Keith Frankish and William M. Ramsey (eds.)
The Cambridge Handbook of Cognitive Science.
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Frankish and Ramsey have brought us a collection of solid contributions covering a range of topics central to contemporary cognitive science from world leading experts. The handbook will be useful for teaching purposes, especially providing first readings on topics, or for researchers seeking to diversify their knowledge and needing clear and broad introductions to unfamiliar areas. Additionally, if like me you have had hostile reactions to one or other controversial theme in cognitive science then you will likely find the sympathetic accounts of, say cognitive neuroscience (Standage and Trappenberg C12) or evolutionary psychology (Barrett C13) helpful.

Given that this is a broad reaching handbook there are no central themes which bind the chapters together beyond the assumptions common to cognitive science. For example, it would be fair to say that all contributors would agree that the mind is a non-mysterious entity which is open to scientific study via appropriate methods; particularly those of psychology, artificial intelligence and neuroscience. There is little room here for radical eliminativism about the mind, nor are more extreme versions of anti-representationalism given much page time. The collection can thus be seen as fitting appropriately within mainstream cognitive science which assumes a layered ontology (á là Craver) or some form of non-reductive materialism (á là Fodor) and that the mind is (at least to some extent) a representational and computational mechanism.

Due to this fact, it is important that a comprehensive overview of the nature of mental representation is given. This is precisely what we get from Von Eckardt in Chapter 2. There are some argumentative weaknesses in this chapter. For example, Von Eckardt apparently has not noticed that her extensive discussion of the necessity of interpretation or consumption of vehicles solves the problems she raises with second order resemblance accounts of content grounding. Nevertheless this chapter provides a useful introduction to the necessity of a tripartite analysis of representation (á là Peirce) and a helpful (and mercifully clear!) overview of the main classes of theories of content determination.

A shortcoming of the text has to do with the relationship between Von Eckardt's chapter and the following contribution from Thagard on cognitive architectures. Thagard covers well some historically important approaches to understanding mental computations, specifically rule-based digital computation (AKA GOFAI) and connectionism. However, the deep implications of this debate for cognitive level explanation are not adequately explored. Despite Von Eckardt's introduction of different accounts of content grounding, neither she nor Thagard explore how these relate to different notions of computation, nor do they even mention the possibility of content driven (as opposed to rule and syntax driven) computation.

Following these chapters on foundational issues, which are partnered with a very handy historical discussion of key advances in the 20th century by Abrahamsen and Bechtel, the volume moves onto discussion of various cognitive phenomena. I will give a brief statement of the usefulness of this section without discussing all the chapters. This is not to say that the chapters I do not discuss are not worth discussing; merely that the nature of these contributions can be

highlighted by picking a few examples. Across the board these contributions are clear, useful and contain much material that will be of great benefit for students in coming to think about difficult material. For example, O'Callaghan in his entry on perception helps us understand representational accounts of perception in the following way:

'Illusory and veridical experiences share representational *content*, but among the *objects* of perception are ordinary external things and features. Awareness of public objects is mediated in the sense that it requires representing those objects, but this need not be mediation by some entity *of which one is aware*. Perceptual representation need not be like viewing a picture. It is more like *being* the picture.' (75, emphasis original).

These chapters also include much material which will be useful fodder for debate. Aside from O'Callaghan's unfortunate overstating of the abilities of those with blindsight (86-87), Pacherie's discussion of Libet and Wegner's controversial interpretations of their own experimental findings will stoke the passions (102- 5), whilst at the same time be useful for pure philosophy students as a starting point for understanding the reasoning skills needed to interpret psychological results.

The interdisciplinary skills needed to fully grasp the text are on display again in Oaksford, Chater and Stewart's discussion of deductive reasoning and decision making (C7). For example, although they do well to remind readers of the meaning of symbols such as '¬' (132) some experience in reading formal logic notation will greatly assist students' comprehension of this work. Similarly some experience with the various ways of diagramming linguistic structure will help with understanding of Jackendoff's (C9) discussion of language.

It is likely that in using this book you will find that some chapters will be more useful than others. For example, I find it unlikely that I would chose to use Lycan's entry on consciousness (C11). This reflects more of difference in priorities regarding what material to give to advanced students than a judgement of quality. In particular my preference would be to give such students a text which opened up the possibility of reasoning from data-based theories of consciousness to solutions to philosophical problems. In contrast Lycan prioritizes characterizations of the problem of consciousness highlighting surprising phenomena (e.g. inattentional blindness) and traditional problems (such as the explanatory gap). Whilst he mentions mechanistic accounts – particularly access based accounts such as global workspace theory – he offers little discussion of how such accounts might be thought to explain consciousness. This, of course, highlights the strength of the handbook format which, in giving us a set of standalone contributions allows teachers to select what they determine to be the most relevant texts for the courses they wish to teach.

Following these discussions of cognitive phenomena, the final section of the book sympathetically presents four research programs within cognitive science that have been, in some way, controversial. Cognitive Neuroscience, for example, has been criticized for taking too simplistic a view of cognition and ignoring complexities discovered within the bounds of psychology. Others have wondered whether particular techniques popular within cognitive neuroscience (such as fMRI) are able to contribute to our understanding of cognition beyond the behavioural tasks they employ. In their contribution Standage and Trappenberg take on the second of these concerns by suggesting various computational models of brain regions can link findings in neuroscience and psychology. Most importantly they attempt to show that such models can answer questions about *how* particular brain structures contribute to cognitive functions.

Evolutionary Psychology is occasionally attacked for not being a 'real' science in that it has

been accused of positing arbitrary and untestable explanations. Barrett's contribution helps alleviate this worry by using examples from good evolutionary research which do lead to testable predictions; for example, with regard to differences in care given to genetic and step children. He goes on to discuss how the methods of comparative psychology may be plausibly extended to test further hypotheses regarding selection pressures leading to capacities for mindreading and the like.

The chapters of these final sections offer more than just a defence of the research programs. They also do well to discuss where the programs are headed and Shettleworth offers a very informative potted history of the study of animal minds early in her contribution.

All in all Frankish and Ramsey have collected a strong set of essays which will successfully serve the purposes of a handbook. Impressively the standard is even and high for all contributions and so the usefulness of each chapter will be limited only by particular researcher or teacher preferences and not by failings of particular contributors.

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