Shifts and reference

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Abstract

Maudlin's 'metric essentialist' response to the hole argument of general relativity is well-known, but differs strikingly from his response to what is often regarded as being the analogous problem in the context of Newtonian gravity (*viz.*, the possibility of a Leibnizian static shift), which centres around a certain epistemological argument. In this paper, we explicate the reasons underlying this divergence of responses. We then apply recent work from the philosophy of language in order to assess Dasgupta's arguments, centred around the notion of 'inexpressible ignorance', that Maudlin's epistemological argument given in response to the static shift is unsuccessful. Finally, we analyse how the epistemological argument plays out in the context of the gauge redundancy in electromagnetism, finding that the situation is interestingly different from the spacetime case.

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1 Introduction

Few (if any) topics in the philosophy of spacetime have received more robust study over the past thirty years than the hole argument. Recall that the target of this argument, as presented in its modern form by Earman and Norton [9], is 'manifold substantivalism'—the view that the spacetime manifold of general relativity (GR) is physically real. The argument proceeds as follows. If $\mathscr{M} := \langle M, g_{ab}, \Phi \rangle$ is a model of GR (here, M is a four-dimensional differentiable manifold, g_{ab} is a generic Lorentzian metric field obeying the Einstein equation (presented explicitly below), and Φ is a placeholder for matter fields), then so too is the model $d_*\mathscr{M} := \langle M, d_* g_{ab}, d_* \Phi \rangle$ related to $\mathscr{M}$ by a diffeomorphism d (stars indicate push-forwards); *prima facie*, these models represent different distributions of metrical and material fields over spacetime, yet nevertheless they are empirically equivalent: having fixed a representational context, no observer 'embedded' in the worlds represented by either $\mathscr{M}$ or $d_*\mathscr{M}$ would be able to tell which model truly represents the physical goings-on.[1] Thus, there arises in GR an underdetermination problem *vis-à-vis* solutions of the theory such as $\mathscr{M}$ and $d_*\mathscr{M}$, related by diffeomorphism. As Earman and Norton note, this can also be converted into a problem of indeterminism in GR: suppose that $\mathscr{M}$ and $d_*\mathscr{M}$ are identical up to some spacelike Cauchy surface Σ, but differ in some designated region (the 'hole') thereafter. Just given data on (the physical correlate of) Σ, no observer would be able to tell whether their world will evolve as per $\mathscr{M}$, or as per $d_*\mathscr{M}$—indeed, there is no fact about which of these will occur, given the dynamics of GR.[2]

Earman and Norton's solution to the hole argument is to reject the physical reality of the manifold M—in which case, one can no longer articulate the difference between the worlds represented by $\mathscr{M}$ and $d_*\mathscr{M}$, since there no longer exist manifold points to which the positions of (the physical correlates of) g_{ab} and Φ may be referred.[3] Maudlin's own response to the hole argument, first presented in [25], differs radically, for Maudlin sees the problem not as an argument for *relationism* about the manifold, but rather as

[1] Why do we write here 'having fixed a representational context'? Being isomorphic, both of $\mathscr{M}$ and $d_*\mathscr{M}$ are equally apt to represent the same possibilities. However, if one of these models is elected to represent a possible world—thereby fixing a representational context—then the other model cannot be taken to represent that world, at least within the same representational context. This being said, even within a representational context, the worlds represented by such models are (almost) invariably taken to be empirically equivalent (the only author to deny this claim, to our knowledge, is Weatherall—see [46]). For further discussion of all of these points, see [36].

[2] This second point implies, according to Earman and Norton [9], that GR is radically indeterministic. Note that this is a(n apparent) fact about GR, and can be divorced from epistemological considerations; this will be of relevance below.

[3] Of course, a positive metaphysical picture of a general relativistic world in which the reality of the manifold is denied has yet to be offered: see [8, ch. 9] for one attempt to do this, which makes appeal to 'Einstein algebras'.

an argument for a particular form of *substantivalism*. On Maudlin's 'metric essentialist' view, we are to reject the possibility of all but one of the worlds represented by the elements of the class of models of GR related by a hole diffeomorphism—because the manifold of GR is taken to have its metrical properties *essentially*. If only one of these worlds is possible, then the hole argument is blocked, in both its underdetermination and indeterminism forms.[4]

All of this is well-known. What is also known is that Maudlin embraces a *different* solution to what is often regarded as a parallel problem in the context of Newtonian gravitation theory—*viz*., the static shift. Recall that, if $\mathscr{N} := \langle M, t_{ab}, h^{ab}, \nabla, \varphi, \rho \rangle$ is a model of Newtonian gravitation theory set in Galilean spacetime (NGT) (here, t_{ab} and h^{ab} are fixed temporal and spatial (degenerate) metric fields on M of respective signatures $(1,0,0,0)$ and $(0,1,1,1)$; ∇ is a derivative operator on M compatible with t_{ab} and h^{ab}; and φ and ρ are real scalar fields on M which represent, respectively, the gravitational potential and matter density—for more details, see [22, ch. 4]), then so too is $d_*\mathscr{N} := \langle M, t_{ab}, h^{ab}, \nabla, d_*\varphi, d_*\rho \rangle$, in which d is a diffemorphism implementing the displacement of the matter content of the universe by a certain vector from its position in $\mathscr{N}$ (again, here we have fixed a representational context).[5] For example, if $\mathscr{N}$ represents the centre of mass of the universe as being located *here*, then $d_*\mathscr{N}$ represents the centre of mass of the universe as being located (e.g.) *five metres to the left of here*. Again, the static shift is often taken to lead to a problem of underdetermination: no observer 'embedded' in the worlds represented by either $\mathscr{N}$ or $d_*\mathscr{N}$ would be able to tell which model truly represents their world.

In response to the static shift, Maudlin writes the following:

> If Clarke is right, the material universe *could have been* located elsewhere in absolute space—that is, located some other place than it is, keeping all the relative positions the same. But we do not need to make any observation to know that this did not

[4] In fact, the situation is more subtle, in light of a critique of Maudlin's metric essentialism due to Norton [30]. Norton's challenge is to identify *which* of a class of isomorphic models can represent a possibility—why *this particular model*, and how can we distinguish this model from an 'imposter'? We endorse Pooley's response to Norton:

> Abstracting from the pragmatics of representation, all isomorphic models *are* equally suited to represent the same spacetime. But, in practical situations, some model or other will be singled out, normally *quite arbitrarily*, to represent a physical possibility. The advocate of [Maudlin's position] claims only that, *relative* to such a choice of one model, the others must be viewed either as representing impossible worlds (*per* the haecceitist essentialist) or as representing nothing at all (*per* the anti-haecceitist). [33, p. 101]

[5] Since $\mathscr{N}$ and $d_*\mathscr{N}$ are isomorphic, the same points as articulated in footnote 1 apply in this case.

> *actually* happen: by hypothesis, the other placement of matter is counterfactual. [27, p. 46]

Maudlin is here stating that the force of the static shift can be blunted by appeal to a particular *epistemological* argument: I *know* that I am *here*, not five metres to the left of here. Thus, the static shift does not lead to a genuine problem of underdetermination.

This response to the static shift on Maudlin's part is strikingly different from his response to the hole argument. The first central aim of this paper, addressed in §2, is to consider this argument in detail, as Maudlin presents it. That achieved, we then seek in §3 to identify the reasons for which Maudlin offers a different response to the hole argument than to the static shift. In §4, we address Dasgupta's critiques of this argument, which are based around a notion of 'inexpressible ignorance', and dissect said critiques using resources from the philosophy of language. Finally, in §5, we explore how these responses play out in a structurally similar case—namely, the interpretation of gauge transformations in electromagnetism; we find that the situation is interestingly different in that context. This paper has an appendix, in which we provide a short history of the response which Maudlin offers to the static shift.

2 Spatial and temporal static shifts

It is worth dwelling on the exact nature and form of Maudlin's epistemological argument regarding the static shift in NGT. Here is how he puts the point in an earlier paper:

> Various positional states of the universe as a whole are possible: It could be created so my desk is *here*, or three meters north of here, or 888 meters from here in the direction from Earth to Betelgeuse, and so on. Which is the *actual* state of the world? Now the answer is easy: In its actual state, my desk is here, not three meters north or anywhere else. [24, p. 190]

An alternative way to put Maudlin's point is the following: What *exactly* does the spatial static shift suggest that we are ignorant of? I *know*—*qua* observer 'embedded' in the world represented by the relevant Newtonian model—that I am *here*, not three metres to the north of here or anywhere else. Indeed, as Maudlin points out, the specification of any shifted scenario will always be such so as to determine antecedently whether such a scenario is actual or not. As he writes:

> [O]ne finds that the static shift does not result in an indistinguishable state of affairs, nor does it imply that there are any real but empirically undeterminable spatiotemporal facts about the world. The world described by the shift may be *qualitatively* indistinguishable from the actual world in the sense that

> no purely qualitative predicate is true of the one which is false of the other. But we have more than purely qualitative vocabulary to describe the actual world; we have, for example, the indexicals, without which the Leibniz shift cannot be described. [24, p. 190]

Maudlin's point is an interesting and important one. In particular, it suggests that, in the case of models of NGT related by a Leibnizian static shift, no substantive epistemological problem would arise *even if we assumed that such models represent physically distinct (but empirically indistinguishable) scenarios*. By extension—and as we discuss below—in the case of models of GR related by a hole diffeomorphism in the underdetermination version of the problem, a substantive epistemological problem should also be avoidable. (The question of whether Maudlin's argument suffices to overcome any epistemological challenge presented by the hole argument in its indeterminism form is more delicate, but will also be addressed below.)

So far, we have considered just *spatial* static shifts—but, of course, in NGT *temporal* static shifts are also possible—these involve a global, time-independent repositioning of the world's matter content *in time*. For instance, a temporal shift might move the world's entire material content three seconds to the future of where it actually happens to be in absolute time. By analogy with the spatial static shift, one might be led to infer that Maudlin's point would, again, be that such a shift also generates no genuine epistemological problem, for similar reasons to those discussed previously. (For instance: is the present time *now*, or three seconds to the future of now?) However, the reasons Maudlin adduces for thinking that temporally shifted scenarios generate no epistemological problem appear to be crucially distinct from those adduced in the case of the spatial static shift:

> A universe created 15 billion years ago is observationally distinguishable from one just like it (i.e., having a qualitatively identical total history) which began within the last four minutes. Things would look *awfully* different if the big bang had occurred in the last half hour. [24, p. 190]

Maudlin, it seems, is not merely claiming that the temporal shift generates no *epistemological* problem for any Newtonian observer. Rather, he is claiming that such worlds are straightforwardly *empirically* distinct: intuitively, things would *not* look and feel and taste and sound and smell the same for any observer in the two shifted scenarios. ("Things would look *awfully* different if the big bang had occurred in the last half hour.")

One might read Maudlin as having made a straightforward mistake here: *in enacting the temporal shift, he has forgotten to shift the observer*. In enacting the spatial static shift, recall, Maudlin's point—at least as we interpret it—was not that everything would "look *awfully* different" if everything was moved three metres due north. It was that, *in spite* of things looking awfully *similar*—the worlds being, in a simple and intuitive sense, empirically

indistinguishable—no genuine *epistemological* problem is generated (even if we regard such shifted scenarios as being genuinely physically distinct). Indeed, it is straightforward to recognise that if *everything else* were shifted three metres due North, but *I* remained fixed, things would tend to be noticeably different. (My desk, for instance, would be three metres further away from me.) But to understand static shifts in this fashion is to misconstrue their nature.[6]

In fairness to Maudlin, he immediately goes on to note:

> Of course, if the big bang had occurred four minutes ago then in another 15 billion years there might be someone who looks just like me writing a sentence that looks just like this. But that person would have no difficulty determining that he is not alive *now*, just as I have no difficulty knowing that I will not be alive *then*. And though he would produce the same characters and phonemes as I, the indexicals in his language would guarantee that his utterances would not mean the same thing as mine. [24, p. 190]

Understood in *this* way, the analogy with the spatial static shift—suitably construed, so as to involve a shift of the relevant observer—is straightforward. That is, Maudlin's point (again) is, or at least seems to be, that neither observer, in the temporal shift or spatial static shift case, would face any genuine epistemological problem ("Is this time *now*? Am I located *here*?"), in spite of the observational indistinguishability of their respective situations.[7]

Ultimately, all of this is to say that one must be careful in how one formulates the epistemological argument—for while this argument (if success-

[6] See [34, p. 80] for a similar analysis (cf. also [36]). We are in full agreement with Pooley when he writes the following of Maudlin's argument in the case of the temporal static shift:

> Now this is not quite right. If we hear the counterfactual "things would look awfully different if the big bang had occurred four minutes ago" as true, this is because the time at which we place ourselves in the counterfactual scenario is now. Things would indeed look awfully different if we could but exist in such conditions to make any observations. But this counterfactual scenario is not the one that the static shift asks us to consider. In another billion years there is "someone who looks just like me writing a sentence that looks just like this" because, in the appropriately Leibniz-Shifted world, that's where I am temporally located. Had the world been as the shift scenario describes, things would have seemed to me to be just the same. [34, p. 80]

[7] All notions of observational indistingiuishability in the foregoing are 'immanent': they are associated to 'how things look' for an observer embedded in a world. There is also a 'transcendental' notion of observational equivalence, which is associated to field values at spacetime points (different field values at the same point in different models being associated to transcendental observational distinguishability). By introducing this distinction, one can, perhaps, argue that Maudlin is making use of the transcendental notion of observational equivalence in the first of the above passages on temporal static shifts—but would agree that the models remain immanently observationally indistinguishable. For more on these two notions of observational distinguishability, see [36].

ful) *does* afford a means of identifying which of a class of statically-shifted worlds is one's own, it does *not* render those worlds *empirically distinguishable* for an observer embedded in the world, as Maudlin might be read as suggesting in the case of the temporal static shift. There is some evidence that other authors do commit this mistake—for example, in a footnote to his recent paper on the hole argument, Weatherall writes in the context of the hole argument in GR (in its underdetermination form) that

> if one has an observer at a given point p, the situation where the metric at p is g_{ab} and the metric at that point is $\tilde{g}_{ab}$ will in general be distinguishable—for instance, in one case, one might be happily working at one's desk; and in the other, plummeting into a black hole. [46, p. 336, fn. 20]

Whether (as with Maudlin) such a reading is truly fair to Weatherall requires more detailed discussion—for which we refer the reader to [36]. The only point which we wish to register here is that there is a natural sense in which Weatherall *could* be read as making the same mistake that one might attribute to Maudlin, in the case of the temporal static shift.

3 Static shifts and holes

In the previous section, we explored Maudlin's epistemological argument, given in the case of the (spatial) static shift in NGT. Our purpose in this section is to explicate (one potential—and we think plausible—reconstruction of) why Maudlin offers a *different* response to the static shift in NGT than to the hole argument in GR.

The central dynamical equation of general relativity is the Einstein equation,

$$G_{ab} = 8\pi T_{ab}, \tag{1}$$

where G_{ab} is the Einstein tensor (ultimately a complicated expression in the metric field g_{ab} and its derivatives, assuming metric compatibility), and T_{ab} is the stress-energy tensor associated with the matter fields Φ in the solution of the theory under consideration. (Ultimately, T_{ab} is some complicated expression in terms of the Φ and the metric field g_{ab} and their derivatives—see [21].) Famously, this equation is *diffeomorphism invariant*: arbitrary diffeomorphisms take solutions to solutions. (For a precise contemporary discussion of diffeomorphism invariance and its relation to general covariance, see [35].)

The analogous dynamical equation of NGT is the Newton-Poisson equation,

$$h^{ab}\nabla_a\nabla_b\varphi = 4\pi\rho. \tag{2}$$

Unlike (1), (2) is not diffeomorphism invariant—acting on (2) with a diffeomorphism associated with an affine transformation, for example, one finds

that solutionhood is preserved only when the condition

$$d_* h^{ab} = h^{ab} \tag{3}$$

is satisfied (note that, in deriving this result, we do not transform the fixed fields—cf. [35]); that is, solutionhood is only retained when an affine transformation corresponds to a global *Galilean transformation*. (In addition to rigid Galilean transformations, (2) is also invariant under a richer class of time-dependent transformations; this will be of relevance below.) Invariance of (2) under Galilean transformations is related to the *kinematic shift* problem in Newtonian gravitation: while kinematically-shifted solutions are physically distinct in Newtonian mechanics set in Newtonian spacetime, due to this spacetime setting having extra structure (namely, a fixed vector field σ^a, representing facts about the persistence over time of points of absolute space) with respect to which these kinematic shifts are referred, such is *not* the case for Newtonian mechanics set in Galilean spacetime (i.e., what we are calling 'NGT'), in which this extra structure has been excised.[8]

In this paper, our central concern is with a *different* class of transformations under which (2) is invariant—namely, the static shifts introduced in §1. There is a sense in which static shifts in NGT are analogous to hole diffeomorphisms: in both cases, solutions related by the diffeomorphism under consideration are isomorphic. However, it is also important to stress a clear difference between the two transformations: in GR, hole diffeomorphisms (in the indeterminism version of the problem) act non-trivially only to the future of the spacelike hypersurface Σ; by contrast, static shifts in NGT are rigid: they act in the same way on all manifold points. There is no NGT analogue of a shift (i) entirely to the future of Σ, such that (ii) the shifted models are isomorphic.

This point is crucial in accounting for why Maudlin addresses the static shift via an epistemological argument (of the kind we have witnessed above), yet addresses the hole argument via metric essentialism. We will very shortly give this account; however, before doing so, it will be illuminating to first present a natural candidate answer to this question—which, for reasons we will explain, is in fact specious. This candidate answer runs as follows: while the epistemological argument is sufficient to address the static shift, and *also* the underdetermination problem in the case of the hole argument, it is insufficient to address the indeterminism problem in the case of the hole argument. The reason is that the worlds under consideration in the latter case are identical up to (the physical correlate of) Σ, but differ thereafter. In this case, any claim that the observer *just knows* that she is *here* is insufficient to determine the exact manner in which one's world will evolve to the future.

This candidate answer is specious for the following reason. As already discussed above, in the case of the hole argument, one has a class of models related by hole diffeomorphisms; supposing that one selects one such

[8]Here, we are assuming for the sake of simplicity an anti-haecceitist ontology of spacetime points.

model to represent the actual world, one knows immediately that all the other worlds represent merely counterfactual possibilities. Crucially, such models are *complete*: they are models of the entire physical world, including regions to the future of (the physical correlate of) Σ. Suppose that the model is specified concretely via a coordinatisation of the manifold and an expression of the metric and matter fields in the given coordinate system. Then, one has a name for every point (the quadruple of its coordinates) and the values of the fields at every point. So, one knows precisely and uniquely how one's world will evolve in the future—contrary to the line of argument given above.

So why, then, *does* Maudlin embrace a different response to the hole argument as compared with the static shift? The true answer to this question has nothing to do with epistemology—for, as we have just seen, one *can* know how one's world will evolve to the future of (the physical correlate of) Σ. Rather, the issue this: the hole argument generates a problem of (radical!) indeterminism for GR: given (the history associated with) hole-diffeomorphic solutions of GR up to Σ, the theory (it seems) simply does not adjudicate on which of the relevant class of possible worlds will be realised. This problem of indeterminism—which, recall, does not arise in the Newtonian case—is not resolved merely by noting that once we have stipulated which model represents our actual world, we no longer have an epistemic problem concerning our world's future development (cf. [36, fn. 8]).[9]

Since the epistemological argument is, therefore, insufficient to resolve the indeterminism problem in the case of the hole argument, Maudlin must recourse to a different tactic. Enter metric essentialism. And since, having introduced metric essentialism, it turns out that this can *also* answer the underdetermination problem in the case of the hole argument, Maudlin (we take it) embraces this solution *tout court*.[10] Ultimately, then, Maudlin's reasons for endorsing different solutions to the static shift versus to the hole argument seem to us to be ones of modesty: while the epistemological argument suffices in the former case since there no indeterminism problem arises, in the case of the hole argument, on the other hand, the indeterminism problem calls for a different solution—*viz*., metric essentialism (for Maudlin, at least!)—which one then notices can be applied to *both* versions of the hole

[9] We thank Carl Hoefer for very clarifying remarks on this and the previous paragraph.

[10] It is worth noting that metric essentialism will not work as a solution to the static shift problem in NGT, for in this theory the geometrical structure of Galilean spacetime is *fixed*, and only the matter content is altered on implementing a static shift. An obvious response here would be to appeal to a generalisation of metric essentialism—e.g. (i) 'matter density essentialism', according to which manifold points have essentially their matter density values given by ρ, or (ii) 'gravitational potential essentialism', according to which manifold points have essentially their gravitational potential values given by φ. Whether such views have the same kinds of virtues that Maudlin adduces for metric essentialism in [25] is, however, unclear. (One way to motivate (ii) might be to argue that, given Knox's 'spacetime functionalism'—see [19], and [38] for relevant discussion—φ is best understood as part of the spatiotemporal content of the world.) Cf. also 'gauge essentialism', discussed in §5 below.

argument, and which Maudlin therefore embraces *tout court* in that context.

There are two final observations to be made on these matters. Against Stachel's point that there is no analogue of the indeterminism version of the hole argument in the case of NGT (see [40, p. 152]), Saunders points out that one can use the invariance of (2) under arbitrary non-rotating accelerative transformations in order to generate a Newtonian version of the hole argument: let the acceleration associated with this transformation be trivial up to Σ, and non-trivial thereafter [39, §1].[11] In this case, for the reasons already explained, metric essentialism does not suffice to resolve the problem, for only the material content of the universe is shifted. In addition, the epistemological argument also does not suffice to resolve the challenge, for just as with e.g. the kinematic shift, the models related by the transformation are not isomorphic; the worlds represented by them differ more than merely haecceitistically (more on this below).

The second observation is this. Consider NGT set in Galilean spacetime (as opposed to NGT set in Newtonian spacetime, which was the case considered by Maudlin). In this case, the notion of the absolute velocity of objects in spacetime remains meaningful (in the sense that the idealised one-dimensional timelike paths through the spacetime representing the trajectories of material bodies still have tangent vectors), but there is no sense in which objects have *this* absolute velocity rather than *that* absolute velocity (this is part of the import of 'sophistication' about symmetries: see [7, 17, 23]). In this case, one might argue that, just as one is able to identify indexically one's position in the case of the static shift in NGT set in Newtonian spacetime, so too is one able to identify indexically one's *velocity* in the case of the kinematic shift in NGT set in Galilean spacetime. (Question: What is my absolute velocity? Answer: *This* one; my absolute velocity could not have been otherwise.) Assuming that there is no disanalogy between position and velocity *vis-à-vis* our ability to make reference to these quantities (on the issue of reference, see the following section), we concur with this verdict.[12,13]

[11] Saunders' argument is anticipated by Stein in [41]; for discussion of Stein on this matter, see [8, p. 55].

[12] Our thanks to Richard Healey for discussions on the content of this paragraph.

[13] In footnote 35 below, we suggest that a sufficiently strong liberal about reference and singular thought (on this liberalism, see below) may be able to refer to their absolute velocity, even in the case of NGT set in Newtonian spacetime. Note also that it may be possible to secure reference to one's absolute velocity by associating a name with a definite description (e.g.: 'Let k stand for my worldline's tangent vector right now.'), rather than by using exclusively indexicals: for more on this possibility, see our discussion on Maudlin's epistemological argument presented in §4.1.3. (Such securing of reference should be possible both in the case of NGT set in Newtonian spacetime and NGT set in Galilean spacetime—though, of course, there would remain something of which of is ignorant in the former case: namely, the magnitude of one's absolute velocity.) Our thanks to Carl Hoefer for discussion on this point.

4 Responses to the epistemological argument

In this section, we address two critical reactions to the above epistemological argument, both due to Dasgupta [3, 4, 5]. The first regards the notion of 'inexpressible ignorance' (§4.1); the second regards the idea of 'God's favourite point' (§4.2). We argue that the second of these responses to the epistemological argument is straightforwardly unsuccessful; the first of these responses is also unsuccessful, albeit for more nuanced reasons.

4.1 Inexpressible ignorance

Dasgupta's response to Maudlin's epistemological argument spans three papers: 'The Bare Necessities' [3], 'Substantivalism vs Relationalism About Space in Classical Physics' [4], and 'Inexpressible Ignorance' [5]. Over the course of these papers, Dasgupta develops gradually his response to Maudlin based upon the notion of inexpressible ignorance. In this subsection, we track this evolution: §4.1.1 deals with his two earlier papers, which follow Maudlin closely; §4.1.2 analyses [5] and its apparent divergence from Maudlin; finally, §4.1.3 suggests an alternative means of bolstering this particular response to Maudlin offered by Dasgupta (albeit one which we also ultimately find to be problematic).

4.1.1 'The Bare Necessities' and 'Substantivalism vs Relationalism About Space': Dasgupta's initial reactions

In the earliest of the three above-mentioned papers, 'The Bare Necessities' [3], Dasgupta presents the following reconstruction of Maudlin's epistemological argument:

> In the case of velocity, we can ask the question 'Am I in a state of absolute rest or a state of uniform motion?'... Maudlin's observation is that in the case of location there is no analogous question: given the resources we have by which to ask the question of where we are in Newtonian space, the only questions we can ask are questions we can readily settle. The point might be put like this. Call a question about our absolute location or velocity *open* if it cannot be reliably answered by verifying facts about the relative positions or relative velocities of material bodies. Then Maudlin's point is that we have the conceptual resources to ask an open question about or [*sic*] velocity through Newtonian space but not about our location in Newtonian space. [3, p. 145-146]

While Maudlin focuses on the fact that we can give *answers* to questions regarding our positions in Newtonian absolute space, and so according to him we are not ignorant about such matters, Dasgupta is concerned with the form

of the *question*. He claims that we are unable to formulate an open question regarding the static shift, and instead suggests reversing Maudlin's above reasoning, to argue that not only are we ignorant of such matters, but, moreover, "we cannot even express what it is that we cannot detect" [3, p. 146].

We find Dasgupta's interpretation of Maudlin through the lens of open questions to be problematic: Maudlin does not appeal to "facts about the relative positions or relative velocities of material bodies"; he uses indexicals to refer directly to absolute spacetime points, hence answering the question. Even granting that his characterisation of Maudlin is correct, given Dasgupta's definition that "a question about our absolute location or velocity" is "open if it cannot be reliably answered by verifying facts about the relative positions or relative velocities of material bodies", is it not in fact a *positive quality* that we have a closed question? Maudlin would likely see a closed question as simply a question that can be answered successfully, hence removing ignorance from the picture. As Perry contends, Dasgupta must "provide some reason to believe there's inexpressible, in-principle ignorance *in this particular case*" [32, p. 233] in order to motivate his reversal of Maudlin's argument, without which the closed question about our position in space appears satisfactory as a resolution to the epistemological problem presented by static shift scenarios.

In 'Substantivalism vs Relationalism About Space' [4], Dasgupta follows a similar line of reasoning to his first paper, though in a more refined manner. There, he reconstructs Maudlin's argument as follows:[14]

> (1) We cannot formulate an unanswerable question about where we are in Galilean space-time.
>
> (2) Therefore, we can know where we are in Galilean space-time. [4, p. 619]

Dasgupta disputes (2), preferring to argue that,

> ...(1) is true because of our expressive limitations. On this view, (1) is true not because we can know where we are in Galilean space-time, but because we lack the capacity to refer to regions of space-time in a way that would allow us to formulate an unanswerable question. [4, p. 619]

Before investigating Dasgupta's motivations for reversing Maudlin's reasoning, we note that there is a particular change of terminology from Dasgupta's previous paper which mandates further scrutiny: his foregoing of the terminology of 'open questions' in favour of the terminology of 'unanswerable questions'. If one assimilates the latter to the former, then our above criticisms of the concept of open questions still stand. Let us grant, though, that there is a difference in the two notions. Recalling Dasgupta's definition of an open question in the context of the static shifts, we would remark

[14] Although Dasgupta, in the following, focuses upon NGT set in Galilean spacetime, identical issues would arise in the case of NGT set in Newtonian spacetime.

that even if "a question about our absolute location or velocity ... cannot be reliably answered by verifying facts about the relative positions or relative velocities of material bodies" [3, p. 146], and so is open on Dasgupta's definition, there might nevertheless remain *in principle* possibilities for answering such a question. This, perhaps, motivates Dasgupta's move from 'open questions' to 'unanswerable questions'. In the ensuing, we will follow Dasgutpa's lead in focusing on the latter.[15]

We consider now two different responses to Maudlin's epistemological argument offered by Dasgupta, which make use of the notion of an 'unanswerable question'.[16] The first of these motivations is found in 'The Bare Necessities':

> ... when one remembers that there are uncountably many shifted worlds that would all look and feel and taste exactly the same as the actual world, there is a clear feeling that our location in space is therefore in some sense beyond our epistemic grasp. And (speaking for myself) this feeling is not dissipated by being told that one cannot formulate an unanswerable question about one's position in space. [3, p. 146]

This is representative of what we imagine to be a widespread initial reaction to Maudlin, but it is inadequate on deeper consideration. According to Maudlin, we *can* refer to spacetime points using indexicals, such that they are indeed within our epistemic grasp, and therefore cannot lead to ignorance.[17]

The second motivation is found in 'Substantivalism and Relationalism About Space', and is (in our view) even less convincing:

> ... the argument that we are ignorant of location was exactly the same as the argument that we are ignorant of velocity. In both cases, there are infinitely many boosted or shifted worlds that look and smell and taste and feel exactly alike, and so are indiscernible in that sense. Why then should the situation be any different in the case of location than velocity? Why, just because I cannot formulate an unanswerable question about my location, should it follow that I am not ignorant at all? [4, p. 619]

Maudlin's entire argument is that the structure of the static shift argument is *in fact different* from the kinematic shift, due to the difference in our referential capabilities towards velocities and positions; Dasgupta simply appears to be begging the question here.

[15] Dasgupta's vacillation between 'open' and 'unanswerable' at [3, pp. 146-147] is unfortunate; nevertheless, his wholesale bypassing of 'open' in [4] suggests that our above reading is reasonable.

[16] Dasgupta in fact offers a third, slightly distinct motivation that we term the 'God's favourite point' argument. This argument is analysed and refuted in §4.2.

[17] Maudlin makes unspoken assumptions regarding indexicals in order to formulate this position; we discuss this in further detail in §4.1.3.

Overall, then, these papers do not present a compelling motivation for a shift towards Dasgupta's perspective. In fact, the situation reduces to two different attitudes towards interpreting the case at hand, aligning with the authors' desired result in the case of the static shift. To Dasgupta, one *cannot* formulate an unanswerable question; to Maudlin, one is *able* to give an answer to the question. As Perry notes, the burden should remain with Dasgupta to articulate a reason why it is problematic not to have an unanswerable question, or what has gone wrong with Maudlin's question (or answer) in the first place. Nevertheless, Dasgupta's approach suggests a subtle issue with Maudlin's account: the latter does not consider whether the *nature* of the question used to interrogate our absolute position will affect his argument, and simply (and somewhat uncritically) presents the answer making appeal to indexicals. Given this opportunity for criticism, an alternative approach to critiquing Maudlin will be presented in §4.1.3. To formulate this approach, however, we must first analyse Dasgupta's third paper on the subject.

4.1.2 'Inexpressible Ignorance': divergence from Maudlin

We now move on to consider 'Inexpressible Ignorance', which, as the title suggests, is the most direct exposition of Dasgupta's notion of inexpressible ignorance. We contend, however, that this paper constitutes a greater departure from Maudlin's original argument than the two articles considered up to this point. To understand this divergence, it is crucial to refer to a passage in 'Substantivalism vs Relationalism About Space' in which Dasgupta concludes that the conclusion of Maudlin's argument does not follow:

> To the contrary, I would appear to have two cognitive failings: a failure to know, and a failure to be able to ask a certain kind of question. Maudlin's view has the bizarre consequence that this double failure amounts to a success!
>
> To defend his view, Maudlin might appeal to a general principle to the effect that one is ignorant about some topic if and only if one can formulate a question about it that one does not know the answer to. Call this the principle that all ignorance is expressible. ... But I think that the principle is false. [4, p. 619-620]

Curiously, Dasgupta portrays in 'Inexpressible Ignorance' this "principle that all ignorance is expressible" as having originated with Maudlin. Below is his reconstruction of Maudlin in that paper:

> Grant that our (supposed) ignorance about position in Newtonian space is inexpressible in this sense. That is the first part of Maudlin's view, and I agree with it. Turn now to his second claim, that *ignorance is always expressible ...* .
>
> Maudlin gave no argument for this second claim. And it is, on the face of it, most implausible. There are (remember) infinitely many shifted worlds that differ with regard to where we are in

> Newtonian space, all of which look *exactly* the same. In the case of velocity, this kind of proliferation of indiscernible possibilities suggested that I am ignorant. Why is the situation any different in the case of position? Why, just because I cannot express my ignorance, should it follow that I am not ignorant at all? Indeed, in the case of position, I appear to have *two* cognitive failings: a failure to know, and a failure to express that ignorance. Maudlin's view has the bizarre consequence that this *double* failure amounts to no failure at all! [5, p. 446]

It seems to us that Dasgupta's response here is unsuccessful, for he has not characterised accurately Maudlin's argument. It is peculiar that, having presented a particular solution to the problem at hand (a solution which is, as Dasgupta notes, hardly defensible in its generality), Dasgupta simply attributes this view to Maudlin. Given that Maudlin never mentions in [24] the notion of inexpressibility, there are two different possible readings of his work on these issues. We argue in this subsection that the latter of these two readings is more plausible—and that, on this reading, Dasgupta's response to Maudlin in this paper fails, if certain philosophical commitments underlying Maudlin's response can be defended successfully.

Reading 1: Statically shifted worlds are distinct, and there is inexpressible ignorance in the case of static shifts, but nevertheless these shifts do not generate an epistemological challenge.[18]

We have already seen that Maudlin regards statically shifted worlds as being distinct. On this first reading of Maudlin, undergirding this difference between such shifted worlds is that there are facts—facts of which we are inexpressibly ignorant—regarding the natures of spacetime points. Thus, on this reading, Maudlin accepts the first of Dasgupta's two premises in his reconstruction of Maudlin's argument in the above quotation: that there is inexpressible ignorance. However, Maudlin (on this reading) denies Dasgupta's second premise in his reconstruction of Maudlin's argument: that ignorance is always expressible. Rather, he maintains (on this reading) that there *can* be cases of inexpressible ignorance, but denies that these always need lead to epistemological problems such as identifying which of a class of statically shifted worlds is one's own. On this reading, Maudlin maintains that there *is* inexpressible ignorance, but nevertheless deploys the above-mentioned indexical argument to state that he *knows* which of these worlds is one's own. The point is that this knowledge regarding these identity of one's world does not necessarily presuppose knowledge of the facts about spacetime points of

[18]Regarding this reading, one might reasonably ask: 'how can there be inexpressible *ignorance*, yet no epistemological challenge?' The point is that one might be (inexpressibly) ignorant of *something*, and yet still (by hook or by crook) be able to identify which of a class of world's is one's own (said ignorance notwithstanding). In virtue of this latter ability, there is (in the sense in which we intend the notion here) no epistemological challenge posed—though, of course, there are still epistemological challenges *tout court*.

which one is inexpressibly ignorant.

Ultimately, we do not think that this reading of Maudlin is stable. However, in order to articulate our reasons for thinking this, we should first introduce our second possible reading of Maudlin: this will require a more detailed discussion.

Reading 2: Statically shifted worlds are distinct, but there is no inexpressible ignorance in the case of static shifts, so these shifts do not generate an epistemological challenge.

On this reading of Maudlin, he denies the first of Dasgupta's above two premises: in spite of the statically shifted worlds being distinct, there is *no* inexpressible ignorance here regarding spacetime points. Rather, on this reading, Maudlin's point is that *there is no fact about which we are ignorant, and nothing is inexpressible*.[19] This reading is supported by (i) Maudlin's writing that "[t]o even formulate the appropriate question in the static case one must indexically pick out a spatiotemporal location" [27, p. 190], (ii) his subsequently stating that "[f]or the substantivalist, terms such as "here" or "now" can be used to drive linguistic pegs into the fabric of absolute space and time. Without such pegs, the static Leibniz shift cannot even be formulated" [27, p. 191], and (iii) his arguing that precisely this "... linguistic wherewithal needed to establish the coordinates also provides us the means of answering the question ..." of one's absolute position [27, p. 191]. On this reading, there is no ignorance in the first place, because the tools we use to pose the question of our position in Newtonian space—indexicals—are precisely those that can be used to answer the question.

Now, of course, in response to this, there is room for Dasgupta simply to deny that the use of indexicals can provide all answers to questions regarding one's position in Newtonian space. Indeed, Dasgupta presents an account of inexpressible ignorance according to which this phenomenon can arise with respect to some entity when one is (a) not acquainted with that object (*nota bene*: Dasgupta does not proffer an analysis of acquaintance—see [3, p. 464]), or (b) does not know the 'full essence' of that object [3, p. 464].[20] Dasgupta then argues that, if we want there to be inexpressible ignorance in the case of static shifts, we had better buy into this account of inexpressible ignorance (which, he claims, is superior to all extant alternatives—see [3, §§2-3]), but then we see that (a) and (b) do indeed fail, so (*pace* this current reading of Maudlin) there is inexpressible ignorance here.

In response to this, one can take the bull by the horns: even accepting this analysis of the origins of inexpressible ignorance, it is not clear that this is indeed inexpressible ignorance in the case of the static shift. There are two

[19]To clarify, it is that nothing is inexpressible in this *particular* case; while this reading is predicated on rejecting the first premise, we remain sceptical that the second premise (that all ignorance is expressible) would be endorsed by Maudlin in full generality.

[20]See [3, p. 462] for Dasgupta's definition of 'full essence', which builds upon a broadly Finean notion of essence—see [11].

ways to do this: deny (b), or deny (a). On denying (b): one might simply object to the heavy-duty metaphysics of essences.[21] However, given Maudlin's own commitment to spacetime points' having essential properties—as made clear in his metric essentialist response to the hole argument—it is not obvious that this response is available to him. On denying (a), there is room to do this, although it will depend upon the particular analysis of acquaintance which one endorses.

Perhaps a more effective response to Dasgupta than either denying (b) or denying (a), however, is to question the appropriateness of Dasgupta's approach to inexpressible ignorance to begin with. Suppose, in particular, that one adopts the 'liberalism about reference and singular thought' defended by Hawthorne and Manley [13], according to which acquaintance is *not* necessary in order to make reference to a given entity. Witness, for example, the following passage:

> Suppose John and David are talking on the telephone, and David says 'It's raining' in a way that makes it clear he is talking about rain at his own location. Suppose further that John's grasp on David's location is very 'thin': he knows only that it is the place David is currently in, but not under various paradigmatic guises—he cannot see it or point it out on a map, and he does not know any proper name for it. Moreover, because the acceptability of 'knowing where' reports require that John grasp the location under the guise salient in the context, he may not count as knowing where David is, or as knowing which location is supplied by context. But liberals about singular thought have no reason to deny that John can think about David's location, and thus no reason to deny that he is capable of grasping the proposition David expressed, understanding what he said, and so on. In this respect, it is just as though David had used an indexical or a newly introduced name to refer to his location. [13, p. 137]

The point is that, given liberalism about singular thought, indexicals and other contextually-specified information are perfectly sufficient to make reference to spatial locations. Thus, Dasgupta's conception of inexpressible ignorance (as presented at this point in his paper) seems, one might say, to rest on a neo-Russellian notion of reference-by-acquaintance which one might reasonably reject (cf. [3, p. 464]). (We discuss further below whether there is any sense in which the notion of inexpressible ignorance might be taken to be consistent with liberalism about reference and singular thought.)

4.1.3 Kaplan's account of indexicals: an alternative attack

Despite all this, there is a possibility of salvaging Dasgupta's account; even if one accepts the above liberalism about reference and singular thought, it ap-

[21] There is, indeed, a precedent for such objections in the literature: see e.g. [42, 47].

pears possible to critique Maudlin's invocation of indexicals in his argument, which relies on several unspoken assumptions. Maudlin *does* appear to assume said liberalism, so as to accommodate our lack of epistemic and causal acquaintance with spacetime points. In addition, however, he makes implicit use of an analysis of indexicals and demonstratives which aligns closely with the influential approach due to Kaplan, most famously presented in [18].

There are three components of Kaplan's approach to indexicals which are particularly useful for Maudlin. First, Kaplan argues that indexicals are directly referential—which, roughly, means that the content of an indexical is just the object to which it refers. This property makes indexicals suitable for the function of driving "linguistic pegs into the fabric of absolute space and time" [24, p. 191]. Second, Kaplan's Corollory 2 states that "[i]gnorance of the referent does not defeat the directly referential character of indexicals" [18]. This ensures that the account is compatible with liberalism about reference and singular thought, since Kaplan aims explicitly to reject "Direct Acquaintance Theories of direct reference", one example of which is Russell's theory [18]. Third, there is the consequence of rigid designation, deriving from Kripke's use of the term [20], which essentially means that once the context of an indexical is fixed, it holds true across all possible worlds—particularly useful for the consideration of static shifts and Maudlin's counterfactual formulation.

There are, however, well-known problems with Kaplanian direct reference accounts of indexicals—some of the most notable among which are analogues to Frege's puzzles regarding proper names, in which two statements that refer to the same object have different truth conditions. One such problem case is that of the the messy shopper (due to Perry [31]): in this case, a shopper sees in a mirror what appears to be another shopper making a mess; unbeknownst to him, *he* is that very shopper. In this case, the shopper simultaneously believes both the statement 'He is making a mess', and the statement 'I am *not* making a mess'. On direct reference theories, these express contradictory propositions, since 'he' refers back to the shopper himself—meaning that the shopper, according to direct reference theories, holds contradictory beliefs. Those who do not wish to accept such a conclusion may accordingly reject Kaplan's account of indexicals; this, in turn, might seem to impair the effectiveness of Maudlin's argument.

Alternatively, the rival 'descriptivist' theory of indexicals attributes "purely qualitative descriptive content" [2, §4.2] to indexicals. A possible consequence of this view is that the semantic category to which indexicals belong changes. A passage from Hawthorne and Manley aligns with this view:

> Take 'here' and 'now'. On the standard Kaplanian conception, these terms as used at a context are referential devices whose semantic value are a place and a time respectively, and hence are rigid designators. [Footnote suppressed.] But this simple picture arguably takes liberties with the semantic category of those ex-

> pressions: they are plausibly better construed as modifiers that generate property expressions out of property expressions. (That is, they are of the same semantic type as 'in Texas'.) Thus, in 'John is smoking here', 'here' does not simply supply a location, as though John is being said to smoke a location. Instead, the result of, say, modifying 'smokes' by 'here' while located at *l* will be a complex expression that expresses a property that applies to a thing iff that thing smokes at *l* (similarly, *mutatis mutandis*, for 'now'). In this way, 'here' and 'now' have a spatially or temporally constraining effect on a predicate. But that does not make it correct to say that 'here' and 'now' simply refer to spatial or temporal locations. [13, p. 245]

If Maudlin accepts a descriptivist account of indexicals, then his epistemological response to the static shift seems to falter (that said, whether it actually does so is not completely clear, as we discuss below), given his having stated explicitly that "all absolute places are qualitatively identical" [24, p. 191]. According to this point of view, spatial indexicals alone would be insufficient to defuse the epistemological challenge posed by the static shift. Thus, our second reading of Maudlin has three key inputs: (i) Hawthorne-Manley liberalism about reference and singular thought, (ii) a Kaplanian account of indexicals, and (iii) an assumption that Kaplanian indexicals can fully charactertise a spacetime point. Hawthorne and Manley, in fact, repudiate Kaplan's account of indexicals (see the above quotation)—in which case, the possibility of Dasgupta's notion (though perhaps not account) of inexpressible ignorance appears to re-arise in this context. While Maudlin in fact (contrary to Dasgupta's reading) forecloses such inexpressible ignorance at the very outset, by tacitly making use of Kaplan's account of indexicals, if one is to reject this account (and, indeed, we have seen that there are reasonable grounds to do so), then it seems that Maudlin must find other resources to refer to spatiotemporal locations.

There is, however, (at least) one possible way to save Maudlin's account, even when working within the framework of a descriptivist conception of indexicals. While Maudlin does indeed need to be able to latch onto particular spacetime points, he need not, in fact, do so via the machinery of indexicals (so this line of thought goes). The reason for this is due to the fact that some names may be introduced via the help of definite descriptions, yet thereafter function semantically as names (e.g. 'Maudlin') or demonstratives (e.g., while pointing, 'that spacetime point'). These names contribute the referent to the determination of truth conditions, and allow for rigid designation; moreover, such naming works without necessarily any direct acquaintance with the object being so designated. Given this, Maudlin may still be able to refer to particular spacetime points. Indeed, this point is arguably present in the quote from Hawthorne and Manley given above: in that passage, the authors offer a semantic analysis of 'John is smoking here' dis-

tinct from that offered by Kaplan, but their analysis nevertheless introduces a name *l* for the place in question, and that name may (in line with the above) function semantically thereafter to contribute the named place to the content (or truth conditions) of statements. This, in turn, seems to be sufficient for Maudlin's response to the static shift to go through, even when working within the framework of a descriptivist account of indexicals.[22]

Returning to our first reading of Maudlin, according to which there is inexpressible ignorance in cases of the static shift, this discussion raises questions about whether the account can, in fact, go through. The reason for this is that one must disambiguate the account of indexicals at play. It seems that something like liberalism about reference and singular thought is a necessary condition for identifying which of a class of statically shifted worlds is one's own, and thereby resolving the epistemological challenge posed by such shifts. Taking this liberalism for granted, then, if Kaplan's account of indexicals is also endorsed, there is in fact no inexpressible ignorance at all, contrary to the claims of our first reading of Maudlin.[23] If, on the other hand, the descriptivist account of indexicals is endorsed, then it is not obvious that one can, in fact, identify indexically which of the class of shifted worlds is one's own—as we have seen in the case of our second reading of Maudlin. However, one might—even in the context of the descriptivist account of indexicals—be able to make (rigid) reference to spacetime points in one's world via definite descriptions and the act of naming (as discussed above), so granting this would again seem to imply that there is no inexpressible ignorance at all. Given all this, we therefore find our second reading of Maudlin to be the more plausible of the two.

Finally, to reprise our readings of Dasgupta in §4.1.1, it is possible that he is taking issue with questions (such as Maudlin's) that are necessarily answerable by virtue of the resources used in phrasing them being the only possible answers. If we reject direct reference in favour of a descriptivist account of indexicals, then we cannot use those indexicals to refer to specific spacetime locations. As a result, the closed question that Maudlin has constructed no longer possesses any meaning involving spacetime; the fact that the same resources are used in both question and answer renders a quasi-analytic connection between them, yet they cannot refer to any particular

[22] We are very grateful to Carl Hoefer for suggesting to us the Maudlin's account may be reconcilable with a descriptivist conception of indexicals.

[23] One might maintain that even if Kaplan's account of indexicals is endorsed, and one can thereby refer directly to the spacetime point which constitutes one's absolute position, there might yet remain inexpressible ignorance—*viz*., of facts underwriting the haecceities of spacetime points. To this, we would reply that (a) this is changing the subject, for the question at hand is whether one can indexically identify one's own position, and (on the above assumptions) this *is* the case, regardless of whether one can know (or even express) everything there is to know about the haecceities of the spacetime points constituting such positions. Moreover, (b) at this point, Perry's response to Dasgupta kicks in once more: the burden remains on the proponent of such a view to explain why we should believe in such facts to begin with. We discuss these matters in further detail below.

region of spacetime. In this situation, Dasgupta's instinct that we're missing something from the picture—that there's more inexpressible ignorance behind the closed question—might be claimed to yield fruit, allowing his concerns of inexpressible ignorance to resurface in a stronger form. However: even in the case in which Dasgupta does indeed appeal to a descriptivist account of indexicals, it bears stressing that it is far from obvious that his argument succeeds. The reason is that—as we have already seem in our discussion of fixing reference via definite descriptions and the act of naming—there are different means of answering the question of where I am located in absolute space beyond mere appeal to indexicals. Thus, it is ultimately not clear that Dasgupta's argument against Maudlin succeeds, on either the Kaplanian or descriptivist conception of indexicals.

In response to our reading of Dasgupta (as embracing, ultimately unsuccessfully, a descriptivist account of indexicals in order to foreclose the success of Maudlin's epistemological argument), one might point to the fact that, at [5, pp. 453-454], Dasgupta considers a "modest externalism" akin to Hawthorne-Manley liberalism about reference and singular thought, according to which "I can know where my desk is in absolute space after all" [5, p. 454]. Note, however, that Dasgupta regards this modest externalism as missing something, precisely because it cannot account for what he believes to be inexpressible ignorance. In light of this, one might say the following: Maudlin's position must incorporate liberal reference, Kaplanian indexicality (or alternatively descriptivist indexicality, if one is willing to secure reference to spacetime points not via indexicals *per se*, but rather via definite descriptions and the act of naming—something which we think *is* possible, as discussed above), and an assumption that such reference can fully furnish the characterisation of a spacetime point. On the other hand, Dasgupta is free to choose his stance with regards to liberal reference and Kaplanian/descriptivist indexicality, but claims that indexicals cannot fully characterise a spacetime point in accordance with his intuition (and presuambly—although he does not engage explicitly with such proposals—*mutatis mutandis* for our alternative proposal for securing reference to spacetime points via definite descriptions and the act of naming), leaving some form of inexpressible ignorance to be explored.

Focusing solely on the use of indexicals, descriptivist accounts do not *have* to be embraced by Dasgupta—but are perhaps more natural for him than Kaplanian accounts, where there has (at least restricting to the referential capacities of indexicals) to be an assumption that there is indeed something about location that one doesn't know. In a way, descriptivist accounts might be taken to afford a way of answering Perry's objection (recall: for Perry, Dasgupta must "provide some reason to believe there's inexpressible, in-principle ignorance *in this particular case*" [32, p. 233]), since there is something clearly missing from the use of 'here', but Dasgupta is still free to be a Kaplanian about indexicals if he so chooses. To be clear, however, and at the risk of labouring a point: in light of our above-discussed alternative

options for securing reference, we still do not think there being in-principle ignorance follows from the descriptivist account of indexicals—this must be considered an *additional* assumption instead.

4.2 God's favourite point

As mentioned earlier, Dasgupta presents a second motivation in 'The Bare Necessities' against Maudlin's epistemological argument:

> Maudlin's view implies that whether something is detectable depends on factors that are, intuitively, entirely irrelevant to the matter. For on his view, whether our location in Newtonian space is detectable depends on whether or not we can ask open questions. So, for example, suppose that God had a favorite point in space. Then we would be able to ask open questions about our location in space, for example 'Am I 3 feet or 6 feet from God's favorite point?' On Maudlin's view, it would then turn out that location is undetectable after all. So on Maudlin's view, whether absolute position is detectable or not depends on whether God had a favorite point. And that seems clearly false: whether or not God has a favorite point is surely irrelevant to my epistemic situation *vis a vis* our position in space! [3, p. 146]

Again, this objection misses the mark. The reason, in this case, is that by introducing a privileged spacetime point, Dasgupta is *changing* the spacetime setting of NGT—in particular, he is augmenting Galilean/Newtonian spacetime with extra structure, effectively transforming it to what is sometimes referred to as *Aristotelian spacetime* (see [8, pp. 34-35]). If such a point were to exist, there would be questions which we could not answer, even in principle (much as in the case of the kinematic shift). This, of course (by a plausible and minimal Occamist norm—cf. [6]), is precisely why we should *not* believe in the existence of such a point! The issue with Dasgupta's objection here, then, is that it merely moves the goalposts, and affords one no reason to think that there is any problem with the epistemological argument *per se*, when such a privileged spacetime point is *not* introduced.

In 'Inexpressible Ignorance', Dasgupta contemplates a very similar situation: a world of two-way eternal recurrence (divided into 'epochs', e_i), but with one exception: there is a 'special' epoch e_S, which "differs from the rest just in the fact that one electron is a little to the left of its counterparts in other epochs" [5, p. 448]. On this case, Dasgupta writes that

> Maudlin's view ... implies that, were that electron a little bit over to the right, I would not be ignorant of which epoch I inhabit. And this is hard to take seriously: surely my ignorance of which epoch I inhabit cannot be cured by minute changes in far-off epochs! [5, p. 448]

In response to this, however, we side with Perry, who writes that

> It seems that Dasgupta is simply wrong here. There is no sense in which the change from [the world with e_S] to [an otherwise-identical world without e_S] merely removes expressibility. Everything we are expressibly ignorant of in [the former] is either false in [the latter], or is something we're also expressibly ignorant of in [the latter]. [32, p. 232]

The overarching point is this: Dasgupta's various motivations for inexpressible ignorance by appeal to 'perturbed' worlds (whether said perturbation is applied at the level of spacetime structure, or at the level of the material content of that world) do not succeed, for they illegitimately transfer expressible ignorance in the former case, to inexpressible ignorance in the latter case, while not recognising the alternative: that there is simply no ignorance *at all* in the latter case.[24]

4.3 Parallels: linguisitic responses to scepticism

There are interesting parallels between (i) the Dasgupta/Maudlin interaction on inexpressible ignorance, and (ii) a better-known debate in the contemporary philosophical literature—*viz.*, that regarding whether one can proffer a linguistic response to philosophical scepticism. Famously, Putnam argued that, since brains-in-vats can only ever refer to vat-facsimiles of real-world objects, they can never articulate the sceptical problem—and so, the issue is dissolved (see [37] for the original source, and [28] for an elegant summary of notable responses). In reaction to this, Nagel maintained that the argument is too quick: perhaps brains-in-vats are simply *inexpressibly* ignorant of real-world facts ("Instead I must say, "Perhaps I can't even think the truth about what I am, because I lack the necessary concepts and my circumstances make it impossible for me to acquire them!"" [29, p. 73]); or perhaps one can make use of non-referring terms to articulate the sceptical scenario ("I can use a term which fails to refer, provided I have a conception of the conditions under which it would refer" [29, p. 72]).[25]

Transparently, in these debates, Dasgupta parallels Nagel, insofar as the latter is to be read as endorsing the possibility of inexpressible ignorance—but who parallels Putnam? If one reads Putnam as stating that, because brains-in-vats are inexpressibly ignorant of real-world objects, they are in

[24] Note also that, even if one grants that there is inexpressible ignorance in such cases, this does not necessarily mean, given the (admittedly problematic) first reading of Maudlin presented in §4.1, that there exists here an epistemological challenge.

[25] There is also a third option, raised by Hawthrone and Manley (albeit not in the context of philosophical scepticism): perhaps reference can be secured *accidentally*. On this, Hawthorne and Manley write that "... one might fail to refer with a putatively logically proper name and not know it; and one might also refer without knowing that one has done so (there being a real danger of illusion)" [13, p. 8]. Although this is certainly a line which one might take towards scepticism in response to Putnam (who, one anticipates, would repudiate the argument), we set it aside in the following.

fact not ignorant of anything at all, then it would seem to be Dasgupta's final reading of Maudlin in [5] who is the appropriate analogue here.

Note, though, that if what we have said in the foregoing subsections is correct, then the response that Maudlin himself (rather than Dasgutpa's reading of Maudlin) would proffer to the sceptical problem is a little different. Suppose, to make the parallel with static shifts more explicit, that we consider various different sceptical scenarios, in which the data supplied to the brain-in-vat is the same, but the real-world facts are altered. Call these 'sceptical shift scenarios'. Then, on our first reading of Maudlin presented in §4.1.2, he would argue that these shifted worlds are genuinely distinct, and there are real-world facts of which we are inexpressibly ignorant, but that there is no epistemological problem, because we can identify indexically which of this class of worlds is our own. On our second reading of Maudlin presented in §4.1.2, he would argue that there is in fact no inexpressible ignorance at all, for we can refer indexically to real-world objects.

Are either of these responses plausible in the sceptical shift scenario? In our view *no*, for one cannot identify indexically real-world objects as one can identify indexically one's own position—the situation is more analogous to the kinematic shift, or to the cases of gauge transformations in electromagnetism (for which see §5 below), than to the static shift. There is, however, one disanalogy between the sceptical shift scenarios and these latter two cases: in the sceptical case, if Putnam is correct, we are *inexpressibly* ignorant of the real-world facts; whereas in the latter two cases, we are *expressibly* ignorant. This difference stands in spite of the fact that we cannot identify indexically our world in either case.

Where, then, does this leave us? If Putnam is the analogue of Dasgupta's Maudlin, and (one aspect of) Nagel is the analogue of Dasgupta, then Maudlin himself finds neither a straightforward nor plausible parallel in the sceptical case—for it is *not* possible for a brain-in-vat to identify indexically real-world facts or objects in sceptical shift scenarios; this blocks both of our own readings of Maudlin in this context.[26]

5 Gauge in electromagnetism

In §3, we presented Maudlin's proposed solutions to both the hole argument and the static shift, and sought to explicate why Maudlin offers a different response in each case. In this section, we consider a structurally analogous

[26]Perhaps one can identify indexically real-world facts or objects *as actual*—but, beyond that, one does not seem to be able to identify them indexically in sceptical shift scenarios. To be clear, note also that there are two senses of 'real' at play in the foregoing: the first meaning 'non-brain-in-vat', and the second meaning 'an element of the ontology of the world'. (A Lewisian modal realist would, of course, repudiate the claim that what is real is exhausted by the ontology of the actual world: we set this aside here.) In our discussion of the sceptical scenarios, we generally had the former in mind, as should have been evident from context.

problem of underdetermination (to both the static shift, and the hole argument in one of its guises) in electromagnetism, and the potential application of these solutions in that context—this comparison will afford some insight.

Solutions of electromagnetism are tuples $\langle M, \eta_{ab}, A^a, J^a \rangle$, where η_{ab} is the Minkowski metric field of special relativity, A^a is the electromagnetic vector potential, and J^a represents a current; dynamical equations for this theory are the Maxwell equations,

$$\nabla_a F^{ab} = J^b, \tag{4}$$

$$\nabla_{[a} F_{bc]} = 0. \tag{5}$$

(Here, the Faraday tensor F_{ab} is defined as $F_{ab} := \nabla_{[a} A_{b]}$, and ∇ is the derivative operator compatible with η_{ab}.) This theory is claimed to manifest gauge redundancy, in the sense that solutions of the theory in which the A^a field differs by a gradient term lead to the same Faraday tensor F_{ab}, and so to the same observable data (since the Faraday tensor encodes the electric and magnetic fields, which are taken to be the observable data of the theory).

In light of this gauge redundancy, the A^a field is often taken to be 'unphysical'; rather, the physical content of electromagnetism is taken to be encoded in F_{ab}. Against this orthodoxy, in his response to Healey on the Aharonov-Bohm effect [26], Maudlin explores the possibility of taking the A^a field to be physical (for details on the philosophical import of the Aharonov-Bohm effect, and on associated issues of locality and separability, see [14, 15]). He writes:

> The question is why gauge-invariance is a sine qua non for physical reality. Suppose, to be simplistic, one thought that the vector potential was real, and that there is ONE TRUE GAUGE which describes it at any time. [Footnote suppressed.] This would immediately render the explanation of the Aharonov-Bohm effect local and separable. What troubles would accrue for such a theory?
>
> One obvious trouble would be epistemological: since potentials which differ by a gauge transformation generate identical effects, no amount of observation could reveal the ONE TRUE GAUGE. This would be generally annoying and a real metaphysical/semantic problem for positivists. But one might be willing to pay this price, especially since the demand that every physically real quantity be accessible to experimental measurement seems defensible a priori only by a positivist of some stripe. One might also worry about problems of determinism: if different gauges really represent different states of affairs (if there is, as it were, an *active* reading of a local gauge transformation), and then *local* gauge transformations may lead to the sorts of problems with determinism that the hole-argument of John Earman and John Norton

> (1987) raised for General Relativity. These problems are certainly not trivial. [26, pp. 366-367]

Maudlin's point here is that, while taking seriously the representational capacities of the A^a field can ameliorate problems of non-locality and non-separability arising out of the Aharonov-Bohm effect, doing so comes with its own problems—*viz.*, the exact analogues of the underdetermination and indeterminacy problems faced in the hole argument. That this is so is clear: if the A^a field is physically real, it is nevertheless underdetermined *which* A^a field in a gauge equivalence class (related by gradient terms) is real—for, as discussed, the empirically observable data is encoded in the F_{ab} field, in which the gauge part of the A^a field is 'washed out'. The indeterminism problem also arises: consider a range of solutions to electromagnetism which agree on the data on some Cauchy surface Σ, but which differ thereafter by local gauge transformations on the A^a field: no observer with access only to data on Σ would be able to predict *which* solution correctly represents her world, *vis-à-vis* the value of the A^a field to the future of Σ—and indeed, the structure of electromagnetism does not specify which of these possibilities will occur.

One point is worth making at the outset here: Maudlin's proposal that there is 'ONE TRUE GAUGE' is *merely* a proposal that we take the A^a field physically seriously; it is *not* a proposed solution to the problems of underdetermination and indeterminism which arise therefrom. One may, however, at this juncture seek to import Maudlin's proposed solutions to the hole argument and to the static shift—namely, metric essentialism and an epistemological argument—to this context. How would they fare?

Begin with the analogue of metric essentialism. In this case, this would be a 'gauge essentialist' view, according to which only one element of the class of worlds represented by gauge-related solutions of electromagnetism is metaphysically possible—*a fortiori* physically possible.[27] As in the case of the hole argument, this would resolve immediately both the underdetermination and indeterminism concerns—although it is not at all obvious that Maudlin's motivations for metric essentialism presented in [25] carry over to this 'gauge essentialism'—in which case, it is not at all obvious that this is a compelling view to hold.[28]

What of the epistemological argument? Recall that this argument succeeded (modulo the issues discussed in §4) against the underdetermination problem in both the static shift and the hole argument, and also against the indeterminism problem in the hole argument (at least in one sense—although the argument is impotent against the charge that the hole argument renders GR radically indeterministic). But how does the epistemological argument

[27] Recall the issues discussed in footnote 4, which apply also in this case—though note that, since models of electromagnetism related by a gauge transformation are not isomorphic, one might (following Fletcher [12]) argue that they do not have the same representational capacities.

[28] Cf. footnote 10.

fare when it comes to the underdetermination and indeterminism problems in the context of gauge transformations in electromagnetism?

Our point in the case of gauge transformations in the standard A^a field formulation of electromagnetism as presented above is the following: the situation here is even worse for the epistemological argument, for in this case the response cannot successfully be levied against the underdetermination or the indeterminism problem. The reason for this is the following: while it is true that I *just know* that I am *here*, rather than *five metres to the left of here*, I do not likewise *just know* which gauge obtains—for internal gauge transformations upon the A^a field, unlike spatial transformations such as the static shift, are not identifiable indexically (cf. our above discussions of the sceptical shift scenarios—although as we noted, if Putnam is correct in that case, the ignorance there is not even expressible). Thus, the situation here is in fact more akin to the kinematic shift in NGT set in Newtonian spacetime than to the static shift: the lack of indexical identifiability means that the epistemological argument cannot get off the ground: just like absolute velocities, we are ignorant (albeit expressibly so) of the 'ONE TRUE GAUGE'.[29,30]

On these matters, Healey [15, §4.4.3] seems to engage—albeit without explicit acknowledgement—with the Maudlin/Dasgupta debate over inexpressible ignorance, when he writes

> The epistemological problems with the localized gauge potential properties view have a semantic aspect. They are connected to the fact that it leads to unanswerable questions. Neither the theory itself, nor anything we can do when applying it, enables us to give determinate answers to questions about how the supposed localized gauge potential properties are distributed. This is not just a failing of language. We cannot even entertain a thought that they are one way rather than another, from among an infinity of gauge-related distributions. But an advocate of the localized gauge potential properties view may deny that this renders these properties problematic. It may be an epistemological defect in a theory to raise meaningful but unanswerable empirical questions. But the semantic features of the localized gauge potential properties view are such that there are questions it does not even permit one meaningfully to ask. And what appeared as an epistemological vice could be seen rather as a semantic virtue—the

[29]Models related by a static shift are isomorphic—unlike models related by a kinematic shift, or by a gauge transformation. Conjecture: epistemological arguments of the kind considered in this paper, which proceed by appeal to the indexical identifiability of models, can be applied only in the former case.

[30]One may be able to use definite descriptions and the act of naming in order to refer to the gauge field at one's spatiotemporal location—cf. our discussion of such a possibility in §4.1.3. Just as in the case of the kinematic shift in NGT set in Newtonian spacetime, however, one would remain ignorant of the *magnitude* of that quantity—see footnote 13.

> virtue of rendering metaphysical questions literally meaningless rather than empirically unanswerable! [14, pp. 122-123]

Healey begins here by suggesting—*à la* Dasgupta—that realists about the A^a field are committed to inexpressible ignorance regarding the values of that field; at the end of the passage, however, he suggests—*à la* Maudlin—that the other side of the coin here is to maintain that there are literally no unanswerable questions regarding the value of the gauge field A^a. In our view, both of these options are problematic: just as in the case of the kinematic shift, there does appear to be a plurality of possibilities for the value taken by the A^a field at any given spacetime point—and these different possibilities are all expressible! Thus, to repeat, we disagree with Healey, insofar as, in our view, the kinds considerations of inexpressible ignorance discussed at great length in the previous sections of this paper simply do not come into play in (this formulation of) electromagnetism.

Why do we add the parenthetical qualification 'this formulation of' above? The reason is that there are, in fact, other formulations of electromagnetism, for which questions of inexpressible ignorance more plausibly apply. In recent years, a great deal of interest has arisen in what Dewar dubbed the process of constructing 'sophisticated' theories, in which one retains the same number of models, but 'forgets' structure, such that the resulting models are isomorphic.[31] One example of this process—already discussed above—is the move from NGT set in Newtonian spacetime to NGT set in Galilean spacetime.[32] Another example is moving from the A^a field formulation of electromagnetism to an alternative formulation in terms of fibre bundles (see [7, p. 501]). Here is not the place to go into the (admittedly beautiful) mathematics of the fibre bundle formulation of electromagnetism; rather, we now simply present this version of the theory and discuss its upshots for inexpressible ignorance in the context of gauge theories.[33]

Models of the fibre bundle formulation of electromagnetism are given by tuples $\langle M, P, P_F, s, \omega \rangle$, where M is a differentiable manifold, P is a principal bundle and P_F is an associated bundle. s is a section of P_F representing material fields, and ω is a connection on P representing Yang-Mills fields. Letting the model $\mathscr{O} := \langle M, P, P_F, s, \omega \rangle$, implementing a gauge transformation on the material and Yang-Mills fields yields a new model $d_*\mathscr{O} := \langle M, P, P_F, d_*s, d_*\omega \rangle$, where d is a diffeomorphism. Technicalities aside, the important upshot here is easy to state: whereas in the A^a field formulation of electromagnetism, gauge transformations yielded distinct but non-isomorphic models, in the fibre bundle formulation of electromagnetism, gauge transformations yield distinct but *isomorphic* models, which differ by

[31] See [7] for the original article on sophistication, and [17, 23] for further explorations and (sometimes critical) discussions of the procedure.

[32] There are some subtleties here—see [23, fn. 26].

[33] Our presentation of the formalism in what follows tracks the elegant discussion of [17, ch. 7]; see e.g. [45] for further discussions of this formalism.

some diffeomorphism d.[34]

Since, in this formulation of electromagnetism, gauge-related models are isomorphic, the analogy with the static shift in NGT, and the hole argument in GR, is more exact. Given this, one might suggest that, in this formulation of electromagnetism, one *can* identify indexically the value of the gauge potential, just as one can (the claim from e.g. Maudlin goes) identify indexically one's absolute position in the spacetime case. Is this indeed the case? The answer is far from obvious to us, for recall that Yang-Mills fields are represented by *connections* on a principle bundle. As Jacobs writes, "While we can easily interpret a section as an assignment of field values to spacetime points, the same is not the case for the connection. The connection specifies relations between points of the principal bundle" [17, p. 193]; as a result of this relational status, it is not *prima facie* clear whether it is the kind of thing which can indeed be identified indexically.

In [17, §7.4], Jacobs goes on to distinguish a 'deflationary approach', according to which "neither the principal bundle nor the connection on it represent anything physical" [17, p. 193], from an 'inflationary approach', which "reifies not the principal bundle but the bundle tangent to it" [17, p. 193]. On the former approach, since the connection is not reified, one might claim that it is not (ay least in any straightforward sense) amenable to indexical identification. On the latter approach, one reifies the 'bundle of connections', which is the tangent bundle TP to the principal bundle P, quotiented by the latter's (Lie) group structure. In this case, one could—potentially!—apply (a version of) Maudlin's epistemological argument in order to maintain that one can identify indexically the value of the gauge potential at one's spacetime point. However, even having gone through this mathematical rigmarole, it is not obvious to us that the approach succeeds. The reason is that the approach still appears sensitive to one's preferred metaphysics of fibre bundles: if one is a 'fibre bundle substantivalist' *à la* Arntzenius [1], according to which the entire bundle is to be construed on the model of an extended spacetime, then perhaps there is room for the observer to maintain that they can identify indexically their position in the entire bundle-theoretic structure, including the bundle of connections, and thereby identify indexically the value of the gauge potential at their point in the fibre bundle. However, if one does not embrace this metaphysical picture, then one would have to give further arguments to the effect that one can identify indexically properties of objects (in this case, sections of the bundle of connections) at one's spacetime point. Absent further argumentation, it is not clear that this is the case: a sufficiently strong Hawthorne-Manley liberal about reference and singular thought might assent to it, but others might demur.[35]

[34] For a rigorous presentation of this result, see [17, §7.4].

[35] This being said, if one is willing to claim that one can identify indexically one's own velocity in the case of Galilean spacetime—recall our discussion of this point in §3—then perhaps one can maintain by analogy that one can identify indexically the value of the gauge potential at one's space-

The upshot of this section, then, is that there are important differences between external (spacetime) transformations and internal ('gauge') transformations. In order to resolve both the underdetermination and indeterminism problems in the case of electromagnetism (in its standard A^a field formulation), the epistemological argument will not suffice, and one must instead (absent some other solution!) appeal to (the perhaps somewhat implausible position of) gauge essentialism. While Healey maintains that there is inexpressible ignorance of the value of the A^a field at one's spacetime point in the standard formulation of electromagnetism, we remain unconvinced; to our minds, shifts to the gauge potential by a gradient term are better understood on the model of kinematic shifts in NGT set in Newtonian spacetime. That being said, there is greater room to claim that there is inexpressible ignorance—or, on the other hand, to run Maudlin's epistemological argument—when one moves to the fibre bundle formulation of electromagnetism, in which gauge-related models are isomorphic. However, the nature of these isomorphic models is very different here to in the spacetime cases of NGT or GR, and it is not obvious to us that arguments such as Maudlin's have any traction in such cases.

6 Close

In this paper, we have undertaken a detailed study of Maudlin's preferred response to the static shift in NGT—namely, a certain kind of epistemological argument. We have distinguished 'good' and 'bad' versions of this argument (§2)—as in the case of (on one plausible reading) Maudlin on the spatial versus temporal static shifts, respectively—and have articulated why Maudlin does not offer this argument in response to the hole argument in GR (§3). In addition, we have addressed two objections to this argument due to Dasgupta (§4), with a focus on Dasgupta's response based upon the notion of inexpressible ignorance; broadly speaking, we have sided with Maudlin and against Dasgupta in these disputes. Finally, we have addressed the possibility (or, as it turns out, impossibility) of the application of the argument to the parallel case of shifts to the vector potential of electromagnetism (§5).

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time point. Note also that this sufficiently strong liberal might simply maintain that one can identify indexically the value of the A^a field at their spacetime point, even in the standard formulation of electromagnetism.

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A History of the epistemological argument

In this appendix, we seek to cast light on some of the history of the epistemological argument which has been the focus of this paper. To our knowledge, the first mention of something like this argument is due to Horwich, who writes:[36]

> [I]t seems to me that Leibniz' argument is quite seductive. For if time does consist of a set of entities—the temporal instants—then it would (given some further plausible assumptions) be the case that there is a possible world, different from the actual one, in which every actual event occurs, but 10 seconds earlier than it does in the actual world. Yet one is reluctant to admit that such a possible world would really be different from the actual world. [16, p. 407]

Horwich continues (we take the liberty of an extended quotation, since the passage is of enviable clarity):

> Why is this? I suspect it's because, not only would such a world be indiscernible, (in the above weak sense) from the actual world, but also there could not be an epistemological issue concerning which of the worlds was actual. In general there may be cases of theories T_1 and T_2, which are observationally indistinguishable and present us with an epistemological problem. We don't know if we are in a world described by T_1 or a world described by T_2. But the supposed difference between W_1 and W_2 is such that no such epistemological problem can arise. Even if we had found ourselves in W_2 we would have arrived at precisely the same theory of the world.
>
> Now this epistemological equivalence does not immediately entail that every sentence true in W_1 is also true in W_2. For if there are instants, then we may introduce reference fixing definitions such as:
>
> > Let k be the instant at which event E occurs.
>
> And then the sentence 'E occurs at k' will be true in W_1 but false in W_2. However, these differences engender no epistemological problems because those sentences which are true in W_2, yet false in W_1, are known *a priori* to be false in W_1. More precisely: there

[36] Note that Horwich's concern here is with temporal static shifts, rather than spatial static shifts.

> is a certain set of sentences (such as 'E is simultaneous with F') whose members are true in both W_1 and W_2. And any sentence which is true in W_1 but false in W_2 follows from the members of this set together with reference fixing definitions such as the one above. Thus we can be quite sure that the sentences which describe W_2 do not all describe our world, even though they have the same observational consequences as those which do. [16, pp. 407-408]

For Horwich, the epistemological *discernibility*, but observational *indiscernibility*, of shifted worlds motivates the conclusion that they should not, after all, be regarded as being genuinely distinct. This, clearly, is a conclusion which Maudlin does *not* draw—and one might reasonably find Horwich's thought that the epistemological argument leads one to regard the shifted solutions as not being genuinely distinct as lacking positive motivation. In any case, Pooley is certainly correct when he writes on the difference between these two authors that "Here Maudlin and Horwich are simply at loggerheads" [34, p. 81].

Let us move on now to the second sustained appearance of the epistemological argument in the literature,[37] which (again, to our knowledge) is due to Field, who once again reaches a conclusion interestingly distinct from that of Horwich:

> Now, one possible reply to [Leibniz's argument] (one that Horwich himself develops fairly persuasively in the article mentioned) is that the supposition [of statically-shifted scenarios] isn't unreasonable in the way that it first appears, and that this is so because the possibility granted ... can't be used to generate epistemological problems about which sort of universe one is in. [10, pp. 76-77]

There are several points to be made here. As Pooley notes, Field misconstrues Horwich's point:

> It is ironic that Field attributes essentially this response to the shift argument to Horwich for, in fact, Horwich's intuition propels him in the opposite direction. [34, p. 81]

That is, for Horwich, the epistemological discernibility (together with the observational indiscernibility) of shifted scenarios suggests that, in fact, these scenarios are *not* genuinely distinct. Field, however, reads Horwich in the opposite manner: he suggests that such epistemological discernibility is precisely what renders it permissible to regard shifted scenarios as genuinely distinct. Whatever one makes of this argument *per se*, it is clear that that it

[37] Between Horwich and Field, there is van Fraassen, who writes in passing that "Note for example that 'I am here' is a sentence which is true no matter what the facts are and no matter what the world is like, and no matter what context of usage we consider. Its truth is ascertainable *a priori*" [44, p. 136].

is inadequate as a reading of Horwich; it does, however (broadly speaking), align Field with Maudlin on this issue.

The final author deserving discussion in this section—and the third (to our knowledge) to write on the epistemological argument—is Teller [43], who states the following:

> Reference in a possible world is established by reference in the actual world ... . In particular, if I talk about a counterfactual situation in which everything has been uniformly moved over from where it now actually is, I speak of a situation in which, for example, I have been moved over from where I actually am ... . Thus, the counterfactual case in which everything has been uniformly moved over is, we can now see, distinguishable from the actual case; for in the counterfactual case, I (to pick an arbitrary example) am now at a different place from the place I can identify in the counterfactual situation as the place I now actually occupy ... . This distinguishability is no 'deep' metaphysical fact. It is just a reflection of facts about how language works in counterfactual contexts. [43, pp. 443-444]

Teller, unlike Horwich but like Field and Maudlin, is comfortable with regarded statically-shifted scenarios as being genuinely distinct. It is clear, then, that the epistemological argument should not be attributed to Maudlin alone. However, what is certainly novel about Maudlin's contribution on these matters is that he is the first to contrast the static shift with the kinematic shift—it is only with Maudlin that we find explicitly the point that the same kind of epistemological argument cannot be mustered in the latter context:

> In sum, the *only* way that the static shift can be formulated is something like, "what if God had created the material universe oppositely oriented *to the way it is oriented now*?", and this is clearly a counterfactual situation. But we can ask "what if God created the material universe at absolute rest?", not knowing whether we describe a counterfactual situation or not. [24, p. 191]

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