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Affect in Visual Perception: A Brief Review of Theories and Perspectives

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Abstract

This article presents a brief overview of how 'affect' has been incorporated by the major theories in the field, in the process of visual perception. This article investigated both classical and contemporary theories. The range of affective involvement varies from none to minimal involvement in theories strongly guided by the bottom up approach like direct

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perception to a significant involvement like contemporary theories like affective realism. Recent neurological findings have furthered the argument of affective salience as a catalyst for the selection of alternate visual pathways to ensure a quicker early perception of stimuli which might be threatening to the perceiver, providing an adaptive value.

Keywords: *Affect, affective realism, direct perception, perception*

Introduction

Perception is defined as, "the process or result of becoming aware of objects, relationships, and events by means of the senses, which includes such activities as recognizing, observing, and discriminating" (APA Dictionary of Psychology, n.d.). This definition at the onset presents a dual nature of perception as both a 'process' and a 'result'. The term 'process' alludes to the involvement of a series of steps in the formation of perception and the term 'result' allows for the quality of consequence to be part of the experience of perception. The process of perception involves a linear progression encompassing three distinct stages where firstly the focus of perception is identified (selection), secondly the information is assimilated (organization) and finally information is donated a meaningful encoding which will aid in future recall (interpretation) (Qiong, 2017).

Specifically, visual perception is defined as, "the awareness of visual sensations that arises from the interplay between the physiology of the visual system and the internal

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and external environments of the observer." (APA dictionary of psychology, n.d.). According to this definition the 'awareness' generated regarding the visual sensations (or meaningful interpretation), involves the contributions of biological, psychological and environmental influences.

Biological components have a semblance of objectivity in regards to the physical components of vision which would largely be assumed to function in a similar manner for all human beings in general however, psychological and environmental influences are idiosyncratic and moreover subjective. This allows for the possibility that interpretations of the same visually encountered stimuli could be different for different individuals. Thus, the view that visual perception is a combination of objective and subjective processes (Hatfield & Allred, 2012) is not a controversial one, and it is largely accepted that visual perception is selective and malleable (Balcetis & Dunning, 2006). However, the factors that influence subjectivity and the amount of that influence is of interest to researchers and has generated enormous debate. Key subjective influence which is focused upon in this article is 'affect'. Specifically, this theoretical review aims to explore if and how traditional and contemporary theories of visual perception permit the influence of affect in its various conceptualizations on the nature, quality and veridicality of visual perception.

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Affect a Working Operationalization

Affect has been interchangeably operationalized in psychology as an experienced feeling or emotion. However, a more ‘core’ or ‘central’ view of affect is fast making a resurgence in psychology which is the consequence of the merging of sensations stemming from both external environmental and internal physiological information creating a distinct mental state which is more universal and possibly primitively adaptive. It can be conceptualized as encompassing a spectrum of emotional states from basic to complex emotions (Barrett & BlissMoreau, 2009). This conceptualization of affect subsumes the concept of ‘mood’ as well. Thus, ‘core affect’ can be understood as a holistic emotional experience at a given moment. Nevertheless, investigations into the role of affect on cognitive faculties have utilized emotions and mood as the main operationalization of affect.

Specific operationalizations that are usually in place to introduce, manipulate or measure affect in psychological research vary from (1) self-report measures where participants indicate their experienced emotional states for example the Positive and Negative Affect Schedule (PANAS), (2) behavioral measures where affective states are deduced through facial expressions, body language, voice etc. via observation, (3) physiological measures like heart rate, galvanic skin responses etc. and (4) implicit measures in the form of attitudes and preferences gathered by investigative techniques like projective techniques which do not depend on conscious awareness.

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Top down and Bottom-up Approaches

Understanding what one has visually encountered is a multi-faceted process involving recognition, interpretation, categorization and also recall. These actions will help individuals' direct actions to avoid threats, recognize rewards and make decisions. Two well researched ways in which humans are known to make sense of encountered stimuli are bottom up and top down approaches.

One way to understand the difference between the two, is to understand where the locus of interpretation of the encountered stimulus lies. Where the stimulus guides or dominates the interpretation process, such an interpretation would be considered as bottom up or data-driven processing. Where there exists an influence from the observer or the situation or observation in the interpretation, such an interpretation would be considered as the result of top down or context driven processing.

Though both bottom up and top down processes work together to provide a meaningful interpretation of an encountered stimulus, the general approach towards the investigation regarding the influence of these two processes has been to study each of them independently (McMains & Kastner, 2011) due to which a holistic understanding of how perception works is still elusive. Theories of visual perception can be divided into these two major approaches. Theories of visual perception could be segregated on the basis of the amount of top down or bottom up influences they allow in the explanation of visual perception.

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Cognition, Affect and Visual Perception

A key conceptual issue embedded with the top down vs bottom up debate is the unclear, dual, concurrent or sequential relationship between ‘perception’ and ‘cognition’. When perception is said to be the consequence of a purely perceptual process then it is viewed as a non-cognitive and an automatic process, whereas those that view it as a cognitive process purport the involvement of stored knowledge in the creation of a final perceived stimulus (Kubovy et al., 2012). There exists a debate regarding the influence of cognition on perceptual processes which is best investigated as the ‘cognitive penetrability hypothesis’. It states that cognitive states play an active role in perceptual processing and do causally contribute in determining the perceptual experience itself (Zeimbekis & Raftopoulos, 2015).

Research in this area differentiates between ‘early’ vision and ‘late’ vision. It is suggested that ‘early’ perception, which pertains to capture of the most basic information of the encountered stimulus like temporality, spatial properties and movement (Watson, 1990) is pre-attentional (Raftopoulos, 2009) and cognitively impenetrable whereas, ‘late’ vision which pertains to the recognition of the object is conceptually modulated (Raftopoulos, 2011) and cognitively penetrable. This cognitive penetration takes the form of inputs from long term memory, knowledge of propositions, attention etc.

Several studies have investigated the phenomenon of ‘affective penetration’ in visual perception. Affective penetration refers to the influence of beliefs, expectations, emotional states and other phenomenological (Pinna et al., 2015) influences on the perception of visual stimuli. Evidence of affective penetration can be gathered in the

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findings where affective states have enhanced awareness (Gantman & Van Bavel, 2014), dictated the priority of selection for perception (Phelps et al., 2006), or alter the subjective experience of the perceived object (Riener et al., 2011).

The Ecological Approach: Direct Perception

Direct perception posits that sensory information embedded in the environment like edges, colors, textures, shape size and position allow sufficient information for the perception of stimuli without the requirement of cognitive processing. Gibson's view presents perception as a process which is devoid of any cognitive inputs making it a largely bottom up approach to visual perception.

Gibson's approach suggests that perception is devoid of cognitive activities, where the agent largely collects information and where cognitive activities have an influence on the action of perception but have no influence on the perception itself (Ben-Zeev, 1981).

Gibson presented a novel view of the relationship between light in the environment and perception which he called 'ambient optic array'. According to this idea observers navigate their way in their environment by utilizing sufficient information provided by an optic array made up of an interplay of rays of lights emanating from and reflecting from objects and generated shadows (Todd, 2020).

J.J. Gibson proposed that encountered stimuli in the environment provide specific affordances based on the nature of the stimulus and the perceiving organism (the agent) (Gibson, 2014). Affordance can be understood as the physical properties of stimuli which permit or restrict the observer from performing certain physical actions.

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Understanding the affordance of a stimulus and selecting a course of action according to the ecological approach does not entail the creation of mental representation or any recall or use of information from stored memory of that stimulus, rather it is the consequence of understanding the physical properties of stimuli and being able to make inferences regarding what behavioral actions that stimuli permits for a specific organism (Gibson, 2014). Thus, though the perception of physical properties does not require inputs from memory, this view does leave open the possibility of idiosyncratic differences in the nature of the affordance perceived by two separate observers as affordance is proposed to be relative to the observer. Affordances are relative to the environment organism relationship.

A concept which suggests that these affordances can also include emotions or affective dimensions to the relationship between perception and action is that of 'affective affordances'. Perception of the same stimuli can evoke different emotions within different individuals and this can lead to clearly different action potentials for those different individuals. For example, for a person with cynophobia an alley with a dog could significantly restrict functionality than someone who loves dogs. This affect based conceptualization of affordance is crucial in the fields of design and human computer interaction to help developers make more user-friendly environments and experiences.

Embodied Visual Perception

An approach which is seen as a contemporary successor of the ecological approach is embodied perception (Dawson, 2022), as it also emphasizes the importance of the

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organism-environment relationship in shaping perception. Perception is not merely the consequence of physiological visual systems but a co-determined process in which meaningful interpretations of stimuli in the environment are those which make most sense with respect to the observer-environment relationship (Kelso, 1995). Proffitt (2006) also envisioned the influence of emotional states on the end result of visual perception (Proffitt, 2006). Proffitt (2013) elaborates on the interaction between 'agency' mediated via past experience and the interpretations one derives of optic flows by alluding to the work done by Held & Bossom, 1961 where they found that kittens who had been provided past perceptual motor experience were provided more logically adaptive responses to stimuli involving qualities of depth and motion (Proffitt, 2013). Firestone (2013) argues strongly against what he himself has labeled as the 'paternalistic vision hypothesis', which states that perception of spatial properties of the environment are dependent on the observer's proclivities and goals (Firestone, 2013).

Affordance in direct perception or observer-environment relationship in the case of embodied visual perception, leave abundant room for the involvement of affect in visual perception via the route of the influence of affect on bodily sensations. A sound example of this is that of 'emotional body feedback', wherein bodily cues in the form of heart rate, galvanic skin responses, posture etc. have shown to have a clear influence on visual perception. Strack et al. (1988) showed that when participants were asked to hold a pen with their teeth, thus facilitating a smile rated cartoons as funnier than when participants

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were asked to hold a pen with their lips, thus inhibiting a smile. This shows the link between motor movements, emotions and visual perception.

Probabilistic Functionalism

Probabilistic functionalism, a theory of perception proposed by Egon Brunswik (1903–1955), suggests that visual perception is the consequence of probabilistic inferences that are drawn in an attempt to reduce the difference between the distal stimulus and the proximal stimulus by the observer based on the visual features of objects and has two separate goals, to identify the stimulus and to decide the consequential course of action in response to the perception of the stimulus. A correlation between the distal and proximal stimulus is assumed to be poor and it is the generation of probabilistic inferences which help reduce this gap between the distal and proximal stimulus and increase the ecological validity of the observation and help an organism make a better decision regarding the usefulness of the object being perceived (Gordon, 2004). Probabilistic functionalism further accentuates the importance of the organism - environment relationship where the individual brings an experience of past interactions with the environment in the perception of future stimuli (Holahan, 1982).

Gestalt Approach

A view characteristically different from direct perception is the Gestalt approach which places the crux of visual perception not in the individual components of the stimulus like edges, colors, textures, etc. but on the assembled “whole” stimulus. Gestalt approach

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envisions a holistic perception of the visual stimulus (Wertheimer, 1923). Though both direct perception and gestalt approaches share the view that visual perception is a noncognitive affair, with gestalt it also has an automatic nature attached to it. By following the gestalt laws of perception, the observer automatically (Marini & Marzi, 2016), engages in an assimilation, grouping and an interpretation of stimuli in the environment. Research by Russell & Driver. (2005), using a novel change detection task found that gestalt visual grouping occurred in an implicit manner and even in an inattentive state.

A key tenet is that perception of a 'whole' is 'different' from the sum of its parts, rather than 'more' than the sum of its parts which it is commonly and perhaps wrongly understood as. The true idea of the concept of 'difference' envisioned is best understood by the gestalt concept of emergence. Pomerantz, & Cragin (2014) eloquently explain emergence as "those properties that appear, or sometimes disappear, when stimulus elements are perceived as a unitary configuration". An affective influence in the gestalt view could be argued to be present in the manner in which individuals organize and interpret parts to create holistic perceptual experience.

Constructivists Approach

A theory of visual perception pertaining to the top down approach is the constructivist theory of perception. According to constructivist theory, percepts formed about objects in the environment are a consequence of the interaction between the encountered stimulus, past knowledge, schemas and the observer's current mental states (Catling & Ling, 2012). Visual perception is viewed as a process of intelligent problem

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solving (Kubovy et al., 2012), which involves creation of hypotheses and past encounters to interpret stimuli which are generally assumed to be ambiguous (Spillmann, 2011). This view is formally presented by Gregory as ‘perception as a hypothesis’ where he suggests that observers carry out a hypothesis generation and testing process which involves an amalgamation of a general understanding of physical attributes of physical objects and past experience, to make a survival relevant interpretation of objects from an infinite number of interpretations (Gregory, 2015).

Visual perception is essentially a cognitive process though, it is proposed to be automatic. Among some of the early ideas which donated such a character to this approach was that of ‘unconscious inferences’ put forth by Helmholtz. Unconscious inferences are those inferences made automatically, during the process of perception that are informed by prior experience with similar stimuli or knowledge of spatial or physical properties of stimuli which are not adequately available during the mere physiological act of gathering sensory input (Meyering & Meyering, 1989). Thus, unconscious inferences are assumed to be a key ingredient in the journey from sensation to interpretation and therefore perception.

Affective Realism and Predictive Coding

Affective realism is the ideology that views affect as an integral part of visual perception. Affective realism purports that affective states like emotions, moods, motivations etc., play a constructive role in what we visually perceive in terms of how we

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interpret and encode visual stimuli (Barrett & Bar, 2009; Siegel et al., 2018). It could be suggested that this influence alters the very nature of visual perception and does not merely add an ideographic subjective affective layer on some object whose physical properties are to be objectively experienced in the same manner by all observers (Siegel et al., 2018).

The affective prediction hypothesis views affective input during the moment of perception not as a consequence of encountering and interpreting the stimuli, but as a contributing factor to visual perception itself. This idea goes completely against the position of direct perception but this view has found some empirical support. Stefanucci and Proffitt (2009) found that participants under the influence of an induced negative affective state overestimated height, especially when looking downwards as compared to participants in a neutral state. This bias in height perception correlated with existing anxiety of heights. Van Ulzen et al. (2008) found that stimuli ('geometric circles' in this study), were judged to be larger when accompanied with negatively loaded images as compared to circles presented along with positive or neutral images. These studies provide evidences for how affective states do have a measurable influence on size and proximity of stimuli during the act of visual perception

Probabilistic functionalism and the constructivist approach both have within them an effort on the part of the perceiver, be it conscious or not to bridge a gap between the registration of a 'percept' and its 'perception'. Another theory along the same theoretical lines is predictive coding. Predictive coding posits that the brain is in a constant, unified and active interpretation of stimuli which aids in the meaningful perception of the stimulus (De-Wit et al., 2010). This interpretation takes the form of predictions, informed by stored

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models which are relevant to the encountered stimulus. If the prediction matches the incoming information then no further action is required however, if there is a mismatch then an 'error signal' is registered and the brain makes appropriate adjustments to stored internal models. Neuropsychological evidence for predictive coding in visual perception comes in the form of differences in the observed blood oxygenation level-dependent (BOLD) signal in response to anticipated versus unanticipated stimuli, suggesting a preparedness by the brain to encounter incoming stimuli and an early decision to allocate resources in the perception of stimuli (Alink et al., 2010).

Affective realism and predictive coding views taken together strongly proposes affect to be a strong top down influence asserting that an observer's perception of the world is in essence not veridical, but a best/closest guess, which is an amalgamation of incoming sensory input and gaps in that information (when it is incomplete or ambiguous) filled up by previously stored cognitive patterns, concepts, schemas, moods, emotion etc.

A theme that seems to emerge taking into account the non-veridical interpretation of stimuli, is that visual perception under negative affective salience seems to be enhancing or enlarging objects which could be argued to occur in order to provide an evolutionary advantage to alarm and force the organism to orient and take quick steps to react or respond to threat. Neurological evidence seems to provide some support for this assertion.

Neurological Evidence for the Role of Affect on Visual Perception

Proponents of affect as a 'core' feature of experience also argue for an adaptive advantage of affect (Barrett & BlissMoreau, 2009). For this to be true there must be

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evidence of an alteration in perception based on affective salience or valence. Neurological evidence for the influence of affect on visual perception arguably to provide the perceiver an adaptive advantage against threat is building up. Phelps et al., (2006) found that stimuli in the form of human faces when evoked the fear emotion significantly, improved performance on the orientation discrimination task by facilitating the increase of contrast sensitivity and therefore enhancing visual perception. They argued that negative emotional stimuli could nudge the amygdala to expedite early mechanisms of visual perception and thus quicken visual perception.

Öhman et al., (2001) found support for the "threat superiority effect" (Fox & Damjanovic, 2006), showing that threatening stimuli are both more quickly and accurately detected than neutral stimuli. The possibility of a subcortical pathway towards visual processing of affectively salient stimuli is also proposed wherein emotionally salient stimuli are processed by the amygdala via a fast ‘low road’ pathway bypassing cortical visual processing, permitting quicker visual perception which definitely would be of adaptive value (Pessoa & Adolphs, 2010). These researches provide an adaptive reason for why neural activity for visual perception is dependent on the emotional quality of the stimulus.

Neural evidence for a negativity bias in visual perception has also been well established in the findings that regions like amygdala, ventromedial prefrontal cortex and the anterior insula all have shown differential activation and speed of processing for affectively negative stimuli rather than neutral and positive ones (Carretie et al., 2009). Anderson et al., (2013) found that under specific conditions where cortical processing is

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impaired due to scarcity of resources or inattention towards threatening stimuli in the immediate environment, amygdala processing though not clearly automatic is enhanced to allow the detection of threat.

Vuilleumier et al., (2001) were successful in showing that different brain regions are activated in response to fearful and neutral stimuli. Specifically, they found that the right fusiform activity was higher for fearful than for neutral stimuli. Suggesting an affective salience-based modularity in the brain with respect to visual perception. Anderson & Phelps, (2001) found via investigation on the detection of fearful stimuli in the form of fearful faces that individuals with lesions in the amygdala were impaired in the detection of fearful faces. Therefore, Vuilleumier et al., (2001), Anderson & Phelps, (2001), all argue for a potential modularity in the brain specific to the visual perception of affectively salient stimuli.

Conclusion

The conceptualization of affect as ‘core affect’ which is a more basic and primitive experience than emotions or moods makes it hard to rule out the influence of affect in any theory or perspective of visual perception. Diverse perspectives of visual perception can modify the influence of affect in the process of visual perception to vary in intensity from being mild to significant, to vary in temporality from having an early or late impact or to vary in duration from being transient to enduring. Regardless, the influence of affect in visual perception is worth investigating. Establishing a well-defined and accepted

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nomenclature, though a difficult task, would aid the research community in this field significantly to investigate, share results, retest, refute or validate findings and understandings in the role of affect on visual perception.

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