

Rescuing Qualia

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2021

Abstract

Daniel Dennett provides many compelling reasons to question the existence of phenomenal experiences in his paper titled *Quining Qualia*, however, from the perspective of the individual, qualia appear to be an inherent feature of consciousness. The act of reflecting on one's experiences suggests that subjective feelings and sensations are a necessary element of human life, as personal opinions on various artistic works are apt to demonstrate. This paper argues that by considering subjective experiences from a naturalized functionalist perspective, a comprehensive explanation for qualia can be provided given its origins in evolutionary biology. As information passing through the nervous system, qualia serve to guide the behaviour of individuals to ultimately facilitate survival. Specifically, qualia are representations of environmental features, existing as information messages supported by neural physiology and encoded in electrochemical formats. In addition to addressing the *Hard Problem of Consciousness* and clarifying the four properties Dennett associates with qualia, this theoretical foundation enables further metaphysical discussion on the nature of consciousness more generally. Although many outstanding questions on the contents of subjective experiences are apt to linger given the *explanatory gap*, a robust theory for the existence of qualia can be developed through the integration of ideas and concepts from a variety of domains.

Introduction

We are all explicitly familiar with one or more qualia even though attempts to sufficiently articulate its nature may be difficult or feel inadequate to externalize. This troubling relation has resulted in much discussion on the topic with plenty of debate on whether these aspects of consciousness even exist, producing conclusions discrediting the reality of qualia. Specifically, the essay by Daniel Dennett titled *Quining Qualia* outlines a set of reasons which aim to explain away phenomenal experiences by suggesting ‘qualia’ as a concept is incoherent. Although many of the examples Dennett appeals to introduce challenging questions which may not have answers at present, other questions can be clarified if one reflects upon their own experiences or defers to scientific literature for support. Dennett ultimately concludes that since we do not have a good grasp of qualia, we are justified in removing them from our philosophical lexicon. This *eliminativist* stance (Seager 159) stands in opposition to those who are interested in studying qualia, as others have noticed a connection between phenomenal experiences and various sensations or emotions (Dretske 157; Wright 2). Additionally, qualia have piqued the interest of researchers from a variety of scientific domains, suggesting Dennett’s recommendation to retire this concept have not been taken up by all. Despite this ongoing debate, it seems we have had adequate evidence for an explanation of consciousness for quite some time, and the true problem turns out to be, above all, related to philosophical perspective. By studying a wide variety of topics related to human consciousness, qualia can be sufficiently explained and thus defended against the *eliminativist* stance.

To argue for the existence of qualia, I begin by summarizing Dennett’s *Quining Qualia* and his argument for why this idea can be dismissed. The next section introduces a selection of *intuition pumps* Dennett provides to demonstrate his concerns, however, I also suggest other ways to consider each scenario by appealing to empirical evidence. The last example Dennett provides involves the sound of a guitar, and taking inspiration from his allusion to the notion of *timbre*, the discussion which follows

explores the relation between the qualia and music as an artistic medium. Specifically, a discussion on Sergei Prokofiev's symphony *Peter and the Wolf* illustrates particular examples of how the composer relies on only musical qualia to portray the story's characters. While efforts to demonstrate how individuals can connect with particular qualia are argumentatively helpful, any explanation aiming to elucidate qualia must find a way to connect to preexisting scientific theory or empirical evidence. The next section introduces David Chalmers' *Hard Problem of Consciousness* which inquires about the existence of phenomenal experiences in human consciousness, and by jointly appealing to evolutionary biology and neuroscience, explains how this problem does indeed have a feasible solution. Considerations for the evolutionary development of human consciousness, however, must also consider the effects of social environments and their shaping of qualia and other aspects of subjective experience. While phenomenal experiences are useful for governing the behaviour of individuals, knowing the phenomenal experiences of others may be of use as well. The subsequent discussion expands on this evolutionary summary to outline how qualia are shared between people, particularly analyzing the Danish quale *hygge*. By this point, we will have covered significant empirical ground, from the internal and experiential to its relation to the physical world, and as such, are able to engage in metaphysical speculation. Given that *information* refers to both a semantic message and a structure, qualia exist as the information passed through the nervous system of individuals as they engage with their environment. Thus, we are justified in defending qualia and its significance for life, as a naturalized functionalist perspective has been demonstrated to be sufficiently robust and plausible for the purposes of rekindling metaphysical conjecture. Since we are interested in better understanding the interaction of physical systems over time, it is in our best interest to integrate knowledge from an array of subjects appropriate, and if we are interested in the human mind, this necessarily involves the arts and humanities as well as the sciences. Through an investigative process of piecing together new explanations and theories for the existence of other minds, not only can we explain qualia, but a new

avenue for discussion on the metaphysical nature of consciousness may assist in further explaining other questions related to subjective experience and conscious awareness.

Exploring Dennett's Arguments

In *Quining Qualia*, Dennett provides an argument which aims to dismiss the idea of phenomenal experiences. Specifically, his claim states “conscious experience has no properties that are special in *any* of the ways qualia have been supposed to be special” where qualia are considered “special properties, in some hard-to-define way” (Dennett, ‘Quining Qualia’ 382). That being said, he does grant that “one’s own appeal to a modest, innocent notion of properties of subjective experience” is warranted, but wants to state that our overall understanding of qualia is vague and ill-informed (Dennett, ‘Quining Qualia’ 382-83). It is worth noting, however, that ‘qualia’ from Dennett’s perspective is a reaction to a philosophical tendency to create new terms for familiar concepts and appeal to jargon when generating arguments or explanations (Dennett, ‘Quining Qualia’ 381). He thinks the term ‘qualia’ is like an outdated understanding of a scientifically-studied phenomenon, comparing it to the *élan vital* and its relation to DNA (Dennett, ‘Quining Qualia’ 382). Given that the scientific concepts we use tend to change over time, Dennett wants to suggest that a similar case applies here and as a result, are able to do away with philosophical notions of qualia. Since then, Dennett’s stance seems to have softened somewhat as hinted at in a recent publication, where he postulates some type of middle ground is likely the case (Dennett, ‘How Our Belief in Qualia Evolved, and Why We Care so Much’ 4). He grants that while it may be a bit extreme to suggest there are *no* qualia or that they are not a real phenomenon, he maintains that our current understanding is likely misguided to some degree.

The reason why we can do away with qualia, according to Dennett, is because our experiences do not contain properties that are ineffable, intrinsic, private, and directly accessible (Dennett, ‘Quining

Qualia' 385). Since we cannot express the *exact* way we see or taste, for example, these experiences are rendered ineffable because no description adequately captures their nature (Dennett, 'Quining Qualia' 384). One reason for this ineffability is due to the fact that they appear to be indivisible, or "atomic and unanalysable... 'simple' or 'homogeneous'..." (Dennett, 'Quining Qualia' 385), making it difficult for individuals to describe or depict these inner experiences. Moreover, qualia are considered private properties of experience as other people are unable to access one's own thoughts and feelings. Furthermore, qualia are also directly accessible to the subject as "immediate phenomenological qualities" (Dennett, 'Quining Qualia' 385) as they arise from experience and interaction with the world. When these four considerations are taken together, it becomes rather difficult to talk about qualia in any meaningful way, and as a result, suggests this idea does not refer to anything in human consciousness (Dennett, 'Quining Qualia' 386-87).

To persuade the reader toward a rejection of qualia, Dennett introduces a number of *intuition pumps* (IP) which present a scenario with a set of premises to motivate a certain question, point, or conclusion. Since arguments only operate with well-defined concepts, Dennett thinks these types of thought experiments are the right tools for supporting his claims about qualia, especially considering this topic involves "'intuitive' concepts" (Dennett, 'Quining Qualia' 383). In an attempt to sow seeds of doubt in Dennett's take, I respond to a subset of these IPs with examples aimed at demonstrating a contrasting perspective. The subset chosen purposely includes relatively simple physiological processes for the sake of explanatory clarity, as IPs involving vision, surgical processes, and theoretical technologies require more context and explanation. Furthermore, there are plenty of questions Dennett raises which may not have clear answers at present, however, this fact does not necessarily mean we can discredit the significance of qualia overall. The IPs I do investigate involve our sense of taste, smell, and hearing because these scenarios involve processes which are relatively straightforward, and are thus easier to describe or discuss from an abstract perspective. That said, I did not address IP13 "the

osprey cry” (Dennett, ‘Quining Qualia’ 404) because any reply must also address the epistemic complexity of this thought experiment, a task which involves enough discussion to warrant a separate paper. Although many of Dennett’s IPs indicate a number of mysteries lingering in the specific scientific and subjective details of sensory processing, there are instances where an association between sensory faculties and their resulting phenomenal experiences can be established, suggesting qualia are a significant element of human consciousness.

Intuition Pumps and Replies

In IP1, Dennett discusses his dislike for the taste of cauliflower, wondering why some enjoy it while others do not (Dennett, ‘Quining Qualia’ 383). While there may be one specific flavour associated with cauliflower, Dennett suggests there must be different ways of tasting cauliflower given that individuals demonstrate a variety of preferences. Additionally, Dennett reminds us that qualia have a contextual factor to them as well, as flavours are apt to change based the presence of other foods, appealing to an example involving orange juice tasting sweeter if syrup or pancakes were present simultaneously (Dennett, ‘Quining Qualia’ 383). Hence, our inability to articulate a quale which persists independently of contextual factors suggests there are no qualia at all (Dennett, ‘Quining Qualia’ 384).

Though qualia may be associated with a degree of idiosyncrasy and fluctuation, confusion in this area may be clarified by considering how preferences operate independently of the detection of tastes or flavours. Cauliflower and other *Brassica* vegetables are known to release bitter tasting flavours and individual differences in saliva composition and oral microbiome suggest some may experience an intensity in flavour which others do not (Frank et al. 1). Alternatively, if Dennett had previously encountered a negative association with an instance of eating cauliflower, especially involving feelings of nausea, he may have developed a *conditioned food aversion* as a result (Wolfe et

al. 487), suggesting a reason for why someone may have strong negative feelings about the vegetable. Personal preferences may also depend on the presence of other flavours or chemicals; for example, some only like to drink coffee with milk and sugar. This feature of our sensory processing is often leveraged in cooking and gastronomy, as various food pairings change the way a dish is perceived or enjoyed. Overall, while the discussion of preferences may be complex, identifying a common denominator which runs constant through a range of experiences may be identified by reflecting on a number of previous experiences. Regardless of milk and sugar, there is a particular fragrance associated with coffee which many enjoy, while the taste itself typically introduces a degree of bitterness which may be perceived in a number of different ways. By analyzing the underlying similarities of phenomenal experiences arising from several occurrences, a particular quale may be identified which exists independent of context and preference.

The second intuition pump involves a wine-tasting machine, where Dennett wonders whether the Gallo Brothers could replace their human testers with a machine (Dennett, 'Quining Qualia' 384). He claims that a machine would never come to truly enjoy the taste of wine like humans do, and that the properties of the machine's internal states will not be "special in the way qualia are" (Dennett, 'Quining Qualia' 384). He does grant that a machine might be able to perform better than professional wine-tasters on tests of accuracy and consistency, however, these objective measures are derived from the wine's physical properties. Therefore, since only humans are able to understand the subjective properties of wine, one may begin to wonder whether we can even understand what we are referring to, as nothing exists to facilitate further discussion or clarification on the topic (Dennett, 'Quining Qualia' 385).

It is true that a machine will not have a subjective perspective of the taste of wine, as it lacks the biochemical machinery humans use to process physical substances. While a computer may be able to create associations between measurements and predefined properties like 'sourness' or 'sweetness', the

connective structure which results is not subjective because the computer is an object and not a subject. As a tool constructed from a series of programmed instructions, computers today lack the capacity for autonomy and self-awareness. Though the machine may perform better than humans at detecting certain objective properties of wine, our biological heritage provides us with a unique perspective which may be modified with repeated encounters. Through reflection and introspection, individuals may improve their ability to notice a wine's various qualities, such as its body or top-notes, especially as one compares their experiences to existing knowledge, expectations, or memories of previous encounters. If there were no perceptible differences between grapes, each region's wine would taste similar, with no noticeable differences from year to year. Although human belief may shape the way wine is perceived and therefore valued, experts will still argue for the existence of something inherently similar between certain batches or environments.

The next two scenarios to examine involve Mr. Chase and Mr. Sanborn, where IP7 explores reasons for changes in phenomenal experience. Dennett introduces us to two individuals who work for Maxwell House coffee as consistency tasters, ensuring the flavour remains unchanged over the years (Dennett, 'Quining Qualia' 389). After roughly six years, Chase tells Sanborn that he no longer likes the taste of Maxwell House coffee despite it still tasting the same, stating specifically "I no longer like *that taste* at all" (Dennett, 'Quining Qualia' 390). Sanborn replies with his own account of the coffee's flavour and states that it no longer tastes like it used to, and that he prefers the original flavour. Although Chase's phenomenal experiences of tasting coffee have not changed, his feelings about the flavour have, while Sanborn is experiencing the exact opposite; his attitude towards the flavour has not changed but his perception of Maxwell House coffee has (Dennett, 'Quining Qualia' 390). Dennett goes on to suggest that these people may be experiencing changing preferences, changing qualia, or a combination of the two. This generates a problem for qualia because we cannot determine which combination of factors cause a change in perception, despite the fact that individuals experience these

changes directly (Dennett, 'Quining Qualia' 391). Dennett states that since we cannot be wrong about these private, immediate experiences, any speculation from Chase and Sanborn about their changing experiences remains unknowable given the privacy of qualia (Dennett, 'Quining Qualia' 391).

In IP8, Chase's taste buds have been surgically altered to respond differently, where "sugar tastes salty, salt tastes sour" (Dennett, 'Quining Qualia' 394). Complicating this scenario further, Dennett suggests that Chase has since altered his behaviour to compensate for this abnormality, *acting as if* sugar still tasted sweet. He is so convincing, in fact, that even behavioural tests indicate his tastes are "normal" which allows Dennett to suggest that two possible circumstances are taking place: either his internal structures have returned to their pre-surgery status, or they have not while Chase believes they have. Just as we saw in the previous IP, we are unable to know which of these possibilities has actually occurred, as a description of qualia is insufficient to determine which aspect of processing has been impacted (Dennett, 'Quining Qualia' 394). Again, this suggests that while we may have a "privileged view" of qualia due to their privacy, this does not include a sense of how they arise in the body (Dennett, 'Quining Qualia' 396).

While a neurologist or cognitive psychologist may not be able to verify the contents of one's experience, patient reports still provide clues as to what might be happening in the body. Although Dennett does acknowledge that behavioural testing may offer some indirect evidence to determine which of the factors may be involved, we can expand on this idea by further considering scientific research in multiple domains. A doctor or clinician is able to consult scientific literature from cognitive psychology and neurology to determine what the potential causes could be, and by ordering diagnostic tests, can determine which reasons are more likely to be the case. Any abnormalities or physical indicators may be recognized as evidence for or against a specific theory or idea, as a specialist's training and expertise within a specific domain provides them with a unique perspective on the situation. Working together, the researcher and the patient are able to examine their combined

knowledge to determine which factors are likely to have contributed to a shift in experience. While some changes may indicate signs of pathology, others may be benign or even beneficial, potentially as a result of learning or adaptation. It seems feasible that over time, Chase's employment has expanded his ability to detect particular qualities inherent to specific regions or beans, and as a result, no longer likes the Maxwell House blend. Sanborn, on the other hand, has experienced a perceptual change rather than a shift in preference, suggesting neurological tests are required to identify why this change has occurred. Although these tests may not uncover the evidence Sanborn needs to remain confident in his unchanged preference for Maxwell House coffee overall, a neurologist's expertise is still required to determine which causal or physical factors may be responsible. Just as Sanborn is incapable of knowing the private, subjective experiences of another, he is similarly unable to independently determine nervous system functionality as it occurs inside his own body. These examples demonstrate the limitations of qualia, and while phenomenal experiences are useful for generating an understanding of certain events or states of affairs, they alone are incapable of determining the causal or mechanical details responsible for the generation of certain subjective experiences.

Switching to the experience of drinking beer in IP9, Dennett addresses a source of confusion when thinking about acquired tastes (Dennett, 'Quining Qualia' 397). If one were to refer to *that taste*, are they pointing to the quale present after the first sip of beer, or the one arising many years later? Claiming that no one likes the first sip of beer, Dennett suggests that it seems the taste one comes to enjoy is not the same as the one experienced the first time around. The problem, however, is that this relocates the quale of beer from existing as an intrinsic property to being an extrinsic, relational feature that changes over time. This idea is also mentioned in IP10, as Dennett discusses how certain genes code for specific physiological outcomes, like a sensitivity to gustatory bitterness (Dennett, 'Quining Qualia' 397; Hayes et al. 255). Since subjective reports may be dependent on one's genetic constitution,

it seems as though there is no inherent property in certain chemical compounds which is responsible for a particular quale to arise.

In addition to any extrinsic properties associated with qualia, intrinsic elements arise as a result of the interaction between a stimulus and the human body. While one's preferences for certain flavours may change over time, like an acquired taste for hops in beer, other flavours may remain notably unpleasant irrespective of context, like bitterness arising from poisonous plants. The difference here rests in the chemical composition of the substances themselves, where one may be associated with some type of harm or adverse reaction upon contact. This effect, however, is still dependent on the way a body responds to a particular substance, suggesting the intrinsic properties of qualia are tacitly reliant on the physiological systems which produce them, a topic I continue to explore throughout the rest of this paper.

Returning to the taste of cauliflower in IP11, Dennett describes a situation in which a pill cures him of his dislike for cauliflower, while the intrinsic taste of cauliflower remains mostly unchanged. At the same time, Dennett admits that his experience now is so different that he does not want to state cauliflower tastes the same as it did before (Dennett, 'Quining Qualia' 399). Despite nothing existing within his experience to tell him what is going on, it seems as if this pill has subtly changed aspects of his physiology which, in turn, has produced a slightly altered experience of cauliflower. While Dennett grants that cauliflower has "dispositional, reaction-provoking properties" (Dennett, 'Quining Qualia' 399), this scenario demonstrates that there are no intrinsic properties responsible for the taste of cauliflower.

Given my previous reply which introduces an alternative perspective on intrinsic properties, what can be said about the effects of this pill? Perhaps this intervention has altered neuronal activity in one or both of Dennett's orbitofrontal cortices (W. Li et al. 1460; Rolls et al. 17; Seubert et al. 2452), leading to an increased pleasure response upon consuming cauliflower. Although the cauliflower quale

hasn't changed, his attitudes toward it have, so much so that Dennett might believe the flavour now is truly different from what it was before. To know for certain, however, one is required to analyze both Dennett's account detailing his subjective experiences and the neurological processes which support these effects. When these two perspectives are considered together, one becomes better equipped to determine which aspects of experience have changed and why.

The last intuition pump to address is IP15 which involves the sound of a guitar. Dennett asks whether this sound contains “describable parts” or is instead “one and whole and ineffably guitarish” (Dennett, ‘Quining Qualia’ 409). He suggests we often consider the sound to be entirely guitarish, and in an effort to demonstrate the different components of a sound wave, Dennett appeals to the presence of harmonics or overtones when an open string is plucked. When a guitar player lightly places their finger on the string at the fret an octave higher than the open string, the instrument isolates the overtone without the presence of the lower frequencies previously heard from the open string. Although the two notes sound alike, the sound qualities are not identical, suggesting our notion of *guitarishness* may be more complicated than we believe it to be (Dennett, ‘Quining Qualia’ 409). Moreover, he mentions that there is “nothing to stop further refinement” of our ability to hear and describe these sonic components, suggesting qualia have parts that might contribute to, or detract from, their overall form. As a result, this complexity and potential inconsistency makes it difficult for individuals to identify and articulate what is being experienced when engaging with certain qualia like the sound of instruments.

Interestingly, this IP provides us with a fairly easy example of qualia given how much we know about sound, music, and auditory processing, in addition to a lexicon and set of related concepts which provide a foundation for exploring phenomenal experiences. The property Dennett is implicitly referring to in IP15 is *timbre*, or the tonal and textural qualities produced by physical features of the instrument (Menon et al. 1742; Wolfe et al. 264). In fact, Dennett himself provides us with this definition immediately after introducing the harmonic example: “after all, it was by the complex

pattern of overtones that you were able to recognize the sound as that of a guitar rather than of a lute or harpsichord” (Dennett, ‘Quining Qualia’ 409). Instead of discussing timbre further, Dennett goes on to state that while our subjective experience of the open string may be different after having heard the isolated overtone, the sound of the open string itself has not changed. While this is true, there is more going on in this situation than he describes here, some of which is mentioned in a previous IP when Dennett inquires as to whether “your middle C is the same as my middle C” (Dennett, ‘Quining Qualia’ 406). Here, he is referring to a specific pitch or frequency, namely 261.6 Hz (Wolfe et al. 322), where its *fundamental frequency* is the lowest frequency present (Wolfe et al. 264). Dennett continues by wondering whether different people have distinct discriminatory profiles, suggesting we all may experience various features of the environment in slightly different ways (Dennett, ‘Quining Qualia’ 407). This seems to be the case when we consider the experiences of those with *absolute* or “perfect” pitch, as these individuals report associating colours, feelings, or characteristics with specific musical notes (Sacks 137–38). Furthermore, one’s ability to discriminate and recognize sounds, like overtones or intervals, may improve with time and practice as well, a suggestion Dennett himself provides at the bottom of page 408. Listening exercises like the one provided in IP15 which aim to isolate certain sounds may even facilitate the development of pitch discrimination, allowing individuals to notice parts of a sound which had previously remained undetected. While our phenomenal experiences contain an element of perceived wholeness or consistency, qualia like *guitarishness* often includes a range of properties which all contribute to the way it may be perceived. Although one may notice new qualities within the sounds emitted from a guitar, these sounds will never cease to sound *guitarish* in some way or another.

In conclusion, though Dennett’s arguments against qualia identify many areas of uncertainty, there seems to be enough room for refutation especially when one turns to scientific literature for assistance. Before expanding on a biological explanation of qualia, however, a brief discussion of its

relation to art and music as forms of self-expression assists in demonstrating the existence of qualia. This is due to their accessibility through specific mediums and given their subjective, creative origins within the minds and bodies of the artist, they are capable of tapping into the perspectives and minds of audiences. In engaging with arts and humanities, individuals directly aim to express elements of phenomenal life which may not be adequately expressed through language, open to be interpreted freely by others. Through these mediums, subjectivity aims to generate specific ideas in the minds of others to establish a connection between these private inner lives. Even when works inspire feelings of disagreement or confusion, there still remains an experience characterized by specific qualities.

Appealing to Art and Music

While Dennett's queries surrounding human preference can be applied to almost any of our subjective experiences, engaging with one's personal feelings about artistic works and other cultural products may shed some light on qualia more generally. Given that one person's favourite genre of music may be another's least favourite, for example, it seems there is something which causes these feelings to emerge in people. You can ask yourself this question too; "what is it about *my* favourite painting, photo, or song that I appreciate?" Although the answer may be murky, our emotions and feelings indicate to us that some type of qualia must exist, as without them, we would likely feel indifferent about art and music in general. To generate a preference for or against some object or stimulus, there must be a property humans appeal to within the decision-making process. Considering *guitarishness* comes in different flavours, as a performer's playing style influences the way music is created and perceived by others, subjective qualities must exist to explain how individuals arrive at an opinion on a certain work or genre of music.

Furthermore, by claiming that properties of subjectivity are intrinsic to the stimulus itself, an explanation can be produced for any invariance or similarities experienced throughout multiple

contexts. As mentioned in my reply to IP9 and IP10, this intrinsicity is generated from the interaction of external environmental properties and human physiological processes, as our bodies and their sensory organs create representations of aspects of the physical world through a process known as *transduction* (Wolfe et al. 352). Thus, our experiences of guitar music or a sip of wine are situated and embodied in a manner which generates subjective feelings in response to, or *about*, the guitar or wine. Artists who successfully manipulate these responses are able to shape the way others feel as they engage with the work, suggesting qualia are relied upon to depict an artist's subjective experiences for the purposes of communicating ineffable feelings or ideas.

An example of musical depiction through timbre can be seen in the symphonic work *Peter and the Wolf* by Sergei Prokofiev. It tells a story of a Soviet pioneer boy living on a farm with his grandfather and a few animals, where each character is represented by different musical instruments (Morrison 46). Peter is represented by a string quartet while his grandfather is portrayed by a bassoon; a duck is depicted by an oboe, a flute portrays a songbird, and the wolf is represented by horns (Morrison 47). The reason Prokofiev chose these instruments is because the qualities of their sounds remind us of the sounds of animals or specific voices, where he takes advantage of this perceptual feature to teach children about the timbral qualities of these instruments (Morrison 47). From our point of view, there is something-it-is-like to hear a guitar or a songbird, and this representation may have similar features to another, like a flute playing a sequence of high notes. By identifying these associations, artists can reference different ideas that others can immediately understand. The reason music provides a compelling example of qualia is due to the fact that music is able to evoke emotional responses, potentially giving rise to a series of subjective feelings. Additionally, music can be systematized and expressed in symbolic notation, enabling musicians to depict these subjective experiences visually or conceptually through a vocabulary and theory designed to articulate the relationship between subjective events and objective stimuli. Thus, as a combination of subjective

experiences resulting from written or verbal instruction, a range of ideas can be expressed or communicated by playing musical instruments in a certain way. While some qualia may seem ineffable, others have resulted in entire fields of study.

In conclusion, analyzing one's own personal feelings about art and music provides an approach for exploring qualia, as preferences always point to an underlying element from which an opinion is derived. Formalizing or creating terminology for inner experiences and studying their relation to external events creates a language which can provide others with a rough idea about what one is experiencing. By identifying similarities between qualia, a set of references or depictions can be created and shared which potentially assist others identify and engage with their own inner experiences. While there may be differences between individuals, we can be confident that our experiences are relatively similar given the assumption that sensory organs and processes do not differ considerably between individuals. Though the contents of another's subjective experiences are unverifiable at present, known as the *explanatory gap* (Levine 359), domains in the arts and humanities demonstrate the reality of phenomenal experiences as they are depicted through a variety of mediums. With the reality of qualia thus secured, the next step involves identifying a causal explanation for the emergence of phenomenal experiences.

Connecting the Subjective to the Objective

While explanations for the origins and nature of consciousness seem to continually evade philosophical elucidation, answers to our questions on the mind can be answered today if one defers to scientific literature from a variety of domains. The *Hard Problem of Consciousness* posed by David Chalmers inquires about why is it that we have phenomenal experiences in the first place (Chalmers 201). Appealing to evidence and theory from evolutionary biology, however, provides a framework which can account for the generation of subjective experience in humans. Two researchers, psychiatrist

and neurologist Dr. Todd Feinberg and biologist Dr. Jon Mallatt, suggest subjectivity arises from the development of living organisms over millions of years (Feinberg and Mallatt, *The Ancient Origins of Consciousness* 17), as these self-organizing systems produce emergent behaviours which give rise to system-level capacities like pre-reflective consciousness (Feinberg and Mallatt, ‘Phenomenal Consciousness and Emergence’ 2). Since all living organisms adapt to environmental changes and aim to maintain proper system functioning, evolutionary pressures enabled species to develop various reflex programs as a result of these biological tendencies (Feinberg and Mallatt, *The Ancient Origins of Consciousness* 24). As the nervous systems of complex organisms continued to improve over millions of years, species developed unique physiological solutions to mitigate various challenges as they arise, eventually giving rise to intelligent species like elephants, magpies, and humans. Creatures like worms, jellyfish, and sponges are considered non-conscious because their nervous systems respond automatically to stimuli, forming fixed patterns of responses and behaviours (Feinberg and Mallatt, ‘Phenomenal Consciousness and Emergence’ 5; Feinberg and Mallatt, *The Ancient Origins of Consciousness* 20). Vertebrates, on the other hand, are phenomenally conscious organisms given their neural complexity, improved sensory organs, and a capacity to store memories (Feinberg and Mallatt, ‘Phenomenal Consciousness and Emergence’ 5; Feinberg and Mallatt, *The Ancient Origins of Consciousness* 26). Since these capacities are all meant to facilitate an individual’s continued survival, their resulting subjective experiences are therefore properties of the body aimed at responding and adapting to environmental changes (Feinberg and Mallatt, ‘Phenomenal Consciousness and Emergence’ 10; Feinberg and Mallatt, *The Ancient Origins of Consciousness* 222). For example, the pain which arises upon fracturing a bone signals an injury has occurred, motivating individuals to temporarily alter their behaviours to prevent the break from getting worse or failing to heal properly. Therefore, a reply to the *Hard Problem* exists: phenomenal experiences are an adaptive trait inherent to relatively

complex nervous systems, one which facilitates the execution and governance of adaptive behaviours (Feinberg and Mallatt, *The Ancient Origins of Consciousness* 225).

Qualia are explained similarly by robotics engineer Dr. Pentti Haikonen as part of a discussion on the requirements for creating conscious machines. He suggests qualia arise from percepts produced by sensory mechanisms as physiological systems respond to various aspects of the environment (Haikonen, *Consciousness and Robot Sentience* 13). Because qualia are generated as a result of sensory organ functionality, their content serves as a representation of real-world properties from the subject's perspective and potentially distinct from its objective form (Haikonen, 'Qualia and Conscious Machines' 227). The examples Haikonen appeals to are "blueness" and "sweetness" to show how from an external point of view, nothing exists to suggest a particular hue or taste exists when inspecting chemical compounds or waves of photons (Haikonen, *Consciousness and Robot Sentience* 14). Rather, it is the act of interpreting certain compounds or wavelengths which then gives rise to qualia. Given the primacy of these sensations, Haikonen suggests qualia are self-explanatory, requiring no further interpretation to determine their meaning or relation to the environment (Haikonen, *Consciousness and Robot Sentience* 14; Haikonen, 'Qualia and Conscious Machines' 232). Unlike symbols, which require further processing or interpretation to be understood, the meaning of qualia are directly apparent to individuals as physical experiences (Haikonen, *Consciousness and Robot Sentience* 20). Haikonen also connects qualia to the *Hard Problem of Consciousness* by stating "to be conscious is to have phenomenal experience with qualia" (Haikonen, *Consciousness and Robot Sentience* 35), where the awareness of subjective experiences arises from the integration of information within and between different neural networks (Haikonen, *Consciousness and Robot Sentience* 39). When considered together, these explanations of phenomenal experiences provided by Haikonen and Feinberg and Mallat suggest a naturalized theory of conscious exists by investigating the origins of the human brain and its functional capacities.

From this perspective, it can be suggested that the ineffability of qualia is due to the fact that their existence predates reflective awareness, however, the development of the neocortex and human culture seems to have improved our ability to understand and articulate phenomenal experiences. Since species living in social groups usually require a means of communicating to one another for cooperation, these settings carry the potential to further develop the bodies and behaviours of its members for improved communication (Tomasello and Vaish 238). Through evolutionary processes, species like humans develop cultural practices and communal knowledge for the sake of organizing the group and shaping the behaviours of its individual members (Tomasello and Vaish 239). Since this knowledge likely includes information about the internal states of group members, certain qualia may become less ineffable than others based on their familiarity, as a frequently experienced sensation is more likely to be noticed and referenced. As new forms of representation developed over time, such as visual art, music, and writing systems, certain qualia could be uniquely portrayed and thus further clarified or exemplified through novel artistic or cultural products. Although qualia may originate as ineffable experiences, the development of the brain, along with various social or cultural practices, has generated the capacity to improve our ability to articulate and represent certain phenomenal experiences through reflection and expression.

Qualia for Communities

Not only are qualia are important for guiding the behaviours of individuals, they are similarly important for other individuals as well. Generally speaking, social groups promote survival because individuals work together for a shared goal, where community members are expected to conduct themselves in a manner which considers the needs and desires of others. Since this typically involves protecting others from environmental harms, the personal experiences of group members are often useful for determining ways to ensure the safety and security of others. By appealing to qualia, many

individuals can learn about phenomenal experiences which occur as a result of interacting with some stimulus. For example, the entire group does not need to test an unfamiliar berry to know that its ingestion leads to a stomach ache, provided one individual reports their experiences after trying it for themselves. Those witnessing the situation are able to learn about the berry's effects and subsequently communicate these outcomes to other individuals at a later point in time, allowing information and meanings to be disseminated to those absent at the time of discovery. Consequently, the berry takes on a specific meaning by the group as something to be eaten or avoided due to the experiences of one individual, potentially saving members from experiencing either the berry's ill effects or starvation. In this way, sharing one's experiences with other group members facilitates the production of knowledge about the world as it affects individuals from an embodied perspective.

While certain qualia may be communicated through linguistic descriptions, these representations are limited as they attempt to articulate experiences and feelings which arise from the body. Given that phenomenal experiences emerge from physiological functioning, accounts or descriptions provided by individuals must appeal to distinct concepts or knowledge to establish an association as a point of reference. For others to properly understand what another is referring to, specific words or concepts must be identified which can adequately represent the sensation or experience one is attempting to convey. If the recipient of the message is able to understand the message and relate its contents to their own experiences, a similarity between the depiction and its bodily referent has been identified and articulated. Consequently, descriptions of our sensations and experiences often appeal to similes and metaphors which create an analogy or comparison individuals can use to deduce the referent. For example, the sensation of *frisson* feels like a wave of shudder or chills and is often accompanied by an emotional component as well, like excitement or surprise ('Frisson'). While this may accurately depict what frisson feels like, those unable to relate can only imagine how these words operate together conceptually to produce such a sensation. Therefore, the

ineffability of qualia may be reduced if cleverly represented by propositions or utterances, however, translating propositions into bodily experiences involves considerably more introspection.

While challenging at first, this effort to compare the experiences of others to one's own perspective generates positive outcomes for the group as individuals improve their ability and capacity to relate to one another. If enough people are able to relate to a particular quale, it may become incorporated by cultural attitudes, norms, or ideas to become a meme which can be exported to other communities. From this shared perspective, intersubjective phenomenal experiences, or social qualia, can be fostered by settings aimed at causing a particular sensation within its members. An example of a social quale is the Danish *hygge* which refers to a feeling of relaxed well-being with an appreciation for small pleasures (Levisen 80). Derived from the Norwegian verb which means "to console, to encourage", *hygge* it provides a window into a cultural ideal which strives for positive sociality and togetherness (Levisen 80-81). As a concept, it encompasses aspects of physical and social environments that can be referred to when individuals attempt to articulate their subjective experiences. In this way, Danes partake in an adaptive cultural experience which is made explicit through both language and behaviour (Levisen 114). Therefore, we can state that there is something-it-is-like to experience and practice *hygge*, an omnipresent quale overtly expressed in Danish society.

In conclusion, by outlining the evolutionary origins and development of human life, an explanation for phenomenal consciousness, and its varying levels of ineffability, can be postulated. Although qualia may be studied from an objective point of view, they are not reducible to objective states of affairs and exist in a format generated by neural processing. Instead, an explanation for qualia requires the combination of perspectives derive from both objective studies and subjective experience, as captured by the sciences and arts. Human development with its rich cultural heritage supplies a naturalized functionalist perspective capable of providing reasonable answers to lingering questions about the mind. While it has been established that neural processes physically support qualia, appeals to

neural processes themselves does not provide us with any insight into their subjective elements. With this in mind, what *are* qualia and what are they made of?

Qualia as Information

As representations of environmental stimuli, qualia exist as information generated and supported by the nervous system and its electrochemical signals. It is important to note that this idea of “qualia as information” is explored briefly by David Chalmers in his self-proclaimed *proto-theory* of consciousness (Chalmers 277), suggesting information states representing phenomenal experiences arise with the realization of physical information states in the brain (Chalmers 286). From here, Chalmers thinks that by connecting these two domains, we may uncover a set of laws which provides a “fundamental theory of consciousness” (Chalmers 287). Although it may seem as though Chalmers is on the right track, he does not specify how these two information states are ultimately related, leaving the theory open for further discussion. This final section analyzes *information theory* to determine the relationship between phenomenal experiences and their physical foundations.

Since information theory is a complex topic and spans multiple disciplines (Gray 373), this section will only introduce a few necessary concepts for discussing ‘information’ in a general sense. Oftentimes, information is considered to be *semantic*, or referring to concepts or states of affairs in the world, where messages are embedded in symbols or text to be identified by a reader (Shannon 379). Alternatively, information can also refer to the data or conceptual structure that the message is embedded in, since this structure is capable of transmitting the message from one source to a destination of some type (Shannon 381). Definitions of information have continued to expand over the years, where contemporary, domain-general notions state that information is also *well-formed*, *meaningful*, and *truthful* (Floridi 42; Sommaruga 255). Although these additional requirements are important to consider in discussions about neural or mental processing, for the purposes of introducing

an explanation of qualia, my focus will remain on information as it pertains to *data* and *meaning*. By ‘data’, I am referring to the taxonomically neutral concept which suggests that singularly, a *datum* is relational entity where *data* represents the relational structure generated from the relations between entities (Floridi 43). Examples include the black and white stripes of a bar code, or the strings of ones and zeros storing text or images inside electronic devices. From this perspective, we can see how data can be a source of information and semantic meaning, in addition to viewing data as a medium which meanings can be embedded in (Leonelli 198). Furthermore, *information-processing* refers to the series of steps or functions that aim to translate or transform incoming data to identify or obtain a message (Gray 379). Information-processing may also include functions such as data storage and retrieval, along with encoding and decoding (Floridi 47; Fresco and Wolf 81). Taken together, information and information-processing interact together to generate a system capable of transforming and storing data.

Since ancient Greece, ideas about the body operating like a machine or a series of processes have been appealed to in attempts to provide an explanation for subjective experiences, contributing to the development of *functionalism* as a philosophical perspective for explaining consciousness (Levin). Despite empirical support for this view given the scientific literature on human physiology, functionalism has yet to develop a compelling account for consciousness and subjective experiences (Levin). Arguably, the reason for this may be due to a lack of consideration for the significance of the data itself, as data may be expressed in a variety of different forms, influencing the ways in which it may be processed and stored by a system. The human body relies upon a wide variety of sensory modalities to detect multiple types of data produced by the environment, where specific physiological processes are only triggered by certain physical properties or states. For example, light waves are unlikely to elicit a response from the ear drum but are likely to activate cells in the retina instead, suggesting inherent properties of external stimuli are important when considering functionalist explanations for aspects of human consciousness. While our experiences are highly dependent on the

physiological processes supporting them, they are also dependent on individuals interacting with specific types of incoming data as well.

The idea that qualia exist as information also seems to have evidential support. In a publication by neuroscientist Dr. Roger Orpwood, experimental findings suggest neuronal activity indeed represents semantic information as messages are encoded in networks of cells firing in response to a stimulus (Orpwood 11). Appealing to Claude Shannon's distinction between information as semantic or structural, Orpwood describes the reciprocal relationship between the two versions of information as it exists in neuronal activity (Orpwood 4). While information structures, existing as networks of neurons firing in response to some stimulus, may represent information messages, messages must also be identified from information structures through processes involved in recognition and identification (Orpwood 3). Furthermore, Orpwood describes how these networks communicate by receiving, interpreting, and transmitting information to and from other populations of neurons, preserving the information message as the structures which express it are modified through subsequent processing (Orpwood 4). Neural networks can also use their own outputs as inputs to create a local feedback loop where the network re-identifies the information message inherent in the information structure (Orpwood 5). As a result, not only does the output represent the information message, the output also represents the fact that this representation is identical to the message last identified by the network (Orpwood 7). This re-referencing allows individuals to better identify the information message as an image or internal representation of the external stimulus (Orpwood 10). To demonstrate this using an example, Orpwood appeals to the olfactory processing of hydrogen sulphide, a chemical compound which smells like rotting eggs (Rochette and Vergely 136). Individuals with their attention directed to the scent are able to form an inner representation of the odour as a result of information feedback loops supported by a specific network of neurons (Orpwood 9). He concludes the paper by presenting an array of experimental findings which support this explanation, suggesting that although much about

this proposal seems promising, further research into the distinction between conscious and unconscious processing is required (Orpwood 14).

As an organizer of information, the human brain is responsible for ensuring individuals behave in appropriate ways for the sake of protecting themselves and the people they care about. While it may be physically comprised of neurons and electrical signals, the information stored and processed by the central and peripheral nervous systems is only accessible to the body's owner, the self-aware individual. While humans may have created methods for indirectly portraying this information, the ability to verify subjective content requires a means of uncovering the messages embedded within neural structures. As such, the explanatory gap can be accounted for, but not removed, by appealing to information theory, as the dual nature of 'information' as structures and messages explains why subjective experiences are private. To eliminate the gap, however, new technologies will be required to read and interpret meaningful content from decoded neuronal signals.

Finally, this application of information theory can also account for the intrinsicity of phenomenal experiences. Originating from environmental causal processes and detected by sensory systems as incoming data, the intrinsicity arising from qualia is a product of two interacting variables: the structures and relations which comprise this incoming data, and the way this information is processed by a particular embodied nervous system. To expand on the example involving the smell of rotting eggs, the intrinsically bad smell is partly due to the presence of sulphur within the compound (S. Li et al. 13281). To be defined or thought of as offensive or revolting, however, requires a process which labels the incoming chemical compound as such. As individuals detect the chemical, physiological systems respond based on the substance's properties, determining the best course of action in reaction to the stimulus. It seems possible that other forms of living organisms may associate an alternative meaning with hydrogen sulphide, and if it were to signify food, would likely motivate the individual to approach the source of the stimulus, rather than avoid it. Therefore, the intrinsicity of

qualia arise from the interaction of environmental stimuli as it is recognized and processed by the body's various physiological systems.

Concluding Remarks

Qualia are real not only because of the evidence for their existence from a variety of domains, but because existing scientific explanations for phenomenal experiences are capable of reinvigorating metaphysical discussions on the nature of consciousness more generally. While we still lack verification for the *contents* of subjectivity, evidence for the existence of phenomenal experiences has been identified by both the arts and sciences, suggesting that attempt to cast aside this notion are overall detrimental for our understanding. As humans and as sensing beings, qualia are what adds richness and dimension to experience, even when one encounters unpleasant stimuli. From food preferences to music preferences, the mere fact that we care one way or another suggests something necessarily resides beyond the opinion, otherwise it would refer to nothing or assured indifference. Furthermore, given that plausible explanations for the *Hard Problem of Consciousness* have been identified, additional metaphysical abstraction suggests that qualia are information messages which are currently inaccessible to all except the owner of the body processing them. Just as we are unable to see what information is stored in a computer hard drive without a way to access it, information about one's experiences is stored in the body and recalled when cued. The difference between computers and animals is our capacity for self-governance and our ability to learn, as neural structures are able to reorganize in ways which better responds to aspects of the environment. As the brain continued to evolve, our forms of representation did as well and once externalized in various mediums, could act as sources of information for others about events both internal and external to the body. Thus, qualia are simply a bodily form of representation which emerges from pre-reflective awareness.

Works Cited

- Chalmers, David. *The Conscious Mind: In Search of a Fundamental Theory*. Oxford University Press, 1996.
- Dennett, Daniel C. 'How Our Belief in Qualia Evolved, and Why We Care so Much: A Reply to David H. Baßler'. *Open MIND*, Theoretical Philosophy/MIND Group – JGU Mainz, 2015. DOI.org (Datacite), <https://doi.org/10.15502/9783958570665>.
- . 'Quining Qualia'. *Consciousness in Modern Science*, Oxford University Press, 1988, pp. 381–414.
- Dretske, Fred. 'Phenomenal Externalism or If Meanings Ain't in the Head, Where Are Qualia?' *Philosophical Issues*, vol. 7, [Wiley, Dr. Enrique Villanueva, Ridgeview Publishing Company], 1996, pp. 143–58. JSTOR, <https://doi.org/10.2307/1522899>.
- Feinberg, Todd E., and Jon Mallatt. 'Phenomenal Consciousness and Emergence: Eliminating the Explanatory Gap'. *Frontiers in Psychology*, vol. 11, Frontiers, 2020. *Frontiers*, <https://doi.org/10.3389/fpsyg.2020.01041>.
- . *The Ancient Origins of Consciousness: How the Brain Created Experience*. MIT Press, 2016.
- Floridi, Luciano. 'Information'. *The Blackwell Guide to the Philosophy of Computing and Information*, John Wiley & Sons, Ltd, 2004, pp. 40–61. *Wiley Online Library*, <https://doi.org/10.1002/9780470757017.ch4>.
- Frank, Damian, et al. 'In-Mouth Volatile Production from Brassica Vegetables (Cauliflower) and Associations with Liking in an Adult/Child Cohort'. *Journal of Agricultural and Food Chemistry*, American Chemical Society, Sept. 2021. *ACS Publications*, <https://doi.org/10.1021/acs.jafc.1c03889>.
- Fresco, Nir, and Marty J. Wolf. 'Information Processing and Instructional Information'. *The Routledge Handbook of Philosophy of Information*, Routledge Handbooks Online, 2016. www.routledgehandbooks.com, <https://doi.org/10.4324/9781315757544.ch09>.

- 'Frisson'. *Merriam-Webster.Com Dictionary*, Merriam-Webster,
<https://www.merriam-webster.com/dictionary/frisson>. Accessed 2 June 2021.
- Gray, Robert. 'A Brief Historical Review of the Development of the Distinction between Data and Information in the Information Systems Literature'. *AMCIS 2003 Proceedings*, Dec. 2003, p. 372.
- Haikonen, Pentti O. *Consciousness and Robot Sentience*. 2nd ed., vol. 04, WORLD SCIENTIFIC, 2019. DOI.org (Crossref), <https://doi.org/10.1142/11404>.
- . 'Qualia and Conscious Machines'. *International Journal of Machine Consciousness*, World Scientific Publishing Company, Apr. 2012. world, www.worldscientific.com, <https://doi.org/10.1142/S1793843009000207>.
- Hayes, John E., et al. 'Supertasting and PROP Bitterness Depends on More Than the TAS2R38 Gene'. *Chemical Senses*, vol. 33, no. 3, Mar. 2008, pp. 255–65. Silverchair, <https://doi.org/10.1093/chemse/bjm084>.
- Leonelli, Sabina. 'The Philosophy of Data'. *The Routledge Handbook of Philosophy of Information*, Routledge Handbooks Online, 2016. www.routledgehandbooks.com, <https://doi.org/10.4324/9781315757544.ch17>.
- Levin, Janet. 'Functionalism'. *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta, Fall 2018, Metaphysics Research Lab, Stanford University, 2018. *Stanford Encyclopedia of Philosophy*, <https://plato.stanford.edu/archives/fall2018/entries/functionalism/>.
- Levine, Joseph. 'Materialism and Qualia: The Explanatory Gap'. *Pacific Philosophical Quarterly*, vol. 64, no. 4, 1983, pp. 354–61.
- Levisen, Carsten. *Cultural Semantics and Social Cognition: A Case Study on the Danish Universe of Meaning*. De Gruyter Mouton, 2012. ocul-gue.primo.exlibrisgroup.com, <https://doi.org/10.1515/9783110294651>.

- Li, Shengju, et al. 'Smelling Sulfur: Copper and Silver Regulate the Response of Human Odorant Receptor OR2T11 to Low-Molecular-Weight Thiols'. *Journal of the American Chemical Society*, vol. 138, no. 40, American Chemical Society, Oct. 2016, pp. 13281–88. *ACS Publications*, <https://doi.org/10.1021/jacs.6b06983>.
- Li, Wen, et al. 'Right Orbitofrontal Cortex Mediates Conscious Olfactory Perception'. *Psychological Science*, vol. 21, no. 10, SAGE Publications Inc, Oct. 2010, pp. 1454–63. *SAGE Journals*, <https://doi.org/10.1177/0956797610382121>.
- Masson, J. Moussaieff, and Susan McCarthy. *When Elephants Weep: The Emotional Lives of Animals*. Delacorte Press, 1995.
- Menon, V., et al. 'Neural Correlates of Timbre Change in Harmonic Sounds'. *NeuroImage*, vol. 17, no. 4, Dec. 2002, pp. 1742–54. *ScienceDirect*, <https://doi.org/10.1006/nimg.2002.1295>.
- Morrison, Simon. 'The People's Artist: Prokofiev's Soviet Years'. *The People's Artist*, Oxford University Press. oxford.universitypressscholarship.com, <https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780195181678.001.0001/acprof-9780195181678>. Accessed 1 July 2021.
- Orpwood, Roger. 'Information and the Origin of Qualia'. *Frontiers in Systems Neuroscience*, vol. 11, Frontiers, 2017, p. 22.
- Rochette, L., and C. Vergely. 'Le sulfure d'hydrogène (H₂S), un gaz endogène à l'odeur d'œuf pourri, pourrait être un régulateur des fonctions cardiovasculaires'. *Annales de Cardiologie et d'Angéiologie*, vol. 57, no. 3, June 2008, pp. 136–38. *ScienceDirect*, <https://doi.org/10.1016/j.ancard.2008.02.014>.
- Rolls, Edmund T., et al. 'The Representation of Information About Taste and Odor in the Orbitofrontal Cortex'. *Chemosensory Perception*, vol. 3, no. 1, Mar. 2010, pp. 16–33. *Springer Link*, <https://doi.org/10.1007/s12078-009-9054-4>.

- Sacks, Oliver. *Musicophilia: Tales of Music and the Brain*. Knopf Canada, 2010.
- Seager, William. *Theories of Consciousness : An Introduction and Assessment*. Routledge, 2016.
www.taylorfrancis.com, <https://doi.org/10.4324/9780203485583>.
- Seubert, Janina, et al. ‘Orbitofrontal Cortex and Olfactory Bulb Volume Predict Distinct Aspects of Olfactory Performance in Healthy Subjects’. *Cerebral Cortex*, vol. 23, no. 10, Oct. 2013, pp. 2448–56. *Silverchair*, <https://doi.org/10.1093/cercor/bhs230>.
- Shannon, C. E. ‘A Mathematical Theory of Communication’. *The Bell System Technical Journal*, vol. 27, no. 3, July 1948, pp. 379–423. *IEEE Xplore*, <https://doi.org/10.1002/j.1538-7305.1948.tb01338.x>.
- Sommaruga, Giovanni. ‘One or Many Concepts of Information?’ *Formal Theories of Information: From Shannon to Semantic Information Theory and General Concepts of Information*, edited by Giovanni Sommaruga, Springer, 2009, pp. 253–67. *Springer Link*, https://doi.org/10.1007/978-3-642-00659-3_10.
- Tomasello, Michael, and Amrisha Vaish. ‘Origins of Human Cooperation and Morality’. *Annual Review of Psychology*, vol. 64, no. 1, 2013, pp. 231–55. *Annual Reviews*, <https://doi.org/10.1146/annurev-psych-113011-143812>.
- Wolfe, Jeremy M., et al. *Sensation and Perception*. 4th edition, Sinauer Associates, 2015.
- Wright, Edmond Leo. *The Case for Qualia*. MIT Press, 2008.