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Qualia

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Qualia are the qualitative or subjective aspects of experience. Consider what it's like to stub your toe, to take a sip of freshly brewed coffee, or to view the Northern Lights in the night sky. Each of these experiences has a distinctive feel to it, a distinctive set of qualitative or subjective aspects—their *qualia*. Qualia are at the very center of your experience of the world. They are why you find some meals delectable and others repulsive, some works of art beautiful and others ugly, and some activities desirable and others unwelcome. Yet, it is unclear whether and how qualia are compatible with a scientific understanding of the world. Even with a complete neuroscientific account of the brain, many philosophers have argued that it would remain unexplained why a certain brain process gives rise to an experience with one set of qualia as opposed to another or to no qualia at all. This challenge has been referred to as the *hard problem of consciousness*. In contemporary philosophy of mind and cognitive science, considerable attention has been devoted to explicating this apparent problem and, correspondingly, to developing answers to it.

History

Although philosophers have long been interested in subjective aspects of mind, the term *qualia* and the corresponding singular term *quale* were not used in this context until the late 19th century when they were introduced into philosophical discussion by Charles Sanders Peirce, the founder of American pragmatism ([Fisch, 1982](#), p. 478). In the early 20th century, the terms gained greater currency via their use by philosophers such as C. I. Lewis in connection with the development of the *sense-data theory* of perception ([Lewis, 1956](#)). According to this theory, perception of objects does not proceed directly but rather indirectly; when someone looks at an object, like an apple, they perceive it by forming a private, picture-like image of the apple in their mind. This picture-like representation is what is meant by a *sense-datum* (the singular of sense-data, sometimes also called *the given*). Philosophers like Lewis used the term *qualia* to pick out the distinctively qualitative properties of a sense-datum.

As the 20th century progressed, the sense-data theory began to fall out of favor, and skepticism about the existence of sense-data led some philosophers to a corresponding skepticism about the existence of qualia. However, even if there are reasons to doubt the existence of sense-data, the notion of qualia does not need to be rejected entirely, as there are more theoretically neutral ways of understanding it. One might believe that experience has qualitative aspects—that experience has qualia—without believing that individuals perceive the world by way of sense-data. Along these lines, by the second half of the 20th century, the notion of qualia became largely detached from its association with the sense-data theory and became used as a term synonymous with *phenomenal character* ([Tye, 2021](#)) or the *what-it-is-likeness* of experience ([Nagel, 1974](#)). In contemporary philosophical discussion, reference to qualia should not be understood to imply commitment to any particular view of perception (for further discussion of the history of the term “qualia,” see [Crane, 2000](#) and [Keeley, 2009](#)).

Historically, philosophers had often endorsed a theory of mind known as *dualism*; on this view, the mind is fundamentally a different kind of thing from physical things like bodies and brains ([Descartes, 1993](#)) [see [The Mind-Body Problem](#)]. However, in the 20th century, two alternative theories of mind gained in popularity. According to *physicalism*, mental states are fundamentally physical states; their nature can be explained wholly in physical terms, presumably in terms of facts about brain states ([Smart, 1959](#)). According to *functionalism*, in contrast, mental states are fundamentally functional states; their nature can be explained wholly in terms of the functional roles that they play ([Putnam, 1960](#)), and such functional roles might be supported by physical substances other than brains (consider, for example, a noncarbon-based lifeform).

As physicalist and functionalist theories came under increasing scrutiny, arguments concerning qualia played a prominent role in the criticisms that were aimed at them (see the section “Core concepts”). The basic problem that qualia pose for such theories can be summarized in terms of the notion of the *explanatory gap* ([Levine, 1983](#)). Suppose, for example, that the physicalist identifies pain with a certain brain process such as c-fiber firing. For the physicalist, the claim that pain is identical to c-fiber firing is typically taken to be analogous to other kinds of scientific discoveries, such as the claim that heat is mean molecular kinetic energy. However, although the discovery that heat is mean molecular kinetic energy provides a complete explanation of the nature of heat, the discovery that pain is c-fiber firing is not fully explanatory in the same way. Still left unexplained is why pain feels the way that it does. There does not seem to be anything about the process of c-fiber firing that would make sense of pain having one set of phenomenal properties rather than another. When it comes to qualia, there is a gap in the explanation provided by physicalist and functionalist theories.

At the end of the 20th century, discussions of qualia began largely to be subsumed under discussions of the so-called *hard problem of consciousness* ([Chalmers, 1995, 1996](#)). Philosophers now tend to distinguish two different kinds of problems about consciousness. The so-called easy problems are those in which what is required is an explanation in terms of computational or neural mechanisms. This kind of explanation can be provided using the standard methods of cognitive science. Easy problems concern matters like stimulus response, information processing, behavioral control, and attention. Many of the leading contemporary theories of consciousness, such as the *global workspace theory* ([Baars, 2005](#)) or the *integrated information theory* ([Tononi et al., 2016](#)), along with attempts to identify the neural correlates of consciousness ([Koch et al., 2016](#)), have made considerable progress addressing these easy problems.

In contrast, the hard problems do not seem susceptible to explanation via the standard methods of cognitive science. The paradigmatic hard problem concerns experience and, in particular, its subjective aspect. In line with worries about the explanatory gap, the hard problem suggests that additional questions arise even once cognitive science addresses the easy problems. For example, along with the visual and auditory information processing done by cognitive systems, it is an open question why there is also visual and auditory experience—

such as sensations of rich purple and orange hues and also shrill beeps and dulcet tones (see [Chalmers, 1996](#)). In short, the hard problem concerns the special difficulty that comes with explaining the existence of qualia.

Core concepts

Qualia and functionalism

Inspired by an analogy between minds and machines, many philosophers of mind and cognitive scientists in the 20th century were drawn to the functionalist theory of mind. On this view, mental states are defined in terms of their functional role, that is, in terms of their causes, their relations to other mental states, and their behavioral effects. For example, a functionalist might define pain as the kind of state that (a) results from a bodily injury like a cut, scrape, or burn; (b) produces other mental states like the belief that something is wrong, the desire for relief, and emotions of unhappiness and anxiety; and (c) produces behavior such as cries of “ouch,” groaning, and movement away from the painful stimulus. According to critics of functionalism, however, it is not clear how this definition adequately accounts for qualia because it seems conceptually possible that someone be in a state that plays the functional role of pain even while lacking any painful qualia. On the assumption that the qualitative aspects of pain are essential to it, functionalism cannot adequately capture pain. This is often referred to as the *absent qualia objection* ([Fodor, 1981](#)).

This objection is often motivated by the consideration of hypothetical systems that are functionally identical to systems with qualia but that themselves lack qualia. For example, imagine a robot system operated by millions of people in contact with one another by handheld radios ([Block, 1978](#)). Each person is assigned a simple task corresponding to the functional role played by a single neuron in the brain of a corresponding human. If the robot were to bump its head, then it would be in the same functional state as the human who bumps their head. Although the human would experience pain qualia when they did so, it has struck many philosophers as implausible that the robot system operated by millions of distinct individuals would experience any pain qualia in the same scenario, or indeed, any qualia at all.

Faced with this objection, functionalists have suggested various responses. One response is to insist that the robot system, if it really were in a state that was functionally identical to pain, would likewise experience pain qualia. The inclination to think otherwise implies a failure to successfully imagine what one has been asked to imagine ([Dennett, 1991](#)); perhaps, for example, the immense size of the system makes it difficult to grasp its full totality ([Lycan, 1987](#)).

In addition to the absent qualia objection, critics of functionalism raise a parallel objection often referred to as the *inverted qualia objection*. The inverted qualia objection draws inspiration from concerns first raised in the 17th century about how any two people can be sure that they are having the same qualitative experiences as one another when interacting with objects in the world ([Locke, 1689/2008](#)). For example, one person looking

at a blue violet might have the same sensation that another person experiences when looking at a yellow marigold and vice versa; moreover, this might happen without either person having any way to tell. Such a possibility seems to pose a particular problem for the functionalist. One person might be in a functional state that defines the visual experience of green and yet have the qualia that another person is having when that person is in the functional state that defines the visual experience of red. They will both stop at the same stoplights and sort tomatoes into the same categories of ripe and unripe, even though they are having qualia that are inverted from one another. If the inverted spectrum scenario is a real conceptual possibility—and research in contemporary cognitive science indicates that, at least with respect to some kinds of color inversions, it is (see, e.g., [Nida-Rümelin, 1996](#); [Palmer, 1999](#))—then functionalism cannot adequately account for the qualitative nature of experience.

Qualia and physicalism

Although the dualist takes there to be two fundamentally different kinds of things in the world, mental things and physical things, the physicalist thinks that there is only one kind of thing in the world; for the physicalist, everything that exists is physical in nature. Physicalism, like functionalism, has often been accused of being unable to account adequately for qualia. One form of this accusation stems from consideration of the distinction between the objective perspective and the subjective perspective ([Nagel, 1974](#)). Consider bats, for example. Although bats are mammals, and thus presumably are conscious, the fact that they navigate the world via echolocation means that their conscious experience is quite likely to be radically different from the conscious experience of humans. Not only do humans lack the ability to experience what it is like to be a bat but, because of the radical difference between bat qualia and human qualia, humans also lack the ability even to imagine what they are like. What it is like to be a bat is a subjective phenomenon, not accessible from an objective point of view. Because physicalist theories of mind are specified in wholly objective terms, this means such theories cannot capture what it is like to be a bat—or at least, there is no way of comprehending how they could do so.

A second famous qualia-based argument against physicalism derives from a thought experiment involving a color scientist named Mary who has spent her entire life in a black and white room and has never had experience of color ([Jackson, 1982](#)). Suppose that Mary lives at a time in the future when scientists have a complete physical theory of color and human color vision. While in the room, Mary uses textbooks and black and white videos to learn this physical theory. Over time, she fully masters this theory and comes to know all the physical facts about color. Now suppose that one day Mary is released from the room and sees a ripe tomato for the first time. Plausibly, Mary learns something new upon seeing the tomato; in particular, she comes to know what seeing red is like. Because she knew all the physical facts about color while she was in the room, her new knowledge—knowledge about color qualia—must be knowledge about something other than

physical facts. This line of reasoning, often referred to as *the knowledge argument*, results in the conclusion that physicalism must be false.

A third argument considers hypothetical creatures called *zombies*—or sometimes, *philosophical zombies* to distinguish them from the zombies of horror films ([Chalmers, 1996](#)). A person's zombie twin is molecule-for-molecule identical to them but lacks qualia. Consider Zoe and her zombie twin ZombieZoe. ZombieZoe can be said to be conscious in the psychological sense—she has thoughts and acts in accordance with them, just as Zoe does—but ZombieZoe is not conscious in the phenomenal sense. If ZombieZoe stubs her toe, she will wince and say ouch, just as Zoe does. However, although Zoe will experience pain qualia, ZombieZoe does not. As this description suggests, the zombie argument has much in common with the absent qualia argument (see the section “Qualia and functionalism”). Insofar as zombies are conceptually possible, and many philosophers have thought that they are, physicalism must not be correct. According to the physicalist, whenever there is a difference in qualia, there must be a corresponding physical difference to account for it.

Faced with these challenges, physicalists have employed two different strategies for response. First, it might be questioned whether people are really imagining what they think they are imagining. Perhaps when they consider the Mary case, they are only imagining that Mary knows a lot of science; perhaps they fall short of imagining that she knows all the physical facts. Or perhaps when people consider the zombie argument, they are only imagining a creature that is extremely similar to a human being but not microphysically identical to it ([Dennett, 1995](#)). Second, many philosophers have suggested that we should be wary about drawing conclusions about the metaphysics of mind based on considerations about what we can and cannot imagine ([Churchland, 1996](#)). Moreover, some have charged that mere conceptual possibility is not enough to show us about what's possible for our world ([Hill & McLaughlin, 1999](#)).

In addition to these big-picture strategies for response, various targeted strategies have been adopted as well. For example, in response to the bat case, some have suggested that it is a mistake to think that bats really have qualia ([Akins, 1993](#)). In response to the knowledge argument, some physicalists have argued that Mary does not gain factual knowledge when she leaves the room but rather acquires a new set of abilities, for example, the abilities to recognize, imagine, and remember what red is like (e.g., [Lewis, 1990](#); [Nemirow, 1980](#)). Others have argued that Mary does not learn a new fact upon leaving the room but rather comes to appreciate an old fact under a new guise ([Balog, 2012](#); [Tye, 1986](#)). And in response to the zombie argument, some have argued that there is something incoherent about trying to imagine a zombie; to do so, we would have to engage in a first-person imagining—imagining what it is like to be a zombie from the inside—but doing so is impossible because by definition there is nothing it is like to be a zombie ([Marcus, 2004](#)). Despite these responses, however, the bat argument, the knowledge argument, and the zombie argument remain powerful challenges to physicalism.

Questions, controversies, and new developments

Defining qualia

Although qualia are often said to be *ineffable*, that is, incapable of being meaningfully described ([Block, 1978](#)), there have been numerous attempts in the philosophical and cognitive science literature to flesh out some of the core characteristics of qualia ([Block, 1987](#); [Ramachandran & Hirstein, 1997](#)). Underlying the qualia-based challenges to functionalism and physicalism (see the section “Core concepts”) is the idea that qualia are *irreducible*, that is, that they cannot be wholly captured by way of physicalist or functionalist explanations. This depends on the claim that qualia are *intrinsic* rather than *relational* properties. To understand this distinction, it may be helpful to compare mass versus weight. An object has the mass that it does purely in virtue of the way it is; mass is an intrinsic property. However, an object has the weight it does only in virtue of other properties about the world such as gravity; weight is a relational property. If qualia are intrinsic, then they cannot be defined in relation to neural mechanisms (as the physicalist aims to do) or in relation to behavior (as the functionalist aims to do).

In recent years, the claim that qualia are intrinsic properties of experience has been questioned by philosophers embracing *representationalism* (also called *intentionalism*) about consciousness ([Harman, 1990](#); [Tye, 1997](#)). Many mental states have representational content; they are about something. Beliefs, for example, are paradigm examples of representational states; my belief that there is a hummingbird in the garden represents the hummingbird. In contrast, qualia were traditionally thought to be paradigm examples of nonrepresentational states; the itchy sensation I have on my shoulder does not seem to represent anything. Representationalists reject this traditional view of qualia. In their view, qualitative states like itches and pains are representational in nature; for example, they might represent bodily damage. Although in its weaker forms, representationalism claims only that qualitative character depends on representational content, in its strong form, representationalism claims that the qualitative character can be identified with the representational content of mental states. Because representational content is a relational feature, the truth of representationalism—or at least, representationalism in its strong form—entails that qualia are not intrinsic features.

Although many philosophers embrace some form of representationalism, objections have been raised to it. For example, some philosophers point to qualitative experiences like afterimages and blurry visual experiences that seem to have qualitative content that cannot be wholly explained by their representational content ([Block, 1996](#); [Kind, 2008](#)). Other objections arise from the consideration of qualitative experiences like moods that plausibly lack representational content altogether ([Kind, 2013](#)).

Another definitional matter about qualia concerns how people come to have knowledge about them. Although people learn about the world outside us by way of perception, it has traditionally been thought that they learn about their qualia by way of *introspection*, what might be roughly thought of as a kind of inner perception—

although note that not everyone understands introspection in these terms (see [Byrne, 2018](#)) [see [Introspection](#)]. Moreover, in line with a long tradition dating back at least to Descartes' work in the 17th century ([Descartes, 1993](#)), it seems that one's introspective knowledge of one's own qualia is especially trustworthy; although someone might be wrong about whether the crayon on the table is red, it seems implausible that they can be wrong about whether they are having a red sensation. Qualia are thus often defined partly in terms of introspectability, that is, in terms of the claim that they can be known by introspection. Against this, some contemporary philosophers have denied that we can really know about qualia by way of introspection; rather, we make inferences about what qualia we are having based on what our experience is representing ([Shoemaker, 1994, 1996](#)).

Some have taken these definitional disagreements to suggest that there is a deep incoherence underlying the traditional conception of qualia ([Dennett, 1988](#)). Consider, for example, the fact that beer is often said to be an acquired taste. When one comes to like beer, a question arises as to whether one's qualitative experience changes or one comes to have different reactions to the same experience. On the one hand, if there is no way to tell the difference, this would call into question the claim that we can tell what qualia we have by way of introspection. On the other hand, if the process of coming to enjoy the taste of beer changes the experience itself, then this would seem to allow relational properties (our attitudes and reactions) to constitute qualitative experience, thereby calling into question the claim that they are intrinsic. This point can be further defended by reflecting on interpersonal differences in taste experience ([Dennett, 1988](#)). Consider the fact that a small percentage of people experience a soapy-like taste when eating cilantro. This experiential variation, which can be traced to variation in olfactory receptor genes ([Eriksson et al., 2012](#)), suggests that taste depends on the relations that properties of a substance have to one's olfactory receptors and thus that taste qualia are not intrinsic properties after all.

Cognitive phenomenology

In addition to the controversy over how the notion of qualia should be defined, a second controversy concerns which mental states have qualia. One key locus of this controversy surrounds the issue of conscious thought. Consider a cherry lollipop. Before you read that sentence, you were presumably not thinking about cherry lollipops, but even though you were not thinking about them, you probably had various beliefs about them, for example, that they are red. Upon reading the sentence, that belief becomes conscious; you now have the conscious thought that cherry lollipops are red colored. While having this conscious thought, you might form an image of a cherry lollipop, and presumably that imagery experience has qualia. However, one might further question whether there are also qualia associated with the thinking of the thought itself independent of the mental image. The predominant view in the history of philosophy answered this question in the negative. Insofar as there are qualia associated with thinking, they derive from the qualia associated with the content of

what is being thought. More recently, however, defenders of a view known as *cognitive phenomenology* have argued for an affirmative answer to this question (see, e.g., [Montague, 2016](#); [Pitt, 2004](#)).

In arguing for the existence of cognitive phenomenology, philosophers often point to the fact that we might have many different kinds of mental states involving the same content. Not only might someone think that there are cherry lollipops in the candy jar but they also might hope or dread that there are cherry lollipops in the candy jar. Normally, individuals can tell immediately and directly which mental states they are having. It is hard to see how one could do so if there were no cognitive phenomenology to which one could attend.

Against this, philosophers who oppose the postulation of cognitive phenomenology suggest that individuals have various other ways to tell which mental state they are in. Moreover, insofar as there seem to be qualitative aspects associated with thinking a thought, these are better explained by other qualitative experiences we are simultaneously having. When someone thinks that cherry lollipops are red, for example, they might have various emotional reactions, and they might also engage in subvocalization, uttering the thought to themselves. The fact that there are qualia involved in hearing oneself subvocalize a thought does not mean that there are qualia involved simply in thinking the thought (see, e.g., [Carruthers, 2006](#); [Robinson, 2005](#)).

Machine qualia

In contemporary discussion, questions arise not just about which mental states have qualia but about which beings have mental states with qualia. Although many philosophers in the 17th and 18th centuries famously treated animals as mere automata lacking qualia (for an overview, see [Allen & Trestman, 2024](#)), in contemporary cognitive science, there is widespread acceptance that a wide variety of nonhuman animals have the capacity to feel pleasure and pain. Recently, increasing attention has also been paid to the issue of plant mentality and plant qualia (see, e.g., [Maher, 2017](#)). Over the last several decades, with the rise of increasingly sophisticated machine systems, there has been a special interest in the question of whether artificial intelligence (AI) systems might have qualia [see [Consciousness and AI](#)]. With the introduction of large language models and society's increasing dependence on them, this question has taken on a growing urgency among philosophers, cognitive scientists, and AI researchers ([Gamez, 2008](#)) [see [Large Language Models](#)].

Even when machines engage in sophisticated behavior, many have the sense that they are simply philosophical zombies. It is a thorny issue to sort out how we might determine whether machines have qualia and how we might test this. Discussions typically call upon the Turing test for machine thinking ([Turing, 1950](#)) [see [The Turing Test](#)]. A common objection to the test concerns consciousness, as many have thought that a machine could provide answers that would be adequate to fool an investigator into identifying it as human even if it were not conscious. In responding to this objection, one might note that refusal to attribute thought to a machine as a result of its performance on the Turing test raises the specter of *solipsism*, the view that an individual has no way of knowing of the existence of thinking beings other than themselves.

Recently, several tests have been proposed to tackle the issue of machine consciousness more directly. Consider the AI consciousness test, a question-based test that aims to assess a machine’s consciousness by seeing whether it would be able to talk coherently about consciousness without having been taught anything about it ([Schneider, 2019](#)). A key reason that one generally accepts that other humans are conscious is their quick conceptual mastery of issues that seem to require first-hand qualitative experience—issues involving selfhood, reincarnation, and body swapping. Just as someone who has been deaf from birth cannot fully grasp what it is like to hear a piano concerto, it seems implausible that an entity who entirely lacks qualia would be able to grasp the hard problem of consciousness or invent consciousness-based concepts on its own. Thus, if researchers could “box in” an AI system such that it never received any direct information about conscious experience, they could administer the AI consciousness test and ask the AI various questions that would shed light on whether it can plausibly be said to be conscious. That said, how to achieve this boxing in is a vexed matter, for it is hard to see how to segregate out facts about consciousness from the data and inputs that would need to be provided to the AI for it to achieve broad-based intelligence and conversational competence ([Vaidya & Krishnaswamy, 2024](#)). A different worry arises from the thought that machine qualia might be very different from human qualia and thus that tests based on facts about human consciousness might be unfair to machines ([French, 1990](#); [Haikonen, 2009](#)).

Panexperientialism

A basic presupposition underlies debates about machine qualia (and, likewise, debates about animal and plant qualia), namely, that qualia will only be found in beings who have a certain degree of cognitive sophistication. However, on certain versions of a view called *panpsychism*, this presupposition should be rejected.

Panpsychism, a view that dates to antiquity, is often loosely cast as the view that everything has a mind, but in contemporary discussions, it is often more carefully specified as the claim that mentality is a fundamental aspect of reality that can be found everywhere throughout the universe. Some panpsychists make this claim not about mentality in general but about consciousness. This version of panpsychism is often referred to as *panexperientialism*.

For the panexperientialist, qualia might be seen as properties akin to mass and charge. On this view, not only will qualia be found in organic systems like humans and animals but also in inorganic objects like a nugget of gold, a copper wire, or a rock. In fact, even the most basic components of reality—like electrons and quarks—will also have qualia. Although panexperientialism strikes many as intuitively implausible, even crazy, a number of contemporary philosophers believe that some version of the view holds great promise for solving the hard problem of consciousness ([Chalmers, 2016](#); [Goff, 2017](#)).

Broader connections

Issues about qualia are highly relevant to various topics of interest both within and outside of cognitive science. One notable connection is to debates about the moral status of nonhuman beings. Whether a given being has moral status seems to be tightly intertwined with the question of whether there is something it is like to be that being. Considerable work has been done on this question in connection with nonhuman animals. The fact that nonhuman animals have the capacity to feel pleasure and pain is often called upon in arguments for the moral status of animals (for a classic treatment of this issue, see [Singer, 1975](#)).

A similar dialectic is in play concerning the moral status of AI systems. If, like humans and nonhuman animals, machines can feel pleasure and pain, then that seems to suggest that they too are deserving of moral status ([Torrance, 2008](#)). The ramifications of this claim have recently been the focus of increased attention from philosophers, especially given the recent advent of sophisticated large language models and claims made about their potential sentience ([De Cosmo, 2022](#)). If AI have qualia, then AI suffering is a matter that needs to be taken seriously ([Dung, 2025](#)).

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