

The epistemic value of good sense

Revision for *Studies in the History and Philosophy of Science*

Abrol Fairweather

Department of Philosophy, San Francisco State University, 1600 Holloway, San Francisco, CA, 94122

Abstract

This paper examines competing interpretations of Pierre Duhem's theory of good sense recently defended by David Stump and Milena Ivanova and defends a hybrid reading that accommodates the intuitions of both readings. At issue between Stump and Ivanova is whether Duhemian good sense is a virtue theoretic concept. I approach the issue from the broader perspective of determining the epistemic value of good sense *per se*, and argue for a mitigated virtue theoretic reading that identifies an essential role for good sense in theory choice. I also show that many important issues in both philosophy of science and 'mainstream' value driven epistemology are illuminated by the debate over the epistemic value of good sense. In particular, philosophical work on the nature of cognitive character, rule governed rationality and the prospects of epistemic value t-monism are illuminated by virtue theoretic readings of Duhemian good sense.

## 1. Rival readings

Pierre Duhem's contention that scientific theories can only be tested in conjunction with auxiliary hypotheses leads to the well-known worry that multiple revision strategies are equally viable options in the face of disconfirming observations, leading to the deeper worry that a scientific theory can never be definitively refuted. Assuming rational theory choice is grounded in empirical evidence, we then face the challenge of explaining how theories can be rationally chosen when empirical evidence fails to determine one theory as uniquely choice worthy. An additional worry is that to ground theory choice in anything else impugns the objectivity of the theory chosen, and perhaps of science itself. Moreover, Duhem suggests an urgency to the situation, something must be done, this state of indecision cannot continue indefinitely (Duhem 1954, pg. 218 ). If we grant this much, or something close to it, we have a real epistemic problem<sup>1</sup>. Much has been written about the legitimacy and variations of the problem of underdetermination, but the current inquiry focuses narrowly on Duhem's solution. In particular, our focus here is virtue theoretic readings of Duhemian good sense and the epistemic value generated by the exercise of its constituent virtues<sup>2</sup>.

David Stump (2007) argues that Duhem's solution to underdetermination is found in a cluster of moral and intellectual virtues called good sense. Duhem's guiding image is "the scientist who acts as an impartial judge and makes a final decision." (ibid., pg. 155). The virtues of impartiality, sobriety, intellectual courage, humility, rectitude and probity steer scientists between retaining the theory being tested but not the auxiliaries (timidity), and rejecting the theory being tested but keeping the auxiliaries (boldness). Scientists exercising good sense thus converge on one uniquely choice worthy theory. Importantly, because the choice cannot be underwritten by the standing one theory receives from empirical methods alone, the fact that good sense selects a theory is what makes it the choice worthy theory. Duhem meets the challenge to scientific knowledge from underdetermination with the virtues. Call this *the virtue-theoretic solution*.

To call Duhemian good sense a virtue theoretic solution to underdetermination will be controversial for a few reasons. It will no doubt be controversial to locate some share of the epistemic value of our currently accepted scientific theories in properties of the scientist, rather than in properties of the science itself. This is true even in mainstream epistemology, as Stroud notes that our continued acceptance of a theory in the face of underdetermination "could only be explained by appeal to some feature or other of the knowing subjects rather than of the world they claim to know" and this typically is seen as "undermining our knowledge of the world"(1984, pg. 248). The direction of analysis going from the believer to their beliefs is the

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My aim in this paper is not to settle any questions about the proper form and strength of arguments for underdetermination, which continues to be a multi-faceted and hotly debated issue. Here I aim simply to better understand the epistemic axiology engendered in Duhem's solution vis-a-vis good sense.

<sup>2</sup> For a comparison of Quine and Duhem on underdetermination, see Fairweather (2011).

defining move of virtue epistemology<sup>3</sup> and thus challenges the intuition that epistemic credibility is threatened by giving states of the knowing subject a constitutive role in conferring important epistemic standings on a belief or theory. Thus, one criterion we can use to determine whether Duhemian good sense is a virtue theoretic concept is whether he reverses the traditional direction of analysis where good making properties of beliefs confer good making properties on believers to one where the good making properties of believers (their abilities, virtues, competences) confer positive epistemic standing on beliefs appropriately grounded in their cognitive character. On Stump's reading, Duhemian good sense satisfies the direction of analysis criterion because the fact that a theory is picked out by the virtues of the scientist exercising good sense is what confers the epistemic standing of being uniquely choice worthy on a theory, and that is an important epistemic standing. This looks like a clear connection between Duhem's account of theory choice and the defining commitment of VE.

A different test for whether Duhemian good sense is virtue theoretic is whether it satisfies the 'success from ability' (e.g., Greco, 2010, Sosa, 2007, Pritchard, forthcoming) model that is now the dominant general position amongst virtue epistemologists. A theory will have to include an ability attribution and show that the relevant ability brings about an important form of epistemic success in order to be a proper virtue epistemology on this approach. Whether good sense is a virtue theoretic epistemic concept in this sense will depend on whether it counts as an ability and how we read the epistemic standing of its products. On Stump's reading, good sense is the ability to distinguish appropriate occasions for timidity and boldness, and the conferral of unique choice worthiness is the relevant epistemic success brought about by the exercise of the ability. Again, we seem to have a clear connection between Duhemian good sense and a defining commitment of virtue epistemology.

Ivanova (2009) challenges both of the above grounds for attributing a virtue epistemology to Duhem. Stump and Ivanova agree on the content of the moral and intellectual virtues constituting good sense. But, the epistemic standing a theory attains when it is the outcome of good sense is a significant point of disagreement. On Ivanova's reading, good sense confers some provisional standing on the theory it selects, but only support from later evidence determines theory choice (ibid, pg. 62). Ivanova's account appears to significantly deflate the epistemic value generated by the exercise of good sense, whereas good sense generates a very important epistemic value on Stump's reading. On Ivanova's deflated reading, the results of good sense are neither enough of an epistemic achievement to satisfy the success from ability criterion, nor sufficient to meet the challenge of underdetermination. The deflated reading thus attempts to undermine one leg of the virtue theoretic reading, since we no longer have a robust epistemic standing generated by the exercise of the virtues.

Ivanova raises the additional worry that there is no way to determine which of two scientists really exercises good sense when both claim to have it, but are led to choose different theories (ibid, pg. 60). One is led to timidity, the other to boldness, both in the name of good sense, and ultimately to accept rival theories in response to a recalcitrant observation. How can it be determined which scientist is truly exercising good sense? Is there a fact of the matter here?

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<sup>3</sup> See Greco and Turri (2011)

This raises the concern that good sense is not a well defined ability, and thus sufficient neither for meeting the success from ability criterion nor for grounding rational theory choice.

Here, I aim to sort out the specific points of disagreement between Stump and Ivanova, identify a number of problems facing both accounts, and defend a hybrid account that accommodates insights from both accounts and locates a novel epistemic value for the virtues that challenges the orthodox epistemic axiology of truth value monism.

### The virtue theoretic reading

As no existing form of virtue epistemology is shaped around the project of resolving underdetermination, Stump's virtue theoretic reading may hold as much interest for virtue epistemologists as for philosophers of science. Because underdetermination arguments are common fare in analytic epistemology, a virtue based solution to underdetermination is potentially relevant to a wide range of traditional epistemic issues<sup>4</sup>. Our more narrow focus in this section is to extend some of Stump's insights on how good sense connects to virtue epistemology, and consider an objection to his reading that emerges from Quine's approach to underdetermination.

Stump argues that Duhem abets the virtue epistemologist's project of demonstrating the insufficiency of reliabilism (2007, pg. 152) Process reliabilism is a form of epistemic rule consequentialism<sup>5</sup>, and thus evaluates cognitive processes in terms of the veritic outputs of the associated cognitive rules. Stump notes that rule governed empirical methods generate the problem of underdetermination, but cannot resolve it. There is no algorithm for determining the proper revision strategy in the face of disconfirming observations, nor for determining which theory has greater support from theory virtues<sup>6</sup>. Rule governed scientific inquiry simply leaves us at underdetermination. Good sense, on the other hand, is an intuitive, non-rule governed form of inquiry, the epistemic value of which is not determined by the reliability of any specifiable process or rule. Since the epistemic standing a theory receives from good sense is essential to resolving underdetermination, rule-based reliabilism is importantly insufficient in the context of theory choice.

However, a reliabilist reading of good sense is still an option. There are non-rule based forms of reliabilism developed in virtue epistemology where the agent or their abilities and capacities, rather than belief forming processes, are the subject of reliability attributions. John Greco (1999, 2001) developed a form of virtue epistemology called "agent reliabilism". This approach defines knowledge as success from a reliable ability in the agent that manifests their cognitive character. The important difference from process reliabilism is that abilities rather than processes are the subject of reliability attributions and the abilities must be those grounded in the

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<sup>4</sup> In the final section of this paper, I argue that the Value Problem is importantly connected to underdetermination, a point which has not been noticed in contemporary literature.

<sup>5</sup> This is a generally recognized point now, but the earliest statement of the axiological claim is R. Firth (1981)

<sup>6</sup> For a thorough discussion of the inconclusive role of theory virtues see Tulodziecki (2007)

agent's cognitive character. A similar view is articulated in Sosa's account of performance normativity which attributes reliability to the skills and competences of a virtuous epistemic agent (2007, especially chapter 5). Agent reliabilism seschews rules, roughly in the way that virtue ethics does, so Stump's point against rule-based epistemic norms still stands. Yet, the virtue theoretic reading can still hold onto a form of reliabilism, if the agent's abilities or character is reliable. Here, the virtue theoretic reading of theory choice may benefit from examining the many species of virtue epistemology currently available. Good sense may turn out to be read as agent reliabilist, responsibilist, regulative, neo-Aristotelian or perhaps some other form of VE not yet developed in print<sup>7</sup>.

One thing that remains unclear is just what a virtuous scientist exercising good sense is doing. What sort of non-rule governed inquiry is this? We consider this question directly below, but first examine some general features of the virtue theoretic solution. My aim here is more ampliative than exegetical, extending points from Stump's virtue theoretic reading, and making use of two relatively unanalyzed notions contexts of inquiry. In *UD inquiry* we are trying to resolve the problem of theory choice, whereas in *non-UD inquiry* we either have not yet faced the problem, or have resolved it for the time being<sup>8</sup>. The virtues of good sense do not have a constitutive role in generating the epistemic standing of theories in non-UD inquiry. Method and evidence reign when they can, but epistemic normativity becomes aretaic in UD inquiry with the express purpose of resolving underdetermination. The success condition for the relevant virtue or ability is simply to break the empirical stalemate in an appropriate way, where good sense supplies the relevant sense of appropriateness. The constitutive virtues of good sense do not import radically new values into our epistemic axiology, since objectivity, neutrality and the like are already valuable in the application and choice of empirical methods. The move to UD inquiry keeps these values fixed, but they regulate a different form of inquiry, they regulate good sense. The virtue theoretic reading exhibits axiological continuity between the two contexts of inquiry and thus provides a constraint on admissible resolutions to underdetermination by precluding the introduction of radically new epistemic values<sup>9</sup>.

Virtue epistemology provides another basis of continuity by way of character. Scientists engage largely in rule governed inquiry in non-UD contexts; hypothesis testing, gathering and systematizing data, modeling, inducing observational consequences. These characteristic forms of inquiry inevitably develop a specific cognitive character in the scientist. To introduce another concept that will remain relatively undefined, call this the scientist's methodological cognitive character (MCC). This is the set of abilities, skills and dispositions a scientist acquires and expresses through the structured forms of inquiry involved in applying scientific methods. MCC is not a constitutive element of non-UD inquiry because engaging in such inquiry is not defined as the exercise of any character in the agent. Rather, this cognitive character is an inevitable

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<sup>7</sup> In Fairweather (2011), I suggest a novel form of virtue epistemology inspired by Duhem.

<sup>8</sup> There is at least a rough correspondence between these two forms of inquiry and Duhem's distinction between the mathematical mind and the intuitive mind. For a more complete discussion see Stump (2007).

<sup>9</sup> This keeps the spirit of Duhem's point that science does not proceed by introducing radical new hypotheses, but here clearly applied to epistemic values. (1954, pg. 252) as cited in Ivanova (2009)

result of repeated non-UD inquiry. MCC becomes constitutive of UD inquiry and triggers different sensitivities in MCC than those triggered in structured scientific inquiry. It is one cognitive character in both cases, but it plays a very different role and has different sensitivities and characteristic operations in different contexts of inquiry. Thus, the norms of good sense share the general epistemic values and cognitive character with non-UD inquiry, but the norms of UD inquiry regulate different cognitive operations, and successful regulation is constitutive of successful UD inquiry<sup>10</sup>.

We have a glimpse into how continuity of character across divergent contexts of inquiry might work in reasoning with theory virtues. Henderson and Horgan (2009) suggest that, in addition to “general inferential competences”, ordinary reasoning must include dispositions to respond to global features of an agent's cognitive system to avoid frame-type problems associated with unmanageable computational complexity. They call these global features *morphological content*, and argue that it is epistemically significant but often not consciously represented in ordinary reasoning. The significance of and sensitivity to morphological features of theories will likely be involved in reasoning with theory virtues. Duhem argues that reasoning with theory virtues cannot be strictly rule governed because no algorithm can determine choice worthiness on the basis of simplicity, conservatism, explanatory power, elegance and the like. General inferential competences will thus not be sufficient here. Rather, reasoning with theory virtues will involve global morphological features of theories, cognitive dispositions sensitive to these morphological features and non-rule governed cognitive transitions. Though MCC is developed through methodological non-UD inquiry, it has sensitivities to morphological features of theories that are triggered by consideration of theory virtues in non-UD inquiry. MCC is then a multi-purpose set of cognitive dispositions and abilities with different sensitivities triggered in different contexts of inquiry. Consideration of theory virtues in UD inquiry triggers sensitivities that may remain largely dormant in cognitive dispositions reinforced by structured scientific inquiry. My point in introducing morphological content is not to defend a position on the epistemology of theory virtues, but to further illustrate how one cognitive character can have rule governed and non-rule-governed expressions<sup>11</sup>.

Even if this is a promising line for reasoning with theory virtues, this will not be Duhem's account of theory choice because he denies that theory virtues get us out of underdetermination. It may nonetheless be a useful model for understanding good sense. Clearly, details will need to be worked out. What morphological features is good sense responsive to, and morphological

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<sup>10</sup> Stump's reading of Duhem suggests that what I am calling MCC will also engage with the scientist's moral character. Whether or not clear differences between moral and epistemic virtues can be drawn and how they are integrated in an agent is a hotly debated issue in virtue epistemology, but this should be compatible with the general line taken here

<sup>11</sup> The application of morphological content to the epistemology of theory virtues may be a promising line. Horgan, Henderson and Tiensen have developed this theory, but not with explicit reference to theory virtues. Henderson and Horgan mention theory virtues in their initial characterization of morphological content, but are more concerned with individual reasoning than scientific reasoning. These topics converge if theory virtues are significant elements of ordinary reasoning. I explore this in “Theory virtues and morphological content” (manuscript in preparation).

features of *what*? Is it features of theories themselves, or perhaps the track record of timidity and boldness in the history of science? However these important details are worked out, a reading along these lines supports the agent reliabilist reading of good sense as an ability that expresses the scientist's cognitive character. The appeal to MCC thus supports a virtue theoretic reading and allows us to unify the two forms of inquiry introduced above. Duhemian VE will now require success in making theory choice determinate in a way that expresses the scientist's cognitive character in accordance with norms that preserve non-UD epistemic values. What differs between UD and non-UD inquiry are the specific operations and sensitivities of MCC triggered in the different contexts of inquiry. The appeal to the scientist's character is attractive in part because it unifies various strands of the virtue theoretic solution and retains the connection to core scientific rationality that radical anti-realist resolutions often sever.

Virtue epistemologists are interested in epistemic axiology or epistemic value theory. Most notably, we see this in the rapidly growing literature on the value of knowledge and The Value Problem<sup>12</sup>. The main point of contention here is whether truth is the only fundamental intrinsic value relevant to determining the value of knowledge. I will later argue that the value problem and the problem of underdetermination are intertwined. Much of the Value Problem literature aims to show that relegating our epistemic axiology to truth and the means to truth will not sufficiently explain the greater value we attribute knowledge over merely true belief. It would appear that resolving UD will force a similar axiological change to any theory that admits it, as whatever epistemic values were driving inquiry into UD are shown to be insufficient for having done so. Revising fundamental epistemic values understandably prompts worries about radical conclusions, relativism, anti-realism and the like. But we see that Duhem can avoid significant changes in epistemic axiology by shifting the form of inquiry regulated rather than the values themselves. This is a nice move. While Duhem's epistemic values are not the same as the truth monist's and neither is he out to provide an analysis of the concept of knowledge, both aim to preserve their fundamental epistemic values in resolving deep epistemic challenges.

Despite these parallels, I will argue that Duhem's solution is incompatible with epistemic value t-monism. One epistemic value comes to the fore in characterizing good sense, if not for the first time, at least in a new way. The success condition for good sense is to break the empirical stalemate, and thus to insure that 'choice worthy theory' remains a *sui generis* kind. Clearly the intuition driving the epistemic problem of underdetermination is that a theory must not only be choice worthy, but uniquely so, it must have unique epistemic standing. The shortcomings of the empirical methods that lead to UD is their failure to maintain *sui generis* standing for one theory. There is a failure to confer uniqueness. In the final section of the current inquiry, I argue that recognizing the epistemic value of uniqueness forces the rejection of epistemic value t-monism. This points to another way in which Stump's virtue theoretic reading fruitfully connects with work in VE.

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<sup>12</sup> For an overview of the huge amount of work on the value problem, see Pritchard (2007a)

However, there is a lurking problem for the virtue theoretic reading, and we can see this by comparing Duhem's approach with Quine's<sup>13</sup>. Here we consider the resolution required to support his naturalism<sup>14</sup>, namely the sectarian line where one's home theory or mother tongue is deemed uniquely choice worthy. One motivation here is Quine's 'maxim of minimum mutilation' (1992, pg. 14). This principle counsels that the theory within which we realized that there are empirically equivalent alternatives is the one to which we should remain faithful, since no alternative theory has shown itself to be more choice worthy. The relevant fact for making theory choice determinate is the fact that determines which of them counts as "one's own". Assuming there is some such fact<sup>15</sup>, it quickly pares the field of candidates down to one, and we break the empirical stalemate.

For better or worse, one theory gets unique epistemic standing on Quine's sectarian line, and he is able to get out of the problematic established by empirical equivalence. Many will turn a wary eye to the means by which this standing has come about, as this sounds more like a vice epistemology than a virtue epistemology. We have nothing like Duhem's laudable virtues of objectivity and neutrality, in fact quite the opposite. As the sectarian moniker suggests, the choice worthy theory 'earns' its standing through partiality to one's own, or perhaps 'epistemic loyalty'. Nonetheless, the move to UD inquiry may also be a move from vice to virtue for some forms of cognitive activity.

Quine's determinacy restoring values may offend our deepest convictions about what matters in inquiry and knowledge, but they might also be necessary. How exactly will the Duhemian values of objectivity and neutrality succeed in distinguishing one theory over others if they are empirically equivalent? Neutral, objective arbiters of truth are left without a basis for theory choice if such arbitration relegates itself to the empirical merits of theories. Presumably that is what makes an inquiry objective and impartial. But then a virtuous Duhemian scientist considering empirically equivalent theories will end up like Buridan's Ass caught between Max Black's balls. Good sense regulated by Duhem's laudable epistemic values is thus not an effective procedure. Call this the *Objectivity Problem* for the virtue theoretic reading. While the interesting and fruitful connections with virtue epistemology are intact, it is not clear how Duhem's virtue theoretic approach can succeed in securing uniqueness. A more thorough development of the epistemic psychology of good sense will be needed to avoid this problem.

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<sup>13</sup> This is not to suggest that Quine and Duhem see the problem itself in the same way. Quine has many formulations and responses to UD, and breaks with Duhem in many ways, most notably in the global holism as opposed to Duhem's local holism. For a thorough discussion see Hofer and Rosenberg (1994)

<sup>14</sup> The many approaches to underdetermination in Quine is discussed in Bergstrom, L. (1993)

<sup>15</sup> The indeterminacy of translation may show that there is no such fact (see Gibson, 1987, Searle 1987), but here we adhere to the policy of restricting our concern to the epistemic axiology engendered in Quinian solutions, not their justifiability even by his own lights.

## The evidential reading

Ivanova (2009) challenges the virtue theoretic reading. On her reading, exercising good sense will emerge as neither a success nor an ability in the sense needed to meet the general criteria for virtue epistemology. Ivanova argues that Duhem accepts a weak form of UD (ibid, pg. 59), and this is very important in her account of the epistemic standing a theory receives when selected by good sense. According to weak UD, a theory can be underdetermined by all available evidence at a given time, but not by all evidence *tout court*, or at all times. According to Ladyman (2002), evidence not yet available, or a more precise understanding of currently available evidence, may later clinch theory choice even if it is underdetermined by the current interpretation of evidence in hand. On the weak reading, underdetermination from empirical evidence is a temporary epistemic condition that arises when we evaluate theories in light of incomplete evidence, or evidence incompletely understood, and theory choice is in principle, and perhaps in practice, decided solely on evidential grounds. Call this the evidential reading.

This allows Ivanova to claim that when scientists choose a theory through the exercise of good sense, "their choice is justified only retrospectively by empirical evidence" (ibid., 60). At some time *t*, choice between T-1 and T-2 may be underdetermined relevant to all evidence available at *t*, but new compelling evidence will later be adduced at *t-2* for one of them, and this later evidential support is what makes theory choice determinate, not being selected by good sense. While Ivanova says that good sense gives a theory "some provisional standing...the fact that these theories are later supported by empirical evidence shows that good sense leads to the right choices." (ibid., 60) Good sense is thus an explanatory hypothesis "posited post hoc to explain the history of science: it cannot determine choice in the face of underdetermination." (ibid, 63) Thus, it is not because a theory is chosen by good sense that it attains what we will call *fundamental* epistemic standing, because "good sense is not sufficient to provide us a basis for theory choice...it can be descriptive, but it cannot provide us with a solution when faced with the problem of theory choice." (ibid.,61) Only evidence gives a theory fundamental epistemic standing according to Ivanova. The virtues of good sense do not confer fundamental epistemic standing. Good sense does not confer uniqueness.

The evidentialist view of theory choice clearly conflicts with Stump's virtue theoretic reading (2007). Of course, Stump need not deny that being supported by future evidence confers an important additional standing on a theory. Compelling new evidence E for a theory T should, *ceteris paribus*, boost the epistemic standing of T independent of E. Stump and Ivanova can easily agree here. The difference between them is over the epistemic value generated by good sense *per se*, independent of new evidence. For Stump, the epistemic value generated by good sense *per se* significantly changes a chooser's epistemic circumstance, taking us from (a) to (b) below.

(a) considering multiple theories that are equally choice worthy relative to all currently available empirical evidence E, plus any epistemic standing that comes from theoretical virtues (tv)

(b) considering one choice worthy theory on the basis of available empirical evidence E, (tv) *plus* the additional epistemic standing from good sense.

With no change in support from E or (tv) in going from (a) to (b), the epistemic value generated by good sense suffices to bring about the important change in epistemic circumstance that leaves us with only one currently choice worthy theory. Ivanova's account requires that going from (a) to (b), where theory choice is the determinate choice at (b), requires some change in E or (tv). Based only on the epistemic value generated by good sense, going from (a) to (b) will not be a transition to determinate theory choice for Ivanova.

### Reliable Good sense

I will argue that Ivanova's diminished reading of the epistemic value of good sense cannot explain how theory choice becomes determinate from later evidence, nor does it undermine the virtue theoretic reading. Ivanova claims that theories distinguished by good sense are often later supported by compelling new evidence and become parts of a natural classification. The capacities exercised by scientists using good sense are thus tracking evidentially important features of theories, and are epistemically reliable capacities<sup>16</sup>. If a belief P is the product of a reliable capacity or process this fact constitutes evidence in favor of P. Thus, if the products of good sense reliably turn out to be supported by compelling new evidence, then being the product of good sense will be evidence for any theory with such a distinguished etiology.

But, now it appears that future evidence is not needed to evidentially distinguish the theory chosen by good sense, because the reliability of good sense is itself evidence supporting that theory. Ivanova's claim about the track record of good sense thus supports the agent-reliabilist virtue theoretic reading examined above. The scientist exercising good sense is a reliable epistemic agent, and a scientist that does not exercise good sense will fail to be a reliable agent in UD inquiry. If we maintain Ivanova's position and insist that the theory selected by good sense is still not finally choice worthy without future evidence, we need some relevant difference between the kind of evidence that comes from reliable good sense and the future evidence Ivanova has in mind, perhaps new observations, and, even then, to motivate withholding fundamental epistemic standing for theories merely supported by the evidence of good sense.

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<sup>16</sup> That good sense is epistemically reliable is an interesting empirical claim. For Duhem, this would not be 'alethic reliability', but rather reliability in choosing theories that become part of a natural classification. One difficulty in supporting this claim is that if a different theory were chosen by good sense, it may also have been supported by future evidence and become part of a natural classification, or, given holism, it could have been reconciled with that future evidence through suitable auxiliary adjustments. Good sense would then attain a strong track record no matter which of the two theories were chosen, and this doesn't seem right. For the current discussion, I will assume these cases do not obtain, and accept Ivanova's 'track record' claim for good sense

An agent-reliabilist virtue theoretic reading of Duhemian theory choice appears to be on solid ground. The reliability Ivanova attributes to good sense gives us the success condition necessary for a virtue theoretic reading. It is important to note that we do not engender any radical subjectivism or anti-realism by allowing the character of the scientist a significant role in determining the epistemic standing of their science. Good sense confers an objectively valuable standing on a theory because it tracks objectively valuable properties that correlate with the epistemic goals of empirical adequacy and natural classification. It may be objected that, if the sole value of good sense is its reliability, we do not have the right direction of analysis for a true virtue theory. Epistemic value is really seated in reliability, not the virtues *per se*, even if it is the virtues to which we attribute reliability. The capacities comprising good sense are properly deemed virtues because of the good standing of their products, and the good standing of these products is determined independently of their being grounded in virtuous capacities<sup>17</sup>.

We can see clear differences between mere reliabilism and virtue reliabilism in Ernest Sosa's (2007) approach, which grounds epistemic value in performance normativity. Sosa defines knowledge as apt belief, where aptness is largely defined in terms of the reliability of a capacity or competence in appropriate conditions (Sosa, 2007, chapter 4 *passim*). If the exercise of a competence is accurate (true) and adroit (manifesting an agent's skill), then it will be knowledge if its accuracy is sufficiently due to the exercise of the skill rather than luck. Sosa's account is not merely reliabilist because only stable and enduring properties of agents support reliability attributions, capacity reliability is determined with respect to conditions appropriate for its exercise, some skill must be involved, and the reliability must be explained by the exercise of the capacity. It is reasonable to think that some of these additional conditions will be part of a full explanation of the reliability of good sense, and thus distinguish it from bland reliabilism. Good sense seen as the skillful exercise of cognitive character in UD-inquiry will include abilities of discernment and judgement required for such inquiry to be properly guided by objectivity, neutrality, and probity, and sensitivity to when UD-inquiry is called for at all. While Stump's account is more paradigmatic of responsibilist virtue epistemology<sup>18</sup>, Ivanova's account has a clear analogue in Greco's agent-reliabilist virtue epistemology and Sosa's AAA account of epistemic virtue. Thus, a virtue theoretic reading can accommodate her view thus far. The greater challenge to a virtue theoretic reading comes from the diminished she attributes to the products of good sense. I argue that this position is deeply problematic and points to a value of good sense independent of its reliability.

### The problem of deflated good sense

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<sup>17</sup> The appropriate reading of the direction of analysis criterion for distinguishing true virtue theories continues to be a source of disagreement within virtue epistemology. A very nice treatment of weak and strong virtue epistemology Blackburn (2001) highlights the difficulties of finding the right level of caution to grant virtue terms in defining core epistemic concepts.

<sup>18</sup> Kidd (2011) defends a virtue-responsibilist reading of Duhem in support of Stump's virtue theoretic reading, and against Ivanova's evidentialist reading. While there are a number of problems facing Kidd's account (see Ivanova forthcoming), Stump's reading does appear to be responsibilist because the proper sensitivity to the values of objectivity, neutrality and the like are what make the scientist's choice virtuous, not the external success of their choice.

Ivanova may claim that good sense, even though reliable, confers no important epistemic value on its products before they are supported by new evidence. Indeed, this seems to be her view. It is only an undefined provisional standing or temporary acceptance that good sense confers upon its outputs (2009, pg. 62), and enjoying this standing plays no further role in her explanation of theory choice<sup>19</sup>. Whatever standing good sense confers upon its products, it does not appear to be very valuable epistemically, at least for determining which theory has fundamental epistemic standing. So, it's possible that Duhem does not engender a virtue theoretic commitment on Ivanova's reading if, despite its reliability, good sense confers no important epistemic standing on its outputs.

I will argue that this position is untenable. If only evidence (and theory virtues) can determine theory choice and good sense plays no important role in a theory attaining fundamental epistemic standing, there should be no need for good sense at all. But, consider what happens when we proceed without it. Facing underdetermination, we keep in play all theory revision options available at  $t$ , and let time and future evidence decide which is uniquely choice worthy. This may be less efficient, since good sense will likely get us to the same theory earlier, but doing without it should not fundamentally change the outcome of the deserving theory becoming uniquely choice worthy from future evidence.

However, without good sense, new evidence will never be sufficient to determine just one theory amongst a range of revision options ( $R_1, R_2, R_3 \dots R_n$ ). Duhem considers the case of a putatively crucial and decisive experiment that will decide between two hypotheses  $H_1$  and  $H_2$ , where some experimental evidence  $E$  clearly favors  $R_1$  by virtue of a failed observational consequence (not- $E$ ) of  $H_2$ . We now get his classic argument that theory choice is nonetheless underdetermined because suitable auxiliary revisions are available to the conjunction of  $H_2$  and the whole "theoretical scaffolding" that generated observational consequence (not- $E$ ), such that  $H_2$  is retained and compatible with  $E$ . We are now facing underdetermined theory choice, but instead of singling out one theory through good sense, we provisionally retain  $H_1$  and  $H_2$ , and keep testing and gathering evidence. Following Ivanova, we should later at  $t-2$  get compelling evidence  $E_2$  for the theory that would have been selected by good sense, say  $H_1$ . However, the same or comparable revision strategies that kept  $H_2$  available at  $t-1$  will be available at  $t-2$  when we get the new evidence favoring  $H_1$ , and  $H_2$  can be kept alive at  $t-2$  through some revision strategy that squares it with  $E_2$ . So, we are right back where we started, essentially the same situation as in the original crucial experiment case. The situation may indeed be worse, since there will be multiple revision strategies at  $t-2$  for each of the theory revision options retained at  $t-1$ . Our load of competitors is growing exponentially. Perhaps some of our ever growing options will be weeded out by theory virtues. But if theory virtues will be sufficient for theory choice at  $t-2$ , then they presumably could have been at  $t-1$ . We then would not have underdetermination in the first place, and no need for good sense.

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<sup>19</sup> It's not clear how this provisional standing differs from the provisional standing that most, if not all, of our beliefs and theories enjoy, but presumably that can be worked out.

Independent of good sense, theory choice could never become determinate, even with new confirming evidence<sup>20</sup>. However, with good sense conferring uniqueness on one theory and putting others out of the running for equal consideration, that same future evidence can later count decisively in its favor. This shows an interesting fact that new evidence in favor of a theory gives it a different epistemic standing depending on whether we are considering it alongside or independent of meaningful rivals. In the former case, new confirming evidence does not make a theory the determinate choice with fundamental epistemic standing. In the latter case, that same evidence determines theory choice and confers fundamental epistemic standing.

This shows that good sense is doing something important, independent of its reliability, but what? We now have two important epistemic values and epistemic standings; uniqueness from good sense and clinching support from new evidence. I argue that good sense confers uniqueness the theory it selects, but does not confer fundamental epistemic standing on that same theory. Subsequent evidence confers fundamental epistemic standing on a theory, but only because it previously attained unique standing from good sense. The result is that evidence alone can never confer uniqueness, but it can confer fundamental epistemic standing to a theory that already has uniqueness. Call this the hybrid reading.

On the hybrid reading, epistemic virtues are not doing all the heavy lifting because good sense alone does not confer fundamental epistemic standing. However, the contribution from virtues in the agent are necessary because absent the conferral of uniqueness we have interminable UD, even with compelling new evidence in hand. The epistemic virtues thus play a necessary but not sufficient role in theory choice. The hybrid account has an essential virtue theoretic element, but remains importantly connected to the objective goal of empirical adequacy. Ivanova's account needs to see Duhem as a virtue epistemologist to the extent that one essential value is conferred on a theory only when it is appropriately related to a scientist's good sense.

### The ability problem

A different worry raised by Ivanova is that there is no way to determine when a scientist is really exercising good sense. Good sense is not a well defined ability. This would be an objection to both the virtue theoretic reading and the hybrid reading. If this is correct, then the ability variable in the success from ability criterion will not be satisfied. Ivanova describes a plausible case where two scientists both claim to have it, but are lead to select different theories (2010, pg. 61). The disagreement itself is not the problem, but that there appears no possible way to resolve the question of who truly has good sense. There is no observational ground or explicit method that will decide which of the two has it. If we allow that both of our scientists are exercising the ability, we get the problematic result of interminable underdetermination noted

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<sup>20</sup> I will not argue the point here, but this may also show that any meaningful distinction between weak and strong underdetermination requires attributing a significant role to good sense.

above. But, if we insist that only one of them is exercising the ability, we have no way to determine which.

Ivanova proposes that future compelling evidence shows which of the two really has it. We noted some problems with this above, but here the support from future evidence is the criterion for who has the ability, not what gives a theory fundamental epistemic standing. The virtue theoretic and hybrid reading can potentially use this criterion without surrendering their position on the epistemic value of good sense. But, to avoid the problem of interminable underdetermination raised above, we will have to claim that one of them is right before the new evidence comes in. The reliability of good sense will not be helpful in this context.

Ivanova offers another resource for getting a well defined ability in her appeal to the perfect scientist. She argues that “we can speak of an ideal scientist possessing various characteristics or virtues such as impartiality, intellectual sobriety, rectitude, probity and intellectual courage. We can idealize the properties and virtues of actual scientists into the properties and virtues of an ideal one. (ibid, pgs. 63-64). This abstraction to an ideal scientist becomes normative because “The actual scientists approximate and resemble to a different degree the action of the perfect one.” The capacities and characteristics of the ideal scientist thus circumscribe the processes that constitute good sense in actual scientists. If we have a well defined concept of the perfect scientist, we should have a well defined ability of good sense in actual scientists.

This is an interesting proposal, essentially constructing a scientific *phronimos* as a source of guidance normativity in scientific practice and theory choice. Our earlier discussion of methodological cognitive character (MCC) may add to her proposal. The image of the perfect scientist may plausibly be seen as an idealized cognitive character (MCC) developed through non-UD inquiry. Good sense is how that idealized cognitive character would deliberate in UD inquiry. While this move to the perfect scientist points to ways in which we can clarify the definition of good sense, it does resolve the problem of adjudicating conflicting claims of who has it. This is a real difficulty facing the virtue theoretic approach.

Abilities are notoriously difficult to analyze, so Duhem may not have a new or different problem here<sup>21</sup>. Ivanova puts her finger on an area where virtue epistemology needs to sharpen up a bit, and another fruitful connection between philosophy of science and virtue epistemology in work on disposition, competences and abilities<sup>22</sup>. Whether or not this can be worked out, Ivanova appears to have a responsibilist virtue theoretic reading of good sense, but not of theory choice. Even if we grant that no significant epistemic standing comes from the exercise of good sense, the concept itself has become virtue theoretic when shaped around the perfect scientist. While deflating the epistemic value of good sense is problematic for the reasons given above, Ivanova has a virtue theoretic reading of good sense, but not of theory choice.

### Good sense and the value problem

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<sup>21</sup> For a discussion of the many difficulties involved in analyzing abilities see Maier (2010)

<sup>22</sup> Many fruitful connections between virtue epistemology and philosophy of science are examined in Fairweather (2012). Recent work on dispositions in particular can be found in K. Steuber, G. Damschen, and R. Schnepf (eds.) (2007)

I have argued that good sense plays an essential role in theory choice by conferring uniqueness to one theory. Since fundamental epistemic standing still requires support from future evidence, I defend a hybrid theory that seeks to unify the insights of Stump and Ivanova. This section identifies an important issue in contemporary epistemology that the hybrid theory defended here, and work on underdetermination more generally, can illuminate concerning the value of knowledge. A full examination of the connection between the underdetermination and the value problem will not be possible here, but it is an important area for further work on virtue theoretic solutions to underdetermination, and this connection has not been made in the literature on either topic.

The value problem (also known as the *Meno Problem*) and the problem of the underdetermination of theory by evidence have each received considerable attention in recent value driven epistemology and the philosophy of science respectively. What has not been noticed is that they are remarkably similar problems. In some fashion, both show that truth and the means to it are not sufficient resources for constructing an adequate account of knowledge<sup>23</sup>, and both require us to find something else to finish the job. We would expect that the best solution to one will be a strong candidate solution to the other. Below we consider the more narrow question of how Duhem's views on good sense as understood here relate to the value problem.

The axiological challenge known as the value problem is to explain the additional value possessed by knowledge that is not possessed by a merely true belief that falls short of knowledge<sup>24</sup>. The challenge may appear to be easily met because one or two additional conditions will always be satisfied by something that counts as knowledge that will not be satisfied by a merely true belief. The additional conditions for knowledge, however, do not always track the additional *value* of knowledge. Simple reliabilism adds the condition that, in addition to P being true, a belief P must also be the product of a reliable belief forming process to count as knowledge. While the reliability condition may indeed identify something necessarily true of knowledge but not of merely true belief, it does not track their difference in value. The value of a reliable process comes from the preponderance of truth in its products. However, given two beliefs known to be true, one is not shown to be more valuable because it results from a reliable belief forming process. A belief assumed to be true already possesses the value that a reliable process would confer upon it, and that process itself is only valuable because of the true beliefs to which it is a means<sup>25</sup>.

Solving the value problem will thus require something more than finding a condition for knowledge that is not a condition for true belief, but on finding a condition with the right axiological properties. As argued above, one value countenanced in the Duhemian solution to

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<sup>23</sup> This characterization is easily modified to accommodate less realist conceptions of the aim of science by substituting 'empirically adequate' and 'choiceworthy' for 'true' and 'knowledge' respectively.

<sup>24</sup> The literature on the value problem is quite large by now. A very good overview of the problem and variety of solutions is found in Pritchard (2007a)

<sup>25</sup> Goldman and Olsen (2007) defend reliability as what explains the extra value of knowledge.

underdetermination is uniqueness: that for any choice worthy theory on a given subject there is no other theory with that standing on that subject. However, uniqueness cannot be valued because it makes a theory more likely to be true. If uniqueness boosts a theory's evidential standing, the theory that possesses it would not be evidentially on a par with its rivals, and there is no (strong) underdetermination problem to begin with, we just didn't have all the relevant evidence. The value of uniqueness is thus an autonomous epistemic value not swamped by truth.

The argument above moves quickly to a substantive conclusion at the heart of contemporary value driven epistemology, the falsity of value t-monism, and should be given further scrutiny. This is value t-monism, defined as follows by Pritchard (2007b):

“ what makes these goods (justification, rationality) epistemic goods, is that they are a mean to true beliefs. Thus, we epistemically value, say justification, because justified beliefs tend to be true beliefs. Hence the value of this good is parasitic on the epistemic value of true belief in the sense that we only instrumentally epistemically value this good relative to the fundamental epistemic good of true belief.” (Pritchard, pg. 2)...”epistemic value T-monism entails that any epistemic value that is contributed to a belief in virtue of it enjoying an epistemic standing like being justified, or reliably formed is necessarily instrumental epistemic value relative to the fundamental epistemic good of true belief.” (Pritchard, pg. 4)

The question at issue is whether the value of whatever turns out to make theory choice determinate could be grounded in the value of truth. If not, as I will argue, then truth is not the sole fundamental epistemic good. Our question then is whether uniqueness is a veritic or non-veritic epistemic value, whether the value of truth 'swamps' the value of uniqueness. Roughly, one value swamps another if the value of the swamped derives from, or is purely instrumental to, the value of the swamper. Arguably, we see veritic swamping for justification and rationality, and this supports the position that truth and the means to it are sufficient epistemic values for an account of justification. One may have other ideas about justification, but the above line offers a clear example of axiological swamping. The epistemic value of justification is parasitic upon the value of truth. If value T-monism is correct, the value of uniqueness and Duhem's virtues should be swamped by truth, as was the case with justification and rationality. If not, then there exists a fundamental epistemic value other than truth.

I argue that uniqueness cannot be swamped by truth. Veritic swamping in UD contexts is incoherent. Neither uniqueness nor Duhem's virtues can make a theory more likely to be true than it would be without uniqueness or support from the virtues because uniqueness would then be evidence favoring one over other rival theories, and there would be no (strong) UD problem in the first place. If there is an axiological connection between uniqueness and truth, it cannot be

the kind that makes a belief more likely to be true<sup>26</sup>. This leaves the t-monist grasping for a way to explain the axiological connection between truth and uniqueness, if there is one at all.

A veritic reading will have to define uniqueness as a truth-based but non-evidential value. Perhaps this is how theory virtues such as simplicity, elegance and explanatory power are understood. However, these are usually taken as pragmatic rather than truth-indicative properties. Even if theory virtues are given some evidential value, the lack of any systematic contrastive standard to evaluate the degree of support one theory has from theory virtues compared to another theory shows that it is unlikely that unique epistemic standing is achieved even when these properties are included (see Tulodziecki 2007). Thus, even if they are truth-indicative, it's unlikely that they achieve uniqueness, and something more will be needed. This issue requires further consideration to be adequately adjudicated. However, it does highlight yet another way in which Duhem's virtue theoretic solution to underdetermination sheds light on problems at the center of virtue epistemology and value driven epistemology more generally.

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<sup>26</sup> The axiological autonomy of uniqueness does not conflict with the essentiality of uniqueness in theory choice defended above. If the argument of this section is correct, then the value of unique epistemic standing simply cannot be reduced to truth-based values. Thus, neither can the determination of which theory has fundamental epistemic standing.

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