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Title: Enhanced Epistemic Trust and The Value-Free Ideal as a Social Indicator of Trust

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Abstract

Publics trust experts for personal and pro-social reasons. Scientists are among the experts publics trust most, and so, epistemic trust is routinely afforded to them. The call for epistemic trust to be more socially situated in order to account for the impact of science on society, and public welfare in particular, is at the forefront of Irzik and Kurtulmus' (2018) description of *enhanced* epistemic trust. I argue that the value-free ideal for science challenges establishing enhanced epistemic trust by preventing the inclusion of non-epistemic values throughout the evaluation of evidence and communication of these values. By silencing these values, the ideal cannot take into account publics' social and moral responses to inductive risk, which are instrumental for defining and determining public welfare. Furthermore, by emphasising epistemic values almost exclusively in science education and communication, the value-free ideal is presented to publics in such a way that it becomes a social indicator of trust. I show this through examination of the importance of values in decisions to trust, and conclude that values (and restrictions on them) can be used by lay publics to inform decisions about whom to trust.

(192 words)

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Bibliographic statement: T.Y. Branch is a philosopher of science and postdoctoral researcher. She is interested in the role of values in science and science communication. She is also known for her engaged philosophy work in near-living architecture and computer science.

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Enhanced Epistemic Trust and The Value-Free Ideal as a Social Indicator of Trust

1. Introduction

Trust is a crucial dimension of our relationship to ourselves and others. In a world where we cannot know everything nor verify all our beliefs, trust allows us to navigate an environment where it would be impossible, and in some cases even undesirable or irrational, to personally verify everything we believe. Trust has increasingly become the focus of discourse in political and social spheres, but despite calls for greater trustworthiness, understanding what trust is, whom to trust, and the characteristics of epistemic trust in particular, have only recently begun to be explored in detail (Simon 2020).

Among the many individuals we trust, scientific experts keep company with those we trust most (Krause et al. 2019).[i] This can be attributed to at least two factors. First, scientists are imagined to do science not only for their sake, but also for the broader society which supports and benefits from their work (Douglas 2016). This extends to research groups (Wilholt 2016), the social practices of scientific communities, and institutions of science (Wagenknecht 2015). Trust is also afforded to scientists because of science's ability to provide us with the most reliable information about the natural world. It accomplishes this end in large part through its values.

Values intersect science by influencing its practitioners, guiding research, and emerging as both a product and process (Allchin 1999). I use values here to mean dynamic, person dependent and contextual, cognitive and emotional mental processes that can be theoretically and empirically investigated as a combination of mental representations.[ii] As values tend to have a degree of stability, they can be 'articulated and appealed to' (Piso et al. 2016, 216). This permits them to guide practices and determine the 'aims, objects, or ends that activity is directed towards' (Brown 2020, 101-102), making our objectives 'worthy of pursuit' (Elliott 2017, 11).

Scientific experts use a mixture of personal (e.g. ethical), social (e.g. political) and professional (e.g. epistemic) values to carryout and communicate their research. Though science encapsulates diverse sub-disciplines, practices, and findings, what connects these ways of knowing is the priority given to epistemic values like experimentation, replicability, refutation, and revision. In theory, the focus on epistemic values is intended to generate information that is empirically reliable and scientists who are, in some sense, disinterested, by preventing subjective elements like bias and preference from making scientists more invested in particular outcomes over others. Accompanying this emphasis on epistemic values is the fear of non-epistemic values intruding into the scientific process (especially during evaluations of evidence), which can lead to the unwarranted acceptance or rejection of scientific information for subjective reasons. Because non-epistemic values inevitably enter through the scientists that carry out science, ideals aimed at regulating these values were developed.

The aim of defining 'the heart of science' through epistemic values while limiting non-epistemic values is most ardently articulated through the value-free ideal (VFI) for science. The VFI is the idea that epistemic and non-epistemic values can be used when deciding on research questions, crafting hypotheses, deciding processes, practices, and methods of experimentation; however only epistemic values are authorised in the evaluation or analysis of evidence. In other words, 'the justification of scientific findings should not be based on non-epistemic (e.g. moral, political) values' (Betz 2013, 207). This is because epistemic values like testability, predictive accuracy and consistency are envisioned to steer science towards the truth whereas non-epistemic values, such as ethical, social, and pragmatic values, threaten to lead science away from it.

The VFI ultimately came to be seen as an inappropriate ideal for science because of a series of criticisms, the most developed being the descriptive, boundary, and normative challenges (Douglas 2016). The descriptive challenge, proposed by feminist scholars like Fausto-Sterling (1985), Harding (1986, 1991), and Longino (1990) showed how even exemplary seeming science could be based on problematic background assumptions informed by non-epistemic values which blinded it from alternative explanations (e.g. ascribing a 'damsel-in-distress' narrative to the role of the egg in reproduction). The boundary challenge finds a practical weakness in the VFI's necessary distinction between epistemic and non-epistemic values. Rooney (1992), using a historical approach, showed how acceptance or rejection of a theory can hinge on non-epistemic values like metaphysics in the Bohr-Einstein debate around the acceptability of quantum theory.[iii] In the same vein, Longino (1995) employed a feminist critique to show that there is not a consistently applicable and discrete list of epistemic values. Lastly the normative challenge, a test of the ideal qua ideal, highlights the endemic uncertainty unavoidable in science. The issue of inductive risk in science —to be revisited in section 3— articulated by Hempel (1965) and then revisited by Douglas (2000), argues that scientists ought to decide if they have sufficient evidence based on how their research will be used and what the consequences of a false-positive or false-negative error might be (Douglas 2016). Due to these potential consequences, social, political, and ethical factors cannot be avoided and therefore non-epistemic values should not be excluded from the evaluation of evidence. Combined these three challenges have effectively shown the VFI to be an undesirable and unachievable ideal for science.

1.1. When Non-Epistemic Values align with Epistemic Values

While the VFI might have admirable aims in theory, it routinely permits ethically problematic research. Take the infamous Tuskegee Study of Untreated Syphilis (TSUS) designed to observe the natural course of untreated latent syphilis in Black men. From 1932 to 1972 the U.S. Public Health Service (USPHS) sponsored what is believed to be the longest observational study ever conducted (in medicine) (Baker et al. 2005). Tuskegee, Alabama was selected because it appeared to venereologists as "...a 'readymade situation' and an unusual opportunity for a classic study in nature that probably could not be duplicated anywhere else in the world" (Brandt 1978). The population of Tuskegee was 82% African-American at the time the study began. The main purpose of the study —which was hidden from participants— was to evaluate the extent of medical deterioration from untreated syphilis over time (Gray 1998). To get enrolment in the study, people were told that participants would receive free treatment from expert government doctors (Brandt 1978). Instead the 399 men with syphilis who were enrolled in the study because of their "bad blood" (Schmidt 2003) were subject to medical assessments (e.g. physical examinations, blood tests) but only given vitamins, tonics, aspirins, and placebos. This comes despite penicillin being known to be highly effective against syphilis in the 1950s and the military successfully using penicillin even earlier.

Ten years after the start of the study, twice the proportion of syphilitic participants compared to the uninfected control group had died. The researchers concluded that the life expectancy of untreated

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syphilis participants was reduced by about 20 percent (Heller and Bruyere 1946).[iv] In 1966, the methodology and results of the experiment touched Peter Buxton (a venereal disease investigator for USPHS) who expressed 'grave moral doubts' about TSUS in a series of letters to the Centers for Disease Control. They did not reply. This prompted Buxton in 1972 to contact Jean Heller, an Associated Press reporter who published the story on the front page of the New York Times on July 26th, 1972. The story generated enough public outcry for TSUS to be investigated by the Department of Health, Education and Welfare. The department found the study to be ethically unjustifiable and shut it down in 1973. Treatment was authorised for the remaining infected participants, however by this point more than 100 participants had died directly from syphilis or complications associated with it (McLellan 2004). How many partners contracted syphilis and how many children were born with congenital syphilis remains unknown (Yoon 2000; McLellan 2004).[v]

The importance of values in this study cannot be understated. Brandt's (1978) examination of the National Archives is a value-conscious contextual compliment to the Department of Health, Education and Welfare's Final Report which overlooks fundamental non-epistemic values undergirding the study, namely racism. By the 1900s Darwinism had provided a new rationale for racism in America. As a result, medical attitudes concerning Black people, their sexual practices and disease, were aimed at finding differences and framing 'blackness' itself as a subject. Brandt (1978) explains how "in retrospect the Tuskegee Study revealed more about the pathology of racism than it did about the pathology of syphilis; more about the nature of scientific inquiry than the nature of the disease process"[vi] (27).

At first glance, this might not look like a case of VFI guided science because non-epistemic values like racism feature so prominently throughout. However, I posit that the TSUS case is an example of VFI science because the epistemic values TSUS used to frame research, like appeals to continue the study for the sake of comprehensiveness, outweighed any conflicting non-epistemic concerns. To put it differently, although in practice the VFI prohibits the use of non-epistemic values in the evaluation of evidence, if non-epistemic values (i.e. a superiority between races) can be aligned with epistemic values that are attractive to the scientific community (i.e comprehensiveness, 'classic' studies), such research can pass and even be supported by the VFI.

The Tuskegee study is regularly cited as a reason why African Americans are hesitant to participate in medical endeavours (Shavers et al. 2002) like vaccine rollouts (Brandon et al. 2005), which has had direct consequences with respect to COVID-19 (Bunch 2021; Razai et al. 2021). But this is just one value-rich example of many that continue to haunt the Western medical-science complex.[vii] I must acknowledge that by focusing on the VFI as it operates in liberal democratic societies, this paper is limited to the norms and practices of science and science communication in a Western context. The reason for this is two-fold. First, the VFI takes root and is most clearly articulated in the United Kingdom and United States in the mid-twentieth century. The Society for Freedom in Science (SFS) which formed in the UK in 1940 used rhetoric that championed science as 'value-free' and scientists as abstracted from society. According to this view, research was to be determined by scientists' own interests; this approach to science was taken up by Vannevar Bush's in his influential book *Science - the Endless Frontier* (1944). The book argued for science funding from the public purse without scientists having social responsibilities beyond pursuing epistemically sound science, which would automatically produce public good. Second, expanding

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my investigation of the VFI beyond the borders of the West would prove too challenging for all the nuances that would have to be considered. However, the impact of the VFI in contexts outside the West and Global North needs to be investigated because the ways in which Western science interacts with different epistemic understandings to create hybrid knowledges continues to influence the increasingly collaborative and international state of science.[viii]

The ubiquity of the VFI and its permissiveness, reflects a science and set of experts who can professes a commitment to epistemic values whilst being susceptible to non-epistemic values. Understandably when lays publics, especially those in vulnerable positions, get the impression that science is being carried out in such a way that it prioritises epistemic values at the expense of relevant non-epistemic values, they digest this information and use it to inform decisions to trust. But how do lay publics, who do not participate in science or engage scientists directly, develop impressions of the VFI? In the following section I review how the VFI is transmitted through science communication and education (section 2). Then I provide an overview of Irzik and Kurtulmus' distinction between basic and enhanced trust (section 3). This motivates my dissection of implications for enhanced epistemic trust and the importance of values in risk assessments and decisions about who to trust (section 4). I conclude that the VFI is incompatible with enhanced trust and that the VFI can be taken as an informative social indicator of trust.

Before commencing my argument in earnest, let me preface it by acknowledging the following decisions. First, this work will toggle between discussing the VFI as an ideal for science and scientists embodying the VFI. What matters here is that the VFI remains the subject of my exposition in either case. Similarly, when I go on to talk about science communication and science education, I do it in such a way that collapses together science and scientists as those representing the VFI. Furthermore the authors I use to examine trust (namely Irzik and Kurtulmus (2018)) speak of public trust in scientists, but less so about trust in science as a way of knowing. They assume that members of the public have a certain level of trust in science and their account of enhanced epistemic trust does not apply to those who reject scientific methods and practices completely (3). Trust in science as a way of knowing is different than trust in individual scientists. Therefore, trust in scientists as a community of experts, or science as a set of methods, is different than trust in a particular scientist/communicator who may, or may not, agree with the scientific community or share values with specific publics. My analysis of the VFI maps out the route of the ideal through scientists as creators and conduits of scientific knowledge, communicators and educators who translate this information, and lay publics who encounter it. The VFI in this account thus becomes a thread with which to follow how values are prioritised in science, embodied and interpreted by scientists, expressed and transformed by communicators and presented to publics through science communication and education.

2. Communicating the Value-Free Ideal for Science

Publics regularly come to know scientific information through the communication of science. As second-hand knowers who have neither the competence nor the resources to carry-out and assess scientific claims directly, this information is useful for well-informed personal and civic decision-making. As I review here and have argued elsewhere (Branch-Smith 2019), the VFI's exclusion of non-epistemic values from science has had normative and practical consequences for formal science education and informal science communication.[ix] I argue that in both cases, lay publics are presented with a version of science that is stripped of non-epistemic values. Non-epistemic values are inevitable and sometimes desirable in science. Afterwards they will also be shown to be crucial for addressing inductive risk and deciding which experts to trust.

To understand how the VFI is communicated as a social indicator of trust, it helps to first see how science was relayed before the ideal was adopted. Beginning in the 1800s, over a century before the VFI becomes institutionally established, efforts to communicate science envision publics as actively able to engage science directly. Popular titles like Lalande's *L'Astronomie des Dames* (1817) ushered in a print tradition of science communication which continued throughout the 19th century. In addition to print communication, public lectures by scientists like Nikola Tesla (1893) and exhibitions at events like The Exposition Universelle in Paris (World's Fair 1900), exemplified direct communication between scientists and lay publics. Here publics are expected to participate and be entertained by science, but still be able to understand it. The idea of publics as capable of learning from scientists directly would change with the specialisation of science into sub-disciplines (Schofer 2003). In the early to mid-twentieth century, science as something 'too complicated' for publics to understand became an established point-of-view (Bucchi 2008).

As this distance between scientists and publics was being laid out, norms for science would begin to crystallise and eventually become the VFI for science by the start of the Cold War.[x] Throughout the Cold War, new areas of expertise like science journalism and popularisation became responsible for diffusing information from scientists to lay publics. The goal: to establish a baseline of public familiarity with science known as 'science literacy'.[xi] Science literacy is the knowledge people need to 'feel empowered to hold and express a personal point of view on issues with a science component' (Reiss, Millar and Osborne 1998, 12). It focused on value-free scientific facts and thrived as a social goal until the 1960s. Despite the push for greater science literacy, publics science literacy levels stayed mid-range and stable during this time (Nisbet and Scheufele 2009).

Between the 1960s and the 1980s, the deficit model for science communication became the default (Gross 1994). It assumed scientists to be primary epistemic knowers and publics a homogeneous, uninformed mass who were ultimately responsible for their own low science literacy levels. Marked as deficient, lay publics were expected only to absorb science but not critique or engage it directly. Compared to the 19th century, where lay publics were encouraged to approach scientists in science communication contexts like World's Fairs, in the twentieth century, publics were expected to receive information through intermediaries allowing scientists to be further insulated from society. As a result, publics (and their values) quickly lost avenues to access (and inform) science. This allowed scientists to criticise distortions or sensationalism about science without the responsibility for having to correct these distortions. In so doing, the independence of science as characterised by the VFI flourished in science communication along with less recognition of non-epistemic values (Branch-Smith 2019).

Informal science communication is not the only mechanism through which publics are exposed to the VFI; it also guides science education. As with communication, science education began with the goal of science literacy. Assessment instruments to measure science literacy were developed between the early 1950s and 60s to quantify 'cognitive, affective and attitudinal outcomes' (Abd El Khalick 2014, 622). Science literacy in science education would eventually evolve to become 'public understanding of science' where understanding refers to knowing the nature of science (NOS). The NOS, as outlined by pedagogy scholars and social scientists, is knowledge of the practice, findings, and social features of science (Clough 2011). Note the recognition of social, and therefore potential for non-epistemic values in the NOS, which is even captured in science education curriculums (McComas and Olson 1998). Yet the NOS is too broad to be taught in classrooms, especially ones geared towards quantitative testing (Bhattacharyya, Junot and Clark 2013). So to simplify what to teach, it was decided that the elements of the NOS with the most agreement around them, namely those that had scientific consensus, should be prioritised (i.e. the uncontroversial fact-focused findings of science). Science education's emphasis on the relatively unequivocal and uncontested aspects of science came to be known as the consensus view.[xii] However, as normative and practical questions about which non-epistemic values to use and how continues to be debated (Holman and Wilholt 2022), under the consensus view, non-epistemic values cannot be communicated. In other words, despite non-epistemic values being a relevant aspect of scientific inquiry and the NOS, they are masked under the consensus view, making science education a conduit for epistemic values and the VFI instead (Branch-Smith 2019).

As presented, the aforementioned rise of the deficit model in science communication and the consensus view in science education follows the trajectory of the VFI. Now let us briefly review how all three fall from popularity. Diffusionist science communication (e.g. the deficit model) aims at public understanding of science from 1985 into the 1990s after which 'public attitudes towards science' (Gardner 1975) are identified as the problem into the late 1990s and 2000s (Bauer 2008). In the early 2000s, the goal of science communication moves to situating science-in-society, correcting the trust deficit, recognising diverse publics and addressing crises of confidence, but the deficit model is never completely defeated.[xiii] In science education, the consensus view is heavily questioned by the 1980s (Laudan et al. 1986) after which a switch in learning goals occurs and the goal of training future scientists transforms into a broader 'science for all' approach (Duschl and Grandy 2013). The consensus view is revised into the 2000s (Lederman et al. 2002) in order to help it include 'authentic' cases of science in society by the 2010s (Allchin 2011, 2017). In an echo of this revision, throughout the 1980s and 1990s, the VFI also falls under heavy attack from the descriptive (Longino 1990; Harding 1991) and boundary challenges (Rooney 1992; Longino 1995). Eventually the normative challenge comes to defeat the VFI (at least in theory). Alternative ideals to the VFI are proposed in the 2010s and have been categorised by Holman and Wilholt (2022) based on their axiological, functionalist, consequentialist, coordinative or demarcation strategies. Yet despite criticisms towards science communication, education and the VFI, the deficit model remains popular (Simis et al. 2016), there are continued defences of the VFI (Betz 2013), and cyclic revisions of the NOS and consensus view into the 21st century (Lederman et al. 2002; Simis et al. 2016).

In sum, the deficit model for science communication and the consensus view for science education have worked in tandem to reinforce a scientific culture which is forthcoming about epistemic values, but comparatively quiet on non-epistemic values (Branch-Smith 2019). This cooperation strengthens the prevalence of the VFI in science, communication, and education, which I will show promotes taking the VFI as a social indicator of trust.

3. Basic and Enhanced Epistemic Trust

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People use values to attempt to predict good or bad treatment from those they trust. If a scientist represents the values of their institution, but these values do not include avoiding harm or betraying others, then this provides a reason to withhold trust (Potter 2002). A social indicator of trust is an interpersonal and contextual environmental cue which signals to the trustor to trust the trustee. Social indicators of trust are an indispensable tool for epistemic vigilance, or the low-maintenance state which people use consciously and unconsciously to monitor testimony, expert or otherwise (Sperber et al. 2010). To show how the VFI can be a social indicator of trust, I rely on Irzik and Kurtulmus' (2018) distinction between warranted 'basic' and 'enhanced' trust.

Irzik and Kurtulmus' (2018) basic versus enhanced distinction illuminates under what circumstances we might expect publics to invest warranted epistemic trust in science. They do so by investigating how to incorporate the values of publics into science. Their work is aimed at strengthening Kitcher's (2011) expansion of 'well-ordered science'. Kitcher (2011) attributes the decline of public trust in science to two things: value conflict and scientism. To thwart value conflict, Kitcher (2011) recommends 'value-harmony' and sees it as a necessary condition for warranted trust. Value-harmony constitutes agreement between publics' values and those of scientists regarding inductive risk assessments. Irzik and Kurtulmus (2018) rightfully point out that sometimes value tensions are irreconcilable because scientists and publics can prioritise values differently (e.g. individual values versus communal values). They show that in these instances, because value-harmony cannot be achieved, enhanced trust may be unattainable, although basic trust may still be possible. They ultimately conclude that Kitcher's value harmony is needed only in cases where public welfare is at stake, explaining that value harmony is '...too broad for the purpose of trust building because there is no reason to require value harmony in, for example, fundamental research in star formation or unified field theory, where it does not matter for the public how the inductive risks are distributed' (9). Trust in this type of science constitutes basic epistemic trust.

Let M represent a member of the public, S a scientist or scientists and P a proposition or group of propositions. The trustor (M) can have other reasons to believe that P, but the trustee's (S) communication of P must be a distinct reason for M to believe that P. For basic epistemic trust, if S believes that P and communicates it to M honestly, and M takes the fact that S believes and has communicated that P to be a reason to believe that P, where P is the output of reliable scientific research carried out by S, then M relies on S because she has good reasons to believe that P is the output of such research.[xiv] Although basic trust may be sufficient for science which is not envisioned to impact public welfare (e.g. 'fundamental science') this is not the type of science where publics preferred distribution of inductive risks are of concern. For example, the section of the first light reading location for the James Webb Space Telescope's subsequent calibration has less foreseeable consequences of error than when evaluating the effectiveness of face masks during a pandemic. What is required in the latter case in enhanced epistemic trust.

Enhanced epistemic trust is basic epistemic trust *plus* consideration for public welfare given inductive risk. Inductive risk is the result of the inductive gap between hypothesis and evidence. As it is impossible to gather all possible evidence for our hypotheses, and we never have conclusive proof of our theories, there is no trial or set of trials that can tell us whether or not our hypotheses are definitively true or false. This makes every scientific hypothesis vulnerable to two types of error which define inductive risk: accepting a hypothesis to be true when it is false, and failing to accept a true hypothesis. In sum, when M's welfare is at stake, S makes methodological decisions regarding P using social and moral values that more or less match with M's assessments of the risks associated with false positives and negatives. In the following section I elaborate on why values are crucial to enhanced epistemic trust and how the VFI is an obstacle to establishing this type of trust.

4. Tensions between Trusts and the Value-Free Ideal

Irzik and Kurtulumus (2018) specify that they are interested in second-order reasons for warranted epistemic trust 'but not with a socio-psychological account of why public trust or distrust scientists' (3). The authors acknowledge that socio-psychological factors do play a role in decisions to trust, like when second-order reasons with interpersonal dimensions are understood and employed by lay publics even when they fail to master first-order reasons (e.g. statistical evidence).[xv] However, I argue that to set aside the socio-psychological features of why publics trust scientists creates conceptual, relational and practical tensions for basic and enhanced trust.

Conceptually, there is a definitional problem that arises from discounting socio-psychological factors in enhanced trust. First, many desirable values are inherently socio-psychological phenomena. They are learned and understood in relation to others. For example, if we expect scientists to be truthful, this is a socio-psychological reason because we want them to be truthful *to us* given the relationship between science and society. This value can apply to both basic or enhanced epistemic trust.

Furthermore, from a relational angle, basic trust is defined as a prerequisite for enhanced epistemic trust. Enhanced epistemic trust is basic epistemic trust with publics' preferred distribution of risks being taken into account. In other words, publics' social and moral values inform the evaluation of evidence. To explicate the tension, let us consider how the VFI's restriction of non-epistemic values fits with basic and enhanced trust. The VFI is compatible with basic trust because neither require science to be more than a source of reliable research, but as shown with the Tuskegee experiment, it can permit ethically outrageous experimentation. Assuming we hold science to a higher standard and demand that public welfare be taken into account, this requires including non-epistemic values in the evaluation of evidence. The VFI is unable to do this, and so, enhanced epistemic trust defies the VFI qua ideal by integrating non-epistemic values into its requirements. This means science operating and communicated under the VFI, and in the wake of its legacy, risks being unworthy of publics' enhanced epistemic trust.

Lastly, from a practical standpoint, it is unclear how basic trust is able to evolve to take into account inductive risk when the structures that support science (and in many cases science itself) continues to operate under the umbrella of the VFI. For enhanced epistemic trust, scientists must be able to communicate non-epistemic values to publics and publics need a means to communicate their preferred distribution of risks to scientists. The VFI is a hinderance to this in at least two ways. It misrepresents science through science education and communication by masking non-epistemic values in science. Then the science education and science communication models popularised by the VFI are unidirectional, meaning that they are unable to transmit publics' preferred distribution of inductive risks. So even if publics and scientists wanted to discuss values in science, they could not. Thus, if the VFI is signalled to M through the absence of non-epistemic values in science education and communication, and if there are non-epistemic values that M believes should be taken into consideration to account for public welfare, then the VFI can be taken as a social indicator suggesting that enhanced epistemic trust cannot be extended to S.

4.1. Values, Risk Assessment and Trust

To stress the necessity of non-epistemic values in inductive risk and decisions to trust, I rely on Siegrist's (2021) helpful review on trust and risk perception and follow this with some work in the cultural theory of risk perception. Siegrist (2021) finds 'that the observed correlation between trust and risk perception is contingent on the extent of an individual's knowledge, the perceived importance of the issue, and the methods employed to measure trust' (3). In terms of values, a reoccurring finding is that trust is based on perceptions of similarity between the values and interests of trustor and trustee (Earle and Cvetkovich 1995; Braithwaite 1998; Jones and George 1998).[xvi]

The importance of trusters and trustees holding similar values is also seen in the cultural theory of risk perception. According to the theory, publics' perceptions of risk reflect and reinforce their commitments to how they believe society should be organised (Douglas and Wildavsky 1983; Rayner 1992). Douglas and Wildavsky (1983) put forward that 'each culture, each set of shared values and supporting social institutions, is biased toward highlighting certain risks and downplaying others' (14). As a result people selectively credit and dismiss claims of societal risk based on whether the activity defies or conforms with cultural norms and values. Compatibly, the 'cultural cognitive paradigm' or 'cultural cognition theory' also stresses the importance of values for cooperation in risk management (Kahan, Braman et al. 2009; Kahan 2010; Kahan, Peters et al. 2012). Though the theory does not formally employ the notion of trust (Siegrist 2021), it advances that shared values are crucial for perceiving hazards and that these values influence how people interpret new information, namely to fit their predispositions. The consequence is a tendency for individuals to form risk perceptions that are congenial to their values. Kahan (2010) comes to a similar conclusion finding that laypeople tend to believe experts with similar values to their own.[xvii] As a consequence, values (or a lack thereof) are used as a social indicator by lay publics to assess which experts to trust and what information to believe.

4.2. Formal/Informal and Personal/Institutional Social Indicators in Action

To show what values as social indicators look like, I review Branch et al.'s (2022) analysis of discourse surrounding Dr. Didier Raoult, the French microbiologist who rose to international fame for his hydroxycholoroquine recommendation to treat COVID-19.[xviii] Like any expert, Dr. Raoult has both formal and informal social indicators of trust which comprise part of his reputation. Formal social indicators of trust are those that reflect an official schema for putting reputation into an objective format like rating and ranking systems. For example Dr. Raoult's H-index, a reflection of his publications and subsequent influence in the field, are a formal social indicator. Informal indicators are associated with the circulation of opinions which manifest in things like rumours, gossip, the opinions of other experts, and emotions. For instance, rumours about his alleged leadership style being 'patriarchal' (Sayare 2020) can be taken as an informal indicator contributing to his reputation. Besides formal and informal indicators, personal and institutional indicators — among other possibilities— can also inform reputation. Dr. Raoult was prolific on YouTube, his videos often raking up more views than traditional news outlets, in part because of his personal

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charisma. Additionally, his institutional affiliation as the founder and director of the Institut hospitalo-universitaire Méditerrané Infection (IHU) in Marseille (France) could also be taken as a social indicator of trust.

Amongst all these social indicators, Dr. Raoult's value commitments were especially compelling to lay publics (Branch et al. 2022). By professing his adherence to the Hippocratic oath as justification for treating patients with hydroxychloroquine (Sayare 2020), despite calls from the scientific community for more rigour and adherence to conventional methodologies (e.g. randomised control trials), Dr. Raoult endeared himself to many. The values grounding the Hippocratic oath are formal and institutional because they are a keystone tradition in the medical profession but they are also deeply personal because doctors as individuals agree to adopt and embody these values. He further stressed his non-epistemic values by rallying against 'the elite', a sentiment which resonated especially well with members of the Gilet Jaunes movement, marking his rise in popularity as not simply a scientific, but a political event (Berlivet and Lowy 2020).

The values that earned Dr. Raoult's treatment the trust of 59% of the French population (Corsan 2020) and 80% of Gilets Jaunes supporters at one point, despite apprehension from the scientific community, are an important part of what contributed to public trust in Dr. Raoult. He emphasised non-epistemic values relevant to public assessments of the risks (e.g. anti-elitism, patient welfare) over the epistemic values of the scientific community (e.g. replicability). In terms of trust, publics seemed willing to ascribe Dr. Raoult enhanced epistemic trust even though the values used by him were by many accounts, not the appropriate ones. And although this risked misplaced enhanced epistemic trust, it shows how the limitations of the VFI to even discuss which non-epistemic values are desirable becomes a hinderance to establishing trust.

5. Conclusion

Science is in fact never apolitical or disconnected from the scientists that synthesise it and the publics that use it, even if presented that way. In this paper I have begun to explore what the VFI means for trusting scientific experts, but what the implications of the VFI are for trust beyond a Western context, and how trusting scientists relates to trusting science as a discipline and scientific institutions are left to be explored. I have argued that the VFI for science is a social indicator informing publics that non-epistemic values pertaining to their welfare will not be taken into account. This makes the VFI compatible with basic trust, but for the sort of science publics need to act on (e.g. taking a vaccine), enhanced epistemic trust is better suited because the consequences of error are more salient.

To argue that the VFI is a social indicator of trust which deters extending enhanced epistemic trust to scientists may appear counterintuitive at first. Scientists have enjoyed a relatively trusted and privileged position in society precisely because of guiding norms like those found in the ideal. However, we should not expect the VFI to survive in a science that is actually properly responsive to the non-epistemic values of its practitioners and their environments. So although the VFI might be passé in principle, we must still attend to its impact on trust as its legacy is still woven into the institutions that support science, like science education and communication.

Recognising the importance of non-epistemic values for trusting science calls into question if epistemic trust truly captures what trust in science is. The explicit inclusion of non-epistemic values in science affects how evidence is evaluated and communicated, which influences what kinds of evidence grounds rational epistemic trust. Furthermore, considering the interests of publics' requires that research reflect the values of publics, perhaps by taking extra efforts to attend to the values of those who have been inequitably treated by science. Determining who the baseline public should be, their needs, and how to address them will have to be investigated in a collaborative approach which is sympathetic to non-epistemic values and which the VFI will not be able to endure. Hence, the VFI as a social indicator of trust does not reflect a world where science is increasingly being redirected towards trust-building by way of values, as it should be.

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Endnotes

[i] The Pew Research Center finds that public confidence in scientists is on par with confidence in the military (in the United States) and exceeds levels of public confidence in other groups and institutions like the media, business leaders and elected officials (Funk et al. 2019).

[ii] Values have also been described as concepts based on patterns of neuronal firing that can be used to classify objects and make general inferences, set goals and establish beliefs. This allows for an empirically plausible account of their phenomenological and affective nature (Thagard 2012).

[iii] Bohr was interested in quantum theory's predictive success whereas Einstein was concerned by the theory's consistency and coherence. However, because of their "substantive metaphysical beliefs" (Rooney 1992, 16) or theological views on the roles of randomness in the universe (Douglas 2009), it would lead Einstein to heavily critique quantum mechanics despite offering major contributions to the field through his earlier work on the photoelectric effect (for which he won the 1921 Noble Prize).

[iv] A 1955 article found that slightly more than 30 percent of the test group autopsied had died directly from advanced syphilitic lesions of either the cardiovascular or the central nervous system (Peters et al. 1955).

[v] In December 1974, the U.S. government agreed to a settlement of $10 million dollars for participants (Jones 1981). No single participant received more than $40,000 and most got less than $20,000. In 1997, President Clinton called the TSUS survivors and descendants to the White House to issue a formal apology for the United States' role in the study. The National Research Act, the first U.S. measure to codify the protection of human subjects in medical research, was passed by Congress in 1974 as a direct result hearings on the study.

[vi] It should be noted here that the institutions involved in this research - the USPHS, Alabama Board of Health, Tuskegee Veteran's Affairs Hospital, Andrew Hospital, and Tuskegee Institute-- included a mix of black and white professionals. However the role of African-American physicians and nurses is under-acknowledged (Baker et al. 2005) and the extent of their knowledge about the purpose of the study varies in relation to their position in the research hierarchy.

[vii] For an in depth look at the role of skin colour in the American medical-science complex see Linda Villarosa's Under the Skin (2022).

[viii] For some discussion of this, see Gyan Prakash's (1999) *Another Reason* and Timothy Mitchell's (1991) *Colonising Egypt.*

[ix] Informal science communication is optional, dependent on the interests of publics, and occurs in diverse environments throughout various media (e.g. books, videos, museums). Formal science communication --like science education-- is institutionally organised and highly structured (Marsick and Watkins 2001).

[x] The VFI has a history going back hundreds of years (Proctor, 1991), but after World War II an interlocking set of norms and concepts congeal particularly in the US, making value-free science seem obvious, desirable, and achievable (Douglas and Branch, Forthcoming).

[xi] See Richard McCurdy (1958) and research commissioned by the Rockefeller Brothers Fund.

[xii] See the works of Lederman (2002; 2004) and colleagues (Abd-El-Khalick 2006; Bell 2006; Cobern and Loving 2001; Flick and Lederman 2004) who came to make the consensus view influential.

[xiii] For a detailed analysis of this evolution see Bauer (2008).

[xiv] Though some might see this as a relationship of reliance, Irzik and Kurtulumus (2018) argue that if M has reason to believe that P because S not only believes that P but also has communicated to M that P in an honest way, then M is dependent on the goodwill, truthfulness and the ethical integrity of S with respect to P (2). I agree with Irzik and Kurtulmus that this dependence goes beyond mere epistemic reliance and should instead be considered a trusting relation.

[xv] Irzik and Kurtulmus (2018) consider conflicts of interest, misconduct (e.g. plagiarism) or manipulating data as evidence of dishonesty and a second-order reason to withhold trust. Besides dishonesty, other second-order reasons include expertise and epistemic responsibility. For more on these see Anderson (2011) and Goldman (2001).

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[xvi] The importance placed on similar values can extend to trusting institutions (Earle and Cvetkovich, 1999; Earle & Siegrist, 2008; Nakayachi and Cvetkovich, 2010; Siegrist et al., 2000, 2003).

[xvii] For an important critique of the cultural cognition thesis, see van der Linden who argues that it is not a theory about culture or cognition per se; but rather a thesis aiming to explain why specific American groups with opposing political views disagree on certain contemporary science issues. Van der Linden challenges that the theory over generalises specific findings from social psychology and under appreciates the diversity of 'the public'. However, he does not dispute that values are crucial to determining which experts to trust.

[xviii] The scientific community concluded that HCQ should not be used to treat COVID-19 after being found to be ineffective (Horby and Landray 2020; Rosenberg et al. 2020; Magagnoli et al. 2020; Molina et al. 2020) and in some cases harmful (Borba et al. 2020). However, establishing this consensus was not without setbacks, see Mehra et al.'s (2020) highly publicised Lancet article retraction.