DEKI and the Mislocation of Justification: A Response to Millson and Risjord

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In their "DEKI, Denotation, and the Fortuitous Misuse of Maps" Jared Millson and Mark Risjord (MR) take the DEKI account to task for being unable to "distinguish justified surrogative inferences from unjustified ones", which is problem because an analysis of representation "must block unjustified surrogative inferences" (p. 5). This, they say, means that DEKI fails to meet our own Surrogative Reasoning Condition (Frigg and Nguyen 2020, 3)

They reach this conclusion through a thought experiment that they take to show that the DEKI account is open to what they call the *fortuitous misuse* of a representation. Their protagonist is the absent-minded traveller Susan, who, when visiting Paris, by mistake uses a map of Prague to navigate. She uses that map to find her way from the Tour Eiffel to the Jardin des Tulieries, and due to string of lucky coincidences, she does so successfully. Yet, despite reaching her destination, "Susan's conclusions were obtained by luck and unjustified" (p.2). Hence, Susan's use of the map is fortuitous because she gets to where she wants to be, and it is a misuse because the conclusions she draws from the map lack justification. MR point out that Susan's use of the map is consistent with DEKI, and DEKI therefore lacks the means to block unjustified inferences, which MR take to be a red flag.

To assess this argument it is important to be clear on what exactly requires justification, and there seem to be (at least) two different aspects of inferences from representations that might need to be justified. These are *very roughly* analogous to the validity and soundness of a logical argument, and we call them *derivational correctness* and *factual correctness*, respectively. An inference drawn from a representation is derivationally correct if the inferential steps that lead to the conclusion are correct with respect to the rules of the representation and only use premises that form part of the representation. The conclusion of an inference is factually correct if the conclusion is true of the representation's target. MR do not distinguish these two aspects clearly, but the context of their discussion suggests that they require a justification for both. In particular, they seem to require a justification for factual correctness when they sum up their conclusion of the thought experiment by saying that it "highlights the fact that not just any true belief formed from inspecting the map is the conclusion of a justified surrogative inference" (p. 3).

We agree that when drawing inferences from representations we would ultimately like to have a justification of both their derivational and factual correctness. Our disagreement with MR is about where this justification has to come from. MR think that it must come from an account of representation, and they criticise DEKI because it fails to provide the required justifications (and hence fails to distinguish between justified and unjustified inferences). We disagree: while one should expect an account of representation to have something to say about derivational correctness, factual correctness lies squarely outside the remit of account of representation, DEKI or otherwise. Furthermore, DEKI does provide

a justification of derivational correctness, and so it successfully performs those tasks that it actually should perform.

Let us begin with derivational correctness. The locus of justification here is DEKI's key, which provides the rules associated with the representation. Drawing inferences from representations has to be done using the key. Inferences not based on the key are unjustified. If someone looks at the map in our contribution to this volume and infers that everything in Stockholm is pink because the area on the map denoting Stockholm is pink, then their inference is unjustified because it's not based on the key, which does not connect colours on the map with colours of the landscape.

Factual correctness is an altogether different matter. In our exposition of DEKI we are careful to say that representations generate *claims* about their targets, but that these claims can be false (Frigg and Nguyen 2020, 178). Furthermore, their truth-values are not something that the representation adjudicates, let alone justifies. Neither the truth-value of a claim, nor the justification of why a certain truth-value is assigned to it, are intrinsic to the representation. So neither DEKI, nor any other account or representation, should be asked to account for either. Maps (and models) are not special in this regard. The same goes for other representations. Neither sentences, nor paintings, nor caricatures, contain their own truth-values along with justification for them; indeed, not even photographs do. "The cat is on the mat" says something about the cat; it neither assigns, nor justifies, a truth-value to the sentence's content. Likewise, Constable's *Salisbury Cathedral from the Meadows* represents the Salisbury Cathedral as an early gothic building with one tower, but neither the truth-value of the claim that Salisbury Cathedral really is an early gothic building, nor its justification, are part of the painting. Truth-values and their justification are not part of a representation, and so they cannot be expected to appear in an analysis of representation. Contrary to what MR say, the absence of such specifications from DEKI is a feature, not a bug, of the account.

To be clear, we're not saying that conclusions of inferences drawn from representations should not be justified, let alone that there is no such (factual) justification. Of course we do want justification! Our claim is that this justification is not part of a representation's content, and therefore it does not have to be analysed in theory of representation. This sort of justification comes from the outside. We believe that "the cat is on the mat" is true because we see that the cat is on the mat, and we have reasons to trust our senses, or perhaps we have reliable testimony to that effect, not because of what the sentence means. Likewise we can deem the claim, derived from Constable's painting, that Salisbury Cathedral is an early gothic building with one tower true because we stand on the meadow ourselves and see this to be the case. Or we can rely on testimony. This might involve Constable's own testimony, and justifying our belief that the testimony is reliable may involve appealing to Constable's artistic practices. In the context of scientific modelling, justification might come from the theoretical framework in which a model is embedded, the track record of the model as applied to systems of a certain kind, or the model's fit with data (obviously the details of this will depend on the details of the model in question).[1]

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[1] Of course, given that science is a truth-directed enterprise (or, depending on your other philosophical views, an enterprise directed at empirical adequacy or understanding), scientists may *intend* to chose keys that yield conclusions justified in these ways. But these intentions are not necessarily satisfied (and so the intention

The same goes for maps. MR go to great length explaining what justifies the conclusions of inferences drawn from maps (see Section 4 of their paper). They point out that to produce a map, map-makers first identify the relevant territory and then perform detailed measurements (p. 15). Based on these measurements, and possibly other relevant information that they have gathered (about the character of roads, the size of cities, and so on), they then draw up the map and put this information in it. The conclusions we draw from the map are justified because we know that map-makers have followed these procedures and carried them out correctly (p. 16). We agree, but insist that this is not part of the representational content of the map. If we wish to know whether the conclusions we draw from maps are true, and if we want to justify our views, we have to look outside the map. First we have to make sure that we know what projection the map-makers have used, rather than using any projection that comes to mind. And we have to have reasons to believe that the map has been produced correctly. We believe that conclusions drawn from Ordinance Survey maps are true and justify this by pointing out that we know that these maps have been produced through careful and meticulous processes; we don't believe (or believe to a much lesser degree) conclusions drawn from a cheap tourist map because no such justification is available. But none of this is part of the content of the map itself. In fact, we can be misled. One of us has vivid memories of travelling through Yucatán with official government maps, which turned out to indicate non-existent roads (we later learned that the maps were drawn up based on the government's plans to build roads, which, alas, fell prey to budget cuts). The map simply represents the territory as being thus and so; it does not say whether the claims that follow from it are true, nor does it provide justifications.

Justifying claims is the province of epistemology and much can be said about how this is done. At this point, we are merely insisting that epistemology stands apart from semantics. A theory of representation tells us what the representational content of a map is; epistemology tells under what circumstances are justified in thinking that the content (or parts of it) is (are) true. MS's criticism of DEKI is based mingling the two.

Once this is recognised, it is clear that DEKI does not fail the Surrogative Reasoning Condition. The condition says that "[e]very acceptable theory of scientific representation has to account for how reasoning conducted on models can yield claims about their target systems, and there seems to be widespread agreement on this point" (Frigg and Nguyen 2020, 3). In the idiom introduced previously, the condition asks for a justification of derivational correctness, and for the reasons mentioned DEKI fits that bill.

This said, we would also like to highlight how special the circumstances are where the purported lack of justification becomes problematic. It is crucial to the thought experiment the Susan makes a *genuine* mistake when using map of Prague to navigate Paris. MR confirm in personal communication that if Susan *deliberately* took a map of Prague to navigate Paris, then this would not be a fortuitous misuse of the map. At least in the context of scientific practice, this is the right thing to say. While repurposing maps about one city to navigate another is hardly a frequent occurrence, repurposing models of one target to

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alone doesn't provide such a justification), and the question of justification is still external to the representations themselves.

describe another is a common model building technique and it's good to see that MR do not recommend banning this technique.[2] On the other hand, the requirement of making a genuine mistake makes the case so unlikely that one wonders about its relevance in practice. The cases are so rare for maps, that someone who made a related mistake became a national celebrity (cf. the Erwin Kreuz case reported in MR's paper). Rarity turns to near-impossibility when we look at science. Scientific representations like models, theories, or diagrams are typically used by entire scientific communities. The chance that an entire community makes a genuine mistake and conflates a model for one target (e.g. the hydrogen atom) for a model of another target (e.g. Andromeda) are minute. Unless there are more realistic scenarios where the issue arises, we're not sure how much of a problem this is.

Finally, MR suggest that inferentialist accounts of representation avoid this problem because they provide the required justifications. MR mention this in passing and don't provide details. This is an interesting claim and it would advance the debate to see it developed. But it is not immediately clear how inferentialism would do this. Consider Suárez's account, which is the most widely cited inferentialist account of scientific representation, according to which M is a is an epistemic representation of a target T only if (i) the representational force of M points towards T, and if (ii) M allows competent and informed agents to draw specific inferences regarding T (Suárez 2004, 773). At least on the face of it, it is unclear how this account meets MR's justificatory requirements, but we are excited to see how they develop the inferential conception to do so.

References

Frigg, R. (2022). *Models and Theories*. London: Routledge (forthcoming).
Frigg, R., & Nguyen, J. (2020). *Modelling Nature. An Opinionated Introduction to Scientific Representation*. Berlin and New York: Springer.
Suárez, M. (2004). An inferential conception of scientific representation. *Philosophy of Science, 71*(5), 767-779.

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[2] For a discussion of this way of constructing models see, for instance, Ch. 11 of Frigg's (Frigg 2022).