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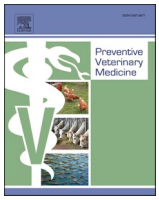

Method in limbo? Theoretical and empirical considerations in using thematic analysis by veterinary and One Health researchers

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ABSTRACT

This article spans a number of theoretical, empirical and practice junctures at the intersection of human and animal medicine and the social sciences. We discuss the way thematic analysis, a qualitative method borrowed from the social sciences, is being increasingly used by veterinary and One Health researchers to investigate a range of complex issues. By considering theoretical aspects of thematic analysis, we expand our discussion to question whether this tool, as well as other social science methods, is currently being used appropriately by veterinary and human health researchers. We suggest that additional engagement with social science theory would enrich research practices and improve findings. We argue that considerations of 'big theory' - ontological and epistemological positionings of the researcher - and 'small(er)' theory, the specific social theory in which research is situated, are both necessary. Our point of departure is that scientific discourse is not merely construction or ideology but a unique and continuing arena of debate, in part at least because of the elevation of self-criticism to a central tenet of its practice. We argue for further engagement with the core ideas and concepts outlined above and discuss them in what follows. In particular, and by way of focusing the point, we suggest that for veterinary, One Health, and human medical researchers to use thematic analysis to its maximum potential they should be encouraged to engage with both broader socio-economic theories and with questions of ontology and epistemology.

1. Introduction

This paper spans a number of theoretical, empirical and practice junctures at the intersection of human and animal medicine and the social sciences. It does this through consideration of how both human and animal health practitioners and researchers deploy various types of "social science" techniques, including thematic analysis, to understand how their practices and interventions are experienced by those involved in human and animal health (Biro et al., 2019; Burckhardt and Anderson, 2003; Kemp et al., 2021; Nashef et al., 1999; Webb et al., 2017).

In recent decades, particularly with the turn to interdisciplinary cooperation (for example in relation to the questions raised by the One Health approach (Abbas et al., 2021; Atlas, 2013; Barnett et al., 2020; Craddock and Hinchliffe, 2015; Ebata et al., 2020; Evans and Leighton, 2014; Galaz et al., 2015; Gilbert et al., 2017; Godfroid et al., 2013; Lapinski et al., 2015; Mackenzie et al., 2013; Pfeiffer et al., 2013; Rüegg et al., 2018; Woods et al., 2017)), veterinary researchers have begun to use qualitative and mixed methods. These are usually borrowed from a broadly defined range of social sciences. Some of the qualitative methods deployed within veterinary and One Health research spaces include thematic analysis (e.g., Doolan-Noble et al., 2023; Hennessey et al., 2021; Khan et al., 2022), content analysis (e.g., Geiger and Hovorka, 2015; Hennessey et al., 2023), interpretive phenomenological analysis (e.g., Dickson et al., 2019; Whitnall and Simmonds, 2021), grounded theory (e.g., Gaida et al., 2018), and ethnography (e.g., Høg et al., 2018; Schneider, 2017). While out of the scope of this paper, we recognise that the usual base data in qualitative studies - language, texts, utterances[1] –- require framing and re-framing. We note in particular that consideration of utterances, metaphors, gestures etc are complex when working within common language communities but are multiplied many

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[1] Though social veterinary studies may also include a range of other data: e.g., animal movements and interactions with others and people, animal noises and smells.

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times when working *across* language communities. Other research within the veterinary and One Health spaces does engage with these topics, using techniques such as conversation and discourse analysis (e.g., Chomyn et al., 2023) and make language a key research focus.

Thematic analysis (TA) is one of the more commonly used tools for qualitative life sciences with numerous authors citing the work of Braun and Clarke (Braun and Clarke, 2006) in their research. While tracing the origins of TA is difficult, this method of qualitative analysis has been attributed to a range of authors. For example, Holton (1973) and Dapkus (1985) used thematic techniques to write, respectively, about the history of physics and human experience of time. For a more in-depth history of TA see Braun and Clarke (2022).

A literature search using Web of Science and the following search terms: ((TS=(veterina* OR "animal health" OR livestock OR pet* OR poultry OR aquaculture)) AND TS= ("thematic analysis")) yielded 444 articles. Further screening of these titles left 296 articles (Table 1). Examination of these by date of publications revealed a marked increase of TA use over the last decade (Fig. 1). These literatures have used TA to examine a range of problems. The following examples include but do not exhaust our findings: disease risk in livestock production (Hennessey et al., 2021), challenges of implementing disease surveillance systems (Abuzerr et al., 2021; Johnson et al., 2018), veterinary employee retention (Adam et al., 2019; Montoya et al., 2021) and professional experiences (Doolan-Noble et al., 2023), and student experiences of education (Sutton, 2007).

Examination of these qualitative approaches reveals a range of methods for collecting and interacting with "data". These provide both opportunities and challenges for researchers. Here, the term "data" is placed in inverted commas to draw attention to a key argument in this paper, that "data" does not have validity independent of any theoretical considerations, particularly, in this context, its location in relation to the broad range of social science theories. Here we argue that TA in veterinary and One Health research could benefit from additional explicit and informed engagement with such theoretical considerations. Doing so could move TA from being an occasionally reductive process to one which is richly embedded in social theory and which thus recognises that how we approach research problems requires at least a passing awareness of what in the Francophone world is described as its problématique, a point on which we elaborate below.

With this in mind, we develop our argument as follows: in section two we situate it within a broad introduction to social theories. In section three we discuss 'big' general theories and methodological considerations while in section four we discuss 'small(er)' (sometimes described as 'middle range') social theory and the creation of meaning. In section five we suggest how these considerations can be used to select an appropriate way of conducting thematic analysis and thus improve the quality of investigations and deepen interdisciplinary understanding.

2. Grappling with theory and identifying an object of study

Social theories can be thought about in terms of 'big' theory. This is theory which deals with methodological concepts of ontology, epistemology and history. It can also be thought about in relation to 'small(er)' social theory. This is theory which informs the method and situates research within a broader context. Here, the words method and methodology require particular attention because, while overlapping, they are not synonymous. Method is how we do research and methodology is how we *think* about how we do research. Methodology is the theory of methods; what they do, why they are to be used, their advantages and limitations. Furthermore, it is important to understand how a research problem is "framed" and in particular its *problématique*[2] (Dudoignon et al., 2014; Klein, 2003). To recognise the *problématique* of a piece of research is to understand the choice of what to study, how to study, and the methods to be deployed. Here, the relation between the researcher and the researched involves self-reflection concerning choice of problem, methods, and the angle adopted to frame the research in relation to the broader context. Thus, for example, to frame a veterinary problem such as chicken production in relation to One Health is to adopt a very different approach to that where the researcher thinks only about one aspect of the system. This could entail study of the health of chickens from hatching to slaughter without, for example, thinking about risks of zoonotic disease emergence (Barnett and Pfeiffer, 2014; Høg et al., 2021, 2018; Liverani et al., 2013; Moyen et al., 2021) or sustainability (Vaarst et al., 2015).

"Framing" (Kornmesser, 2017; Poldsaar, 2010; Schmidt, 2011) may be understood as the way we define the problem we seek to address, thus arriving at a defined "object of study". Framing an "object of study" is at once a personal and also an extremely general process engaging questions of ethics, political beliefs, and assumptions about how societies and economies are structured and located historically. It is personal because it relates to funding sources (Barnett et al., 2020), personal interests, opinions, experiences, insights, biases, beliefs etc. It is general because each of us is situated within a matrix of personal and epochal "history", existing ideas, both accepted and rejected, structures of social and political power, not least the micro-politics and history of a research laboratory and, of course, our career (Kuhn, 1962; Pirozelli, 2019; Read and Sharrock, 2015). Examples of "bias" may include a wide range of phenomena such as once taken-for-granted assumptions that women have nimble fingers as compared to men and are therefore better suited to certain tasks (Elson and Pearson, 1981). Other examples of "bias" as part of "everyday knowledge" at particular times might include "race theory" and the "science" of eugenics (Lombardo and Dorr, 2006; UCL, 2021) and– as implied in the title of this paper – the interlinkage of animal and human health.

Considerations of both personal and general framing can be approached through reflexive practices. Reflexivity in qualitative research provides opportunities to contextualise and understand one's standing in the world and the relationships which exist between the researcher,the researched, and the research product (Dodgson, 2019; Markham, 2017). It is beyond the scope of this article to delve into reflexivity itself, a topic which has been covered by others (e.g., Braun and Clarke, 2022; Mauthner and Doucet, 2003; Olmos-Vega et al., 2022; Palaganas et al., 2017; Wilkinson, 1988). It should be noted that through reflexive engagement, researchers should also question the frames used during the research process. Thus, framing, and the identification of an object of study, is necessarily a dynamic and continuous process.

3. Big theory: methodological considerations

Engaging with big theory requires consideration of ontology, epistemology and history. Ontological considerations force us to address

Table 1
The ten most common journals for veterinary articles using thematic analysis.

Journal	Number of articles
Frontiers in Veterinary Science	33
Veterinary Record	26
Preventive Veterinary Medicine	19
Animals	17
Journal of Veterinary Medical Education	16
Anthrozoos	11
Journal of Dairy Science	11
Plos One	10
BMC Veterinary Research	9
Others (n = 99)	145

[2] We use this term to emphasise that, rather like the term "framing", a research problem involves consideration of what may be described as the angle of attack or approach to a research problem and the relation between the researcher, the object of research and the researched.

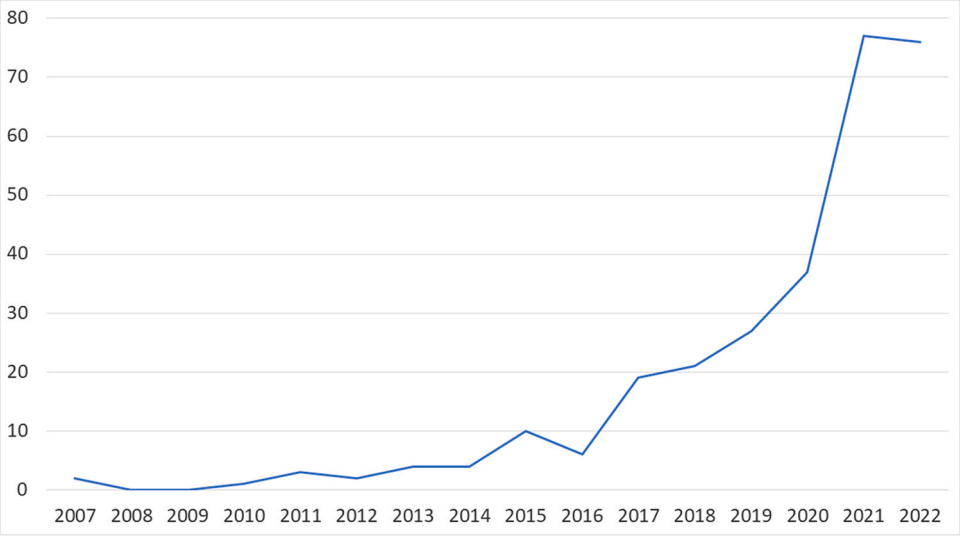

Fig. 1. Annual publication of veterinary literature using thematic analysis since 2007.

how we understand reality; what are our conceptual components, our analytical categories and how these entities relate to each other. Engagement with epistemology requires that we reflect on how our claims to knowledge are constructed in relation to our assumptions as to its origins and framing. These questions concerning assumptions may often impinge upon the location of our problem in relation to its (and our) place in history.

Such challenging considerations help position our approach to and our understanding of the difficulties of accessing/defining reality. Of course, "reality" is a problematic concept. It has particular salience when research is undertaken within an interdisciplinary framework and across cultural contexts, territory where methodological frames of reference, analytical categories and underlying "grand theories" may be unstated and unexamined. We pursue this theme further below. For now we continue the discussion through a brief consideration of some important background issues affecting how we perceive any object of study. We recognise that the following concepts are challenging and complex and note it is beyond the scope of this article to describe them in detail, and encourage further reading (Braun and Clarke, 2022 is a good starting point). Researchers may decide to take a realist ontological position and treat data in a (post)-positivist manner. This creates a so called "small q" qualitative paradigm more closely aligned with quantitative work, where one may believe a single truth can be discovered by the research method (Alvesson and Skoldberg, 2009). Or we may choose a relativist ontological and a contextualist or constructivist epistemological position – a "Big Q" qualitative paradigm - where we entertain the assumption that we, the researcher, and those being researched in some sense *create* "truth", "mythical realities", or "imaginaries" during the process of data collection and analysis (Bishop and Shepherd, 2011). This assumption is one which is most likely to create challenges in working in an interdisciplinary manner between the life sciences and the social sciences.

The sceptical reader may, quite reasonably, enquire why it is necessary to think about these apparently abstruse and certainly difficult questions? The answer is because they are important if we are to work across disciplines and pay attention to their different framings and histories.

On a practical level, this positioning may appear as simply a way to select the most "appropriate" method of thematic analysis. We examine this aspect below. Decisions as to "appropriateness" can have profound implications, not least importing unconscious biases and associated uncritical assumptions as to what is considered "normal" taken-for-granted knowledges. On a deeper level, thinking about these concepts may help to transform/unravel our ways of thinking about "science". During their education, researchers working in the human, veterinary and One Health fields are likely to have had continual, indeed profound and very long, exposure to the quantitative paradigms of reductionism, positivism/realism, objectivity, and the ways in which these remove, expose or at least reduce bias. Such training develops a particular "taken-for-granted" perspective on the world. As a corrective, use of ontological and epistemological conceptual instruments challenge and hopefully help us to embrace and use qualitative methodological research processes properly, thus understanding the implications of taking this or that scalpel to a particular version of reality.

"Science" as an idea and set of practices occupies a dominant, aspirational and, indeed, legitimating position in relation to the production of "knowledge". It is also hugely contentious in some quarters, particularly at present when various conspiracy theories and their sequelae, for example opposition to vaccination as a part of public health interventions, seem to be increasingly prevalent. There is no space here to discuss the nature of "science" other than to note that it is not restricted to slavish inductivism but at its best is informed by imagination, theory and creative curiosity (Rovelli, 2015). And it is in this context that we remind readers that the life sciences are largely located within an intellectual space derived from general agreement (while noting that there remain active and important debates within this broad consensus) about such "grand theories" as evolution, the post-Crick, Watson and Franklin foundations of modern molecular biology, and most recently application of Bayesian-informed artificial intelligence to understanding the cell (Angermueller et al., 2016; Rawlings and Fox, 1994; Sapoval et al., 2022).

To a large degree this is not true of the social sciences: and for good, if uncomfortable, reasons. The social world is deeply tied to the creative and constructive processes of "the mind" (Minshew, 1997; Nagel, 1974; Wellman, 2015) and therefore intrinsically "political" in both the "Big P" and "small p" senses of that word. Different socio-economic theories, and different traditions of such theory, often capture distinct accounts of the worlds we experience, identify different entities of concern, different conceptualisations, and, in research, different "objects of study".

Thus, these 'big' and 'small(er)' theoretical considerations can assist us in framing the process of knowledge construction, be this within a qualitative or quantitative research paradigm. Here, whether we treat meaning and consciousness as data or not, how we understand value systems in which we exist and use these to frame our objects of study, and how we approach theoretical frameworks through induction or deduction, and indeed whether we are able to "understand" the

consciousness of others, is unresolved. Our own, current, theoretical positioning may be summarised ontologically as critical realism and epistemologically as contextualism. Both are informed by a combination of standard scientific veterinary training, political economy, the broad social sciences and a clear and continuing commitment to the value of critical scientific engagement. Our position is characterised in Fig. 2. This schematic endeavours to locate the issue of knowledge construction within a multidimensional problem space.

Within this knowledge construction space, it will be clear that terms such as quantitative and qualitative methods and the data they produce do not refer to unambiguous categories but to continua of methodological, method and theoretical practices and assumptions. The key point is that "data" only exist/are brought into existence as a response to the questions we pose about a phenomenon and the nature of the "reality" within which that phenomenon is located. Furthermore, the relation of these questions to specified and refined theoretical concepts, their indicators, and finally the operational definitions determine how we engage that "reality" (Rose, 1982). In the case of the social sciences these tools may range from the so-called "participant observation" of the ethnographer, through focus group discussions with key informants, to large data banks of official statistics collected by means of carefully constructed questionnaires, and even data derived from satellite observations of indicators of human and animal movements.

The point is that "the social" is in its very nature concerned with relationships. In other words, analysis using social sciences should depart (but does not always do so) from the base recognition that social concepts, including such apparently fundamental concepts as "status groups", "class", "gender", "culture", "profession", "vet", "client", "medication" and much more, should always be understood to exist as relationships rather than "things". For this reason, any "themes" generated via TA should be thought of as imbricated in, produced by, existing only in, relationships. This point is both epistemologically and ontologically significant. It points to ways in which social theory resonates with perspectives drawn from theoretical physics, but which should also apply equally to social theories. Carlo Rovelli suggests that "20th-Century physics is not about how individual entities are *by themselves*, their "thingness" (Rovelli, 2015; van Fraassen, 2010). It is about how entities manifest themselves to one another: it is about *relationships*. In the context of this paper, such an approach also problematises the idea that social science research might involve the mere identification or extraction of "themes" from empirical investigations. This would suggest an ontological position of realism, and that themes are there to be discovered. This is not the case; themes are created through interaction with the data.

4. Small(er) theory: social theory and the creation of meaning

Examination of veterinary literature using TA suggests that most of these papers used TA as a tool for understanding *opinions* or *experiences* relating to a range of topics concerning animal husbandry, companion animals, and the veterinary profession. In this manner, authors can be considered to be taking an experiential approach to analysis. Here, language is used as a tool to communicate meaning, experiences, and opinions of research participants (Braun and Clarke, 2022). Investigation of opinions has its roots in the disciplines of social psychology (Berinsky, 2006; Donsbach and Traugott, 2008; Tourangeau et al., 2000) and the *behavioral sciences* (note US spelling, this discourse is largely, although not exclusively, a US tradition ("Journal of the history of the behavioral sciences (Online)," 1965)). Investigation of opinions within this approach are not always identical to the social sciences practised within the broader European tradition, a tradition which accords considerable weight to social, cultural, and economic contexts in understanding attitudes and opinions. In this tradition, social sciences often look at trends over time and seek to explain why certain behaviours and attitudes exist or come into existence, thus taking a critical approach to analysis and results rather than assuming that the "data" revealed is unproblematic. Consequently, social science research has produced myriad social theories, a potential minefield for the life scientist trying to work within the realm of the social sciences.

Cursory internet searches for 'social theory' yield broad idioms such as Marxism, capitalism, conflict theory, and rational choice theory among others. Social theory textbooks, of which there are many, stretch into those with numerous volumes covering hundreds of different theories (for example Turner et al., 2017 describes over 850 different theories while Michie et al., 2014 describe 83 theories of behaviour change). For the life scientist, stepping into the world of social sciences can be challenging, as can the reverse journey. While thorough literature searches can be one route into enlightenment, another is through multidisciplinary collaborative research, working with social scientists by bringing them into spaces traditionally dominated by life scientists.

Qualitative analyses can also adopt linguistic approaches which treat language differently to experiential research. Here, additional attention

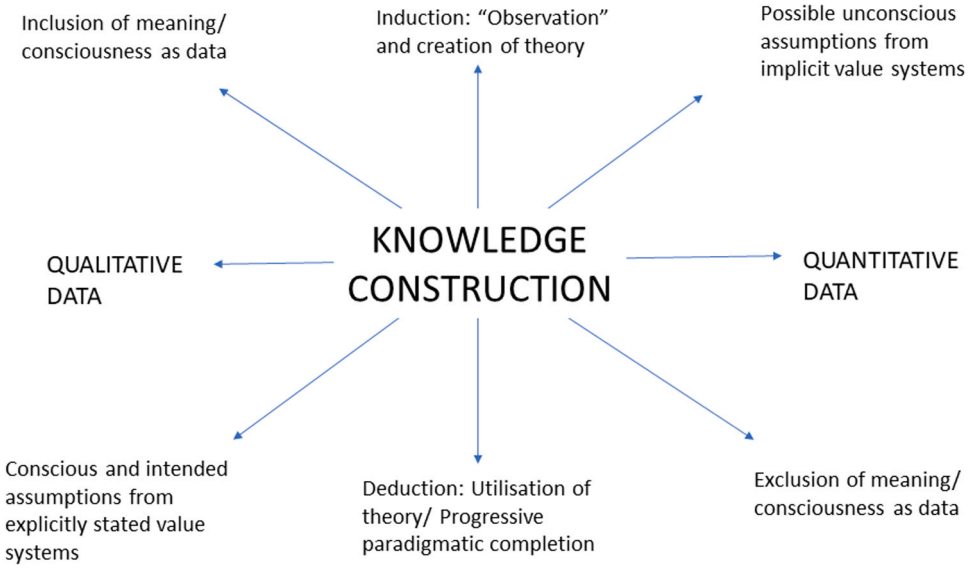

Fig. 2. Different dimensions in the knowledge construction space of qualitative and quantitative research paradigms. This schematic represents a two-dimensional version of what should be thought of as a multi-dimensional space where (i) each of the variables can move in any 360-degree space in relation to the others (ii) the variables are represented as continua not as binaries.

is paid to the words and utterances themselves to understand how language is used to create meaning and reality. As mentioned previously, while not the focus of this article, techniques such as discourse and conversation analysis are two such research methods which make language a core focus of analysis.

In moving from his traditional veterinary background of clinical practice, one of us (MH) found the concepts of social theory and theoretical frameworks challenging and was thus attracted to an inductive, "data driven" approach; an approach which can, in its inductive trajectory, remain isolated from existing social theory. Examination of literature using TA suggests others have taken a similar approach. Here, researchers using a purely inductive method attempt to allow data to "talk for itself" and by being assembled into sets for analysis in some respects may become the object of study itself. However, this arguably reductive process fails to engage with pre-existing researcher biases and assumptions relating to the broader social context within which research is situated. For example, using an inductive approach to examine the economic context of poultry production could naively ignore the taken for granted norms of capitalism. Alternative forms of qualitative data analysis based in inductive approaches – for example grounded theory (Glaser and Strauss, 1967) and interpretive phenomenological analysis (Smith and Osborn, 2003) arguably still require thorough engagement with social theory, i.e., they are not atheoretical methods.

In contrast, deductive methods start from theory and theoretical frameworks are used to guide research conceptualisation, data collection, and analysis. Consequently, results can be contextualised within a corpus of existing theoretical and empirical research. Findings can be assessed as to whether they support theory, contradict/disconfirm it, or suggest revisions of components. It is on this basis that we argue engagement with the plethora of social theories which could relate to veterinary and One Health research provides opportunity both to improve the quality and indeed validity of our qualitative research while linking it to wider debates. In doing this we can situate our professions and their practices in relation to their social and economic contexts. In our current research experiences, examples of such linking include understanding livestock systems in Bangladesh and India (Hennessey et al., 2021, 2023), and the role of hope in affecting adolescent behaviours and opinions in relation to HIV acquisition in South Africa and elsewhere in Africa (Barnett et al., 2015a,b; Gibbs et al., 2023; Hansen et al., 2020; Ngwenya et al., 2021).

5. Selecting a suitable method for doing thematic analysis

In their most recent textbook, "Reflexive Thematic Analysis, a Practical Guide", Braun and Clarke (Braun and Clarke, 2022), describe three distinct ways of approaching TA; "coder reliability", "codebook", and "reflexive" TA. Hence, given the theoretical flexibility of TA – unlike some other methods it is not rooted in a specific ontology or epistemology – it is important to know researchers' methodological positioning to understand their choice of methods. Coder reliability TA uses processes to measure coder agreement between one or more coders, apparently promoting objectivity and aligning with "small q" ways of thinking. Reflexive TA embraces reflexivity and subjectivity and aligns with "Big Q" approaches to research, while codebook TA, which also includes framework analysis, sits somewhere in the middle. Therefore, when selecting and justifying one of these methods of TA, researchers should engage with the broader (and border – between disciplines) 'big' theoretical questions previously discussed (step 2 in Fig. 3). Arguably, researchers adopting small-q approaches, more aligned with quantitative paradigms, should be aware of the larger methodological positioning of this type of approach to appreciate the validity and limitations of their analysis.

In Table 2 we highlight a recent study by (Doolan-Noble et al., 2023) which uses reflexive TA to explore New Zealand veterinarian's experiences of bovine tuberculosis and states the authors methodological position and theoretical framing.

Considering the types of social theory within which to situate our research requires knowledge of the theories relevant to the object of study. For example, one of our (MH) current research topics is contract poultry farming and antibiotic use. Initial framing of the problem came about through engagement with agency theory at the start of a PhD research project. Agency theory was selected as it describes the conflict of interest which can occur between two actors when asymmetry of information exists (see Mitnick, 2013, 1975; Ross, 1973). Subsequent exploration of agency theory throughout the duration of the project led to exposure to other related social theory and their relationships to each other are depicted in Fig. 4. I.e., this theory does not exist in isolation, it has its own history and is derived from and connected to other theory.

This engagement with social theory is required to fully realise the objective of TA, i.e., the production of meaningful themes from coded data. While we do not here go into the detail of coding itself, the following engages with how coded data, be it through an inductive, deductive, or blended approach (Graebner et al., 2012), are treated.

Table 2
Example of work which describes the authors' theoretical positioning.

	(Doolan-Noble et al., 2023) comment	Our interpretation
Ontological position	Interpretivist paradigm	Aligned with relativism
Epistemological position	Pragmatism paradigm	Aligned with constructivism
Theoretical framing	Theory of moral distress	Authors provide a history to the theory and use it to situate their object of study
Use of theoretical framework	Knowledge is based on experiences	Experiential use of a theoretical framework

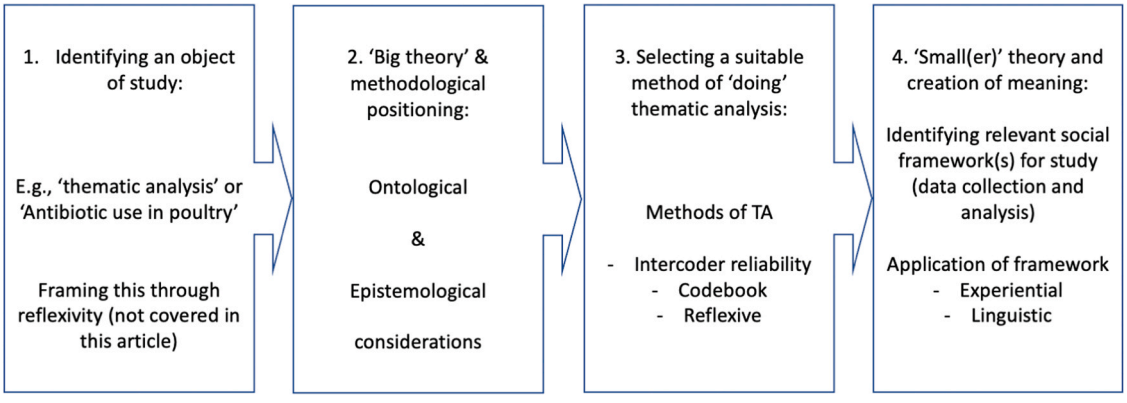

Fig. 3. Schematic of theoretical considerations for selecting a method of thematic analysis.

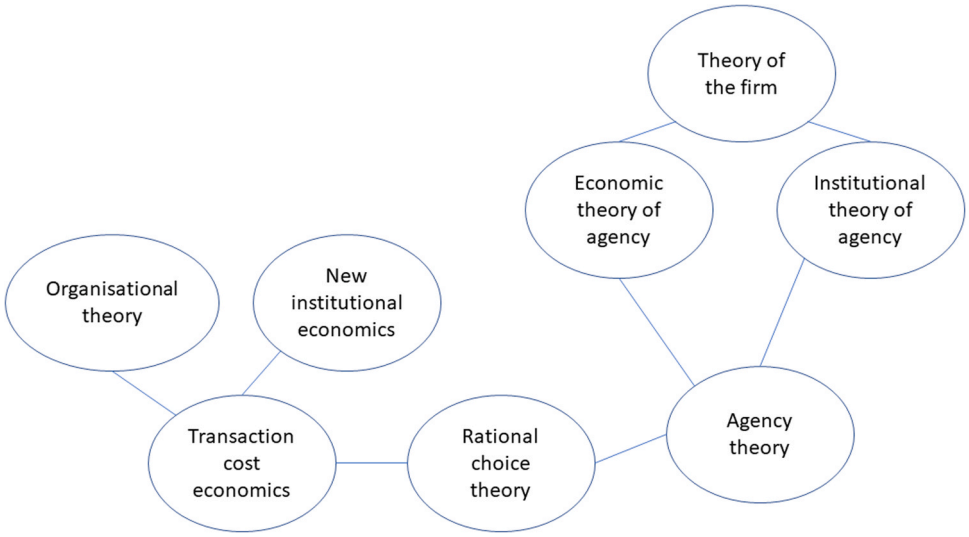

Fig. 4. A *selection* of some of the social theories and their connections relating to contract poultry farming.

Since their original 2006 paper, Braun and Clarke, have developed criteria for what they consider to be a "good" theme. The authors set out that themes should have meaning, i.e., taken in isolation they provide insight to data, including analytical direction, and so move coded data from a purely descriptive account into an interpretive and explanatory realm engaged with social theory (Braun and Clarke, 2022). They argue that some publications claiming to have produced themes, only organise data into categories or topic summaries. Assessing our previous work (Hennessey et al., 2021) using these criteria we come to a similar conclusion. The "themes" we present could be considered underdeveloped and more consistent with topic summaries with analysis remaining in the realm of the descriptive. While it could be argued that this type of analysis is consistent with a form of "semantic thematic analysis" as described by Braun and Clarke in 2006, to do so would not embrace more recent literature (e.g., (Braun et al., 2014; Braun and Clarke, 2022, 2014; Vaismoradi et al., 2016)). We argue that analysis which remains in the descriptive realm is more consistent with 'manifest content analysis'. Here, researchers stay "very close to the text, [using] the words themselves, [describing] the visible and obvious" ((Bengtsson, 2016), bracketed text added).

6. Conclusion

Thematic analysis, within which there exist three distinct approaches, is just one of several methods of conducting qualitative data analysis. Given the increased incidence of its use over the last decade, this approach has clearly proved to be a useful tool for traditional life scientists to engage in qualitative work. However, should veterinary, human medical and One Health researchers wish to conduct qualitative research and use thematic analysis to its maximum potential, engagement with underlying theory is required. Similarly, it may be argued that social scientists working in relation to veterinary and human medical matters should acquaint themselves with at least some of the basics of the life sciences.

Throughout this methodological paper, we have not for reasons of space, properly engaged with the issues of language and performativity. These are critical areas of consideration, especially pertinent for those researchers working in languages and cultures which are not familiar to them. Thus, further critical methodological research could engage with these topics in order to understand how they are currently dealt with within the veterinary and One Health spaces to further advance qualitative research in these fields.

This discussion of qualitative methods should feed into the important and more general question of how non-specialists in the veterinary and/or human medical fields deploy instruments and techniques from other disciplines. Here we are arguing that a truly interdisciplinary engagement between veterinary (and indeed other life science practitioners) and the social sciences, requires engagement with the ways in which research and day to day practices in those disciplines should be understood as situated within a complex multidimensional knowledge production space.

This perspective recognises that scientific discourse cannot be dismissed as merely construction or ideology. It must be seen as having at its core a continuing arena of debate about methodology. This is in part at least because of its elevation of *self-criticism* to a central tenet of its practice and why we argue for further engagement with the core concepts discussed in this paper.

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Declaration of Competing Interest

We can confirm that the authors declare no conflict of interest.

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References

Abbas, S.S., Shorten, T., Rushton, J., 2021. Meanings and mechanisms of one health partnerships: insights from a critical review of literature on cross-government collaborations. Health Policy Plan. https://doi.org/10.1093/heapol/czab134.

Abuzerr, S., Zinszer, K., Assan, A., 2021. Implementation challenges of an integrated One Health surveillance system in humanitarian settings: a qualitative study in Palestine, 20503121211043040 SAGE Open Med. 9. https://doi.org/10.1177/20503121211043038.

Adam, K.E., Baillie, S., Rushton, J., 2019. Clients. Outdoors. Animals.': retaining vets in UK farm animal practice—thematic analysis of free-text survey responses. Vet. Rec. 184, 121. https://doi.org/10.1136/vr.105066.

Alvesson, M., Skoldberg, K., 2009. Reflexive Methodology, second ed. SAGE Publications Inc, London.

Angermueller, C., Pärnamaa, T., Parts, L., Stegle, O., 2016. Deep learning for computational biology. Mol. Syst. Biol. 12, 878 https://doi.org/10.15252/msb.20156651.

Atlas, R.M., 2013. One Health: its origins and future. Curr. Top. Microbiol Immunol. 1–13. https://doi.org/10.1007/82_2012_223.

Barnett, T., Fournié, G., Gupta, S., Seeley, J., 2015a. Some considerations concerning the challenge of incorporating social variables into epidemiological models of infectious disease transmission. Glob. Public Health 10, 438–448. https://doi.org/10.1080/17441692.2015.1007155.

Barnett, T., Pfeiffer, D., 2014. Are infection control policies fit for purpose? Eur. J. Companion Anim. Pract. 24.

Barnett, T., Pfeiffer, D.U., Ahasanul Hoque, M., Giasuddin, M., Flora, M.S., Biswas, P.K., Debnath, N., Fournié, G., 2020. Practising co-production and interdisciplinarity: challenges and implications for one health research. Prev. Vet. Med. 177, 104949 https://doi.org/10.1016/j.prevetmed.2020.104949.

Barnett, T., Seeley, J., Levin, J., Katongole, J., 2015b. Hope: a new approach to understanding structural factors in HIV acquisition. Glob. Public Health 10, 417–437. https://doi.org/10.1080/17441692.2015.1007154.

Bengtsson, M., 2016. How to plan and perform a qualitative study using content analysis. Nurs. Open 2, 8–14. https://doi.org/10.1016/j.npls.2016.01.001.

Berinsky, A., 2006. American Public Opinion in the 1930s and 1940s: the analysis of quota-controlled sample survey data. Public Opin. Q. 70, 499–529. https://doi.org/10.1093/poq/nfl021.

Biro, E., Kahan, Z., Kalman, J., Rusz, O., Pákáski, M., Irinyi, T., Kelemen, G., Dudas, R., Drótos, G., Hamvai, C., 2019. Cognitive functioning and psychological well-being in breast cancer patients on endocrine therapy. In Vivo 33, 1381–1392. https://doi.org/10.21873/invivo.11615.

Bishop, E.C., Shepherd, M.L., 2011. Ethical reflections: examining reflexivity through the narrative paradigm. Qual. Health Res. 21, 1283–1294. https://doi.org/10.1177/1049732311405800.

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3, 77–101. https://doi.org/10.1191/1478088706qp063oa.

Braun, V., Clarke, V., 2014. What can "thematic analysis" offer health and wellbeing researchers? Int. J. Qual. Stud. Health Well-being 9, 26152. https://doi.org/10.3402/qhw.v9.26152.

Braun, V., Clarke, V., 2022. Thematic Analysis a Practice Guide. Sage Publications, London.

Braun, V., Clarke, V., Rance, N., 2014. How to use thematic analysis with interview data. pp. 183–197.

Burckhardt, C., Anderson, K., 2003. The quality of life scale (QOLS): reliability, validity, and utilization. Health Qual. Life Outcomes 1, 60. https://doi.org/10.1186/1477-7525-1-60.

Chomyn, O., Wapenaar, W., Richens, I.F., Reyneke, R.A., Shortall, O., Kaler, J., Brennan, M.L., 2023. Assessment of a joint farmer-veterinarian discussion about biosecurity using novel social interaction analyses. Prev. Vet. Med. 212, 105831 https://doi.org/10.1016/j.prevetmed.2022.105831.

Craddock, S., Hinchliffe, S., 2015. One world, one health? Social science engagements with the one health agenda. Soc. Sci. Med. 129, 1–4. https://doi.org/10.1016/j.socscimed.2014.11.016.

Dapkus, M.A., 1985. A thematic analysis of the experience of time. J. Pers. Soc. Psychol. https://doi.org/10.1037/0022-3514.49.2.408.

Dickson, A., Smith, M., Smith, F., Park, J., King, C., Currie, K., Langdridge, D., Davis, M., Flowers, P., 2019. Understanding the relationship between pet owners and their companion animals as a key context for antimicrobial resistance-related behaviours: an interpretative phenomenological analysis. Heal. Psychol. Behav. Med. 7, 45–61. https://doi.org/10.1080/21642850.2019.1577738.

Dodgson, J.E., 2019. Reflexivity in qualitative research. J. Hum. Lact. 35, 220–222. https://doi.org/10.1177/0890334419830990.

Donsbach, W., Traugott, M.W., 2008. Thousand Oaks, CA. The SAGE handbook of public opinion research. Sage Publications.

Doolan-Noble, F., Noller, G., Jaye, C., Bryan, M., 2023. Moral distress in rural veterinarians as an outcome of the Mycoplasma bovis incursion in southern New Zealand. N. Z. Vet. J. https://doi.org/10.1080/00480169.2023.2174202.

Dudoignon, N., Bouard, D., Kolf-Clauw, M., Degryse, A.-D., Denais-Lalieve, D., Liabeuf, M., Vidal, S., 2014. Rôles des vétérinaires dans les animaleries de laboratoire. Responsabilités et formation. Bull. Acad. Vet. Fr. 167, 51. https://doi.org/10.4267/2042/53723.

Ebata, A., Hodge, C., Braam, D., Waldman, L., Sharp, J., Macgregor, H., Moore, H., 2020. Power, participation and their problems: a consideration of power dynamics in the use of participatory epidemiology for one health and zoonoses research. Prev. Vet. Med. 177 https://doi.org/10.1016/j.prevetmed.2020.104940.

Elson, D., Pearson, R., 1981. Nimble fingers make cheap workers": an analysis of women's employment in third world export manufacturing. Fem. Rev. 7, 87–107. https://doi.org/10.1057/fr.1981.6.

Evans, B.R., Leighton, F.A., 2014. A history of one health: EN- a history of one health -FR- Histoire du concept " Une seule santé " -ES- Historia de "Una sola salud. Rev. Sci. Tech. 33, 413–420. https://doi.org/10.20506/rst.33.2.2298.

Gaida, S., Härtl, A., Tipold, A., Dilly, M., 2018. Communication identity in veterinary medicine: a grounded theory approach. Vet. Rec. Open 5, e000310. https://doi.org/10.1136/vetreco-2018-000310.

Galaz, V., Leach, M., Scoones, I., Stein, C., 2015. The political economy of One Health research and policy. STEPS Work. 81.

Geiger, M., Hovorka, A.J., 2015. Animal performativity: exploring the lives of donkeys in Botswana. Environ. Plan. D. Soc. Sp. 33, 1098–1117 https://doi.org/10.1177/0263775815604922.

Gibbs, A., Desmond, C., Barnett, T., Shahmanesh, M., Seeley, J., 2023. Is hope associated with HIV-acquisition risk and intimate partner violence amongst young women and men? A cross-sectional study in urban informal settlements in South Africa. AIDS Care 35, 833–840. https://doi.org/10.1080/09540121.2022.2143470.

Gilbert, M., Xiao, X., Robinson, T.P., 2017. Intensifying poultry production systems and the emergence of avian influenza in China: a 'One Health/Ecohealth' epitome. Arch. Public Heal. 75 https://doi.org/DOI 10.1186/s13690-017-0218-4.

Glaser, B.G., Strauss, A., 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine Publishing Co, Chicago.

Godfroid, J., Al Dahouk, S., Pappas, G., Roth, F., Matope, G., Muma, J., Marcotty, T., Pfeiffer, D., Skjerve, E., 2013. A "One Health" surveillance and control of brucellosis in developing countries: moving away from improvisation. Comp. Immunol. Microbiol. Infect. Dis. 36, 241–248. https://doi.org/10.1016/j.cimid.2012.09.001.

Graebner, M.E., Martin, J.A., Roundy, P.T., 2012. Qualitative data: cooking without a recipe. Strateg. Organ. 10, 276–284. https://doi.org/10.1177/1476127012452821.

Hennessey, M., Fournié, G., Hoque, M.A., Biswas, P.K., Alarcon, P., Ebata, A., Mahmud, R., Hasan, M., Barnett, T., 2021. Intensification of fragility: poultry production and distribution in Bangladesh and its implications for disease risk. Prev. Vet. Med. 191, 105367 https://doi.org/10.1016/j.prevetmed.2021.105367.

Hansen, C.H., Lees, S., Kapiga, S., Seeley, J., Barnett, T., 2020. Measuring hope amongst Tanzanian women who participate in microfinance: An evaluation of the Snyder hope scale. Glob. Public Health 15, 402–413. https://doi.org/10.1080/17441692.2019.1682027.

Hennessey, M., Ebata, A., Samanta, I., Mateus, A., Arnold, J.-C., Day, D., Gautham, M., Alarcon, P., 2023. Pharma-cartography: Navigating the complexities of antibiotic supply to rural livestock in West Bengal, India, through value chain and power dynamic analysis. PLoS One 18, e0281188.

Høg, E., Fournié, G., Hoque, M.A., Mahmud, R., Pfeiffer, D.U., Barnett, T., 2018. Competing biosecurity and risk rationalities in the Chittagong poultry commodity chain, Bangladesh. Biosocieties. https://doi.org/10.1057/s41292-018-0131-2.

Høg, E., Fournié, G., Hoque, M., Mahmud, R., Pfeiffer, D., Barnett, T., 2021. Avian influenza risk environment: live bird commodity chains in Chattogram, Bangladesh. Front. Vet. Sci. 8 https://doi.org/10.3389/fvets.2021.694753.

Holton, G., 1973. Thematic Origins of Scientific Thought: Kepler to Einstein. Harvard University Press, Cambridge, MA.

Johnson, I., Hansen, A., Bi, P., 2018. The challenges of implementing an integrated One Health surveillance system in Australia. Zoonoses Public Health 65, E229–E236. https://doi.org/10.1111/zph.12433.

Kemp, K.A., Naqvi, F., Quan, H., Paolucci, E.O., Knudtson, M.L., Santana, M.J., 2021. Eliciting patient experiences about their care after cardiac surgery. CJC Open 3, 427–433. https://doi.org/10.1016/j.cjco.2020.11.016.

Khan, X., Lim, R.H.M., Rymer, C., Ray, P., 2022. Fijian farmers' attitude and knowledge towards antimicrobial use and antimicrobial resistance in livestock production systems-a qualitative study. Front. Vet. Sci. 9 https://doi.org/10.3389/fvets.2022.838457.

Klein, Y., 2003. Le dépassement de la problématique de l'art. Ecole Nationale Superieure Des Beaux-Arts de Paris, Paris.

Kornmesser, S., 2017. Frames and concepts in the philosophy of science. Eur. J. Philos. Sci. 8, 225–251. https://doi.org/10.1007/s13194-017-0183-3.

Kuhn, T.S., 1962. The structure of scientific revolutions, International encyclopedia of unified science. University of Chicago Press, Chicago.

Lapinski, M.K., Funk, J.A., Moccia, L.T., 2015. Recommendations for the role of social science research in One Health. Soc. Sci. Med. 129, 51–60. https://doi.org/10.1016/j.socscimed.2014.09.048.

Liverani, M., Waage, J., Barnett, T., Pfeiffer, D.U., Rushton, J., Rudge, J.W., Loevinsohn, M.E., Scoones, I., Smith, R.D., Cooper, B.S., White, L.J., Goh, S., Horby, P., Wren, B., Gundogdu, O., Woods, A., Coker, R.J., 2013. Understanding and managing zoonotic risk in the new livestock industries. Environ. Health Perspect. 121, 873–877. https://doi.org/10.1289/ehp.1206001.

Lombardo, P.A., Dorr, G.M., 2006. Eugenics, medical education, and the Public Health Service: another perspective on the Tuskegee syphilis experiment. Bull. Hist. Med. 80, 291–316.

One health: the human-animal-environment interfaces in emerging infectious diseases. The concept and examples of a one health approach. In: Mackenzie, J.S., Jeggo, M., Daszak, P., Richt, J.A. (Eds.), 2013, Current topics in microbiology and immunology, volume 365. Springer, Heidelberg. https://doi.org/10.1007/978-3-642-36889-9.

Markham, A., 2017. Reflexivity: Some techniques for interpretive researchers [WWW Document]. URL ⟨https://annettemarkham.com/2017/02/reflexivity-for-interpretive-researchers/⟩ (accessed 6.18.21).
Mauthner, N.S., Doucet, A., 2003. Reflexive accounts and accounts of reflexivity in qualitative data analysis. Sociology 37, 413–431. https://doi.org/10.1177/00380385030373002.
Michie, S., West, R., Campbell, R., Brown, J., Gainforth, H., 2014. ABC Behav. Change Theor.
Minshew, N.J., 1997. Theory of mind. Mindblindness: an essay on autism and theory of mind, by Simon Baron-Cohen. 1995. Cambridge, MA: MIT Press. 171 pp., $22.50. J. Int. Neuropsychol. Soc. https://doi.org/10.1017/S135561779723403X.
Mitnick, B., 2013. Origin of the theory of agency: an account by one of the theory's originators. SSRN Electron. J. https://doi.org/10.2139/ssrn.1020378.
Mitnick, B.M., 1975. The theory of agency: the policing "paradox" and regulatory behavior. Public Choice 24, 27–42.
Montoya, A.A.I., Hazel, S.J., Matthew, S.M., McArthur, M.L., 2021. Why do veterinarians leave clinical practice? A qualitative study using thematic analysis. Vet. Rec. 188, 49–58. https://doi.org/10.1002/vetr.2.
Moyen, N., Hoque, M.A., Mahmud, R., Hasan, M., Sarkar, S., Biswas, P.K., Mehedi, H., Henning, J., Mangtani, P., Flora, M.S., Rahman, M., Debnath, N.C., Giasuddin, M., Barnett, T., Pfeiffer, D.U., Fournié, G., 2021. Avian influenza transmission risk along live poultry trading networks in Bangladesh. Sci. Rep. 11, 19962 https://doi.org/10.1038/s41598-021-98989-4.
Nagel, T., 1974. What is it like to be a bat? Philos. Rev. 83, 435–450. https://doi.org/10.2307/2183914.
Nashef, S.A., Roques, F., Michel, P., Gauducheau, E., Lemeshow, S., Salamon, R., 1999. European system for cardiac operative risk evaluation (EuroSCORE). J. Eur. Assoc. Cardio-Thorac. Surg. 16, 9–13. https://doi.org/10.1016/s1010-7940(99)00134-7.
Ngwenya, N., Barnett, T., Groenewald, C., Seeley, J., 2021. Complex trauma and its relation to hope and hopelessness among young people in KwaZulu-Natal, South Africa. Vulnerable Child. Youth Stud. 16, 166–177. https://doi.org/10.1080/17450128.2020.1865593.
Olmos-Vega, F.M., Stalmeijer, R.E., Varpio, L., Kahlke, R., 2022. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. Med. Teach. 1–11. https://doi.org/10.1080/0142159X.2022.2057287.
Palaganas, E., Sanchez, M., Molintas, M.V.P., Caricativo, R., 2017. Reflexivity in qualitative research: a journey of learning. Qual. Rep. 22, 426–438. https://doi.org/10.46743/2160-3715/2017.2552.
Pfeiffer, D.U., Otte, M.J., Roland-Holst, D., Zilberman, D., 2013. A one health perspective on HPAI H5N1 in the Greater Mekong sub-region. Comp. Immunol. Microbiol. Infect. Dis. 36, 309–319. https://doi.org/10.1016/j.cimid.2012.11.005.
Pirozelli, P., 2019. Thomas Kuhn's theory of rationality. Manuscrito 42, 1–46. https://doi.org/10.1590/0100-6045.2019.v42n3.pp.
Poldsaar, R., 2010. Foucault framing Foucault: the role of paratexts in the English translation of the order of things. Neohelicon 37, 263–273. https://doi.org/10.1007/s11059-010-0047-8.
Rawlings, C.J., Fox, J.P., 1994. Artificial intelligence in molecular biology: a review and assessment [and Discussion]. Philos. Trans. R. Soc. Lond. Ser. B Biol. Sci. 344, 353–363. https://doi.org/10.1098/rstb.1994.0074.
Read, R., Sharrock, W., 2015. Kuhn's fundamental insight-reflection on the "social sciences," as a pedagogical and philosophical tool for thinking adequately about the natural sciences. In: Kindi, V., Arabatzis, T. (Eds.), Kuhn's The Structure of Scientific Revolutions Revisited. Routledge, London and New York, pp. 64–88.
Rose, G., 1982. Deciphering Sociological Research. The Macmillan Press Ltd, London & Basingstoke.
Ross, S.A., 1973. The economic theory of agency: the principal's problem. Am. Econ. Rev. 63, 134–139.
Rovelli, C., 2015. Seven Brief Lessons on Physics. Allen Lane, London.
Rüegg, S.R., Neilsen, L.R., Buttigieg, S.C., Santa, M., Aragrande, M., Canali, M., Ehlinger, T., Chantziaras, I., Boriani, E., Radeski, M., Bruce, M., Queenan, K., Häsler, B., 2018. A Systems Approach to Evaluate One Health Initiatives. Front. Vet. Sci. 5, 23. https://doi.org/10.3389/fvets.2018.00023.
Sapoval, N., Aghazadeh, A., Nute, M.G., Antunes, D.A., Balaji, A., Baraniuk, R., Barberan, C.J., Dannenfelser, R., Dun, C., Edrisi, M., Elworth, R.A.L., Kille, B., Kyrillidis, A., Nakhleh, L., Wolfe, C.R., Yan, Z., Yao, V., Treangen, T.J., 2022. Current progress and open challenges for applying deep learning across the biosciences. Nat. Commun. 13, 1728 https://doi.org/10.1038/s41467-022-29268-7.
Schmidt, J.C., 2011. What is a problem?: On problem-oriented interdisciplinarity. Poiesis Prax. 7, 249–274. https://doi.org/10.1007/s10202-011-0091-0.
Schneider, M., 2017. Wasting the rural: meat, manure, and the politics of agro-industrialization in contemporary China. Geoforum 78, 89–97. https://doi.org/10.1016/j.geoforum.2015.12.001.
Smith, J.A., Osborn, M., 2003. Interpretative phenomenological analysis. In: Qualitative Psychology: A Practical Guide to Research Methods. Sage Publications, Inc, Thousand Oaks, CA, US, pp. 51–80.
Sutton, R.C., 2007. Veterinary students and their reported academic and personal experiences during the first year of veterinary school. J. Vet. Med. Educ. 34, 645–651. https://doi.org/10.3138/jvme.34.5.645.
Tourangeau, R., Rips, L.J., Rasincki, K., 2000. West nyack. The Psychology of Survey Response. Cambridge University Press.
Turner, B.S., Kyung-Sup, C., Epstein, C.F., Kivisto, P., Ryan, J.M., Outhwaite, W., 2017. The Wiley Blackwell Encyclopedia of Social Theory, 5 Volume Set (Wiley Blackwell Encyclopedias in Social Sciences), 1st ed. Wiley-Blackwell.
UCL UCL Eugenics Inquiry Response Group Report London 2021.
Vaarst, M., null, null, Steenfeldt, S., null, null, Horsted, K., null, null, 2015. Sustainable development perspectives of poultry production. Worlds Poult. Sci. J. 71, 609–620. https://doi.org/10.1017/S0043933915002433.
Vaismoradi, M., Jones, J., Turunen, H., Snelgrove, S., 2016. Theme development in qualitative content analysis and thematic analysis. J. Nurs. Educ. Pract. 6, 100–110. https://doi.org/10.5430/jnep.v6n5p100.
van Fraassen, B.C., 2010. Rovelli's world. Found. Phys. 40, 390–417. https://doi.org/10.1007/s10701-009-9326-5.
Webb, S.M., Crespo, I., Santos, A., Resmini, E., Aulinas, A., Valassi, E., 2017. Management of endocrine disease: quality of life tools for the management of pituitary disease. Eur. J. Endocrinol. 177, R13–R26. https://doi.org/10.1530/EJE-17-0041.
Wellman, H.M., 2015. how theory of mind develops. New York. Making Minds. Oxford University Press.
Whitnall, V.M., Simmonds, J.G., 2021. Occupational stress and coping strategies in experienced Australian veterinarians. Vet. Rec. 189 https://doi.org/10.1002/vetr.202.
Wilkinson, S., 1988. The role of reflexivity in feminist psychology. Women's. Stud. Int. Forum 11, 493–502. https://doi.org/10.1016/0277-5395(88)90024-6.
Woods, A., Bresalier, M., Cassidy, A., Mason Dentinger, R., 2017. Animals and the Shaping of Modern Medicine: One Health and Its Histories. Cham: Palgrave Macmillan, Cham.