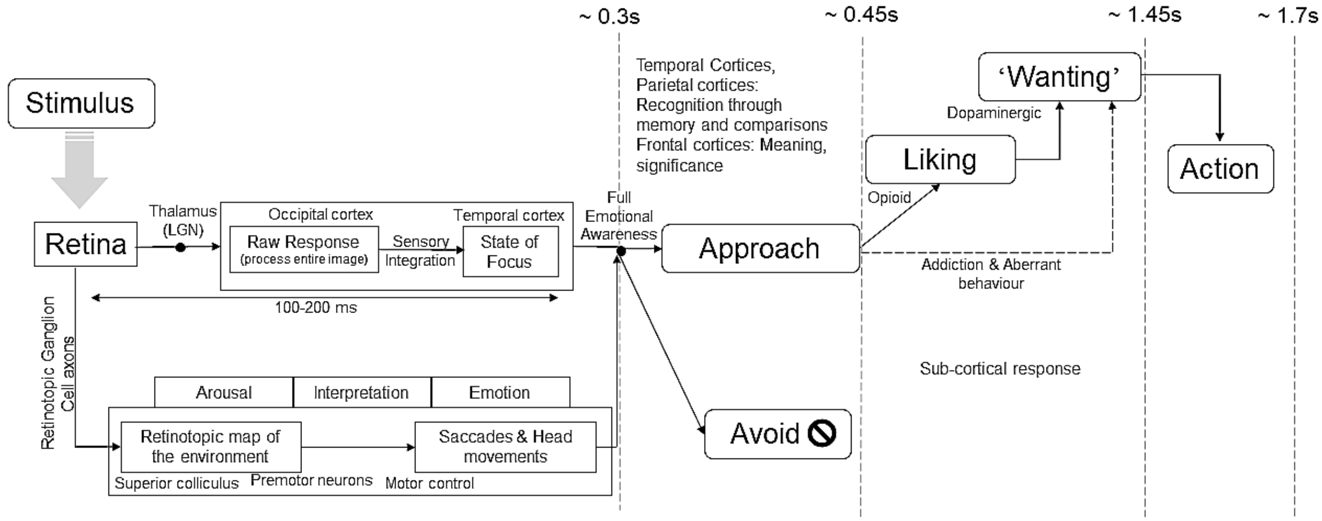

Figure 1: Neurophysiological flow and steps in interpretation of visual stimulus in a normal person.

(Desimone & Duncan, 1995). The temporal cortices play a role in recognizing high level object descriptions, faces and objects.

After about 350ms, the complete meaning of the stimulus has been evaluated by the brain and is brought to full emotional, conscious awareness in the PFC (Carter, 2019). A conscious response is then triggered in the body. The authors postulate this as the automatic *approach-or-avoid* response. Hence, establishing *category need* in the first 350ms of a visual stimulus may be relevant. Since the emotion pathway through the superior colliculus generates micro-saccadic reflexes in less than 350ms, it may also be wise to establish the *emotional trigger* at the fore of the visual stimulus.

Post the reflexive approach-or-avoid response, the brain must begin the process of meticulously analyzing the object that caused the reaction. The raw response after initial visual processing through the visual cortices is sent to temporal and parietal cortices. The temporal and parietal cortices recognize a visible object through memory and comparisons, while the frontal cortices associate meaning and significance. For a product tile, *past-experienced utility* and the *core category benefit* are reinforced through memory associations and context instantiation. In humans, hedonic evaluation of instant experienced utility is what Berridge (1999) calls 'liking'. At a non-conscious level, 'liking' reactions result from activity in hedonic hotspots, that paint hedonic value on a sensation. Hypothalamic stimulation via dopaminergic neurons ascribes motivational effects and incentive salience to objects and actions (McClure, Daw, & Montague, 2003). Brain structures most strongly linked to incentive salience are the neostriatum, nucleus accumbens, amygdala and frontal cortex (Berridge, 1999). For example, monetary reward-cues and vivid imagery are ascribed incentive salience and may have motivational effects. Thus, we propose that dopamine is responsible for converting an object that is 'liked' into object that is 'wanted'. Beagley and Holley (1977) concluded the sensory-embedded nature of stimulation-elicited motivation, for example, a visual of food may be effective in eliciting motivation. Finally, once a stimulus is 'liked' and 'wanted', an action is triggered through the motivated behavior (Berridge, 1999).

Discussion

We find coherence for our model from other studies of the visual stimulus as well. The Vienna Integrated Model of Art Perception (VIMAP) presents that the brain forms a 'gist' of the rudimentary visual features as early as 100ms, via bottom-up processing (Pelowski, 2017). Consistent with our model, a non-conscious approach-avoidance decision takes place at 300-400ms, signaled by the activation of the frontal brain regions. Brielmann & Dayan (2021) brok down the aesthetic value into fluency of the stimulus and the learning from the stimulus. This idea corroborates with our idea of building a visual stimulus processed within ~2 seconds. Ramachandran's (1999) research describes how anticipation in a visual stimulus creates engagement. Anticipation may code for the pursuit of reward in non-conscious 'wanting' which leads to an action.

We propose this construct based on studying about neurological phenomena to improve communication through a digital medium. Future directions for the authors include empirical experimentation to collate the neurological phenomena and (digital) human behaviour.

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