What Can Information Encapsulation Tell Us About Emotional Rationality?*

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ABSTRACT: What can features of cognitive architecture, e.g. the information encapsulation of certain emotion processing systems, tell us about emotional rationality? de Sousa proposes the following hypothesis: "the role of emotions is to supply the insufficiency of reason by imitating the encapsulation of perceptual modes" (de Sousa 1987: 195). Very roughly, emotion processing can sometimes occur in a way that is insensitive to what an agent already knows, and such processing can assist reasoning by restricting the response-options she considers. This paper aims to provide an exposition and assessment of de Sousa's hypothesis. I argue information encapsulation is not essential to emotion-driven reasoning, as emotions can determine the relevance of response-options even without being encapsulated. However, I argue encapsulation can still play a role in assisting reasoning by restricting response-options more efficiently, and in a way that ensures which options emotions deem relevant are not overridden by what the agent knows. I end by briefly explaining why this very feature also helps explain how emotions can, on occasion, hinder reasoning.

KEYWORDS: emotional rationality; information encapsulation; modularity; frame problem

1. Introduction

The last few decades of emotion research in philosophy, and to an extent in cognitive psychology, has involved a full-blown assault on what Solomon dubs the "The Myth of the Passions": the treatment of emotions "as irrational forces beyond our control, disruptive and stupid, unthinking and counter-productive, against our "better interests", and often ridiculous" (1977: 106). Emotions, it has been argued, and with some qualifications empirically demonstrated, play a role in reasoning, aid us in action, are to a certain extent under our control, and exhibit intentionality. These factors, especially the role emotions play in reasoning, are also said to make them, *contra* orthodoxy, rational. Or more carefully, emotions are things that can contribute, in a positive way, to whether their bearers are rational.

One way of arguing for this conclusion draws on the cognitive architecture of the mind. That is to say they concern ways of carving up cognitive processing theorised by cognitive science, and have their roots in computational theories of the mind. Such accounts are interesting in two respects. First, ways of modelling cognitive architecture in cognitive science tend to be both empirically informed and empirically tractable; they make claims about ways of carving up cognitive processing that, at least in theory, can be empirically tested. What is to be gained by such accounts, therefore, are empirically-

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driven descriptions of the precise way emotions assist reasoning, which can in turn confirm or disconfirm our initial *a priori* speculations about emotional rationality. Second, and relatedly, if cognitive architecture has a bearing on emotional rationality, we can't expect to have a complete account of emotional rationality simply by armchair theorising because how cognitive processing is actually structured will turn out to be an empirical issue.

These features make an investigation into an account of emotional rationality grounded in cognitive science philosophically pressing. But they do so only on the proviso that cognitive architecture actually has a bearing on emotional rationality. A possible way it does is hypothesised by de Sousa (1987). This hypothesis draws directly on a key concept of cognitive science, *viz.* information encapsulation. Very roughly, a system is informationally encapsulated if the function it computes is insensitive to information stored in other systems, especially systems which encode high-level representations like beliefs and desires. Fodor (1983) takes information encapsulation to be the "essence" of modularity, and argues most mental activity besides central cognition, e.g. perceptual processing, language processing and motor-control, are informationally encapsulated. For instance, he argues visual processing is modular given that visual illusions, like the muller-lyre illusion, persist despite our explicit knowledge to the contrary. In the muller-lyre illusion, we continue to see the lines as being of different lengths even when we come to discover that they are actually of the same length.

de Sousa's hypothesis is this: "the role of emotions is to supply the insufficiency of reason by imitating the encapsulation of perceptual modes" (1987: 195). The idea, briefly, is when we consider a response-option to a given situation, reason alone can't determine which information is relevant from the vast store of information which the agent knows, as assessing whether each piece of information is relevant would be too cognitively demanding. Emotions assist reasoning by pre-highlighting certain pieces of information as relevant or "salient". This is achieved by emotions "mimicking" the information encapsulation of perception, i.e. by emotion processing being temporarily insensitive to information stored outside certain channels, e.g. channels to do with belief.

This hypothesis can be challenged on two fronts. First, on whether emotion processing can be informationally encapsulated, even temporally. Second, assuming it can be, on whether it can still, nevertheless, play the role de Sousa ascribes to it in emotion-driven reasoning. As it stands, there is empirical evidence to suggest that emotional processing can, sometimes, be informationally encapsulated. That is, multi-pathway models of emotional processing are confirmed at a neurobiological level, where some emotion processing is found to occur "off-line" without considering what the agent already knows.[1] A careful examination of the second challenge, however, has not been taken up. This paper aims to make up for this neglect by addressing the question, What can information encapsulation tell us about emotion-driven reasoning? In other words, What can information encapsulation tell us about emotional rationality?

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[1] Multi-level theories of emotion processing have been proposed by Leventhal (1979), Barnard (1985), LeDoux (1996), amongst others. See Teasdale (1999) for a review.

In what follows, I provide an exposition of de Sousa's hypothesis, and then explain why it is misleading. In particular, I argue information encapsulation is not essential for emotion-driven reasoning, as emotions can fulfil their role of highlighting certain pieces of information as salient without being informationally encapsulated (§2). However, I argue information encapsulation still proves relevant for emotional-driven reasoning in that it ensures (i) emotions can fulfil this role in an efficient manner, and (ii) the fulfilment of this role won't, insofar as emotions are encapsulated, be overridden by what the agent knows (§3). I end by briefly explaining why this very feature also helps explain how emotions can, on occasion, hinder reasoning (§4).

2. How Emotions Assist Reasoning

What can information encapsulation tell us about emotional rationality? de Sousa, as a matter of fact, provides six principles of rationality, each of which lends itself to an independent account of how emotions can be rational. The account of rationality that has a bearing on our question, however, only concerns his principle of *strategic rationality*. Rationality, it is assumed here, is a teleological concept: anything can be rational to the extent that it fulfils its function. The function of emotion, broadly speaking, is to guide us in reasoning. But more specifically, their biological function is to do something reason can't, *viz.* to determine the salience of features of perception and reasoning. The information encapsulation of emotions on this picture bears on emotional rationality in that it plays a role in how emotions fulfil this function.

An exposition of this picture is provided in the context of how emotions can help solve what de Sousa calls "the philosophers' frame problem":

> [W]e need to know when not to retrieve some irrelevant information from the vast store of which we are possessed. But how do we know it is irrelevant unless we have already retrieved it? I proffer a very general biological hypothesis: Emotions spare us the paralysis potentially induced by this predicament by controlling the salience of features of perception and reasoning; they temporarily mimic the information encapsulation of perception and so circumscribe our practical and cognitive options (de Sousa 1987: 172).

Before unpacking this picture, it is worth stressing that the original frame problem has its roots in artificial intelligence. This problem has been taken up and formulated in several distinct ways[2], all of which, though related, arguably only bear a loose resemblance to the problem identified above. Evans (2002), for instance, goes so far as to say that de Sousa's discussion of the above problem *qua* frame problem is a red herring. In order to avoid muddying the waters, the scope of this paper will be

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[2] Chow (2013), for instance, discusses six different versions of the frame problem.

restricted to *the philosophers' frame problem*, i.e. the one outlined above, as opposed to the plethora of related problems discussed under the umbrella of "the frame problem".

Even with our scope restricted in this way, the problem, as well as the proposed solution to it, still requires interpretation along several distinct lines; some of which will turn out to be relevant to an exposition of the role emotions play in assisting reasoning broadly construed, and others more specific to how their encapsulation enables them to play this role. I begin by discussing interpretations along the first of these lines.

The problem, in its broadest form, is a problem about how to restrict the amount of information to be computed for us to get an appropriate response-option. de Sousa himself takes it as a constraint of the problem that we not only strict the amount of information, but that we are also able restrict information to those that are relevant or salient: "No logic determines *salience*: what to notice, what to attend to, what to inquire about" (1987: 191).[3] It is here that emotions come in by fulfilling their biological function of determining salience. But why pure reason alone can't determine salience isn't entirely clear. Spelling this out is crucial for getting clear on the precise role information encapsulation is supposed to contribute to this picture.

There appears to be at least three factors relevant to why pure reason can't tell us which response-option to consider, and thereby giving rise to the philosophers's frame problem. de Sousa himself sometimes talks as if the information that needs to be restricted is that which the organism already knows, i.e. how we determine what's relevant "from the vast store of which we are possessed" (pg. 172). He elaborates, "The frame problem arises only when we consider what to do with information interpreted and stored in an intentional system" (pg. 195). If the information we need to determine as salient is information the agent already knows, there are two possibilities as to why reason alone can't determine which information is relevant. First, it would simply be too cognitively demanding to individually figure out whether each piece of information is relevant; and that remains so even if we only consider those sub-personally available to the agent. Second, even if such a task were cognitively possible, it remains unclear whether reason alone can determine which pieces of information are relevant under the time-constraints required to respond to certain situations.

To elaborate, some discussions of the frame problem build in a time-constraint to determining which pieces of information are relevant. For example, in Dennett (1984) we find the tale of a robot who when faced with a ticking bomb whiles away precious time considering everything it knows. This constraint is not explicit in de Sousa's version of the problem, but it stands to reason that some real-life cases will come with significant time-constraints, e.g. figuring out the best response-option when faced with a mugger. Fodor (1987: 26) calls this "Hamlet's problem: How to tell when to stop thinking". If reason can only determine which information is relevant by considering each piece of information individually, reason alone can't determine which pieces are relevant under such time-constraints, i.e.

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[3] de Sousa's (pg. 194) exposition of why the frame problem isn't the problem of induction also makes explicit that the frame problem he has in mind is one concerning which information is relevant.

except sometimes by random. So here we have another factor that explains why reasoning alone can't solve the philosophers's frame problem, at least when we consider real-life instances of where the problems arise.

Now consider a different way of interpreting the information that needs to be restricted. This stems from a related, though, distinct formulation of the philosophers' frame problem: "Assume all the powers already listed — logic, induction, and more-than-encyclopaedic knowledge: the *philosophers' frame problem*, roughly, is how we make use of just what we need from this vast store, how not to retrieve what we don't need" (de Sousa pg. 193). On this way of understanding what is at issue, the problem is not just how to restrict propositional knowledge the agent already knows, but also all the inferences they can draw, and all the response-options they can consider. (So more accurately, the situation is such that we need to not just restrict the information over which to compute, but the computations themselves as well). Reason alone can't restrict information *thus construed* because of the two aforementioned factors. It would simply be too cognitively demanding to draw each inference before assessing whether it is relevant, not to mention this would take an unrealistically long amount of time. de Sousa himself considers the inferences drawn to be "from a potential infinity" (pg. 195). If this turns out to be the case, even setting aside the previous two factors, it would be straight out impossible for reason to determine which inferences, from a set of infinity, are relevant to a given response-option. This is the third factor that accounts for why reason alone can't determine salience.

The above discussion is telling not only because it helps us get clear on exactly what gives rise to the philosophers' frame problem, but because this in turn lets us see more clearly what is required to solve it. The role of emotions, recall, is to supply insufficiency of reason. For de Sousa, this is achieved by emotions mimicking the information encapsulation of perception. What the above ways of understanding the factors which give rise to the philosophers' frame problem bring out, however, is if information encapsulation is relevant to solving the problem, it is relevant only to the extent that it helps determine the salience of information. This is because on this picture, the role of emotions, *in essence*, is to supply the insufficiency of reason by determining the salience of information.

So how exactly do emotions determine which pieces of information are relevant? On certain ways of understanding emotions, it is in their very nature that they determine the salience of patterns of perception and reasoning — and crucially, they do so regardless of whether emotion processing is sometimes informationally encapsulated. There are two features, ones we uncontroversially ascribe to emotions, which work in conjunction to explain how they determine salience. First, emotions have an affective component, and the types of affective components they do have marks them out as having a valence. The idea, very roughly, is emotions feel good or bad; they appear positive or negative.[4] Second, emotions are not only representational, but they have an evaluative component: they assign a positive or

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[4] See Colombetti (2005), Prinz (2010) and Carruthers (2017) for overviews of emotional valence.

negative value to their intentional objects, i.e. what they are about or in response to.[5] The fact that emotions have an affective component with a valence explains why their representational component is evaluative. In brief, emotions feel good or bad, and in virtue of that, their intentional objects are represented as also being good or bad; as being positive or negative. This helps explain why emotions bias certain pieces of information over others. We are drawn to pieces of information represented as positive or negative whilst neglecting ones that aren't represented in either of these ways.

Crucially, emotions can determine the salience of information whether or not they are informationally encapsulated. To be informationally encapsulated is for our emotion generation systems to be insensitive to top-down influence, e.g. from propositional knowledge already possessed by the agent. Emotions can bias certain pieces of information whilst being insensitive in this way. This is confirmed by multi-pathway models of emotion generation at the neurobiological level. Emotional responses, especially fear responses, can be triggered by stimuli "off-line" without activating the cortex, and thereby without the agent being consciously aware of the stimuli. Such emotion processing is said to occur without any top-down influence from the agent's beliefs. To the extent that such emotions have an evaluative component, they can bias certain response-options over others. However, emotional responses, like those involved in fear, can also be triggered "on-line", and in a way that is susceptible to top-down influence. Such emotional responses result from neural circuits that activate the cortex, consciously register the stimuli, and are influenced by background information possessed by the agent.[6] Emotions triggered in this way, to the extent that they have an evaluative component, can also successfully bias certain response options over others.

In summary, a careful examination of the possible factors which give rise to the philosophers' frame problem, as well as de Sousa's proposed response to it, puts emotional salience at the heart of how emotions solve this problem. Emotions assist reasoning, and *ergo* make their bearers rational, insofar as they determine patterns of salience. But what's more, we now see that we can provide an explanation of how emotions determine salience in virtue their very nature *sans* any further claims about emotion processing being informationally encapsulated. This makes the hypothesis under investigation — "the role of emotions is to supply the insufficiency of reason by imitating the encapsulation of perceptual modes" (de Sousa 1987: 195) — mysterious. Precisely what is it that the temporary encapsulation of emotions contributes to how they determine the salience of features of perception and reasoning, and thereby assist reasoning?

3. The Role of Information Encapsulation in Emotion-Driven Reasoning

[5] The evaluative nature of emotions is discussed by Solomon (1976), de Sousa (1987), Greenspan (1988), amongst others.

[6] This is proposed by several multi-level theories of emotion generation, and confirmed for fear generation at the neurobiological level by LeDoux (1996).

3.1 Efficiency of Response-Options Selections

As I see it, there are two major ways the information encapsulation of emotion processing contributes to emotion-driven reasoning. In neither way does information encapsulation *determine* the salience of features of perception and reasoning. Instead, encapsulation makes a contribution to how such salience is determined, and in a way that is conducive to how emotions help solve the philosophers' frame problem. In the first instance, encapsulation helps emotions determine the salience of information in an efficient manner. There are two facets to how it does so, one of which concerns speed, and the other cognitive cost.

The need for speed speaks directly to the philosophers' frame problem construed as one having a time constraint, i.e. we assume the problem comes with Hamlet's problem built in. One benefit of a system being informationally encapsulated, and thereby ignoring background information, is we can focus and process in-coming information in a quick and efficient manner. As Fodor notes, "speed is purchased for input systems by permitting them to ignore lots of facts" (1987: 70). It might, therefore, be assumed that emotional processing being informationally encapsulated is required to solve this particular version of the frame problem.

It is plausible that encapsulation is required to solve the frame problem under certain time-constraints. Seeing a snake on a hike-trail or wearing off the path of an oncoming car, for example, are cases where an emotional response trigged bottom-up would be beneficial, and precisely for guaranteeing the speed of an appropriate response. But top-down effects can also be quick, and it isn't clear whether all instances of Hamlet's problem, or even most, require emotion processing to be encapsulated. Take Dennett's example. It is hard to see why it would be essential for the robot's system to be encapsulated for it to escape the ticking bomb. The processing that generates its response-options might be susceptible to top-down influence, but it may still select a response-option within the required time. (In fact, it is highly likely that the selection of an optimal response-option in this situation requires top-down influence, as the robot will need to recall its knowledge of possible escape routes, its knowledge that bombs are hard to diffuse etc.). Not all instances of the frame problem, even when they arise with significant time-constraints, then, seem to require the super quick reflex-like response-options that can only be triggered by emotional responses being encapsulated.

The take home message shouldn't be that the speed at which response-options are selected is unimportant, nor that encapsulation doesn't matter for these purposes. Rather, the point is encapsulation does make us select response options quickly, but the specific speeds at which only it can help us do so is only necessary in a limited range of instances — even within the subset of frame problems seen through the lenses of Hamlet's problem.

While the facet of speed only matters in a limited range of instances, the contribution encapsulation makes to minimising cognitive costs plausibly applies to all instances of the philosophers' frame problem. For any given instance where there is a range of response-options to choose from,

background information may bear on selecting the best possible options, and in a timely fashion required by the specific instances. Nevertheless, were it possible to select the relevant options without considering such information, we can resolve frame problems without the cognitive costs acquired when we consider such information. A potential benefit of this is agents are better able to allocate their cognitive resources to other tasks, e.g. how to best follow through with the response-options they have selected.

It is important, however, not to overestimate how much cognitive cost is actually minimised when emotional processing is encapsulated. Encapsulated systems are insensitive to information stored in other channels. When perceptual processing is encapsulated, for example, this is taken to mean background information, e.g. what the agent believes, does not influence what we perceive. By contrast, when this process is claimed to be "cognitively penetrated", the claim is not that what the agent actively considers affects what they perceive; though it very well might. Instead, the claim is the agent's beliefs affect their perception regardless of whether they actively consider these beliefs. In this way, any cognitive costs to the agent that are spared on account of emotion processing being encapsulated needn't involve anything resembling deliberation, or even any conscious activity for that matter. Subsequently, emotion-driven reasoning, when emotion processing is encapsulated, no way ensures any significant gains when it comes to the minimisation of cognitive costs.

Both facets discussed above play a role in how emotions determine the salience of features of information, though the role they play is minimal and in most cases inessential. The next way encapsulation of emotion processing contributes to emotion-driven reasoning will prove far more crucial. This can be brought out in the context of why information encapsulation was thought relevant for the original frame problem(s) in artificial intelligence, and why it fails to play the same role when it comes to the philosophers' frame problem.

3.2 Maintaining Response-Option Selections

The first discussion of how information encapsulation bears on the frame problem was discussed by Fodor (1983, 1987, 2000). In his discussion, Fodor argues that frame problems don't arise for informationally encapsulated systems because there is only a small amount of information over which to compute. Chow provides the following exposition:

> To be more precise, encapsulated systems avoid relevance problems in two subtly distinct ways: Not only does the small amount of information contained in the system's database constitute all the information that the system can consider, thus considerably reducing the number of computations needed for information search, but that small amount of information constitutes the one and only set of background information against which relevance is determined. The more encapsulated a system is, the more tractable its computations will be, and the less relevance problems will be problems. (2013: 315-316)

Chow here is discussing one version of the frame problem, which he calls the 'Generalised Relevance Problem': "how a cognitive system can make determinations of what is relevant to a given task with reasonable levels of success" (pg. 313). Since informationally encapsulated systems are insensitive to propositional knowledge the agent already knows, such systems significantly restrict the amount of information that can bear on a response-option. Fodor argues that systems like perceptual processing are encapsulated, but he also argues that central cognition isn't given its holistic nature. The upshot of this is that frame problems still arise for computations to be carried out by central cognition.

In this context, it is not far-fetched to suppose de Sousa's proposal is a way of explaining how we can solve the frame problem faced by processing at the level of central cognition. Emotions "mimic" the encapsulation of perception, and *ergo* restrict the amount of information over which to make computations at this level. We find an exposition compatible with this picture when we closely examine what de Sousa supposes is achieved by the encapsulation of emotion processing:

> [A]n emotion limits the range of information that the organism will take into account, the inferences actually drawn from a potential infinity, and the set of live options among which it will choose. (de Sousa 1987: 195)

If we take the inspiration for this to be Fodor's suggested proposal as to how we solve the frame problem, a plausible interpretation has it that the temporary information encapsulation of emotions don't really solve the problem for central cognition as much as prevents the problem from arising despite its usual holistic nature. There are, however, two major worries with this proposal. First, it remains unclear how the Fodor-inspired move actually addresses the frame problem understood as a problem of not just restricting information, but restricting it to that which is relevant to achieve reasonable levels of success when it comes to choosing response-options.

This worry is accounted for given the overall framework de Sousa proposes. Emotions bias certain pieces of information, and they acquire the biases they do have for a variety of cultural and biological reasons. de Sousa's exposition employs the notion of "paradigm scenarios" where we first acquire our knowledge of which emotional responses are appropriate for a given situation. The appropriateness of future emotional responses are measured against the backdrop of the responses acquired during these scenarios. The details don't really matter for current purposes. What does is the availability of plausible developmental stories which explain why we acquire our emotional biases. These suffice to explain why our biases confer salience to information relevant to achieving reasonable levels of success. In brief, both cultural and biological evolution selects for emotional biases that, on the whole, achieve reasonable levels of success. Once again how the philosophers' frame problem is resolved, then, is explained without the need to make any commitments to emotion processing being informationally encapsulated.

The second worry, like the first, concerns a lack of success when we apply the Fodorian move to the philosophers' frame problem. The crucial feature of an encapsulated system, de Sousa notes, is it "limits the range of information that the organism will take into account" (pg. 195). This is ambiguous as to whether the information limited is background information or in-coming information. Informationally encapsulated systems successfully limit background information. To be an encapsulated information processing system is simply to be insensitive to background information — except for any information stored within that very system. Consequently, there is no question of whether they limit background information. Informationally encapsulated systems, however, do not limit in-coming information. This is significant because insofar as solving the philosophers' frame problem also requires limiting in-coming information, the information encapsulation of emotion processing will not fully resolve this problem.

To elaborate, as we noted earlier, the frame problem in its broadest form is a problem about how to restrict the amount of information that is to be computed for us to get an appropriate response-option. This understanding of the problem gives way to three possible interpretations: we need to restrict (i) background information, (ii) in-coming information, or (iii) both. Fodor's discussion of the frame problem assumes (i), whereas prevailing discussions of the philosophers' frame problem, including de Sousa's own, centres on (iii). The inclusion of (ii) is perhaps clearest in Faucher and Tappolet's exposition of de Sousa's proposal where they write, it "is natural to think that emotions influence what we attend to and determine what information we take in" (2002: 108). Quite independent of de Sousa, the function of emotion, construed as a mechanism that biases in-coming perceptual information, is discussed within the context of both evolutionary psychology and neuroscience. For evolutionary psychologists Ketelaar and Todd, "specific emotions might help to solve the problem of what information to attend to in specific environmental circumstances" (2001: 194). Likewise, for neuroscientist Panskepp, emotions help "modulate attentional and sensory-motor sensitivities relevant for the evolved behavioural tendencies" (2000: 22). Faucher and Tappolet themselves argue the thesis that emotions bias perceptual data is empirically borne out, at least with regards to the emotion of fear and anxiety.

Assuming another way emotions assist reasoning is by limiting in-coming information, we face similar problems when we try to find a role for how information encapsulation of emotion processing helps with this task as we do when we try to determine the precise role it plays in assisting reasoning when it limits background information. Informationally encapsulated systems don't restrict in-coming information. They are neither insensitive to certain kinds of in-coming information, nor do they mark certain pieces of such information as more salient than others. As before, how emotions determine the salience of information, in this case in-coming information, can be explained in terms of their affective component. Emotions bias certain in-coming information over others because they have an affect component, which helps evaluate certain pieces of information as being positive or negative. Moreover, emotions acquire the biases they do have for a variety of cultural and biological reasons. A story of

how emotions determine the salience of features of perception can, therefore, be told *sans* any commitment to emotion processing being encapsulated.

To recap, a focus on information encapsulation within the context of the philosophers' frame problem, I suggest, stems from the role Fodor attributes to it with regards to the frame problem in artificial intelligence. The two problems discussed above, however, demonstrate how information encapsulation of emotion processing cannot resolve the philosophers' frame problem. The encapsulation of emotion processing fails to resolve this problem because it does not determine the salience of information — be it in-coming information or the relevant background information. We then reach a negative verdict. Nevertheless, putting aside the role Fodor attributes to encapsulated systems helps us see an alternative way encapsulation of emotion processing might be relevant for the philosophers' frame problem. Emotional processing, on occasions it is encapsulated, doesn't determine our emotion-driven biases, but rather ensures these biases are not overridden.

We have predetermined biases which emotions seek to highlight in virtue of their affective components. Provided our emotional responses, and their ensuing biases, are triggered without considering background information, this ensures these biases are manifested in a way that isn't overridden by what the agent knows or believes. For instance, there might be various evolutionary or sociological reasons why our fear responses are more acute for unrecognised noises, especially when they are coming from the periphery, or other cases of visual disintegration, say walking in a dark alleyway. These responses seek to highlight such noises over other perceptual data, e.g. the beautiful reflection of yellow light from a streetlamp on the wet pavement. Moreover, they do so regardless of what the agent believes. An aesthete might have certain beliefs about the good life being one where she appreciates beauty wherever possible. These beliefs may, in practice, result in tendencies to prioritise perceptual data which lead to aesthetic experiences. Nevertheless, her fear responses, where they are informationally encapsulated, ensure these responses, and the ensuing biasing of unrecognised auditory data, are not not overridden by her aesthetic beliefs and belief-based tendencies. She may live her life religiously practising her appreciation of beauty, but her fear responses ensure she prioritises potential sources of danger when considering response-options, e.g. when walking in a dark alleyway.

Information encapsulation of emotion processing plays the same role when it comes to restricting non-perceptual information. Emotions bias certain inferential patterns over others. Moreover, emotion processing being encapsulated ensures these biases are not overridden. The aesthetic, for instance, might be prone to contemplating the beautiful, even when walking in dark alleyways by herself. But the information encapsulation of the mechanisms that trigger her fear responses ensure these responses are triggered by unrecognised noises, regardless of her intentions. Moreover, these responses in turn prioritise inferences concerning the selection of response-options to threat over the sorts of inferences involved in contemplating the beautiful.

The claim here isn't that there can't be any top-down effects of cognition on emotion processing. Through training, various beliefs might come to penetrate such processing, especially

diachronically. Cognitive behavioural therapy might, for example, be employed to dull our fear responses to walking in dimly lit streets.[7] However, where emotion processing "mimics" the encapsulation of perceptual processing, emotions can continue their role of acting as biasing mechanisms which seek to prioritise certain pieces of information over others. In other words, the information encapsulation of emotion processing guarantees these biases are not overridden by what the agent believes. Encapsulation doesn't, then, determine the salience that emotions confer information, but rather turns out to be necessary for guaranteeing that emotions can fulfil this role of determining salience.

4.   The Role of Information Encapsulation in Hindering Reasoning

Emotions assist reasoning by acting as a biasing mechanism that biases certain features of perception and reasoning over others. This very function of emotion can also explain the way emotions sometimes hinder reasoning and thereby make their bearers irrational. As before, the major contribution emotions make to issues to do with rationality, in this case irrationality, can be explained without any commitments to their information encapsulation. Instead, informationally encapsulated emotion processing provides a possible mechanism by which such cases of emotional irrationality are brought about.

It bears noting here that there are a plurality of emotional phenomena discussed under the "irrational emotions" banner. Information encapsulation has consequences for at least two of them. First, emotions are deemed irrational when they clash with the subject's considered judgements. These emotions, also dubbed "recalcitrant emotions", are irrational from the subject's own perspective.[8] For instance, to borrow from Greenspan (1981), you fear Fido, your neighbours' dog you judge to be harmless. What is salient in this case isn't whether Fido is actually dangerous but that you fear him despite judging that he isn't. The information encapsulation of emotion processing goes a long way to explaining how such emotions come about. A fear of dogs might have been acquired during certain paradigm scenarios. Provided fear responses triggered by dogs are immune to top-down influence from cognitive states like judgement, a fear of Fido will persist despite the judgement that he is harmless.

A view like this is suggested by Griffiths (1990, 1997) when he seeks to explain what he calls "irrational emotions". In brief, he argues such emotions can be explained by modular emotion generation systems that can give rise to emotional responses *sans* the cognitive processes that lead to judgement. In such a case, you will fear Fido despite not making the judgement that he is harmless. This is not strictly an explanation of recalcitrant emotions, as here we have an emotion in the absence

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[7] A subject might undergo such therapy if trauma has induced debilitating fear responses to walking unaccompanied in dark streets.

[8] For a discussion of recalcitrant emotions, see Greenspan (1981), Helm (2001), and D'Arms and Jacobson (2003).

of the relevant judgement, as opposed to an emotion with clashes with a judgement. But such a case might also be classified as irrational under certain liberal notions of emotional irrationality.

It is important to note that in both instances, a story of why these emotions are irrational can be told without any claims about information encapsulation. In genuine recalcitrant cases, what does the work of explaining why recalcitrant emotions are irrational has to do with the conflict between emotion and judgement, as opposed to anything to do with informational encapsulation as such. Likewise, in the case of groundless emotions, why these emotions are irrational has to do with the very fact that they are, at least from the subject's perspective, groundless. Nevertheless, as we saw, encapsulation of emotion processing explains how such emotional episodes come about.

Information encapsulation also bears on possible explanations of irrational emotions, as conceived from viewpoints that outstrip the subject's own perspective. Under de Sousa's teleological conception of rationality, emotions are rational when they fulfil their biological function, i.e. determine the salience of features perception and reasoning. It is tempting, on this basis, to assume emotions are irrational when they inhibit this function. Such an account, however, most plausibly speaks to how emotions can be arational as opposed to irrational. This is clear when we focus on the philosophers' frame problem. Emotions help solve this problem by assisting reasoning by drawing our attention to some information over others. If emotions were to simply fail to draw our attention in this way, the frame problem remains unresolved, but not in any way in which the problem is worsened. A lack of attentional biases doesn't 'distort' reasoning. Rather, it simply leaves reasoning as it were.

A second, better, way of understanding of emotional irrationality under the teleological conception of rationality is to draw on the purpose of our biological functions. These functions tend to be geared towards achieving certain goals, the central one presumably being to maintain the survival of the organism, if not the species. Once we factor this into the equation, the whole point of emotions fulfilling their biological function is to ensure certain further goals are met, e.g. goals to do with survival. This picture lends itself to a different way emotions might turn out to be irrational. Emotions are irrational when they disrupt reasoning. Moreover, they do so when they limit the set of perceptual cues and live response-options to ones that are suboptimal or detrimental to the organism. For example, a phobia of spiders will turn out to be irrational when it focusses an agent's attention on spider-related information at the expense of neglecting information that is more conducive to achieving their goals.

The teleological notion of emotional irrationality, like the ones mentioned earlier, can be made sense of without any commitment to emotion processing being informationally encapsulated. But also like before, encapsulation provides an explanation of how such irrational episodes are possible. We might acquire emotional responses to certain situations during paradigm scenarios that are actually detrimental to our long-term goals. For instance, certain environmental factors, such as parenting, might make a subject react overly jealous to any scenario that has the slightest potential for infidelity. Provided the emotion processing that triggers these bouts of jealousy are encapsulated, the subject will

be unable to override them, even if they cause significant psychological distress and impedes their ability to form anything resembling a meaningful relationship. These episodes of jealousy are irrational because they conflict with the agent's long-term goals, but they are possible, and persist, because the mechanisms that generate them are informationally encapsulated.

Overall, what is striking here is that it is the very feature that explains precisely how emotions assist reasoning, which also explains how they, on occasion, hinder reasoning. That is, information encapsulation provides the mechanisms by which emotions can contribute to our rationality, but it is these very mechanisms that also explains how they sometimes make us irrational. Crucially, there is no tension between the two stories.

5. Conclusion.

This paper concerned itself with what cognitive architecture could tell us about emotion-driven reasoning. To that end, we assessed a hypothesis about a particular feature of such architecture owing to de Sousa: "the role of emotions is to supply the insufficiency of reason by imitating the encapsulation of perceptual modes" (1987: 195). We now find this interpretation to be misleading. The central role of emotion in emotion-lead reasoning isn't to mimic the information encapsulation of perception but to determine the salience of information; something it can do without being informationally encapsulated. However, we also see there is a sense in which de Sousa was on the right track. Emotions do "control" the salience of features of perception and reasoning. The positive parts of this paper fleshed out precisely how this is so. The encapsulation of emotion processing ensures emotions can fulfil their central role in an efficient manner, and in a way that isn't overridden by what the agent knows. The price we pay for these benefits, we saw, is emotional processing can sometimes lead to us being irrational, i.e. on occasions when emotions determine the salience of information in a way that conflicts with our considered judgement or is detrimental to our long-term goals.

If the above account of how emotions contribute to reasoning is correct, analyses of emotional rationality can proceed without any presuppositions about cognitive architecture. That is, we can, at a level of abstraction, explain how emotions assist reasoning without making any commitment to emotion processing being informationally encapsulated. Nevertheless, if we are serious about providing a detailed story as to precisely how emotions assist reasoning, including an account of the mechanisms by which it does so, information encapsulation will be part of the parcel of such a story. How philosophically pressing knowing about cognitive architecture is to the endeavour of explaining emotional rationality will, then, depend on just how deep you want your theory to go.

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