



A Humean modal epistemology

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Abstract

I present an exemplary Humean modal epistemology. My version takes inspiration from but incurs no commitment to both Hume's historical position and Lewis's Humeanism. Modal epistemology should meet two challenges: the Integration challenge of integrating metaphysics and epistemology and the Reliability challenge of giving an account of how our epistemic capacities can be reliable in detecting modal truth. According to Lewis, modal reasoning starts from certain Humean principles: there is only the vast mosaic of spatiotemporally distributed local matters of fact. The facts can be arbitrarily recombined. These principles cannot be taken for granted. I suggest a bottom-up approach instead: Humean principles of recombining the mosaic of facts can be retrieved from the evolutionarily instilled and empirically informed use of imagination in exploring everyday circumstantial possibilities. This use of imagination conforms to a primitive conception of matter as freely recombinable. The modal beliefs that can be obtained from generalizing the more elementary exercise of imagination have to be corrected. Recombination is limited by sortal criteria of identity. Moreover, the overall picture of a recombinable spatiotemporal mosaic must be weighed against the results of science.

Keywords Hume · Humeanism · Humean supervenience · David Lewis · Imagination · Modal epistemology · Modal · Possibility · Impossibility · Necessity · Plenitude · Recombination · Conceivability · Naturalism · Modal realism

I shall outline an exemplary version of modal epistemology that is Humean in spirit. Modal epistemology, the study of how we know possibility and necessity, has been largely shaped by the Humean tradition of using imagination as a guide to modal knowledge. However, the potential of a broadly Humean approach has not yet been exhausted.

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My Humean proposal aims at addressing two major challenges to modal epistemology (cf. Thomasson 2018):

- (i) The Integration Challenge.
- (ii) The Reliability Challenge.
- (i) The Integration Challenge concerns the integration of metaphysics and epistemology. Any metaphysical theory must at least in principle be compatible with an epistemology telling how we know the theory (cf. Peacocke 1999, p. 1). Ditto for *modal* metaphysics and *modal* epistemology.
- (ii) The Reliability Challenge is to explain why our capacities of acquiring knowledge in a certain field are reliable. Joshua Schechter divides the challenge into two questions¹:

‘The Operational Question: How does our cognitive mechanism for [modal judgements] work such that it is reliable?’

The Etiological Question: How is it that we have a cognitive mechanism for [modal judgements] that is reliable?’ (Schechter 2010, p. 444)

A *naturalistic* version of the Etiological Question for modal epistemology was originally raised by Robert Nozick. Whenever we come up with claims to knowledge of a certain sort, such claims at least in principle have to be compatible with a naturalistic explanation of how we can be reliable in judging these claims, perhaps an evolutionary one. Nozick drew sceptical conclusions for *modal* epistemology from this requirement: ‘...we do not appear to have such a faculty, and it is implausible that evolutionary processes would instill that within us...’ (2001, p. 122).

A Humean perspective on modal metaphysics and epistemology has good prospects of meeting both the Integration and the Reliability Challenge even in the naturalistic version. It is part and parcel to the Humean enterprise to develop epistemology and metaphysics with mutual regard to each other and to look for a naturalistic explanation of our cognitive capacities.

I shall summarize the Humean characteristics of my proposal to come:

- (i) In order to meet the Integration Challenge, modal metaphysics must be informed by psychological and epistemological considerations.
- (ii) The reliability of our epistemic capacities can be given a naturalistic (i.e. evolutionary) explanation.

I distinguish between more elementary and scientifically informed modal beliefs. The former can be accounted for as follows:

- (iii) The prime guide to modal knowledge is not principled reasoning but the use of imagination.
- (iv) Imagination is a capacity of simulating a recombination of actual spatiotemporal patterns. The accessibility of such a recombination is honed by experience.
- (v) Accessibility is projected as external modal entrenchment.
- (vi) The arbitrary recombining of particular matters of fact in imagination is evidence that there are no ties in nature over and above the spatiotemporal mosaic of these particular matters of fact.

¹ Thanks to an anonymous referee for reminding me of Schechter’s article.

I add two correcting factors to the elementary use of imagination. First, I introduce conventional criteria of identity, a move which does not seem alien to a Humean outlook. Second, I invoke science to correct our more elementary modal beliefs:

- (vii) Scientific theory may lead to revising the picture of the world as a spatiotemporal mosaic of particular matters of fact.
- (viii) It may reveal ties in nature which rule out certain possibilities acknowledged by folk theory.

I depart from Hume in certain aspects, especially in accepting at most a moderate version of Hume's scepticism. There are substantial metaphysical truths e.g. regarding necessary causal relationships, and we can know them. Still I grant that we may be unable to judge many modal issues (could there be a particle that is both positively and negatively charged? Cf. Lewis 1986a, b, p. 114).

I shall give brief summaries of my arguments at the beginning of each section. Here I present a general outline: (1.) I start with a basic picture of modal reasoning to be refined and corrected. (1.1.) As for the Operational Question, (1.1.1.) our core capacity of arriving at modal knowledge is not reasoning from principles of recombination. Rather such principles are implicit in the use of imagination. (1.1.2.) Imagination is holistic and subject to implicit constraints. (1.1.3.) It works by simulating recombinations of facts. Experience makes recombinations more or less accessible. (1.1.4.) Accessibility is projected as graded possibility. (1.2.) On the Etiological Question: imagination is evolutionarily useful in providing reliable guidance to modal constraints on everyday situations. (1.3.) Principles of recombining the spatiotemporal mosaic are *prima facie* justified by using imagination in accordance with our primitive conception of material objects. (2.) The basic picture of imagination-guided modal knowledge needs refinement by overriding considerations. (2.1.) One kind of overriding considerations arises from sortal criteria of identity. (2.1.1.) These criteria are largely conventional, (2.1.2.) but they are subject to an adequacy requirement. (2.2.) A second kind of overriding considerations arises from the results of scientifically 'anatomizing nature': science may uncover ties in nature and rebut presuppositions like a fundamental spatiotemporal order. (2.3.) The use of imagination has to be amended by the overriding considerations. (2.4.) The resulting modal epistemology does not depend on Lewisian modal realism. Modal realism is one explanatory hypothesis among others.

1 A basic Humean picture of modal imagination

1.1 Answering the operational question

I shall sketch an answer to the *Operational Question*: how does modal reasoning work? My Humean picture centers on the use of imagination.

1.1.1 A bottom-up approach to principles of modal reasoning

Modalizing does not start from principled reasoning but from recombination built into the use of imagination.

A Humean outlook that meets the Integration Challenge combines metaphysics with epistemology. I have to address the former as far as it bears on the latter. One natural starting point for a Humean metaphysics is *Humean supervenience*:

MOSAIC: ‘Humean supervenience is ... the doctrine that all there is to the world is a vast mosaic of local matters of fact, just one little thing and then another. (But it is no part of the thesis that these local matters of fact are mental.) We have geometry: a system of external relations of spatio-temporal distance between points. Maybe points of spacetime itself, maybe point-sized bits of matter or aether fields, maybe both. And at those points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. For short: we have an arrangement of qualities. And that is all. All else supervenes on that.’ (Lewis 1986b, p. x)

According to Lewis, modal reasoning is informed by a related principle:

RECOMBINATION: ‘I require a *principle of recombination* according to which patching together parts of different possible worlds yields another possible world. Roughly speaking, the principle is that anything can coexist with anything else, at least provided they occupy distinct spatiotemporal positions. Likewise, anything can fail to coexist with anything else.’ (Lewis 1986a, b, pp. 88–89)

According to Hume himself, the core capacity informing our modal beliefs is imagination; there is a well-established connection between the use of imagination and beliefs about possibilities:

‘Tis an establish’d maxim in metaphysics, *That whatever the mind clearly conceives includes the idea of possible existence*, or in other words, *that nothing we imagine is absolutely impossible*.’ (Hume 1739–1740, p. 1.2.2.8)²

Lewis also assigns a role to imagination, but he describes this role as informal reasoning from RECOMBINATION:

‘We get enough of a link between imagination and possibility, but not too much, if we regard imaginative experiments as a way of reasoning informally from the principle of recombination.’ (Lewis 1986a, b, p. 90)

² An anonymous reviewer raised a thorny issue that plagued theories like Descartes’s and Hume’s: when do we *clearly* conceive something? I shall not use the categories of clarity and distinctness. Instead, I take it to be part of the proper function of imagination that one is prompted to withhold judgement when one’s imagination is not sufficiently differentiated, just as one refrains from judging on the basis of perception when is not sufficiently well-placed.

If Lewis were right about the role of RECOMBINATION, modal epistemology would have to account for it.³ In how far is reasoning from RECOMBINATION a reliable way of arriving at modal claims?

One way of answering this question is to derive RECOMBINATION from modal realism: any recombination is made true by a real universe. Yet modal realism is a highly daring theory. In my opinion, its main justification consists in its role in explaining a plethora of modal truths about particular recombinations of particular facts (cf. Section 2.4). On pain of circularity, our justification for believing these modal truths should not in turn depend on modal realism. Moreover, the question remains how we know which worlds there are.

Alternatively, one may derive RECOMBINATION from MOSAIC. If there are no ties over and above local matters of fact, nothing prevents their redistribution, one might say. Yet MOSAIC itself cannot be simply taken for granted. I mention two exemplary objections (Maudlin 2007, pp. 63–77): first, quantum entanglement shows that physical states do not supervene on local matters of fact. Second, the same total distribution of local matters of fact is compatible with several differing systems of laws. For instance, an empty Minkowski space–time is a model for the laws according to General Relativity, but also for rivaling systems of laws. Hence the laws do not have to supervene on the total mosaic of local matters of fact.

These objections illustrate how controversial MOSAIC is. I anticipate my modest strategy of dealing with them (to be developed in Sect. 2.2). I content myself with a *prima facie* justification of MOSAIC and RECOMBINATION starting from our evolutionarily useful everyday deployment of imagination Sect. (1.3). MOSAIC and RECOMBINATION hold only as far as science does not posit anything that does not supervene on the spatiotemporal mosaic. I leave it to the ongoing debate on the metaphysical implications of fundamental physics to determine in how far MOSAIC and RECOMBINATION apply more generally.

MOSAIC and RECOMBINATION cannot simply be taken for granted as principles for modal reasoning. To deal with this motivational gap, I reverse Lewis's approach. Rather than starting from demanding and contentious principles, the Integration and the Reliability Challenge can easier be met by a *bottom-up* approach to particular modal claims. MOSAIC and RECOMBINATION are not general *premises* used in our more mundane exercises of modal reasoning. Proceeding in accordance with them is *built into* the reliable use of our mental capacities to figure out particular modal claims.

My strategy of building general modal principles into the use of mental capacities is inspired by Williamson's proposal that modal constraints are not independently known but implicitly guide the reliable use of imagination in developing counterfactual suppositions (Williamson 2007, p. 170; Yli-Vakkuri 2013, p. 619). I do not commit myself to a counterfactual-based modal epistemology, though.

³ Lewis invokes further principles like *plenitude*: there are no arbitrary gaps in the space of possibilities (cf. Lewis 1986a, b, p. 114) Such principles also raise issues of justification, which I cannot address here.

1.1.2 Imagination as a holistic capacity of simulation

Imagination is a holistic capacity of simulation. It can recruit any mental resources. Depending on the issue addressed, it is more or less constrained by implicit information that can only be retrieved by the very exercise of imagination.

I start from an empiricist tenet: our first acquaintance with facts is due to perception of spatiotemporally located particular matters of fact. We thereby enjoy an appearance that there are such facts, which makes us inclined to believe so. Perception in turn informs imagination. Imagination is a capacity of *simulating* patterns of particular matters of fact, often by *recreating* mental states dealing with these patterns (Currie and Ravenscroft 2002, p. 11). The most obvious use of imagination consists in recreating perceptions or perceptual contents ‘off-line’, without being in contact with the environment. Yet imagination is holistic (Williamson 2007, p. 143). It can recruit all background knowledge and all epistemic capacities that may be useful in simulating particular patterns. If empirical information is stored in a certain format rather than others, imagination fares better in retrieving and manipulating it than more abstract reasoning. As an example, one may think of a runner visualizing her route around a skunk in her way (cf. van Leeuwen 2011, pp. 69–70).

One challenge to using imagination as a guide to possibility is that imagination is not per se constrained by possibility. Many authors acknowledge a more liberal use of imagination, which is not subject to modal restrictions (e.g. Priest 2017). A nuanced picture of the freedom of imagination has been forcefully defended by Peter Kung (2010, 2016). According to Kung, imagination may combine qualitative (quasi-pictorial, quasi-perceptual...) and assigned descriptive content. For instance, we may conjure up an image of a bar of transparent material. The image may come with a ‘label’, say ‘bar’, but we may also add a stipulation, e.g. ‘a bar of transparent iron’. Such free stipulations do not tell us anything about what could and what could not be the case, e.g. whether there could be transparent iron (van Inwagen 1998, p. 79). Kung thus restricts the contribution of imagination to justifying modal claims to the contribution of qualitative content. If the non-qualitative content is to be modally constrained, these constraints must be imposed by hand.

Indeed qualitative and assigned content may be combined in an imagination as described by Kung.⁴ Yet this concession does not force us to be sceptical about the contribution of non-qualitative content. Such content is not inert. I follow Williamson in assuming that imagination is used in a restrained way as a guide to life matters, addressing questions what will and could happen, what alternatives of action there are, and so on:

‘The default for the imagination in its primary function may be to proceed as “realistically” as it can, subject to whatever deviations the thinker imposes by brute force...’ (Williamson 2007, p. 142)

The crucial difference of Williamson’s compared to Kung’s view is that the use of imagination in addressing possibilities is subject to a richer set of background

⁴ I follow everyday language in using ‘imagination’ indiscriminately for a capacity, its exercise, its product, its content, or its object, letting context decide which reading is most appropriate.

constraints. These constraints neither boil down to qualitative content nor to explicit assigned content. To get a better idea of the resulting *implicit* role of such constraints, consider Williamson's account of the folk physics backing our everyday counterfactual assessments:

'...the folk physics needed to derive the consequents of counterfactuals such as [If the bush had not been there, the rock would have ended in the lake] from their antecedents may be stored in the form of some analogue mechanism, perhaps embodied in a connectionist network, which the subject cannot articulate in propositional form... the supposed premises may not be stored in a form that permits the normal range of inferential interactions with other beliefs, even at an unconscious level.' (Williamson 2007, p. 145)

Williamson's use of folk physics gives us a good example of the ways in which experience hones imagination. For instance, when we consider whether a rock would have fallen into the lake but for the bush that stopped it, we impose certain regularities concerning the trajectory of the rock. When we seriously set out to imagine what *would* have happened, the simulative use of imagination is strongly restrained. It may be restrained by an explicit theory, but it will often be partly restrained implicitly. One may be reliable in simulating the trajectory of the rock without being able to calculate it. Williamson uses the implicit role of folk physics as part of a reliable way of forming belief instead of an explicit premise to avoid the problem that our reasoning would otherwise depend on a false premise, folk physics being false as a theory. I take this more restrained counterfactual use of imagination as a model for the modal use of imagination more generally.

Williamson's picture is supported by results of cognitive science. According to these results, we use a quasi-Newtonian 'physics engine' in simulating counterfactual scenarios:

'...the mind can use a quasi-Newtonian simulation to predict how a physical scene would unfold over a short time-span, in the same way that a real physics engine can quickly simulate the results of acting in a game world. My intuitive, commonsensical judgment that if Finbarr drops his glass it will probably break is based on the underlying computations of a mental physics engine with an approximate understanding of bodies and the forces acting on them.' (McCoy et al. 2019, p. 237)⁵

While such a physics engine may partly be hard-wired, it must also draw on empirical information. Such information will be only partly explicit. To a large extent, it will simply be stored as dispositions how to run the simulation that are triggered by a counterfactual issue like 'what if Finbarr were to drop his glass?'

McCoy et al. carry the hypothesis that imaginative simulation is indispensable for retrieving theoretical information one step further: for the parallel case of judging how one would decide between different actions in far-fetched decision situations, they argue that simulating scenarios often is the only way of accessing one's decisions, as contrasted to simply deriving them from independently accessed beliefs and

⁵ I am grateful to an anonymous referee reminding me of the work of Kung and McCoy et al.

preferences. The beliefs and preferences that rationalize one's decision have to be retrieved by working backwards from one's imagined decisions:

'A very natural way (and perhaps, the most natural way) for us to approach a novel decision is to start by simulating ourselves in the proposed scenario(s), seeing how we'd respond, and reverse-engineering our preferences from this response.' (McCoy et al. 2019, p. 243)

Learning about oneself from imagining a decision situation does not seem confined to conjuring up qualitative content like motor imagery or what it feels like to act in a certain way, though it may involve such content. As McCoy et al. emphasize, we need to draw on some implicit 'mental engine for generating self-simulations' (McCoy et al. 2019, p. 246). The mental engine is driven by an 'intuitive theory' that is implicit in the use of imagination (cf. McCoy et al. 2019, p. 241).

In sum, the epistemic contribution of imagination can be expected to be more complex than Kung's theory predicts. The modal use of imagination is subject to tacit background constraints. These constraints are activated by using imagination in accordance with one's intention to seriously address a modal issue. They operate on qualitative and descriptive content and their combination. They are largely informed by experience. They are not always retrievable independently of using imagination.

Having outlined a general approach to imagination as a holistic capacity of simulation, I shall now sketch a broadly Humean picture of how elementary modal uses of imagination arise from experience.

1.1.3 Empirically informed recombination

Imagination recombines experienced spatiotemporal patterns in simulating variations of the actual world. Accessibility to imagination is projected onto degrees of possibility.

According to the Humean picture, imagination works by a copy-and-paste procedure (cf. Section 1.3, Gendler and Hawthorne 2002, pp. 21–22). Such a procedure can be inscribed into the holistic picture of imagination developed so far, although the latter does not reduce to copy-and-paste. The process involves separating and recombining parts of the spatiotemporal patterns perceived. Imagination cuts out one item located at one location in spacetime, copies it and inserts it at some other location in spacetime, thereby replacing a different item. In doing so, imagination is in principle unlimited. However, it develops tendencies.

Recombinations of the actual spatiotemporal structure of the world differ in their *accessibility*. I think of accessibility in terms of our dispositions to come up with certain imaginations upon receiving suitable stimuli. The less easily accessible an imagination is, the more effort in terms of internal and external stimuli it takes to generate it.

Things can be more or less accessible to imagination for various reasons, imaginative resistance, lack of experience (the missing shade of blue), different degrees of complexity, and so on. Our tendency of using accessibility as a measure of possibility must come with a sensitivity to such distinctions. It is part of the proper functioning of imagination in addressing a modal issue to come with an awareness of the right kind of accessibility. One simple idea would be that we register and interpret the effort it

takes to imagine something. When forming a modal judgement, we interpret the effort as tracking external modal entrenchment.

Part of the relevant stimuli that make us use and interpret imagination in this way are modal issues. Such issues can address any kind of modality, and their role in stimulating exercises of imagination varies accordingly. Only an exercise of imagination that responds to a modal issue raises an ‘appearance of possibility’ (Yablo 1993, p. 5). Such an appearance is subject to a success condition: ‘to find p conceivable is to be in a state which (i) is veridical only if possibly p , and (ii) moves you to believe that p is possible.’ (Yablo 1993, p. 12). It takes suitable stimuli to come up with a certain exercise of imagination, and it takes suitable stimuli for that imagination to raise an appearance of possibility. A modal issue looms large among these stimuli.

I use Hume’s account of causation as an illustration of how experience makes imaginative recombinations more or less accessible. I do not incur a commitment to Hume’s views on causation in particular, though. According to Hume, facts which are perceived frequently together are less easy to separate in imagination than combinations which are perceived rarely or never:

‘Tis natural for men, in their common and careless way of thinking, to imagine they perceive a connexion betwixt such objects as they have constantly found united together; and because custom has render’d it difficult to separate the ideas, they are apt to fancy such a separation to be in itself impossible and absurd.’ (Hume 1739–1740, p. 1.4.3.9)

Having observed constant combinations of certain objects (which may be construed as events, spatiotemporally instantiated properties, etc.), it becomes difficult to imagine them separated, i.e. one without the other. We project a corresponding modal entrenchment: there are connections among the objects, which makes it difficult for them to become separated.

Notwithstanding the difficulty of separating frequently observed combinations, imagination retains the capacity of separating *any* part of a spatiotemporal pattern from any other, as Hume points out with regard to causal connections:

‘The separation, therefore, of the idea of a cause from that of a beginning of existence, is plainly possible for the imagination; and consequently the actual separation of these objects is so far possible, that it implies no contradiction nor absurdity; and is therefore incapable of being refuted by any reasoning from mere ideas; without which ‘tis impossible to demonstrate the necessity of a cause.’ (Hume 1739–1740, p. 1.1.3.3)

Since any combination can be imagined separated, there is no strictly necessary connection.

Hume draws a rather dismal picture of how carelessness and custom lure us into imagining that we perceive a connection between objects which is not in fact perceived. Hume’s scepticism may be avoided by a more differentiated conception of a necessary connection. Causal connections presumably do not come with the strongest kind of alethic necessity but may still be necessary in some suitable sense that distinguishes them from mere coincidences.

For instance, when you imagine a carefully placed row of dominoes falling, it is easy and natural to imaginatively anticipate the standing dominoes to follow suit in due order and to project a corresponding causal chain. In contrast, it takes a slight effort to imagine the causal chain broken, one domino remaining upright in spite of the impact of its falling predecessor. Thus, we are inclined to believe that it is easier for the dominoes to fall than to remain upright, resisting the impact. By a suitable centering assumption (the actual is most easily realized) we can conclude that the dominoes will fall if the situation is actual. In the next section, I shall present a corresponding differentiated account of absolute (metaphysical) possibility and higher and lower degrees of possibility.

In sum, I interpret tendencies of the sort observed by Hume as part of a process of learning from experience. Experience (conceived more broadly than Hume conceives perception) leaves an informative imprint on our dispositions of imagining reconfigurations of our environment (cf. Jenkins 2010).

1.1.4 Projecting accessibility to imagination as graded modalities

We tend to project differences in imaginability as degrees of possibility. Alethic modality becomes arbitrarily fine-grained, reaching from contextually highly restricted circumstantial possibilities to metaphysical possibility as the limiting case.

As we have seen in his account of causality, Hume assumes that we have a natural tendency to externalize: just as perception comes with an immediate inclination to believe that there is an external world of spatiotemporal objects corresponding to the variety of perceptions, our use of imagination comes with an appearance that degrees of imaginability (accessibility to imagination) track independent structures: degrees of imaginability conform to degrees of external *modal entrenchment*. Other things being equal, the more accessible some variation of the pattern is to imagination, the easier it could have come to pass, the *higher its degree of possibility*.

One may doubt the claim that possibility is graded. However, there is linguistic evidence for such a claim:

‘Consider comments after a swiftly extinguished fire in an explosives factory:

(38) There could have been a huge explosion.

(39) There could easily have been a huge explosion.

The truth-value of both (38) (on a natural reading) and (39) depends on the location of the fire, the precautions in place, and so on. The mere metaphysical possibility of a huge explosion is insufficient to verify either (38) (so interpreted) or (39). The restricted nature of the possibility is explicit in (39) with the word “easily”; it is implicit in the context of (38).’ (Williamson 2007, p. 177)

Given such linguistic evidence, many authors follow Kratzer (1991) in assuming graded *alethic* possibilities. Such possibilities differ with regard to how much of the actual pattern of things is to be preserved (cf. Müller 2012; Kment 2014; Vetter 2015).

In order to get a better idea of graded modalities, I build on the usual classification of modalities. It is standard to distinguish epistemic, deontic, and alethic modalities. I am interested in alethic modalities. There is cross-linguistic evidence that among the different meanings of modal expressions like ‘can’, a specific alethic meaning usually

precedes the others: this meaning concerns what one can do and what opportunities for action there are (cf. Vetter and Viebahn 2016, p. 12). These results support the claim that the first modalities encountered in human development are alethic ones, in particular those concerning our own actions and opportunities for action.

Consider actions and opportunities for action. I could take a walk instead of writing. The chair in my office provides an opportunity of reaching the upper rows of the bookshelf, provided it is placed two feet to the left. A little abstraction leads from such close possibilities for action to more detached ways things could be, for instance possible ways for a ball to emerge from a box in standard psychological experiments with children (cf. Section 1.2, Edgington 2004, p. 6; Vetter and Viebahn 2016, p. 22). Further abstraction eventually reaches the most permissive ways things could be. These are usually called metaphysical possibilities.⁶ Metaphysical possibility is often described as possibility tout court (van Inwagen 1998, p. 72; Hale 2003, p. 3). It may be defined as including any degree of alethic possibility down to some absolute minimum, whereas more restricted possibilities are delimited by a higher threshold for the degree of possibility.

Just as imagination has a role in making us aware of graded possibilities, it also has a role in the process of abstracting from close towards less close possibilities. Hume's theory of causality provides an example. Hume claims that any purported causal link can be imagined broken: the cause occurs, but the effect does not, or the effect occurs without a cause. Yet this takes a departure from our established 'common and careless' ways of using imagination. The departure informs us about more detached possibilities than we normally reckon with. In sum, imagining provides us with a rich array of particular modal judgements concerning graded alethic possibilities.

1.2 Answering the Etiological question

The exercise of experience-fed imagination in anticipating possible spatiotemporal patterns is evolutionarily useful. For instance, anticipating graded possibilities and impossibilities plays a key role in our framing relevant alternatives for future outcomes.

My simple Humean picture of the interaction of experience and imagination can be elaborated such as to meet the second part of Schechter's Reliability Challenge, the *Etiological Question*: how did our capacities of modalizing evolve?

Beings with our epistemic capacities would not have developed had the immediate circumstances not displayed certain regularities, and they won't survive without these regularities continuing to hold in the future. It is an evolutionarily useful trait that our epistemic capacities reliably pick up these regularities and anticipate possible variations in accordance with them. One way of doing so is by a division of labour between experience in recognizing the present pattern and imagination in extrapolating possible variations of this pattern. In finding variations of patterns that have been more regularly perceived less accessible, other things being equal, and projecting these variations as having a lower degree of possibility, imagination allows us to reliably

⁶ There may be even more permissive notions of possibility like logical or conceptual possibilities. However, there are doubts as to whether they carve a boundary in reality rather than our ways of accessing reality (cf. van Inwagen 1998, pp. 71–72).

deal with more or less eligible future alternatives to the present situation as far as the same regularities that held in the past are going to hold in the future.

One may wonder what the positive survival effect of taking certain things to be merely possible or impossible is. In particular, why should it be relevant to reason in terms of possibilities as distinguished from reasoning merely in terms of subjective or objective probabilities (cf. Williamson 2007, pp. 139–140)? In the case of one's own capacities and potentials, this question might be less urgent. Yet it becomes more pressing when we come to more detached possibilities.

In order to give a partial answer, I shall look at one exemplary role for possibility, the role of framing alternatives over which to distribute one's expectations. Consider a standard experiment on children's modal reasoning:

'Human adults generate predictions or expectations for one-shot events in novel situations where frequency information is unavailable. So do 12-month-olds. For example, if 12-month-olds see a ball bouncing inside a box that has three openings on one side and one opening on the other, their anticipatory looks show that they expect the ball to emerge from the side with more openings. Moreover, their looking times reflect surprise when the ball emerges from the side with one opening. Both of these results suggest that infants expected the ball to emerge from the side with more openings. These expectations could be generated by calculating the proportion of *possibilities* in which the ball comes out each side.' (Leahy and Carey 2020, pp. 68–69, m.e.)

12-month-olds distribute their expectations at which side of a box a ball will emerge without having observed the frequencies of the ball emerging. It is puzzling how they manage to do so with so limited observational evidence. There must be some background framing assumptions in play.

To appreciate the framing assumptions, I suggest to take a look at how we would describe the situation upon first inspection. It seems natural to describe it as follows:

Possibility assumption: there are only four openings where the ball could emerge.

Indifference assumption: there is no difference that makes one opening more eligible.

From these assumptions, we readily proceed to the assessment that the four paths for the ball are equally likely, and that some of them add up if we ask at which side the ball will emerge.

I assume that this intuitive description captures the way children and adults alike frame the situation. It may be implicit in a 'mental physics engine' used to predict the different outcomes. The framing is defeasible, and there are other framings. We may rein in our expectations and wait for the frequencies. Instead of accepting only four paths as possible, we may assign some minimal positive probability to outcomes beyond emerging from one of the four holes, which is too small for these outcomes to be taken into account. Yet such a practice would raise many questions: which outcomes? What probability? What is the threshold? Such questions are cut short by treating any other outcome as impossible.

Instead of other framings, it presumably is more effective to simply conceive the situation as leaving open precisely four equivalent possibilities and to rule out any alternative outcomes. One way of exploring these possibilities is to imaginatively

trace the trajectories of the ball. Our framing may be partly due to certain hardwired ways of reasoning, but it surely will be largely informed by experience of relevantly similar situations, e.g. experience of balls and their trajectories.

Upon reflection, we may acknowledge alternatives such as the ball getting stuck or being biased in favour of one of the four pathways, but these alternatives seem more far-fetched. They are assigned a lower degree of possibility viz. are impossible in a highly restricted sense. Reckoning with them would perhaps make our reasoning more accurate, but it tends to make even simple everyday situations overly complicated to handle. Still there should be room for refinement. New experiences or simple reflection as applied in Hume's critique of causal reasoning may lead to more differentiated modal framings as discussed in Sect. (1.1.4). While our framing is defeasible, it is subject to a reliability requirement. If it is to be evolutionarily useful, our implicit presuppositions about neglecting possibilities should not be too often defeated by these possibilities becoming real rather than those reckoned with.

I have given an example of the survival value of reasoning in terms of objective, non-self-centred possibilities. A division of labour between possibility and probability may contribute to an effective yet highly defeasible framing of everyday situations even given very limited evidence. We disregard certain outcomes as impossible and then assign probabilities to the remaining ones. Our framing is defeasible e.g. by evidence for further outcomes, but it informs our folk theory of the world and contributes to the swift expansion of the latter by daring extrapolations.

Having addressed the Operational and the Etiological Question for elementary modal uses of imagination, I shall now discuss in how far Lewis's Humean principles MOSAIC and RECOMBINATION can be supported by such a use of imagination.

1.3 Supporting mosaic and recombination

Limited versions of MOSAIC and RECOMBINATION can be supported by a copy-and-paste procedure that is informed by our primitive conception of material objects. These versions are only prima facie justified and may be defeated by overriding considerations, though.

I have suggested that MOSAIC and RECOMBINATION are implicit in our reliable use of imagination and can be justified by this use. I shall now try to make good on this claim. The versions of MOSAIC and RECOMBINATION that can be *prima facie* justified by our elementary use of imagination may not perfectly match Lewis's but come reasonably close to them. These versions concern metaphysical possibility, not more restricted possibilities.

We are familiar with rearranging mid-sized objects and stuffs in space. We easily and reliably extrapolate from actual towards merely imagined rearrangements. Imagining some particular rearrangement provides *prima facie* justification to believe that such a rearrangement is possible. MOSAIC and RECOMBINATION are general principles about such rearrangements: any rearrangement is possible, and there are no ties over and above the spatiotemporal mosaic limiting such a rearrangement.

To approach MOSAIC and RECOMBINATION, I add some assumptions about the implicit conception of matter and spacetime that is built into our use of imagination.

They may be added to the hypothesis of a quasi-Newtonian ‘mental physics engine’ guiding our imagination.

The first assumption is that we conceive of spacetime as a four-dimensional continuous manifold (or perhaps rather of space as three-dimensional and time adding a sui generis (e.g. directed) dimension).

The second assumption is that we conceive of matter as homogeneous stuff that perfectly overlaps with some part of spacetime. This assumption seems controversial. However, it is supported by psychological evidence (Spelke 1990). Building on such evidence, Thomas Sattig suggests to distinguish different layers in our conception of material objects. First, there is a more primitive conception available even to small children. I propose that our imagination of material objects proceeds in accordance with that conception as long as it is not restricted by imposing additional criteria. Second, there is the layer of such additional *sortal* criteria. I shall come to the latter and their role for constraining imagination in the next section.

Material objects according to the primitive conception are identified as follows:

‘According to the principle of cohesion, “two surface points lie on the same object only if the points are linked by a path of connected points.” Thus, when two surfaces are separated by a spatial gap, they are surfaces of distinct objects. According to the principle of boundedness, “two surface points lie on distinct objects only if no path of connected surfaces links them.” Thus, distinct objects have no surface point in common. According to the principle of no action at a distance, “separated objects are interpreted as moving independently of one another if such an interpretation exists.” Thus, objects are expected to act on each other only on contact.’ (Sattig 2012, p. 612)

According to this primitive picture, material objects perfectly overlap with continuous spacetime regions. As far as they are distinct, they (can) move independently. This already gives us a minimal principle of recombination, albeit restricted to distinct objects. There are intricate questions concerning the identity of material objects over time. Since I am only interested in the underlying conception of matter and its recombability, I shall not try to answer these questions. To arrive at this conception of matter, I shall add further assumptions so as to get a more general version.

Just as default reasoning about material objects is guided by the primitive picture of matter, this picture also informs our default exercise of imagination. I supplement the primitive picture by the cut-and-paste-procedure alluded to earlier:

‘Cut_i: If we can imagine a region that is (intrinsically) F adjacent to a (nonoverlapping) region that is (intrinsically) G , then we can imagine a region that is F and withhold imagining a region that is G (where the regions can be either spatial or temporal).

Paste_i: If we can imagine a region that is (intrinsically) F , and we can imagine another region that is (intrinsically) G , then we can imagine adjacent F and G regions (where the regions can be either spatial or temporal).’ (Gendler and Hawthorne 2002, pp. 21–22)

The third assumption that drives our primitive conception of matter becomes: just as we treat matter as perfectly overlapping with continuous spacetime regions, we

treat it as perfectly plastic. Any possible reconfiguration of matter can be represented by an imaginative cut-and-paste procedure as described by Gendler and Hawthorne, and any application of the procedure represents a possible reconfiguration of matter.

I add a fourth radical assumption about the cut-and-paste procedure: the intrinsic properties (if any) of any point-sized piece of matter are preserved if the piece is cut and transferred to another point in spacetime, replacing the matter occupying that point. As long as no additional identity criteria for the material objects under consideration are imposed, imagination proceeds according to the resulting radical version of cut-and-paste. If we take all the beliefs about possible recombinations of matter that we may arrive at in this way together, they are true precisely if MOSAIC and RECOMBINATION are.

I have claimed that the life use of imagination in figuring out possibility is evolutionarily successful. This holds in particular for the primitive use of imagination as described. The latter is largely confined to our dealing with mid-sized material objects and stuffs. It is successful only if it is sufficiently reliable. Since the beliefs formed by the primitive use of imagination are true only if MOSAIC and RECOMBINATION are true, imagination is reliable only as far as MOSAIC and RECOMBINATION are true. Hence MOSAIC and RECOMBINATION must be largely true as far as the life use of imagination goes, but not beyond.

I say ‘largely true’ as some recombinations of material objects that are relevant to the life use of imagination may prove metaphysically impossible. The use of imagination is defeasible, and it is often defeated by overriding considerations, especially where it goes beyond its evolutionarily successful life use. The same goes for MOSAIC and RECOMBINATION. In the next sections, I shall explore some overriding considerations.

2 Refining the basic Humean picture

2.1 Sortal criteria of identity

2.1.1 The role of conventions

The use of imagination in forming modal claims as described in the last sections is liable to correction from different sources. The first source concerns sortal criteria of identity, which I describe as largely conventional. Imagining scenarios also plays a role in retrieving these criteria.

Following Sattig, I have distinguished a primitive conception of material objects from sortal criteria of identity. I shall now use this distinction to inquire into salient amendments to the modal use of imagination as described. Sortal criteria of identity limit the applicability of RECOMBINATION and MOSAIC. They impose restrictions on the spatiotemporal mosaic.

To bring out the role of sortal criteria of identity, I consider an example of Lewis’s:

‘We try to think how duplicates of things already accepted as possible—for instance, because they are actual—might be arranged to fit the description of

an alleged possibility. Having imagined various arrangements—not in complete detail, of course—we consider how they might aptly be described. If things of these kinds were arranged like this, would *that* be a world where Saul Kripke is the son of Rudolf Carnap?’ (Lewis 1986a, b, p. 114)

Lewis considers a salient way of figuring out whether Kripke could have been the son of Carnap: rearrange duplicates of Kripke and Carnap and check whether the arrangement can be described as follows: Kripke is the son of Carnap. Lewis remains highly unspecific about the use of imagination. He remains silent about what guides the arrangement and how it can be constrained such as to respect the standard Kripkean view that Kripke could not have been the son of Carnap.

Putting aside questions of duplicates and trans-world-identity, I shall present a proposal how to flesh out Lewis’s sketchy suggestion, building on the use of imagination in rearranging material objects as described. I assume that Kripke and Carnap are at least partly constituted by certain pieces of matter. Imagination can be used to rearrange matter in a way that makes the matter actually constituting Carnap stand in a causal biological relationship of parenthood to the matter actually constituting Kripke. We may also add or subtract further matter. Given the freedom of imagination in rearranging matter, this seems feasible.

To illustrate the role of sortal criteria of identity, I take Kripkean lore for granted: Kripke could not have been the son of Carnap. In order to impose suitable restrictions on RECOMBINATION, I shall avail myself of a broadly conventionalist interpretation of sortal divisions and their modal import. The minimal metaphysical commitments of the conventionalist picture are congenial to a Humean outlook.

I suggest that our concepts of objects etc. partly work like ‘cookie-cutters’ (Putnam 1988, p. 114). Just as a cookie-cutter selects certain arbitrary patterns from homogeneous stuff, concepts impose certain modal relationships on the Humean mosaic. Whatever is selected by a cookie-cutter *must* fit the shape of the cutter. Yet this is not due to some inherent modal features of the material but due to the function of the cutter to select only the material as far as it fits. To give an example: when we cannot imagine an unmarried bachelor, this is due to ‘bachelor’ carving out only unmarried men.

Conventionalist conceptions of modality have been defended by authors like Sidelle (1989), Einheuser (2011), and more recently Thomasson (2018). The Sidelle-Einheuser view in particular dovetails nicely with the versions of MOSAIC and RECOMBINATION developed so far. According to that view, our sortal concepts impose criteria of identity on ‘stuff’. Stuff is perfectly flexible. It is compatible with any sortal identity criteria whatsoever. I shall build on a corresponding understanding of the matter on which sortal identity criteria are imposed by convention. This understanding has been developed in the last section. The stuff on which sortal identity criteria are imposed is subject to MOSAIC and RECOMBINATION. Any spatiotemporally confined part of matter can be cut from its original spatiotemporal location and inserted at a different spatiotemporal location.

Sortal identity criteria impose constraints on RECOMBINATION. While the matter forming Kripke and Carnap can be arbitrarily recombined, only a smaller number of recombinations are reconcilable with preserving the particular individuals Kripke and

Carnap. The rules for using proper names like ‘Kripke’ and ‘Carnap’ may be obtained by extending the conventionalist view. Names being rigid designators, for the names ‘Kripke’ and ‘Carnap’ to apply, we have to preserve the particular beings the names actually refer to. Sortal identity criteria are relevant to determine what these beings are.

Sortal identity criteria are strongly interdependent. Our identity criteria for human beings as applied to Kripke and Carnap are related to a whole system of classifications. We think of Kripke in terms of an organism evolving continuously from one particular zygote emerging from the intercourse of certain individuals. We think of the organisms involved in terms of certain cell structures, and so on down to, say, certain matter points with their intrinsic properties. Given the limitations imposed by these classifications, a recombination which makes the matter forming Carnap stand in the causal relationship of parenthood to the matter forming Kripke is not compatible with preserving the particular beings Kripke and Carnap. Other recombinations are feasible: for instance, we may easily recombine the matter forming Kripke and Carnap and their surroundings such that Kripke becomes Carnap’s neighbour.

The account can be extended to other standard examples. A posteriori claims to necessity like ‘gold necessarily has atomic number 79’ can be accounted for by factoring them into two parts (Sidelle 1989; Thomasson 2018). First, conventions prescribe that if actually p , then necessarily so. Second, it has to be empirically settled whether p . For instance, the semantic rules for the natural kind term ‘gold’ determine the conditions for some stuff to count as gold. Anything that is gold must have a common empirically detectable deep structure. Chemistry informs us about this deep structure. We can imagine atoms of gold reconfigured such as to instantiate a different atomic number, but the semantic rules plus chemistry tell us that the resulting stuff is not gold.

In order for imagination to have a general role in modalizing, it must also serve as an arbiter on modal claims based on sortal identity criteria. This claim is in tune with many positions on conceivability or imaginability as a guide to possibility (cf. Sidelle 1989; Jackson 1998; Peacocke 1999; Ichikawa and Jarvis 2012). We should not think of conventional elements as always explicitly and knowingly imposed, and of the role of imagination as simply subject to independent knowledge imposed on it. Imagination may be implicitly shaped by processes of language acquisition in a way that resembles the way it is shaped by experience. Due to this formation, it may play an active role in retrieving sortal criteria of identity. For instance, we may have to imagine ‘fantastical, remote cases’ to settle whether an extremely refined artificial organism might count as a *cat* (cf. Jackson 1998, p. 54). I shall say more on this in Sect. (2.3).

2.1.2 The adequacy requirement

Sortal criteria of identity may be largely conventional, but they should also be adequate: our linguistic practice should pay due respect to independent information and the role of concepts in a scientifically informed world view.

The role of concepts in representing the world leads to a further qualification of the conventionalist picture. While I have compared concepts to cookie-cutters, there is an important difference. There may be restrictions on how to carve the cookie-cutters.

To appreciate these restrictions, we may again look at Hume. To Hume, our *ideas* can only serve as guides to modal truth as far as they are *adequate* (Hume 1739–1740, p. 1.2.2.1). For instance, we have adequate ideas of the mereology of space and things in space: ‘But our ideas are adequate representations of the most minute parts of extension...’ (Hume 1739–1740, p. 1.2.2.1). These ideas tell us that there can be no ultimate spatial parts.

In contemporary terms, Hume’s requirement may be put as follows: there are many things which may be settled by convention. It may be a convention that ties the identity of a person to her parents. However, to provide modal knowledge, our concepts should be adequate to any independent information about external features of the world. Thus, our conventions of forming concepts are subject to two conditions:

First, as far as we already have access to independent features of the world, our concepts should conform to them. For instance, our concept of spatial parts ought to respect their infinite divisibility.

Second, our conventions should be reconcilable with the role of concepts in our most efficient ways of theoretically representing the world. To give an example of how our concepts and our world knowledge interact, chemists seem to have taken it to be an a priori truth that acids contain oxygen until they discovered HCl, which they were willing to accept as an acid although it does not contain oxygen (Dowell 2008, pp. 31–32).

One may think of the relationship between empirical theories and convention as a reflective equilibrium. If the story about HCl is right, chemists decided to adopt a convention that tied the concept of an acid to containing oxygen. However, certain empirical discoveries which they did not reckon with revealed that such a convention is not ideal for representing the state of the art in chemistry. So chemists revamped their conventions for the concept of an acid such as to better fit the latter’s representational role. Their modal judgements changed accordingly. As we use ‘acid’, it is neither necessary nor a priori that acids contain oxygen.

The requirement of being adequate to our best ways of scientifically representing the world can be put in terms of *naturalness*. Even if MOSAIC and RECOMBINATION hold for material objects, some ways of further carving up those objects by identity criteria may be more natural than others (cf. Lewis 1983). We thus may invest them with the status of conceptual truths. For instance, we track a more natural distinction in drawing the boundaries of ‘acid’ such as to include HCl rather than to make it a conceptual requirement that acids contain oxygen. In this way, the modal truths which result from applying sortal identity criteria may acquire a metaphysical significance that goes beyond mere conventions.

2.2 Anatomizing nature: science and its metaphysics

The second main source of considerations overriding our primitive use of modal imagination are the results of science. Science may either confirm or refute MOSAIC and RECOMBINATION at a more fundamental level. They may still largely hold for our normal spatiotemporal surroundings.

The first kind of limitations imposed on my version of MOSAIC and RECOMBINATION concerned sortal criteria of identity. The second kind of limitations concerns the results of science. I have presented a *prima facie* justification of MOSAIC and RECOMBINATION by our primitive use of imagination in recombining matter. The justification is defeasible. Philosophers of science have strongly criticized Humean metaphysics as characterized by MOSAIC and RECOMBINATION. I shall present a strategy of accommodating the criticism.

We have seen that RECOMBINATION is overridden by sortal identity criteria when it comes to judging issues like whether Kripke could have been Carnap's son. In a similar vein, MOSAIC and RECOMBINATION may be overridden by scientific considerations. As proponents of 'New Hume' have emphasized, Hume sometimes grants the epistemic possibility of deep ties in nature (cf. Winkler 1991, p. 548; Hume 1757/1779, p. 29). Such ties would defeat certain modal judgements based on an unlimited practice of imaginative recombination.

There is disagreement in the literature as to how the Humean metaphysics fares with regard to fundamental physics. On the one hand, some authors insist that both are perfectly reconcilable. For instance, according to Esfeld (2014), the 'fundamental ontology' of physics reduces to matter points without intrinsic properties. For any point in spacetime, it is either occupied or not occupied by matter. The universal wavefunction supervenes on the total distribution of matter; it is a law simply in virtue of providing the best way of systematizing the total dynamics of that distribution (cf. Esfeld 2014; p. 459, Beebe 2000). There is no tie that precludes any redistribution.

The view just described accords with the primitive use of imagination as presented. With slight modifications concerning e.g. the dispensability of intrinsic properties, MOSAIC and RECOMBINATION can be extended to the whole realm of physics.⁷

On the other hand, I have already mentioned doubts as to whether fundamental physics can be reconciled with Humean metaphysics. These doubts are fueled by arguments like the following⁸: first, physical facts like quantum entanglement do not supervene on the distribution of intrinsic local properties instantiated at points in spacetime (Maudlin 2007, p. 62). Second, the laws do not supervene on a non-nomic base (Maudlin 2007, p. 67; French and McKenzie 2012, p. 55). Third, according to our best theories of quantum gravity, the world is not fundamentally spatio-temporal (Wüthrich forthcoming).⁹

If the critics are right, Humean metaphysics is in trouble. Assume the results of anatomizing nature reveal that MOSAIC and RECOMBINATION (or suitable versions thereof) cannot be upheld at the level of fundamental physics. Still there is a fallback

⁷ Esfeld more recently has espoused 'Super-Humeanism': '...the Super-Humean maintains that there are only sparse points that then are matter points with distance relations individuating these points; but neither is there an underlying space nor are there natural intrinsic properties.' (2020, p. 197) The distance relationships according to Super-Humeanism are weaker than a spatiotemporal order, which leads to a further revision of MOSAIC.

⁸ Thanks to an anonymous referee for pointing out the relevance of this debate.

⁹ In particular, Wüthrich discusses *causal set theory*: 'Causal set theory is based on the assumption that the fundamental structure is a discrete set of featureless basal events partially ordered by causality.' (Wüthrich forthcoming) As distinguished from Esfeld's Super-Humeanism, causal set theory does not seem to give rise to a revised version of MOSAIC that would do with anything close enough to a fundamental spatiotemporal order.

position for Humeans: even if MOSAIC and RECOMBINATION are defeated as general principles for describing the universe and its modal structure, they may still hold within certain limits. For instance, they may largely be true for the mid-sized pieces of matter we are acquainted with and only fail at a deeper level of reality addressed by fundamental physics. The same goes for particular modal judgements. Our judgements based on imaginative recombination may still be useful and largely reliable, for instance judgements regarding whether the table over there could be two feet to the left, or whether Kripke could have been Carnap's son. Only when it comes to physical truths that interfere with our folk theory of material objects in spacetime, our use of imagination may need to be corrected.

Science may thus correct the modal claims based on a prescientific use of imagination. On the one hand, it may impose constraints on recombination. For instance, quantum entanglement may defeat our justification to reckon certain recombinations of elementary particles possible in one sense or the other (nomologically or even metaphysically). On the other hand, science may reveal possibilities beyond recombining the spatiotemporal mosaic. For instance, a general version of MOSAIC would require that things at the fundamental level are spatiotemporal. If science reveals that they are not, it thereby reveals possibilities unattainable to RECOMBINATION. At the same time it sheds doubts on the possibility of a fundamentally spatiotemporal order.

2.3 Amending the use of imagination

For imagination to play a general role in guiding modal judgement, its more elementary use must be amended by the overriding considerations presented in the last sections. It must take on board sortal criteria of identity and the results of science.

I shall now discuss in how far the corrections of the primitive use of imagination outlined in the last sections bear on the modal use of imagination more generally. I shall begin with the constraints imposed by sortal criteria of identity.

The main concern about the modal use of imagination was that imagination is too liberal (cf. Lam 2018). Kung tells us how we can easily imagine Kripke to be the son of Carnap. Just conjure up an image of someone in your mind and add the stipulation that this is Saul Kripke, son of Rudolf Carnap. The modal use of imagination must be more restrained.

Lewis gives a hint at the lacuna that disqualifies an easy imagination of the sort considered as evidence for possibility:

‘... We can imagine the impossible, provided we do not imagine it in perfect detail and all at once. We cannot imagine the possible in perfect detail and all at once, not if it is at all complicated.’ (Lewis 1986a, b, p. 90).

According to Lewis, we can imagine the impossible by leaving out certain details. This is how we can imagine Kripke to be the son of Carnap by leaving unspecified the minutes of how this is to be achieved.

The freedom of imagination does not have to lead to modal scepticism, though. While there are easy ways of imagining Kripke to be Carnap's son, they normally cannot be expected to raise an appearance that Kripke could be Carnap's son, at least

as long as imagination functions properly in addressing the issue. For an imagination to come with such an appearance, it must meet additional criteria. One may derive a requirement of being suitably concrete from Lewis's remark. We cannot imagine the impossible in perfect detail and all at once. Yet by making our imagination suitably detailed, we can ascertain that it respects the boundary of the possible and the impossible (cf. Dohrn 2019, drawing on van Inwagen 1998). This requirement also involves respecting constraints like sortal criteria of identity.¹⁰

The additional requirements for modal imagination to be a reliable guide to modal truth can be written into a procedure of the sort I suggested for the Carnap-Lewis-example, following Lewis: we may imagine matter rearranged such as to make the matter forming Carnap stand in the relationship of parenthood to the matter forming Kripke. We may additionally label the result of the rearrangement 'Kripke, son of Carnap', and doing so might indeed count as imagining Kripke to be the son of Carnap. Yet in order to do so, we have to disregard the identity criteria that come with rigid designators. Taking into account these criteria, we become aware of additional requirements: for a redistribution of matter to constitute a situation in which Kripke and Carnap exist, the criteria of identity for these entities must be satisfied. The redistribution must preserve the actual relationships of parenthood. This is why we don't accept for any particular rearrangement of matter that it is correctly described as a situation in which Kripke is the son of Carnap.

Coming to the results of science, nature at the level addressed by fundamental physics might be continuous with the folk idea of spatiotemporally dispersed matter enshrined in our everyday use of imagination, but it might also be radically different.

Even if science rebuts MOSAIC and RECOMBINATION at the fundamental level, as far as such a rebuttal has no repercussions at other levels, our everyday modal claims remain justified. We may uphold a great many particular modal beliefs arrived at by combinatorial imagination. Presumably things at least at some emergent level are spatiotemporally structured. At that level, RECOMBINATION may defeasibly apply.

I envision a more ambitious role for imagination. Scientific results may interfere with the implicit working conditions of imagination as provided e.g. by our empirically informed 'physics engine'. Still, imagination may play a more far-reaching role even in simulating scenarios that are radically different from our macroscopic spatiotemporal surroundings, provided it is properly instructed by scientific reasoning. Even critics of Humean metaphysics like French and McKenzie accept the relevance of counterfactual scenarios for fundamental physics. While they doubt that imagination can be properly regimented such as to assess scenarios like worlds with a single particle, certain exercises of counterfactual reasoning are permissible:

'...one can still enquire into counterlegals such as what the actual world with its inventory of particles would be like if, say, the relative strength of the electromagnetic force was ten times stronger at a distance of a femtometer... Similarly,

¹⁰ Beebe presents a corresponding interpretation of Hume:

'... for each pair of ideas, we can call to the mind one without the other. But if we do call both ideas to mind and consider them under the relevant relation (greater than, darker than, congruent with) we cannot conceive of the relation failing to obtain.' (Beebe 2006, pp. 29–30)

Generalizing, we can use ideas in imagination while neglecting necessary connections among them. Yet when we attend to these connections, they limit imagination accordingly.

one can make sense of the questions physicists ask of what the world would be like if there was no Higgs mechanism...’ (French and McKenzie 2012, p. 56).

Imagination may play a role in finding and playing through such methodical variations of the actual world, just as it plays such a role for our spatiotemporal surroundings. Of course, it is to be seen whether the implicit background constraints that contribute to the informative everyday use of imagination can be suitably refined. Yet there is reason to be confident. Capacities like perceiving and reasoning can be regimented such as to adapt them to their scientific use. Following Williamson, I have described imagination as a holistic capacity of simulation, recruiting any mental capacity and any piece of knowledge. Imagination may be refined just as the capacities and information it deploys.

2.4 Combinatorialism and modal realism

The modal epistemology developed so far does not depend on assuming modal realism. Still modal realism may be abductively supported as one explanation for the truth of independently justified modal claims. It has to be weighed against alternative explanations and scientific evidence.

In this final section, I shall take a brief look at Lewis’s modal realism. According to Lewis (1986a, b), claims to possibility are made true by worlds. Worlds are causally isolated universes, maximal combinations of spatiotemporally located facts. The plurality of worlds makes MOSAIC and RECOMBINATION true. Any recombination of the Humean mosaic is true at some world. The metaphysics and epistemology developed so far do not come with a commitment to modal realism. Modal realism is not an obvious or uncontested consequence of Humean metaphysics and epistemology, but it should be taken seriously as an integral part of the most elaborate and influential Humean outlook currently on offer. My discussion is limited: I shall not take stance on modal realism as a proposal for reducing modal notions to non-modal ones.

Lewis’s combination of MOSAIC and RECOMBINATION with a commitment to modal realism has sparked epistemological criticism:

‘Modal realism makes it impossible to see why these principles of recombination, guided by imaginative experiments, should be any good whatsoever at revealing to us what is going on in these independent, spatio-temporally and causally isolated worlds.’ (Thomasson 2018)

Such criticism might apply if MOSAIC and RECOMBINATION are justified by modal realism. Yet I have pursued a very different approach, providing an independent justification of MOSAIC and RECOMBINATION by our evolutionarily useful deployment of imagination.

The *prima facie* justification of MOSAIC and RECOMBINATION does not depend on modal realism. Still MOSAIC, RECOMBINATION, and modal realism may support each other. Modal realism provides a metaphysical explanation of why MOSAIC and RECOMBINATION hold as far as they do hold. The spatiotemporal mosaic and its variegated recombinations are realized by a plurality of worlds. Each feasible complete recombination represents a world, and modal claims about the resulting constellation

of things as described are made true by that world. Yet we do not need causal contact to that world for our imagination to provide *prima facie* justification for our modal claims. Modal realism may be abductively supported by its role in explaining these independently justified modal claims. In turn, it may further support these claims, for instance by the coherence of the resulting metaphysics.

As an explanatory hypothesis, Lewisian modal realism has to compete with other explanatory hypotheses. The evidence to be explained does not merely concern particular modal claims which are independently arrived at by using imagination. It also concerns the results of empirical science. It strongly counts against the Lewisian version of modal realism if it cannot account for the structure of the world as described by the best physical theory available (cf. Maudlin 2007; Wüthrich forthcoming). Yet there may be other versions of modal realism than the Lewisian one. It remains to be seen which metaphysical framework provides the best overall explanation.

3 Summary

I set out from two challenges to modal epistemology, the Integration and the Reliability Challenge. Both can be met by a broadly Humean bottom-up approach to imagination, tempered by conventions and theory.

As for the Integration Challenge, my inquiry into the modal use of imagination realizes the Humean paradigm of proceeding from epistemology and philosophical psychology to metaphysical principles like MOSAIC and RECOMBINATION and thereby explains how we defeasibly know such principles.

As for the Reliability Challenge, I have sketched an answer to the Operational Question (how do we modalize?) by presenting an account of our use of imagination; I have sketched an answer to the Etiological Question (how did our capacities of modalizing evolve?) by telling a story of why restrained imaginative recombination is evolutionarily useful.

My answers to the Integration and the Reliability Challenge had to be refined by taking into account overriding considerations arising from sortal criteria of identity and the results of scientific inquiry. Still I think that a good part of an imagination-based Humean epistemology and metaphysics can be upheld even in light of such overriding considerations.

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