Public health reasoning: A logical view of trust

Razonamiento de la Salud Pública: Un punto de vista lógico de la confianza

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Received: 03-02-2014 **Accepted**: 21- 07-2014

Abstract: The public has a pact with the experts who deliver public health. That pact can be characterized as a relationship of trust in which the public trusts health experts to act in its best interests in return for its adherence to recommendations and other advice. This relationship clearly has emotional elements, as evidenced by strong feelings of anger and betrayal when public health recommendations are shown to be wrong. But it also has rational or logical components which are less often acknowledged by commentators. In this paper, these components are examined with special emphasis on the role of authority arguments in mediating the trust relationship between health experts and the public. It is contended that these arguments function as cognitive heuristics in that they facilitate decision-making in the absence of expert knowledge. A questionnaire study of public health reasoning was conducted in 879 members of the public. Participants were asked to consider a number of public health scenarios in which various arguments from authority were employed. Epistemic conditions, known to be associated with the rational warrant of these arguments, were systematically varied across these scenarios. Quantitative and qualitative data analyses revealed that subjects are adept at recognizing the conditions under which arguments from authority are more or less rationally warranted. The trust relationship at the heart of public health has logical components which lay people are capable of rationally evaluating during public health deliberations. This rational capacity should be exploited by experts during public health communication.

Keywords: Argument from authority, expertise, heuristic, public health communication, reasoning, trust.

Resumen: El público tiene un pacto con los expertos que entregan la salud pública. Este pacto puede ser caracterizado como una relación de confianza en la que el pú-

blico confía en los expertos en salud para actuar por su mejor interés en retorno a su adeherencia a las recomendaciones y otros consejos. Esta relación claramente tiene elementos emocionales, tal como se evidencia por los fuertes sentimientos de rabia y traición cuando las recomendaciones de salud pública se muestran erróneas. Pero tiene también componentes racionales o lógicos que son a menudo menos conocidos por comentadores. En este trabajo, estos componentes son examinados con especial énfasis en el rol de los argumentos por autoridad en tanto mediación de la relación de confianza entre los expertos en salud y el público. Se postula que estos argumentos funcionan como una heurística cognitiva en el sentido de que facilitan la toma de decisión en la ausencia de un conocimiento experto. Se aplicó un cuestionario sobre razonamiento en salud público en un estudio con 879 miembros del público. A los participantes se les preguntó considerar un número de escenarios de salud pública en los que varios argumentos por autoridad fueron empleados. Las condiciones epistémicas, asociadas con la garantía racional de estos argumentos, fueron sistemáticamente cruzadas entre estos escenarios. Los datos cuantitativos y cualitativos relevaron que los sujetos son adeptos a reconocer las condiciones bajo las que los argumentos por autoridad son más o menos racionalmente garantizados. La relación de confianza en el corazón de la salud pública tiene componentes lógicos que muestra que la gente común es capaz de evaluar racionalmente las deliberaciones en la salud públcia. Esta capacidad racional debería ser explotada por los espertos durante la comunicación de salud pública.

Palabras clave: Argumento por autoridad, confianza, experticia, heurística, comunicación en salud pública, razonamiento.

1. Introduction

Relationships of trust are the basis of our everyday interactions with others. From purchasing goods to engaging in romantic relationships, we trust other people to operate in good faith with us, and are sorely disappointed when they do not. Public health is another domain of our lives in which trust is fundamental. Without trust, we would be disinclined to heed calls to have our children vaccinated against infectious diseases, to avoid risk-taking sexual behaviour and to modify lifestyles which predispose us to illness and premature death. Yet, there is substantial evidence to suggest that trust in public health is in a precarious state. Factors which have eroded trust in public health include prominent public health failures (e.g. the BSE crisis in the UK), media amplification of health issues (e.g. pandemic influenzas), the perception that science is tainted by conflicts of interest, and an increasing lack of deference to medical expertise. (The reader is referred to Cummings (2014a) for further discussion of these factors.) The com-

bined effect of these factors has been the attenuation of the trust relationship that is the basis of all public health work. To rebuild that relationship will require an understanding of the nature of trust on the part of public health professionals. It is argued in this paper that trust consists of both emotional and logical factors. While emotional factors are what we expect of an affective concept like trust, there has been little attention given to the logical dimensions of this notion. It will be contended that a so-called informal fallacy, known as the argument from authority, provides a logical framework for our understanding of trust in public health. This view is supported through an examination of the logical features of the argument from authority on the one hand, and consideration of the findings of a study of public health reasoning in 879 members of the public on the other hand.

The discussion will unfold along the following lines. The concept of trust in public health has given rise to an extensive empirical literature. Investigators now have a clear understanding of the dimensions of trust which are involved in risk perception. The respective contributions of affective and cognitive factors to trust have also been examined. Some of these studies are relevant to the argument of the current paper and their findings will be considered in section 2. While the work of social scientists on trust has been insightful in many ways, these investigators have failed to establish a logical framework for this concept. In the absence of such a framework, it is difficult to explain how trust is able to influence our rational decision-making. This is where the work of a little known branch of logic called informal logic can make a powerful contribution to an understanding of trust in public health. Informal logicians examine arguments which cannot be characterized by formal (deductive) logic, but which are nonetheless rationally warranted within the particular contexts in which they are used. One such argument, known as the argument from authority, provides a much needed logical apparatus for the dimensions of trust discussed by social scientists. The logical structure of the argument from authority will be examined in section 3. This section will also consider how this argument, like many other so-called informal fallacies, is not only non-fallacious but can function as a cognitive heuristic during reasoning about public health problems. In section 4, the results of a study of public health reasoning in 879 members of the public are examined. This study confirms a significant role for arguments from authority in the logical judgements of

people about public health problems. Finally, the relevance of this finding for trust in public health is considered.

2. Empirical studies of trust

The empirical literature on trust is wide-ranging and, as such, is beyond a comprehensive examination in the current context. However, two aspects of that literature are relevant to the logical view of trust that is proposed in this paper, and will therefore be considered in this section. The first aspect concerns attributes of trust such as perceived objectivity, fairness and competence. Increasingly, investigators are organizing these attributes according to two or more dimensions of trust which appear to have psychological salience for subjects. The significance of these attributes, it will be contended subsequently, is that they provide rational warrant for the premises in an argument from authority. It is by virtue of this probative function in argument that these attributes of trust can be said to play a logical role in reasoning. The second aspect of the empirical literature that is of relevance is the relationship of cognitive and affective factors to trust. In most studies, it is argued either that trust is causally related to these factors (causal view) or that trust is a consequence of cognitive and affective factors (associationist view). According to the logical view of trust proposed in this paper, cognitive *and* affective factors take effect through logical argument with which they are intimately connected.[1] An argument which is particularly significant in this regard is the argument from authority. The logical structure of the argument from authority is, in effect, the overarching mechanism by means of which cognitive and affective components of trust come into play during public health reasoning. But before we can defend this particular claim, it is necessary to consider the insights which empirical studies have contributed to our understanding of trust in a public health context.

[1] The view that trust and affect are intimately connected to argument is in stark contrast to the position which is normally expressed in the literature on risk. For most theorists, trust and affect are distinct from argument and only come into effect during risk perception when argument is absent: 'We will [...] argue in this article that trust will mainly have an effect on choice behaviour in cases where knowledge and arguments are not sufficiently available, urging a person to make affect-based judgments on risky activities' (Midden and Huijts, 2009, p. 744).

2.1. Dimensions of trust

Trust is a complex concept which has both conceptual and psychological elements. The exact nature of these elements has been the focus of much discussion and debate. However, this interest has yet to result in a consensus concerning the main features of trust. As Midden and Huijts (2009, p. 744) acknowledge, there is no universally shared definition of trust with differences evident in the conceptualization, modelling and measurement of this notion among studies. One issue on which theorists do appear to be in agreement is the dimensionality of trust. It is now widely accepted by investigators that the trust concept is not one-dimensional but, in fact, contains many dimensions. Berry (2004, p. 21) captures this idea when she states that '[r]esearch has shown that trust is multifaceted rather than one-dimensional, with relevant factors including perceived competence, objectivity, fairness and consistency'. Berry's four factors are collapsed into three in an investigation by Peters et al. (1997). In a study in which six hypotheses regarding the perceptions and determinants of trust were tested against survey data, Peters et al. found that perceptions of trust and credibility are dependent on three factors: perceptions of knowledge and expertise; perceptions of openness and honesty; and perceptions of concern and care. As one might expect, there is overlap between these factors and Berry's criteria, with knowledge and expertise equating to competence, for example. Earle (2010) argues that there is a consensus among investigators that trust is two- or three-dimensional, with those dimensions capturing social-relational and ability attributes of trust. These dimensions describe the intentions and ability or competence of the trusted other, respectively.

Dimensions of trust have been variously characterized across research studies. Poortinga and Pidgeon (2003) examined the dimensionality of trust in government regulation of risk across the following five contexts: climate change; mobile phones; radioactive waste; GM food; and genetic testing. Risk statements, which examined nine trust factors including competence, credibility, fairness and openness, were found to be described by two main trust components. The first component was a general trust component and comprised competence, care, fairness and openness. The second component included credibility, reliability and integrity. Because this component reflected a sceptical view on how risk policies were brought

about, it was labelled as scepticism. These components were not only reproduced across all five risk contexts but also across different samples of respondents. Poortinga and Pidgeon used these two independent trust factors to propose a typology of trust in government which ranged from full trust to a deep type of distrust. Frewer et al. (1996) argue that knowledge does not in itself lead to trust. Rather, knowledge is linked with other characteristics such as 'truthfulness', 'trustworthiness', 'having a good track record', 'being concerned with public welfare', 'responsibility', 'accuracy' and 'factual'. Highly trusted sources, Frewer et al. suggest, are associated with multiple positive attributes in a type of 'halo effect'. Distrust is also associated with multiple factors including 'distortion of information', 'being proven wrong in the past', and 'biased information'. A source which is accountable elicits higher trust than one which is completely independent, while too much accountability is associated with dishonesty and distrust.

Although it is generally accepted that trust should be analysed according to two or more dimensions, not all of these dimensions are equally significant during risk perception. Earle (2010, p. 542) remarks that across research contexts, the dimension of trust dealing with intentions has been found to be more important (more accessible, more heavily weighted, etc.) than the dimension related to abilities: 'Knowing whether the intentions of the other are good or bad (relative to oneself) is more important than knowing what the other can do'. In this way, studies have reported that the perceived expertise or competence of risk communicators may be valued less than their perceived openness, at least on certain issues. Eiser et al. (2009) asked subjects to rate their trust in six sources of information about the risk of contaminated land in their neighbourhood. The sources included independent scientists, local council property developers, residents' groups, friends and family and local media. It was found that despite being perceived as relatively inexpert, residents' groups and friends and family were highly trusted on account of their perceived openness and shared interests. In this case, openness and shared interests were more significant predictors of trust than the perceived expertise of individual sources. Allum (2007) found that shared values are more important for citizens' judgements of trust in scientists involved in the development of GM food than beliefs about competence and expertise. In a study of public trust in the government's control of tobacco in Japan, Nakayachi and Cvetkovich

(2010) found that assessment of fairness was a stronger predictor of trust than assessment of competency on the issue of increasing tobacco tax. Further research will reveal the respective contributions of these dimensions to trust in particular contexts.

2.2. Causal and associationist views of trust

Alongside examination of the dimensions of trust, investigators have also considered the relationship between trust, belief formation and acceptance during risk perception. Two models of this relationship have emerged as dominant in the literature (Midden and Huijts 2009). In the first model – the causal view – trust is taken to have an impact on the cognitive process of belief formation about risks and benefits which in turn influences acceptance. This model proposes an indirect relationship between trust and acceptance in that the relationship is mediated by belief formation. In the second model – the associationist view – this causal relationship is believed to be spurious as both trust and the cognitive process of belief formation are the consequence of a third factor. This factor describes one's attitude to a particular risk and is an affective evaluation. On this alternative view, there is a direct relationship between trust and acceptance which is not mediated by belief formation. The significance of these models lies in the respective roles of cognitive and affective factors during risk perception. Under the causal view, trust drives belief formation which then influences attitudes towards a potentially risky activity or agent. Cognitive factors are both prior to, and a determinant of, affective judgements. However, under an associationist view, affective factors are the drivers of risk perception, with trust and belief formation emergent on those factors. The causal view assumes that rational, cognitive factors are the dominant consideration in risk perception, while these factors are largely subordinate to affect in the associationist view. The relevance of this positioning of cognition and affect will be addressed in the next section.

Both causal and associationist models have received substantial empirical support. In support of the causal view, López-Navarro et al. (2013) examined the relationship between trust and risk perception in relation to a petrochemical industrial complex located in the port of Castellón in Spain. These investigators found a significant causal relationship between trust in

petrochemical companies and citizens' health risk perception, with trust in companies negatively affecting risk perception. Terpstra (2011) examined the relationship between trust in flood protection, flood risk perceptions and flood preparedness intentions in Dutch citizens in two coastal communities and one river area community. A higher level of trust was found to reduce citizens' perceptions of flood likelihood which, in turn, hampered their flood preparedness intentions. Terwel et al. (2009) examined the relationship between trust, judgements about the risks and benefits of carbon dioxide capture and storage (CCS) technology, and attitudes towards this technology. The organizational position (pro or con) on CCS implementation was found to more strongly affect risk and benefit perceptions and subsequent acceptance of CCS when competence-based trust was high rather than low. Terwel et al. (2009, p. 1138) state that 'the current experimental research offers support for the causal chain account of trust'. A further finding is that the relationship between trust and perceived risks and benefits has been found to obtain only when subjects lack knowledge of an activity or agent. In a study of trust and knowledge in the context of hazardous technologies and activities, Siegrist and Cvetkovich (2000) found strong correlations between social trust and perceived risks and benefits only when subjects did not possess much knowledge of the technologies concerned.

The associationist view also has empirical support. Frewer et al. (2003) obtained evidence that trust is a consequence of the attitudes one holds towards a potentially risky activity or agent. In a study of the attitudes towards GM foods of 1,405 consumers from four European countries, these investigators found little effect of information provision on attitudes to these foods. It was found that the characteristics of information sources and the type of information strategy used had almost no effect on subjects' attitudes to GM foods. Trust did not influence how subjects responded to the information provided but was itself a consequence of subjects' attitudes to GM foods. In a later study of trust in relation to GM foods, Poortinga and Pidgeon (2005) also obtained support for the associationist view. Specific risk judgements, these investigators argued, are driven more by general evaluative judgements than by trust. Bronfman and López Vázquez (2011) examined the relationship between social trust in management authorities

and the degree of public acceptability of hazards for individuals residing in either developed or emerging Latin America economies. Trust in regulatory bodies in Latin American economies was strongly and significantly linked to the public's acceptance of an activity or technology, i.e. there was a direct effect of social trust on the extent of public acceptability. Moreover, a lack of knowledge strengthened the magnitude and statistical significance of the trust-acceptability relationship. Bronfman and López Vázquez (2011, p. 1931) state that this result 'implies that the causal model of trust [...] would have low explanatory power for the trust-acceptability relationship and that acceptance of a particular activity or technology will be mostly governed directly by public trust in regulatory activities'.

3. A logical view of trust

In proposing a logical view of trust in risk perception, my aim is not to challenge research of the type examined in section 2. Rather, my concern is to introduce a novel conceptual perspective, which has much to offer an understanding of trust in public health. The view of trust proposed in this section sets out from the claim that there is a lack of a logical perspective in discussions of trust in risk perception. Regardless of one's position on the relationship between trust and acceptance during risk perception, there is an implicit acknowledgement among investigators that a rational process of sorts is at work in perception. Moreover, this process is assumed to be adequately represented by the inclusion of cognitive factors such as belief formation. However, this understanding seriously underplays the rational, logical character of risk perception in general and of the role of trust in that perception. The type of logical framework envisaged here is overarching in scope and subsumes many of the features described in section 2. But where it differs from the models described in that section is in its explanatory power. Specifically, trust and factors related directly or indirectly to it are mediated through a logical argument, which can account for a range of empirical findings whilst also elaborating the rational basis of risk perception. That trust is related to public acceptance of an activity or technology, either directly or indirectly, is something very much worth knowing. But

this does not tell us the type of rational significance which people attach to this relationship, where this may include the purpose for which trust is invoked in a particular case and the relative importance of trust alongside other rational resources. Only a logical framework which interrogates the rational grounds which people attribute to trust in reasoning can adequately address these considerations. It is to an elaboration of this framework that we now turn.

3.1. Argument from authority

A certain sub-discipline of logic is relevant to the view of trust that will be developed in this section. That sub-discipline is called informal logic. Informal logicians study the many different forms of argument, which cannot be characterized adequately using formal (deductive) logic, but which are nonetheless rationally acceptable. These arguments include presumptive or plausible arguments which do not satisfy deductive criteria such as validity and soundness, even though they are rationally warranted in the particular contexts in which they are used. These arguments also include well-known names such as slippery slope argument and analogical argument, and some like the argument from ignorance and question-begging argument which are altogether less prominent. What these latter arguments have in common is that they are so-called informal fallacies. For most of the long history of logic, these arguments have been characterized as weak or fallacious forms of reasoning by the logicians and philosophers who have commented upon them. It was not until the publication of Charles Hamblin's book *Fallacies* in 1970 that these arguments began to receive the same serious attention that had been afforded to other branches of logic. As part of the more systematic treatment of the informal fallacies which has emerged in a post-Hamblin era, some logicians began to characterize non-fallacious variants of these fallacies.[2] Arguments which had once

[2] Two Canadian logicians, Douglas Walton and John Woods, have been particularly important in this regard. In a large number of books and articles spanning many years, Woods and Walton have undertaken analyses of non-fallacious variants of most of the major informal fallacies. Amongst others, this includes *petitio principii* (begging the question), *argumentum ad ignorantiam* (the argument from ignorance), and *argumentum ad baculum* (the argument from the stick or appeal to force) (Walton, 1985, 1992; Woods, 1995, 2004). Also see Cummings (2000) for discussion of the non-fallaciousness of *petitio principii*.

been criticized for falling short of deductive ideals such as validity came to be described as rationally warranted in certain contexts of use. One such argument is the argument from authority or expertise, also known as *argumentum ad verecundiam* (literally, appeal to modesty). This argument is integral to the logical view of trust that is proposed in this paper and will be examined further in this section.

The argument from authority is a type of defeasible or plausible reasoning of the following form, in which *A* is a proposition, *E* is an expert and *D* is a domain of knowledge. In essence, *E* produces an assertion that a proposition *A* is true. The rational standing of this assertion is dependent on *E*'s credentials as an expert in a particular field or domain *D*. To the extent that these credentials are genuine, a level of rational warrant attaches to *E*'s assertion. This warrant then becomes the basis for claiming with some plausibility that *A* is true:

> *E* is an expert in domain *D*.
> *E* asserts that *A* is known to be true.
> *A* is within *D*.
> Therefore, *A* may (plausibly) be taken to be true. (Walton, 1997, p. 258)

As with other informal fallacies, this argument has been dismissed as a weak form of reasoning by most logicians who have ventured to describe it in historical logical treatises. The logical flaw of this argument, it is claimed, resides in features of the individual whose opinion is the basis of the argument. This individual can only offer a subjective opinion, which is not an objective basis upon which to base a scientific inquiry.[3] After all, subjective opinions may reflect personal interests rather than a concern for the truth. Authorities can make pronouncements outside of their area of expertise and may be opinion trend-setters rather than true authorities.

[3] Whilst not agreeing with this view, Woods and Walton (1974, p. 136) characterize it as follows: 'to allow an appeal to authority as a genuine form of acceptable argument is to throw scientific objectivity to the winds. How often do we hear it said that an explanation or prediction is "scientific" (i.e. reputable) only if it is intersubjective, reproducible, and so not dependent upon the private evaluation of a particular individual? According to this way of thinking an appeal to authority, having intrinsically inexact and subjective elements about it, must be ruled out of the domain of science entirely'.

An authority appeal may also be so vague that it is not possible to identify the individual who produces an expert opinion (Walton, 1989). Accordingly, it is not possible to check the credibility of the authority's statements. Notwithstanding these various flaws of the argument from authority, there are also circumstances under which this argument is rationally warranted. Authorities may be eminently qualified to offer an opinion on an issue. This qualification can be evidenced by academic and other qualifications and by a high professional standing in a certain field. Authorities often make pronouncements out of a concern for truth and are not always motivated by commercial, political or other interests. Authorities often exercise responsibility by limiting their comments to topics of which they have expert knowledge, and clearly indicating when an issue falls outside of their expertise. Under these circumstances, it is rationally warranted to appeal to the opinions of authorities in argument. These valid uses of authority appeals, fallacy theorists have argued, should not be obscured by the many weak or fallacious instances of this argument.

So, it is now widely accepted by logicians that an appeal to authority in argument does not necessarily commit one to weak or fallacious reasoning. However, present-day fallacy theorists have gone further than simply acknowledging the existence of non-fallacious uses of this argument. The argument is now the focus of increasingly sophisticated presumptive and pragmatic analyses. These analyses have resulted in the development of non-deductive criteria against which the argument may be rationally evaluated, both in general and in specific contexts (e.g. legal argumentation) (Walton, 1996, 1997; Godden and Walton, 2006; Wagemans, 2011). One particularly recent development in the analysis of the argument from authority is its characterization as a reasoning heuristic (Walton 2010). Under this view, certain informal fallacies like the argument from authority are not only non-fallacious, but also function as a cognitive shortcut during reasoning about complex problems. These are problems about which we lack (expert) knowledge but which demand a solution nonetheless. The heuristic function of several informal fallacies has been examined in the context of public health problems including the BSE epidemic in the UK and the emergence of HIV/AIDS in the early 1980s (Cummings, 2012a,

2012b, 2013a, 2014b). These fallacies include arguments from ignorance and authority, analogical argument, circular argument and *argumentum ad baculum* or the appeal to force (Cummings, 2002, 2004, 2009, 2010, 2011, 2012c, 2013b, 2014c, 2014d). What these studies revealed is that arguments, which were previously viewed as fallacious, conferred a number of epistemic gains on the scientific inquiries of which they were a part. These gains ranged from bridging gaps in knowledge about a new disease (the argument from ignorance) to using similarity between two pathogens to draw conclusions about the features of the lesser known pathogen (analogical argument). In each of these cases, informal fallacies were shown to function as quick and effective shortcuts which enabled scientists and others to bypass a lack of knowledge and arrive at (mostly) accurate solutions to problems.

A similar heuristic function has been proposed for the argument from authority. According to Walton (2010, p. 164), the type of model that best captures this function is a defeasible argumentation scheme. This scheme is not deductively valid and has both a full and an abridged form. These forms correspond to a complete logical argument and the heuristic based on that argument, respectively. The full form of the scheme is the focus of critical questions which 'flesh out' the rational grounds of an argument. These questions are modelled via assumptions and exceptions (both types of premises) that are added to the explicit premises in the full scheme of an argument (see Figure 1). Assumptions and exceptions may be taken to represent responses to questions that aim to lay bare the rational grounds of a particular argument. For example, in the case of the argument from authority or expert opinion in Figure 1, an assumption to the effect that an individual *E* is an expert in the field to which claim *A* belongs is central to the rational standing of this argument. A parascheme, which models the heuristic that corresponds to the full scheme, overlooks these assumptions and exceptions. This can be seen in Figure 1 where the heuristic jumps to a conclusion ('A is true') on the basis of just two ordinary premises without taking into account any of the assumptions and exceptions:

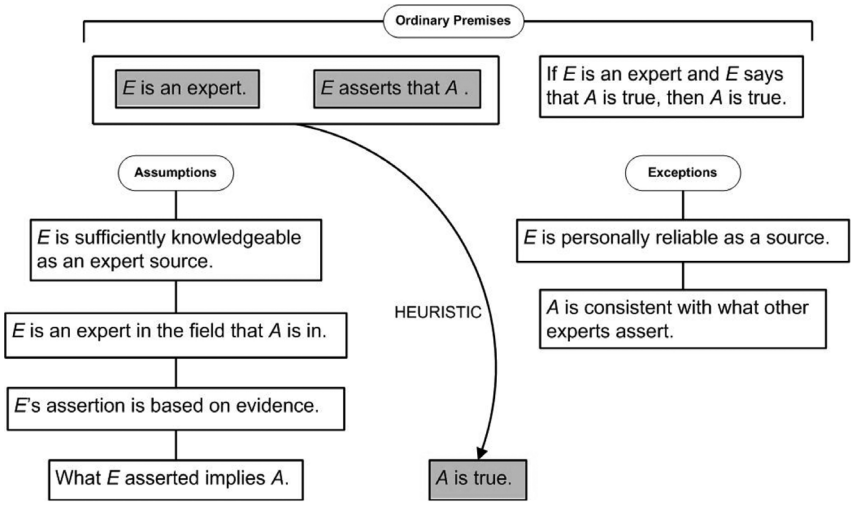


Figure 1. Heuristic of Argument from Expert Opinion, taken from Walton (2010, p. 170).

Walton (2010, p. 171) characterizes the particular heuristic represented in Figure 1 as taking us by a 'fast and frugal leap directly to the conclusion'. In so doing, it bypasses the implicit conditional premise in the top right corner of the above diagram, as well as the assumptions and exceptions. The consideration of these additional factors requires extra processing time. These factors are addressed in a newer (in evolutionary terms) cognitive system which is characterized by controlled, conscious and slow inferential processing. An 'older' cognitive system of reasoning in evolutionary terms, which is the home of heuristic procedures, avoids this additional deliberation. By doing so, this system achieves certain efficiencies such as an increase in the speed of processing.

This view of the argument from authority as a cognitive heuristic marks the most recent turn in a remarkable journey for this argument. This journey has seen the argument move from a place of neglect and condemnation during most of the long history of logic, through a stage of positive re-evaluation to the current point where it is seen to make a substantial contribution to our rational resources. The question now is how this same argument

can shed new light on our understanding of trust in a public health context. It is to that question that we now turn.

3.2. Trust and the argument from authority

The proposal of this paper is that the argument from authority can serve as a logical framework for the notion of trust that is the basis of all public health work. In this section, this idea is teased out in an explicit manner, beginning with an account of how this argument can accommodate the empirical findings relating to trust which were described in section 2. The dimensions of trust that were discussed in section 2.1 effectively ground the premises in an argument from authority. To demonstrate this, we need to repeat the authority argument presented above:

> *E* is an expert in domain *D*.
> *E* asserts that *A* is known to be true.
> *A* is within *D*.
> Therefore, *A* may (plausibly) be taken to be true. (Walton, 1997: 258)

The two primary dimensions of trust – competence and integrity – ground the first and second premises of this argument, respectively. In order for the first premise '*E* is an expert in domain *D*' to be rationally warranted, there must be evidence that *E* has genuine expertise in a particular area. *E* must be able to demonstrate competence in a domain and have expert knowledge of its contents. This competence is normally indicated by academic and other qualifications and/or a high professional standing in a field. The integrity dimension of trust is equally important to the rational warrant of the second premise '*E* asserts that *A* is known to be true'. In order for this premise to be rationally warranted, there must be grounds for believing that *E*'s assertion of a proposition constitutes a credible basis for believing it to be true. Unless *E* is recognised to be honest, objective and reliable, the rational warrant which attaches to his or her assertions will be minimal indeed. Through grounding two different, but equally important, premises in an argument from authority, the competence and integrity dimensions of trust assume a logical character in reasoning for the first time.

This logical view of the dimensions of trust also explains a further em-

pirical finding discussed in section 2.1. That finding concerns the greater importance which people attribute to integrity over competence in their assessments of trust. Specifically, people are so influenced by integrity in determinations of trust that even a small perceived reduction in integrity has a large, adverse impact on trust. Moreover, this impact is disproportionate to any gains in trust that are brought about by the perceived competence of a source. Under a logical view of trust, this asymmetry between integrity and competence is explained in terms of the plausibility of the premises in the above argument from authority. According to the plausible reasoning framework proposed by Rescher (1976), the conclusion of a plausible argument cannot be less plausible than the least plausible proposition among a set of premises: '…the plausibility-ranking of a plausible thesis that is derivable from some group of mutually consistent theses is never to be less than that of the least plausible thesis operative in the derivation' (12). Because people appear to be more doubtful of the integrity than the competence of a source, their inclination in argument will be to attribute a lower plausibility ranking to any premise that is grounded in integrity factors such as openness and honesty. That premise is represented in the above argument from authority by the proposition '*E* asserts that *A* is known to be true'. The low plausibility ranking of this premise tends to exert undue logical sway over the argument in that even a premise with a higher plausibility ranking (e.g. the premise '*E* is an expert in domain *D*') can be undermined by this 'weak link' in the argument. Under a logical view of trust, the asymmetry between integrity and competence in determinations of trust is represented by different plausibility rankings for premises in an argument from authority.

Aside from the dimensions of trust, a logical view of trust can also explain the type of empirical findings which have given rise to the causal and associationist accounts examined in section 2.2. Essentially, the difference between these accounts can be stated in the following terms: either judgements about the perceived risks and benefits of an activity or agent mediate the relationship between trust and public acceptability (causal account), or trust influences acceptability directly (associationist account). The difference between these accounts can be further characterized in terms of cognitive and affective routes between trust and public acceptability. Specifically, judgements about perceived risks and benefits in the causal account

introduce a rational, cognitive component into the relationship between trust and public acceptability. These judgements involve logical thinking as subjects must make a rational assessment of the risk of an activity based on evidence. However, where trust directly influences acceptability, as in the associationist account, an affective route is dominant. Given that there is considerable, empirical support for both these accounts, an account that combines cognitive and affective routes rather than gives precedence to one of these routes, is likely to be a more productive way forward. A logical view of trust, I contend, represents just such an account. The logical, rational approach of the cognitive route is represented by the critical questions to which the assumptions and exceptions of Figure 1 above are answers. This slower, deliberative route of processing, which aims to develop the rational grounds of the argument from authority (and the trust relationship which this argument may be taken to represent), stands in stark contrast to the quick, heuristic route of processing, which is also depicted in this figure. This heuristic, affective route bypasses critical questions and achieves gains in speed and efficiency through doing so.

A logical view of trust is, thus, capable of representing the cognitive *and* affective factors that play an instrumental role in the relationship between trust and public acceptability. Cognitive and affective routes are represented by the deliberative (critical questioning) and heuristic routes of processing displayed in Figure 1, respectively. But this new view of trust can also explain a further empirical finding of both causal and associationist accounts. This is the finding that in the absence of knowledge, the relationship between trust and perceived risks and benefits (causal account) and between trust and acceptability (associationist account) is strengthened. A cognitive route of processing demands a knowledgeable agent who can pose pertinent critical questions and also assess the logical and rational merits of responses to those questions. For example, I can only determine if '*E* is sufficiently knowledgeable as an expert source' (an assumption in Figure 1), if I have *some* knowledge of the area in which *E* is claiming expertise and of what it would mean to be 'sufficiently knowledgeable' in that area. But it is not difficult to think of a large range of domains of relevance to public health (toxicology, virology, etc.) where that knowledge is not available to a reasoning agent. Under these circumstances, reliance

on trust guides the agent's reasoning as a type of default mechanism in the absence of knowledge. This default mechanism is none other than the heuristic (affective) processing route depicted in Figure 1. While cognitive and affective processing routes *can* run in parallel, evolutionary pressures on our rational resources have ensured that the least costly processing route (the heuristic route) assumes precedence wherever this is possible. A lack of knowledge of a field or discipline on the part of a reasoning agent is one scenario where this is possible.

We have seen that a logical view of trust can explain the main empirical findings related to this concept in a more parsimonious manner than has been possible using other models. However, it was emphasized above that the aim of the current discussion is not to replace these models, but rather to demonstrate the insights that a logical view can bring to our understanding of trust in a public health context. Accordingly, it will be useful to highlight a number of specific gains of a logical view of trust by way of a conclusion to this section. Firstly, a logical view places trust at the centre of the rational processes that are the basis of judgement-making. Rather than trust and other affect-based judgements operating apart from logical processes of reasoning, the characterization of trust in the form of an argument from authority allows it to be integral to those logical processes. This view not only achieves a closer alignment between rationality and emotion – it is rational to derive conclusions during reasoning which are based on affective considerations – but it also expands the set of rational resources which can be used in public health deliberations. Secondly, in a logical view of trust, heuristic reasoning is afforded the logical status that is typically reserved for systematic reasoning. Heuristic reasoning simply takes a different (shorter) route to that of systematic reasoning between the premises and the conclusion of an argument from authority. This new, logical standing of heuristic reasoning is consonant with recent approaches to heuristics which emphasize the rational, cognitive virtues of these procedures (e.g. Gigerenzer & Brighton, 2009). Thirdly, if trust is to be explained in terms of the rational warrant which attends the premises in an argument from authority, then this suggests the possibility of a 'logical corrective' to a lack of trust in a public health context. Specifically, we need to examine the rational grounds of people's trust-based judgements.

4. Study of public health reasoning

It was in an effort to explore the rational grounds of people's trust-based judgements in a public health context that a study of public health reasoning was conducted. The full details of this study are reported elsewhere (Cummings, 2014c). In this section, an overview of the main features and findings of the investigation is presented in preparation for consideration of its implications for the conduct of public health communication in section 5. A questionnaire was completed anonymously by 879 members of the public. All subjects were between 18 and 65 years of age and were drawn from diverse socioeconomic, educational and ethnic backgrounds (see Table 1). Subjects were presented with a number of public health problems in a series of passages. These problems represented actual and non-actual (but plausible) public health scenarios upon which various authorities were seen to make an intervention. The eight passages that examined arguments from authority are shown in Table 2. Epistemic and logical conditions which are related to the rational warrant of these arguments were systematically varied across the eight passages. These conditions are also indicated in Table 2. Each passage was followed by four questions which fulfilled a number of different purposes in the study. Two questions required a yes-no response, and were intended to create the impression in respondents that they were participating in a reading comprehension task. A third question required subjects to indicate if they found an authority argument in the passage to be valid, moderately valid or not valid at all. A fourth question asked subjects to develop the grounds for their response to the authority question. The following passage and questions were used to examine the condition <genuine, impartial expertise> in the context of an actual public health problem, the emergence of bovine spongiform encephalopathy (BSE) in British cattle in the 1980s:

> During the UK's BSE epidemic, the government looked to independent expert scientific committees for public health advice. In this way, the Spongiform Encephalopathy Advisory Committee (SEAC) was established to assess the risks that BSE posed to human health. Among the issues considered by SEAC was the safety of beef for human consumption. SEAC consistently advised that beef could be safely eaten by the Brit-

ish consumer. This advice resulted from a process that drew on expertise from a wide range of animal and human health fields. These fields included virology, immunology, neuropathology, veterinary science, public health science, epidemiology and statistics. The experts who delivered this advice were leading figures in their fields of specialisation. Moreover, they were employed by academic departments which enabled them to deliver advice that was independent of political and commercial interference. For example, Professor Jeff Almond of SEAC was an expert in virology and immunology from the School of Animal and Microbial Sciences at the University of Reading.

(a) Name three fields of expertise that were represented on SEAC.

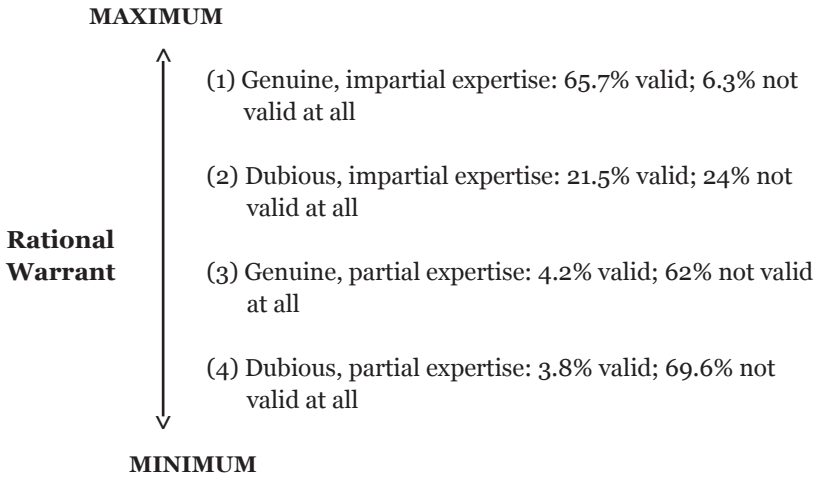
(b) How do you rate the advice given by SEAC?

Circle answer: Valid Moderately valid Not valid at all

(c) Please explain your response to (b).

(d) Did SEAC only contain experts in human health fields?

Quantitative and qualitative analyses of participants' responses provide support for the view that people are attune to the logical and epistemic conditions under which arguments from authority are more or less rationally warranted. Moreover, they are adept at articulating the grounds which hold sway in their logical judgements. As predicted, most subjects rated genuine, impartial expertise as valid in both actual (65.7%) and non-actual (57.1%) scenarios. An altogether smaller number of subjects judged dubious, partial expertise to be valid in actual and non-actual scenarios (3.8% and 3.4%, respectively). Also as predicted, most subjects rated dubious, partial expertise as not valid at all in both actual (69.6%) and non-actual (59.6%) scenarios. Again, a small number of subjects judged genuine, impartial expertise to be not valid at all in actual and non-actual scenarios (6.3% and 9.9%, respectively). Between these extremes of expertise, subjects were adept at varying their logical judgements in accordance with subtle adjustments in the expertise of authorities. This can be seen in the diagram below, where ratings of validity decreased the further expertise was seen to move away from the 'ideal state' (i.e. genuine, impartial expertise). The diagram presents results for passages representing actual public health scenarios:



A number of significant Pearson chi-square values indicated that differences in subjects' logical judgements could not be explained by chance. For example, the distinction between genuine and dubious expertise in scenarios 1 and 8 (see Table 2) and impartial and partial expertise in scenarios 1 and 4 both resulted in significant chi-square values of 0.042 and 0.049 ($p < 0.05$), respectively. Findings of this type suggested that these epistemic attributes of expertise had some psychological reality for subjects in whatever rational capacity they were using to make judgements about the public health scenarios contained in the passages. There was also some evidence that subjects responded differently to actual and non-actual public health events. A significant chi-square value of 0.012 ($p < 0.05$) was obtained for the passage comparison between scenarios 3 and 4. These passages examined the development of Reye's syndrome in children as a result of taking aspirin (actual scenario) and a possible link between the development of a cancer called multiple myeloma and residency in the vicinity of a nuclear facility (non-actual scenario). Subjects were significantly less likely to rate the pronouncements of scientists as valid or moderately valid in the case of Reye's syndrome than they were in the case of the nuclear power facility. Possible explanations of this finding is that subjects are less likely to accept scientific verdicts as valid when there is a perceived health risk to children or when these verdicts are given by American scientists, both of which are features of the passage on Reye's syndrome. This could indicate that the

largely British subjects in the study were displaying greater trust in British than in American scientists. Whatever factor or factors were influential in subjects' ratings of scientific authorities in these particular scenarios, it is further evidence that background knowledge and beliefs play a significant role in the reasoning of subjects.

Responses to the open-ended questions after each passage confirmed these quantitative findings, and supported the idea that specific types of expertise held logical sway for the subjects in this study. A range of positive attributes featured in the grounds advanced by subjects for rating expertise as valid. These attributes included the professional status of experts, which was variously expressed in terms of professional standards, integrity and conduct. The knowledge and disciplinary backgrounds of experts, their level of specialization and their perceived independence were also important determinants of expertise for subjects:

Professional status:
'Although the working group was appointed by and had research funded by BNF [British Nuclear Fuels] the leading academics would have reported the true findings of their research. Their professional conduct would have meant that they are not influenced by BNF' (41-year-old, university educated, British male)

Knowledge:
'As a general practitioner who had medical knowledge and had experienced the respiratory symptoms, he may have a valid point' (43-year-old, university educated, British female)

Independence:
'The SEAC contained experts in a variety of fields. Also the experts were from academic institutes so independent from policy makers' (25-year-old, university educated, British male)

Specialization:
'They are still specialists within an associated field so there [sic] conclusions can be counted towards a decision [...]' (29-year-old, secondary school educated, Irish male)

Disciplinary backgrounds:
'A broad range of scientists from relevant disciplines was selected which gives some credibility' (38-year-old, university educated, British male)

A number of negative attributes were included in the grounds advanced by subjects who rated the expertise in particular scenarios to be not valid at all. These attributes included a lack of knowledge and restricted scope of expertise. Other comments mentioned a lack of objectivity which was often related to the funding of research and payment of consultancy fees. Many respondents also remarked on what they considered to be flaws in scientific methodology. These comments often addressed the size of samples used in studies and the selection of subjects for inclusion in these samples:

Lack of knowledge:
'They were not medical experts so, possibly, they did not have a lot of knowledge of causes and effects of such cancers' (31-year-old, secondary school educated, British female)

Restricted scope of expertise:
'Leading experts and independent figures, but I'd want further details on the expertise of those involved – Almond ticks the 'virology' and 'immunology' boxes, but his school suggests his expertise may relate to animals, rather than humans' (32-year-old, university educated, British female)

Lack of objectivity:
'the findings of the review panel are contaminated by the fact that the experts received a consultancy fee – the introduction of money does not make for an objective enquiry' (48-year-old, university educated, British male)

Flawed scientific methodology:
'The sample of 12 children who he (Dr Wakefield) conducted tests on was an insufficient number to base this link on' (37-year-old, university educated, British male)

> 'Some children were involved in both the studies carried out by Dr Wakefield and this could represent a potential conflict of interest' (32-year-old, university educated, British female)

Subjects could also be seen to weigh up competing considerations. This was particularly evident in passages which examined 'mixed expertise', that is, where a positive attribute on one continuum (e.g. genuine-dubious expertise) was matched with a negative attribute on another continuum (e.g. impartial-partial expertise). It was particularly commonplace for subjects to weigh factors such as expertise and professional integrity against a financial conflict of interest. On some occasions, the positive attribute was seen to 'win out' while on other occasions, the negative attribute appeared to exert greater influence:

> ***Expertise versus conflict of interest:***
> 'The panel consisted of leading experts in pharmacoepidemiology – which gives it some validity – but the fact that the review panel received a consultancy fee from pharmaceutical companies would make me question the review panel's final decision' (37-year-old, university educated, British female)

> 'I can't believe a panel of leading scientific experts would completely prostitute their views for money, and their findings would need to stand up to scrutiny. However, their interpretation of the material is bound to favour the pharmaceutical companies' (50-year-old, university educated, British female)

> ***Conflict of interest versus professional integrity:***
> 'Even though the consultants had all previously worked for mobile phone companies I must assume they individually retain professional integrity – so their response is relatively valid' (58-year-old, university educated, British male)

When confronted with 'mixed expertise', subjects almost always reflected the pull of competing factors by rating these scenarios as moderately valid.

5. Concluding remarks

This paper has proposed a new, logical perspective for the understanding of trust in a public health context. This perspective draws on the conceptual resources of informal logic and, in particular, on an informal fallacy known as the argument from authority. This argument was shown to be anything but fallacious in certain contexts of use. One such context is public health reasoning where a lack of knowledge and certainty precludes the use of deductive reasoning and instead necessitates a form of reasoning based on presumptions. A presumptively characterized argument from authority was shown to explain the main empirical findings relating to trust in a more parsimonious manner than was possible using other models and frameworks. This included so-called dimensions of trust such as competence and integrity as well as the use of trust as a heuristic in reasoning. A logical view of trust emphasizes the role of critical questions in developing the rational grounds of the premises in the argument from authority. These grounds are well developed during systematic reasoning in which there is careful deliberation of a number of factors relating to the rational warrant of the argument from authority. These same grounds are effectively bypassed in heuristic reasoning. To investigate if subjects are adept at recognizing the logical and other factors which are integral to the rational warrant of the argument from authority, a study of reasoning in 879 members of the public was undertaken. Across a number of public health scenarios, logical and epistemic conditions associated with the rational warrant of this argument were systematically varied. As predicted, subjects were shown to be capable of developing the rational basis of the argument from authority, even if they are not always called upon to do so in their daily deliberations about public health problems.

There are clear implications of a logical view of trust for public health practice. This is nowhere more clearly demonstrated than in relation to public health communication. There has been a tendency in such communication to conflate a lack of knowledge on the part of the lay person on matters relating to public health with a lack of a rational capacity to form judgements about issues in public health. The former deficit is an epistemic problem in that a lay person cannot lay claim to the expert knowledge of

the scientist, medical professional or public health specialist. But all too often this epistemic problem is confused with a deficit in the logical, rational resources which people use to form judgements about public health problems. Even in the absence of knowledge – or *particularly* in the absence of knowledge – lay members of the public can draw upon a rich array of rational resources to guide their public health judgements. The argument from authority is one part of this rational tool-kit. We have seen how this argument can mediate the trust relationship between public health experts and the populations served by these experts. We have also seen how lay members of the public are adept at recognising the conditions under which this argument is more or less rationally warranted. To this extent, it is contended that public health professionals should exploit this rational capacity in their communications with the public. Where communications have typically reported public health advice, it is proposed that they should also attempt to reveal something of the rational process which issued in this advice. This could include the authority credentials of those who generated the advice in the reasonable expectation that lay members of the public can discern these credentials and attribute due rational warrant to them. Such an approach to public health communication not only acknowledges the rational capacities of the public, but also allows those capacities to be exercised in important public health judgements.

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Appendix

Table 1. Subject characteristics.

	SUBJECT CHARACTERISTICS (total = 879 subjects)
AGE	Average: 43.8 years Range: 18-65 years
GENDER	Male: 292 subjects Female: 587 subjects
EDUCATION	University level: 589 subjects Secondary school level: 290 subjects
ETHNICITY	White British: 789 subjects White Irish: 30 subjects Asian or British Asian Indian: 15 subjects Asian or British Asian Pakistani: 4 subjects Black or Black British Caribbean: 3 subjects Black or Black British African: 3 subjects Mixed: White and Black Caribbean: 1 subject Mixed: White and Black African: 1 subject Mixed: White and Asian: 1 subject Other: 32 subjects

Table 2. Public health scenarios.

	Description of public health scenario
1	***Genuine, impartial expertise; actual scenario:*** Pronouncements on BSE by the Spongiform Encephalopathy Advisory Committee
2	***Genuine, impartial expertise; non-actual scenario:*** Use of chemicals in food production
3	***Genuine, partial expertise; actual scenario:*** Aspirin use and Reye's syndrome in children
4	***Genuine, partial expertise; non-actual scenario:*** Cancer risks posed by a nuclear power facility
5	***Dubious, partial expertise; actual scenario:*** Safety of the measles, mumps and rubella (MMR) vaccine
6	***Dubious, partial expertise; non-actual scenario:*** Electromagnetic emissions from mobile phone masts
7	***Dubious, impartial expertise; actual scenario:*** Pronouncements on BSE by the Southwood Working Party
8	***Dubious, impartial expertise; non-actual scenario:*** Air-borne chemical emissions from a recycling facility