

# Emotion, Cognition and Artificial Intelligence

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**Abstract** Some have claimed that since machines lack emotional “qualia”, or conscious experiences of emotion, machine intelligence will fall short of human intelligence. I examine this objection, ultimately finding it unpersuasive. I first discuss recent work on emotion (from cognitive science, neuroscience and philosophy) that suggests that emotion plays various roles in cognition. I then raise the following question: are phenomenal experiences of emotion an essential or necessary component of the performance of these cognitive abilities? I then sharpen the question by distinguishing between four possible positions one might take. I reject one of these four positions largely on empirical grounds. But the remaining three positions all suggest that even if emotional qualia play an important role in human cognition, emotional qualia are not essential to the performance of these cognitive abilities in principle, so, e.g., a machine that lacks emotional qualia might still be able to perform them.

**Keywords** AI · Emotion · Cognition · Frame problem

## Introduction

Objections against the possibility of Artificial Intelligence that concern emotion are as old as AI itself; e.g., some claim that machines will never feel emotion, and as a result, machine intelligence will forever fall short of human intelligence. Even before Turing’s (1950) “Computing Machinery and Intelligence”, Jefferson (1949) was already making these sorts of objections to AI:

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Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain—that is, not only write it but know that it had written it. No mechanism could feel (and not merely signal, an easy contrivance) pleasure at its successes, grief when its valves fuse, be warmed by flattery, be made miserable by its mistakes, be charmed by sex, be angry or depressed when it cannot get what it wants.

But what are we to make of such objections? There are a number of distinct though interrelated questions one might ask: does emotion play an active role in the production of certain human cognitive abilities? If so, then which cognitive abilities does emotion help produce? Moreover, if emotion does play a role in cognition, are emotional “qualia” (our conscious experiences of emotion) in particular a *necessary* or *essential* component of the performance of these cognitive abilities, so that, e.g., the only way a machine could perform these cognitive abilities is if the machine had conscious experiences of emotion? Drawing on various work in the philosophy of emotion, and also on empirical research from cognitive science and neuroscience, this paper examines these questions.

## Emotion and Cognition

Do emotions play a role in the performance of certain human cognitive abilities? It appears so; it has become increasingly obvious to many who study the mind (cognitive scientists, neuroscientists, philosophers) that emotion does play various important roles in cognition. In this section, I briefly discuss some specific cognitive abilities in which emotion plays a role. Then I raise the following question: are “emotional qualia” needed for emotion to fulfill its various roles in cognition, or are emotional qualia dispensable so far as cognition is concerned?<sup>1</sup>

One cognitive ability in which emotion seems to play a role is selective attention. It is a familiar fact that we generally focus on particular aspects of our environment while simultaneously ignoring many others; that is, some objects or events in our immediate surroundings become the focus of our attention, while others do not. Furthermore, we tend to focus on those aspects of our environment that are important, salient or relevant, and ignore those that are not. If not for this ability, coping with our environment would be a near Herculean task; while neglecting important objects or events, we would become lost in minutia. For instance, we

<sup>1</sup> One might be wondering what my definition of “emotion” is, or what broader philosophical theory of emotion I’m presupposing (e.g., am I arguing from the perspective of a cognitive theory, feeling theory, hybrid theory, or some other theory)? For now, and this will become clearer as I continue, the only claim I make about the nature of emotion is that it is a multifaceted phenomenon, or consists of several components, and one of these components, whatever the others might be (e.g., judgment, neurophysiological response), are qualitative feels or “emotional qualia.” Of course, cognitive theories of emotion claim that an emotion is simply a judgment that *p*, or a belief that *p*, or some other relation between an agent and a propositional attitude (e.g., see Solomon (1980) and Nussbaum (2001)). Feeling theories emphasize the qualitative or experiential aspect of emotion (see, e.g., James (1884)). Hybrid theories attempt to combine aspects of the different approaches. See de Sousa (2003) for an overview of some of these different types of theories.

might gaze at the patterns in the ceiling tiles as the room burns around us. In the effort to account for this cognitive ability, some have suggested that emotion helps guide attention. Quite simply, we pay attention to those aspects of our environment that evoke emotion, and such aspects are often those that deserve the most attention. For example, when standing in a burning room, we direct our attention to the fire, as opposed to the ceiling tiles, because the fire evokes an emotion, namely, fear. Perhaps emotion is not involved in *all* instances of selective attention (this is ultimately an empirical question); but it is clear that emotion is involved in at least *some* cases of selective attention.

Some philosophers have suggested that emotion helps shape selective attention. Perhaps Descartes (1645/1931, p. 363) was the first; he remarks “wonder is a sudden surprise of the soul which causes it to apply itself to consider with attention the objects which seem to it rare and extraordinary”.<sup>2</sup> Moreover, such claims are supported by a significant amount of empirical evidence. For example, Attar and Müller (2012: introduction) remark, “To date, there is abundant evidence that emotional stimuli receive prioritized processing due to their inherent significance for adaptive behavior and survival” and they cite numerous studies that show this.<sup>3</sup> Likewise, before examining the neural underpinnings of the relationship between attention and emotion in the brain, Schupp et al. (2007) point out that visual attention is drawn to emotionally significant stimuli.

It has also been suggested that emotion is relevant to the “frame problem”, a very difficult problem in Artificial Intelligence that was first identified in McCarthy and Hayes’s (1968) classic paper, “Some philosophical problems from the standpoint of artificial intelligence”. Consider the following cognitive ability: when placed in a specific, real world situation, human agents, with a presumably vast network of prior beliefs and knowledge, are able, in a reasonably efficient (e.g., quick) fashion, to access their specific beliefs and knowledge that are relevant to cope with the situation at hand. The constructions of Artificial Intelligence, however, generally lack this ability; that is, they suffer from the frame problem.<sup>4</sup> Some have suggested

<sup>2</sup> See also de Sousa (1987). The claim that emotion helps guide attention can also be quickly derived from Nash (1989); see also McGill (2003).

<sup>3</sup> For example, in one such study, Lang et al. (1997) showed subjects various photographs (some of these photos evoked either a positive or negative emotion, or were emotionally neutral) and studied their responses.

<sup>4</sup> While discussing the frame problem, Fodor (2000: 42) offers the following alternative, though related, definition:

“The frame problem” is a name for one aspect of the question of how to reconcile a local notion of computation with the apparent holism of rational inference; in particular, with the fact that information that is relevant to the optimal solution of an abductive problem can, in principle, come from anywhere in the network of one’s prior epistemic commitments.

The frame problem’s seriousness should not be underestimated; e.g., Fodor (2000: 42) writes, “In my view, the frame problem is a lot of what makes cognition so hard to understand ... cognitive science without the frame problem is Hamlet without anybody much except Polonius.” In short, if the frame problem turns out to be the *only* aspect of cognition that emotion affects, this alone would imply that emotion plays an important role in cognition. Dennett’s (1987) classic paper on the frame problem is quite interesting; for more discussion, see the other articles in Pylyshyn (1987) and also Ford and Pylyshyn (1996).

that when *we* are placed in a given real world situation, emotion facilitates the recall of the appropriate knowledge and beliefs needed to deal with the situation, that is, emotion helps explain why *we* do not suffer from the frame problem. For instance, if we are in a burning room, our fear not only helps us focus on the fire (or not only guides selective attention), but also helps us quickly recall those beliefs and knowledge (e.g., “one should run from a burning room”) that are relevant to the situation. A construction of AI, however, will not feel fear, and so might spend its time trying to calculate pi to the 10,000th decimal place as the fire rages around it.<sup>5</sup>

Thus far, we have seen that emotion might not only help shape selective attention but might also help us retrieve specific information from memory as it is needed. It is also plausible that emotion plays a role in determining what specific memories make it into our long-term memory in the first place. It is a commonplace fact that people tend to remember those objects or events that are emotionally charged, as opposed to those that lack emotional import. In other words, given two events, one that has emotional import and one that does not, it is more likely that we will remember the former. For example, we are more likely to remember our wedding day, the birth of our child, or the death of a parent than we are to remember an emotionally uneventful day in the second grade.<sup>6</sup> It also seems clear that it is in our best interest to remember emotionally charged events, as these events generally seem to be the most important. Indeed, there is a significant amount of empirical evidence for these claims. For instance, Botzung et al. (2010) showed UNC and Duke basketball fans (a heated rivalry) footage of a championship game which they had already seen. Through MRI, they discovered that the emotional centers in the brain are involved in reassembling memories. Fans were asked to remember if a certain shot went in. What they found was that the stronger the positive emotional reaction to a given shot was, the more likely the fan was to recall accurately if the shot went in. Studies involving post-traumatic stress also suggest that emotion plays a role in determining what we remember and what we do not (though in these cases, we see that strong negative emotions can block what we remember); see, e.g., Rubin (2010).

There is also empirical evidence that emotion contributes to our ability to recognize faces; e.g., V. S. Ramachandran’s (a neuroscientist) explanation of Capgras’ syndrome. Capgras’ syndrome is a rare and rather macabre condition in which a patient “who is often mentally quite lucid, comes to regard close acquaintances—usually his parents, children, spouse or siblings—as imposters” (Capgras’ is sometimes triggered by a brain trauma or lesion) (Ramachandran and Blakeslee 1998, p 161). In other words, one who suffers from Capgras’ syndrome can recognize that someone has the exact appearance of, say, their spouse, but

<sup>5</sup> For the suggestion that emotion can help explain why we don’t suffer from the frame problem, see de Sousa (2003), and Megill and Cogburn (2005). Megill and Cogburn (2005) draws on empirical research from the well-known neuroscientist A. Damasio (e.g., his 1994) to argue that emotion is indeed an important factor in why we do not suffer from the frame problem.

<sup>6</sup> One possible objection is the notion that traumatic events which are highly charged with *negative* emotions are often suppressed from memory. Here, we might have examples in which events that are emotionally charged are *not* committed to long-term memory. But upon closer inspection, even examples such these are evidence *for* the claim that emotion does indeed help determine what events find their way into long-term memory; it is merely that in some cases, emotion ensures that we *will have* a particular memory, while in other cases, it ensures that we *will not*.

vehemently denies that the person is their spouse nonetheless; clearly, Capgras' syndrome can be seen as a failure to properly recognize faces. Ramachandran has hypothesized that after the brain trauma that triggers Capgras' syndrome occurs, the areas in the brain which concern emotion and recognition become severed; as a result, when a patient looks upon their spouse, the patient fails to experience the emotion generally associated with their spouse; and consequently, the patient fails to recognize their spouse (see Ramachandran and Blakeslee 1998, 162). This suggests that emotion plays an important role in facial recognition. And there are many other extant studies that also suggest this. To give just one example, Bate and Cook (2012) suggest that people with Prosopagnosia (an impairment in the ability to recognize faces) might be covertly recognizing faces using affect; i.e., affect is or at least can be involved in facial recognition.<sup>7</sup>

In sum, there is a massive (and growing) amount of empirical evidence from neuroscience and cognitive psychology that shows that emotion plays an important role in certain cognitive abilities (attention, the frame problem, facial recognition and so on) and so in cognition in general.<sup>8</sup> One reoccurring theme is that emotions serve as “cognitive bookmarks” that give some cognitive states or objects in the environment a certain salience or importance over others etc. It appears that emotion often governs the *flow* of information. Emotion helps determine the information that we notice in our environment; the information that will get stored in memory; the information in our memory that will be brought to mind in a certain situation; and so on.

At this point, however, a natural question arises: are the raw qualitative or phenomenal feels associated with emotion, or “emotional qualia” (such as our feelings of sadness, happiness, anger or disgust), needed for emotion to shape cognition, or could emotion shape cognition *even if* we lacked emotional qualia? To clarify, theorists generally recognize that emotion has distinct components: certain emotions can be associated with certain neurophysiological responses, some (cognitive theorists) hold that emotions also at least partly consist in judgments, while many recognize that emotional qualia are also an important aspect of emotion. But, given that emotion is often seen to consist of at least a couple of components, could emotion still play the roles in cognition that it does if one component, emotional qualia, were absent, provided that at least one other component, say, neurophysiological responses, were present? In other words, given that emotion is indeed involved in various cognitive abilities, are emotional qualia in particular a *necessary* or *essential* component of these cognitive abilities?

<sup>7</sup> See also Bate (2012).

<sup>8</sup> And to underscore how important emotion is to cognition and our ability to cope with the world, consider the following example. Assume that Baxter is married to Sally. Further, assume that Baxter lacks emotion. Without emotion, Baxter has poor selective attention; feeling nothing for his wife, he generally ignores her (he often simply stares at the floor). It is their anniversary, but without emotion, Baxter fails to recall this important piece of knowledge, which would certainly help him cope with his present situation (that is, Baxter suffers from the frame problem). Actually, because Baxter lacks emotion, he fails to even recall his wedding day; his long-term memory is simply a catalogue of banal events. Perhaps lacking facial recognition, Baxter fails to recognize his wife when she enters the room etc.

## Conscious Inessentialism: The Possible Positions

I now discuss “conscious inessentialism”, a view that has received a good deal of attention in the philosophical literature on consciousness. There is a close relationship between conscious inessentialism and the question with which the previous section ended, i.e., “are emotional qualia a necessary or essential component of the performance of certain cognitive abilities?”

“Conscious inessentialism”, a concept formulated by O. Flanagan (1992), is the claim that:

For any intelligent activity  $i$ , performed in any cognitive domain  $d$ , even if *we* do  $i$  with conscious accompaniments,  $i$  can in principle be done without these conscious accompaniments (Flanagan 1992, p. 5).<sup>9</sup>

In other words, conscious inessentialism holds that even if we have conscious experiences during the performance of a given cognitive ability, these conscious experiences are *superfluous* to the performance of the cognitive ability, as the cognitive ability could have been performed without them.

To sharpen the concept for our purposes here, I distinguish between “strong conscious inessentialism” (SCI) and “weak conscious inessentialism” (WCI). SCI claims that:

Even if the performance of a given cognitive ability  $c$  by a cognitive agent  $a$  often has conscious accompaniments,  $c$  could be performed by  $a$  even if these conscious accompaniments were absent. The reason (qualia could be removed without affecting cognition) is that these conscious accompaniments are epiphenomena that play no causal role in the production of cognition.

In contrast, WCI claims that:

Even if the performance of a given cognitive ability  $c$  by a cognitive agent  $a$  often has conscious accompaniments,  $c$  could be performed by  $a$  even if these conscious accompaniments were absent. The reason (cognition could proceed in the absence of qualia) is that, even though qualia play a causal role in the production of our cognition, qualia are not essential to the performance of these cognitive abilities (in the sense that our physical organization or cognitive architecture could have been such that cognition could proceed as before in the absence of qualia).

Insofar as both SCI and WCI claim that those cognitive abilities that are performed with conscious accompaniment could be performed in the absence of such accompaniment, both SCI and WCI are equivalent, and both are forms of conscious inessentialism. However, the views differ insofar as WCI claims that the qualia that accompany the production of our cognitive abilities play a causal role, while SCI denies this. If WCI is true, then it is likely that if qualia were absent, our physical organization or cognitive architecture would need to be altered to account for this

<sup>9</sup> See e.g., Moody (1994), Güzeldere (1995) and Flanagan and Polger (1995) for further discussion of conscious inessentialism.

absence; qualia play a causal role in the production of cognition, so if they were removed, this would affect cognition unless other physical changes occurred to account for their absence.

To offer an example of SCI and WCI, and to clarify exactly what these concepts are trying to capture: assume that the cognitive ability in question is facial recognition, and indeed, facial recognition (at least sometimes) occurs with the accompaniment of conscious activity (see above). There are, no doubt, various types of “conscious activity”, but throughout, I will only be concerned with emotional qualia. So, the conscious activity in question here are the experiences of emotional qualia that accompany facial recognition; for instance, our feeling of happiness when we recognize an old friend. Conscious inessentialism, construed broadly, holds that although facial recognition is (at least often) accompanied by emotional qualia (for instance), facial recognition could occur even if emotional qualia were absent; we could recognize our friend even if we didn’t feel happiness. Moreover, both SCI and WCI, as forms of conscious inessentialism, agree that facial recognition could occur without emotional qualia. However, the views differ on how and why that is so. SCI holds that facial recognition can still occur in the absence of qualia—even if the physical organization or cognitive architecture of the agent is held constant—because qualia play no causal role in the production of cognition. WCI holds that facial recognition can still occur in the absence of qualia—but probably *only if* the physical organization or the cognitive architecture of the agent is altered—because while qualia play a causal role in the production of cognition, qualia are not essential for facial recognition.

Taking into account the distinction between SCI and WCI, there are three possible positions on conscious inessentialism, one of which must be true: (1) SCI, (2) WCI, or (3) the denial of conscious inessentialism in general (i.e., the denial of both SCI and WCI). Either qualia *are* needed—in *principle*—for the performance of certain cognitive abilities, or they *are not*. If qualia *are* needed for certain cognitive abilities, or if *certain cognitive abilities cannot possibly be performed in the absence of qualia*, then qualia are not *superfluous* to cognition, and so both forms of conscious inessentialism are false. If qualia *are not* needed for the performance of cognitive abilities, or if *any* given cognitive ability could be performed in the absence of qualia (even if our performance of the cognitive ability happens to be accompanied by qualia), then conscious inessentialism (at least so far as qualia are concerned) is true. Moreover, given a cognitive ability *c* that is accompanied by qualia, then either qualia play a causal role in the production of *c* or they do not. If they do, then WCI is true, and if they do not, then SCI. In short, (1) SCI or (2) WCI is true, or (3) conscious inessentialism is false. Note that conscious inessentialism is false if there is a *single* cognitive ability that cannot be performed in the absence of qualia, *in principle*. But, given conscious inessentialism, if *all* cognitive abilities are such that they could be performed in the absence of qualia, even assuming that the physical organization of all cognitive agents remains unchanged, then SCI is true. If there is a *single* cognitive ability (that is currently accompanied by qualia) that can be performed in the absence of qualia only if the physical organizations of agents are changed, then WCI is true.

There is a close relationship between conscious inessentialism and the question asked above, i.e., “are emotional qualia a necessary or essential component of the performance of some cognitive abilities?” If SCI is true, then qualia are not needed for the performance of any cognitive ability because they do not play a causally efficacious role in the production of cognition. If WCI is true, then qualia are not needed for the performance of any cognitive ability, even though they happen to play a causally efficacious role in our cognition. If conscious inessentialism is false, then certain cognitive abilities cannot be performed in the absence of qualia at all.

## Conscious Essentialism

Thus far, we have three possible positions on conscious inessentialism: weak conscious inessentialism, strong conscious inessentialism, and the denial of conscious inessentialism, or more simply, “conscious essentialism”. Conscious essentialism holds that there are certain cognitive abilities that cannot be performed in the absence of qualia, *in principle*. The presence of qualia is necessary for the performance of at least some cognitive abilities. However, one can further distinguish between weak and strong conscious essentialism. Given conscious essentialism, one might claim that there is no way for some cognitive abilities to be performed without emotional qualia; without emotional qualia, these cognitive abilities cannot even be poorly performed. Call that view “strong conscious essentialism”. Or one might take a weaker stance and claim that there are some cognitive abilities in which emotional qualia play a role for us, and that while these abilities can perhaps be performed without the qualia, they cannot be performed *as quickly or efficiently etc. as we do them* without qualia. Call this view “weak conscious essentialism”. For example, one could point to the fact that often cognitive function is adversely effected when emotional centers are damaged and our conscious experience of emotion is altered, and suggest that this might count as (albeit inconclusive) evidence for *weak* conscious essentialism.

However, I suggest that *strong* conscious essentialism is probably not true; while I cannot conclusively show that strong conscious essentialism is false—indeed, such a refutation would likely come from cognitive psychology or neuroscience—there are reasons for thinking that strong conscious essentialism is the least probable (or at least not the most probable) of the (now) four possible positions. My reasons for doubting SCI are essentially empirical. *First*, in cases of blunt or even flat affect, the performance of certain cognitive abilities is often adversely affected, but not entirely lost. For instance, people who suffer from Capgras’ syndrome lose the ability to recognize some of those who are close to them. But they can still recognize many people (see, e.g., Ramachandran and Blakeslee 1998). This suggests that emotion—and so emotional qualia—is not absolutely essential to the performance of facial recognition, even if it plays a role in some cases of facial recognition, and even if it might be needed to perform the cognitive task as well as we perform it. *Second*, one could point to various advances in artificial intelligence and argue that they suggest that strong conscious essentialism is false. Consider, for example, the recent advances in computer facial recognition; computers are



becoming quite adept at recognizing faces.<sup>10</sup> On the plausible assumption that computers running facial recognition software are not experiencing emotional qualia, these computers are a concrete example of something performing a cognitive ability without qualia that we (at least sometimes) perform with conscious accompaniment. *Third*, empirical research suggests that selective attention is *not always* driven by emotion. For example, Carretié et al. (2004) discuss how selective attention is often drawn to *novel* stimuli as opposed to emotional stimuli; indeed, they set out to study the neural mechanisms underlying our response to *emotional* stimuli because up to that point, a lot of research had focused on the neural mechanisms underlying our response to *novel* stimuli. If selective attention can occur without an affective component, then it can occur without emotional qualia, at least in principle. *Fourth*, as Carretié et al. (2004: 290) point out, selective attention often “involves automatic attention mechanisms that are unconscious”. If these mechanisms can occur unconsciously, then they can occur without conscious accompaniment, i.e., without emotional qualia.

In short, there are empirical reasons for thinking that *strong* conscious essentialism is false. However, *weak* conscious essentialism might be true. That is, while some cognitive abilities that we perform are accompanied by emotional qualia, these cognitive abilities can be performed at least in principle without the qualia; however, perhaps these cognitive abilities cannot be performed as well as we typically do them without qualia?

## Concluding Remarks

Some claim that AI cannot succeed because machines lack emotion; machines do not feel emotion, so machine intelligence will always fall short of human intelligence. In order to examine this objection, I asked three distinct questions. These questions can be answered through an appeal to extant empirical evidence and a simple examination of the possible positions one might take on the role of consciousness in human cognition.

Two questions asked above are, “does emotion play an active role in the production of certain human cognitive abilities? And if so, then which cognitive abilities does emotion help produce?” The empirical evidence is clear: emotion does play a role in various human cognitive abilities, and appears to be involved in selective attention, facial recognition, memory retrieval and so on. A third question asked above is, “given that emotion plays a role in cognition, are emotional qualia in particular a *necessary* or *essential* component of these cognitive abilities?” I discussed four possible positions on this question: (1) strong conscious essentialism (cognition cannot possibly proceed without emotional qualia, qualia are necessary for the performance of certain cognitive abilities); (2) weak conscious essentialism (the relevant cognitive abilities can be performed without emotional qualia in principle, though perhaps not as efficiently as we perform them); (3) strong

<sup>10</sup> See, e.g., Zhang and Zhang (2010). Facial recognition software has progressed to the point where it is finding practical applications (in e.g., jails to ensure that the right prisoner is being released etc).

conscious inessentialism (the relevant cognitive abilities can proceed without emotional qualia, emotional qualia play no causal role in the production of these cognitive abilities for us); and (4) weak conscious inessentialism (the relevant cognitive abilities can be performed without emotional qualia in principle, but only if our cognitive architecture is altered). I rejected strong conscious essentialism on empirical grounds. But note that the three remaining positions all claim that the relevant cognitive abilities can be performed—at least in principle—without emotional qualia. To elaborate, if strong conscious essentialism is false, then either weak conscious essentialism, strong conscious inessentialism, or weak conscious inessentialism is true. But then, the relevant cognitive abilities can all be performed in the absence of qualia (all three remaining views claim this), whether qualia play a causal role in human cognition (as WCI claims) or not (as SCI claims), and whether qualia make the performance of these abilities more efficient than it otherwise would be (as weak conscious essentialism claims). This suggests that objections against the possibility of AI based on the claim that a machine will lack emotional qualia are mistaken. At least in principle, even without conscious experiences of emotion, (at least some of) the cognitive abilities that we perform can still be performed by a machine.<sup>11</sup>

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