

INTRODUCTION

Social sciences and the relationship between human and nonhuman within the One Health framework

Giacomo Balduzzi^{*}, Anna Rosa Favretto^{**}

The One Health (OH) approach adopts a relational perspective that encompasses connections and interdependencies among humans, other living species, and the environment. Since the mid-2000s, and even more so after the Covid-19 pandemic, researchers and policy makers have paid increasing attention on this approach. The article discusses different hypothesis on OH's history. Also, it proposes an understanding of OH's origins closely linked to how contemporary societies are fundamentally reshaping their way of conceiving risks and dealing with them, as Ulrich Beck has taught us. Finally, the Authors describe OH as a bourdieusian field of actors, practices, and relationships. This implies the consequence of considering as knowledge-producing actors also the bearers of those forms of practical, secular, experiential knowledge that are generally excluded from the production of scientific knowledge, in addition to the bearers of knowledge and interests of an economic and administrative nature.

Keywords: History of One Health; Risk Society; Bourdieu; Field Theory; Transdisciplinarity; human and nonhuman relationship.

Introduction

The term One Health (OH) first appeared in the early 21st century (Queenan *et al.*, 2017; Gibbs, 2014) and has since become the leading concept for an integrated approach to public and collective health. This approach views health from a relational perspective that encompasses connections and interdependencies among humans, other living species, and the environment.

For several years, scientists had been focusing on the movements of diseases among human, domestic animal, and wildlife populations, as well as the social, economic, and environmental factors that influence them. According to some estimates, globally, about one billion cases of illness and

^{*} Università degli studi del Piemonte Orientale. giacomo.balduzzi@uniupo.it

^{**} Università degli studi di Torino. annarosa.favretto@unito.it

Giacomo Balduzzi authored §§ 1 to 4, and Anna Rosa Favretto authored §§ 5 and 6.

millions of deaths occur every year from zoonoses. Some 60% of emerging infectious diseases that are reported globally are zoonoses. Over 30 new human pathogens have been detected in the last three decades, 75% of which have originated in animals (Salyer *et al.*, 2017). Nevertheless, a significant proportion of citizens became aware of the links between animal diseases, human health, and the environment only after the Covid-19 pandemic and the huge healthcare, social, and economic impacts it triggered. As the Director-General of the World Health Organization, Tedros A. Ghebreyesus stated, the experience of Covid-19 has taught us that «we can only prevent future pandemics with an integrated One Health approach to public health, animal health and the environment we share» (Ghebreyesus, 2021). Furthermore, the circulation of animal or plant diseases, as well as ecosystem transformations, environmental disruptions, and climate-related disturbances, cause social and economic crises, with huge potential risks also for health and well-being of societies, even when they do not threaten human health directly.

The case of African Swine Fever (ASF) represents an emblematic example of what has just been stated. The ongoing epidemiological wave in Europe originated in 2007 in Georgia and spread to other European countries in 2014; ASF virus genotype II was responsible for these outbreaks, which affected both wild boar and domestic pigs. In August 2018, the disease also reached the world's largest pig producer, China, and then it spread in several Asian countries (Blome *et al.*, 2020). In 2022, 11 EU Member States were affected by ASF Genotype II. Estonia, Czechia, and Hungary notified ASF cases in wild boar only; while Latvia, Lithuania, Poland, Germany, Slovakia, Romania, Bulgaria, and Italy notified ASF cases in wild boar and outbreaks in domestic pigs. In this period, four non-EU countries (Moldova, North Macedonia, Serbia, and Ukraine) notified ASF to the European Union Animal Diseases Information System (European Food Safety Authority, 2023a).

Xylella fastidiosa represents another case of non-human epidemic with devastating effects on societies and local populations. Native to America, the bacterium has been reported on almond and grapevine in Iran and on almond in Israel. In Europe was initially detected in olive trees in Southern Italy in 2013, the bacterium has been reported in France (in Corsica and the Provence Alpes Cotes d'Azur region), in Spain (in the Balearic Islands, in Madrid and Comunitat Valenciana – province of Alicante), in Italy (Apulia and Tuscany), and more recently in Portugal (Porto). In recent years, as is well known, With the scientific advice of experts from EFSA and other European authorities, public authorities have carried out eradication measures

in various areas and plantations affected by the bacterium to contain the spread of this disease and prevent more severe and extensively destructive forms of contagion (European Food Safety Authority, 2023b).

The examples presented above clearly demonstrate the intimate and multifaceted connections that link collective health and the daily life of human societies. All these connections have major implication not only on physical and mental health, but also on the crucial aspects of collective life, such as the economic, relational, and public order issues.

The evidence to date reveals multiple new ways that currently interconnect the human and non-human on one hand, and the biological and social on the other. Phenomena like the loss of species and biodiversity, antimicrobial resistance (AMR) – recently labelled by the Quadripartite as “the silent pandemic” (WHO *et al.*, 2022) –, habitat degradation, land, air, and water consumption, proliferation of invasive alien species, and global climate change. threaten life on the planet in all its forms (animal, human, and plant).

From such a framework, therefore, OH emerges not only as a paradigm for research but also for action. It aims to understand the interdependence among various sectors by conceptualizing health as the interrelation between different living systems, with the goal of implementing integrated actions for the benefit of humans, non-human beings, and the planet.

1. When and how did it originate? Two hypothetical histories of One Health idea

In studying the One Health perspective's new dilemmas regarding the relationship between humans and non-human life, it is crucial to explore its origins and whether it represents a novel approach in medical and health studies. Scholars disagree on this point.

Michalon (2020) notes that there are at least two hypotheses regarding the origin of the One Health concept.

Some scholars (e.g., Rushton *et al.*, 2018; Mantovani, 2013; Zinsstag *et al.*, 2005) follow a first hypothesis that consists in highlighting the historical precedents of an integrated approach to health, thus tracing the origins of OH back to antiquity.

Moreover, there is a wealth of historical evidence that can support such an interpretation. From the very beginning of human history, societies have long recognized the diseases that specifically affect people who work in

close contact with animals, such as distemper, ringworm, plague, and bovine pleuropneumonia (Wilkinson, 1992).

Titus Livius recounts an epidemic of scabies that occurred in Rome in 428 BC. The Roman historian (59 BC-17 AD) describes how the outbreak initially spread among livestock and then passed to humans. It first affected peasants and slaves before invading the entire city (Titus Livius, History of Rome, Book IV, Chapter 30). Several centuries later, the Latin writer Publius Vegetius Renatus (4th century AD) explains the causes, effects, risks, and remedies of “*morbis maleus*”, also known as glanders, describing it as a contagious disease that can take on the characteristics of a true pandemic and be transmitted from horses to human beings (Publii Vegeti Renati, *Digesta Artis Mulomedicinalis, Liber Primus*, chapter 17).

Human medicine was integrated into the medieval universities, whereas veterinary medicine remained largely in the hands of equerries until the 18th century, with the establishment of veterinary schools, initially in France and then in other countries (Zinsstag *et al.*, 2005). It was the domain of blacksmiths, squires, and court officials, such as Giordano Ruffo of Calabria, the veterinary marshal of Emperor Frederick II. Ruffo published his “*Medicina equorum*” in 1250 and, among his many merits, was the first to adopt a definitive system of disease taxonomy. Several generations, in the following centuries, copied, studied, and used that system of classification. The scientific culture of that time struggled, in any case, to hypothesize the possibility of the transmission of a disease from animals to humans. As this example confirms, the history of medicine (Cosmacini, 2011), as well as human knowledge in general, follows a non-linear and non-incremental trajectory, characterized by discontinuities and unpredictability. The records of the devastating epidemic caused by the bacterium *Yersinia pestis* in Asia and Europe between 1346 and 1351 support this claim. Giovanni Boccaccio called the epidemic “*mortifera pestilenzza*” (deadly plague). The contagion caused a demographic collapse that is not easily quantifiable. Nevertheless, it was significant, as recent studies have found that the pottery-using population across a sixth of England was around 45% lower in the centuries after the Black Death than before (Lewis, 2016). According to Tenenti’s estimates (1997), a city like Venice had lost over 30% of its population at the time. Scientists and doctors were unanimous in recognizing the disease’s extreme infectiousness, arguing that the only hope of avoiding it was to stay away from infected areas (Wilkinson, 1992). In July 1348, a few months after the disease first appeared in Venice, the city’s Senate issued stringent provisions with severe penalties to prohibit corpses from entering the town and mandated their immediate removal. The Senate of Venice also

ordered the expulsion of rotting meat from the city within five days after conducting thorough inspections. If anyone had found rotten meat, they would have had to throw it into the water or place it where it could cause the least harm, that is, according to the wording of the original document in Latin, «*in quo factorem reddere minime possint*» (Tenenti, 1997, p. 79). There is no trace in contemporary chronicles of mentions of rats or other animals, nor of fleas, which, as is known, are the vectors of the disease.

The connection between animal and human diseases was only firmly established after a couple of centuries. Staying in Venice, at the end of the 16th century, the Senate issues a decree including the following provisions:

With the purpose of repressing the pestiferous introduction of selling dead meat in Venice (that is, from animals that died naturally, not slaughtered), which, being born from contagion, can generate in human bodies such bad humours that could introduce malignant and poisonous contagion, and unable to find a solution to the uncertainty whether the meat comes from dead or infected animals [...] it is forbidden throughout the upcoming month of August to sell beef, veal, or fresh meat in any butcher's shop or other place in Venice [...] and in the rest of the *Dogado*, sellers [...] shall lose the meat to be burned, and be condemned to row the oar with irons on their feet in the galleys, and under other greater penalties according to the severity of the transgression, as determined by the Magistrate of Health and the Rectors of the city (Decree of the Senate of the Republic of Venice, July 24, 1599, as reported in: Bottani, 1819, pp. 30-31).

After Titus Livius and Publius Vegetius Romanus clearly observed it, the hypothesis of transmission from animals to humans resurfaced in the interpretation of practical data. As the above text clearly shows, the Senate measure follows a contagion detected among cattle in Venice at that time. A severe dysentery, with some fatalities, had affected the citizens after eating infected meat from Hungary (Paulet, 1775). The Lower Danube regions bordering the Black Sea, as well as the markets of Russia and Turkey, were endemic areas for various infectious diseases. As a result, the numerous herds of cattle that arrived in Venice from Hungary – the largest breeding area in Eastern Europe at the time – periodically caused devastating epidemics (Rosa, 2011).

During the early 18th century, cattle plague was raging through Europe. Giovanni Maria Lancisi, an Italian physician at the papal court, studied the transmission of the virus and proposed innovative methods to combat its spread in his book *De bovilla peste* (1715). By adopting epidemiological methods before the time, he suggested the necessity of mandatory culling

not only of sick or suspected animals, but also of all susceptible animals present in the outbreak, thus introducing the practice of stamping out (Mantovani, Zanetti, 1993).

The founding of the Royal Veterinary School in Lyon in 1762, with the collaboration of scientist Claude Bourgelat, marks a fundamental moment that initiated the progressive professionalization of veterinarians. This development coincided with the State's recognition of their role in public health policies.

The history of vaccines is closely tied to the development and spread of this method of interpreting observational data. In 1796, English physician Edward Jenner, who had studied the transmission of cowpox to humans, performed the first vaccination by inoculating a young farm boy with pus obtained from a milkmaid's pustules (Mantovani, 2013).

In the context highlighted so far, Rudolf Virchow (1821-1902), a pathologist and anthropologist, is a highly significant figure. In the 19th century, based on his studies, coined the term “zoonoses”, defining them as “infections caused by contagious animal agents” (Virchow, 1855). Professor of Pathological Anatomy first in Würzburg and then in Berlin, Virchow also served in public institutions both as a member of the city council and as a parliamentarian, combining scientific considerations with aspects of political and administrative nature. He fathered cellular pathology and made a significant contribution to the development of human and veterinary medicine and pathology. According to Virchow, veterinary and human medicine should be considered two closely connected fields. «There is no scientific barrier, nor should there be, between veterinary medicine and human medicine; the experience of one must be utilized for the development of the other» said more than one time (Saunders, 2000, p. 203). However, Virchow's contribution in anticipating and addressing some key issues that are now on the agenda of One Health is not limited solely to zoonoses and cooperation between human and animal medical sciences. Indeed, he fought for medicine to give greater importance to social variables as causes or factors that play a role in generating and/or spreading diseases (Pridan, 1964). In this regard, his thinking anticipated current formulations and strategies related to the so-called social determinants of health (Aldrick, Gottlieb, 2019). In an article published in 1848 in a journal he himself founded, dedicated to health policies and reforms, Virchow argues: «medicine is a social science, and politics is nothing more than medicine on a grand scale» (McNeely, 2014, p. 6).

Zinsstag *et al.* (2005; 2011) ultimately trace OH back to the concept of “One Medicine,” invented by Calvin Schwabe. As a veterinary epidemiolo-

gist, he proposed an integrated approach to human and animal health in his book *Veterinary Medicine and Human Health*, first published in 1964, and later introduced the term One Medicine in the third edition of the work in 1984 (Cardiff *et al.*, 2008; Schwabe, 1984). One Health extends beyond clinical issues to embrace Eco-health approaches, which recognize the interconnectedness of ecosystems, society, and the health of animals and humans (Rapport *et al.*, 1998; Zinsstag, 2011). This holistic approach considers ecological, political, economic, and social dimensions crucial for comprehensive global public health (Rapport *et al.*, 1998; Zinsstag, 2011).

While there is significant empirical evidence of historical precedents for One Health, the idea that this approach is connected to earlier medical and scientific practices is not widely accepted.

As observed by Michalon (2020), most articles that wish implement the OH approach or present the results of its application regularly provide in their Introduction section a narrative about the OH genesis considerable as an alternative to the one we have discussed so far. According to this second hypothesis about the origin, One Health emerged as a radical novelty aimed at responding to unexpected and unprecedented challenges. The series of global health crises that began in the late 1990s have shown the organizational and scientific limitations of the systems of actors in charge of global health management.

From such a perspective, OH «appears as an institutional response to events requiring a new form of governance and expertise» (Michalon, 2020, p. 4). More precisely, according to the sociologist Yu-Ju Chien (2013), the collaborative approach among international organizations such as WHO, FAO, and OIE has been a response to institutional crises generated or revealed by these health crises, in terms of governance and expertise. The OH worked as a tool for pacifying relations between and within international organizations. For example, tensions arise between the OIE and the FAO precisely because each claims expertise and action on animal health protection, with slightly different perspectives (public health for the OIE/livestock and development support for the FAO). The shared agenda provides symbolic legitimacy, highlights common goals among organizations, and accentuates differences in expertise while hiding overlaps, which are a source of tension and rivalry.

The concept of OH lends itself to serve as an «umbrella for diverse visions» (Leboeuf, 2011, p. 50) capable of encompassing under a very broad and flexible wing partnerships, collaborations, research/surveillance/control programs, and other initiatives with extremely diverse objectives, purposes, and actor. From this perspective, OH appears as a “boundary object”

(Chien, 2013), simultaneously concrete and vague, suitable for expressing shared ideas but also adaptable to very specific needs and particular interests.

One Health is a concept whose «productive vagueness facilitates communication among previously independent social worlds» (*ibidem*). Angela Cassidy (2016) suggests that «by using boundary objects strategically, individual and institutional actors can claim legitimacy, gain allies, and bring about changes in working practices» (p. 216). Based on a textual analysis of articles and scientific publications, Cassidy hypothesizes that a new style of agenda building across twenty-first-century science, medicine, and policy has formed around the One Health approach: the “interdisciplinary bandwagon”. At the same time, there is a consolidation of a dominant position of veterinary sciences within the field of public health research. Looking at the sample of publications related to the OH approach analysed during the research, Cassidy notes that as many as 61% of them were published in veterinary science journals. The OH approach, she concludes, aspires to be interdisciplinary and extends its sphere of action beyond science into the field of public policy, having been constructed, oriented, and occupied by a wide range of institutional actors and individual actors from the world of science and research.

So far, we have outlined the two main hypotheses regarding the origins of OH. In our previous works (Balduzzi, Favretto, 2022; 2023), we aimed to transcend the dualism between these hypotheses and develop a perspective that reconciles both continuity and the transformative aspects inherent in the OH approach. These publications suggest an understanding of the historical origins of One Health closely linked to how contemporary societies are fundamentally reshaping their way of conceiving risks and dealing with them.

The next paragraph will summarize the key elements of such a perspective on OH.

2. One Health as a possible utopia in the risk society

Focusing on *Risikogesellschaft* – the “risk society” (Beck, 1992), Ulrich Beck identified, starting in the mid-1980s, a substantial shift in the course of “the continuity of modernization”. Beck wrote that «the social positions and conflicts of a ‘wealth-distributing’ society begin to be joined by those of a ‘risk-distributing’ society». These risks are associated to «global dan-

gers [...] that arise for all of humanity» and «endanger all forms of life on this planet» (*ivi*, pp. 21-22).

What distinguishes the new types of dangers of contemporary “risk society” from the past? According to the sociologist, there are distinctive elements that allow us to recognize the peculiarity of these new risks.

- The dangers of the risk society are global. For example, «forests have also been dying for some centuries now – first through being transformed into fields, then through reckless overcutting. But the death of forests today occurs globally, as the implicit consequence of industrialization – with quite different social and political consequences. Heavily wooded countries like Norway and Sweden, which hardly have any pollutant-intensive industries of their own, are also affected» (*ivi*, p. 22, emphasis in original).
- The risk society produces invisible dangers. Dangers of the past – whether it was the noxious fumes emanating from the turbid and poisonous waters that killed sailors who fell into the Thames in the 19th century or the putrid streets of medieval Paris – «assaulted the nose or the eyes», while «the risks of civilization today typically escape perception and are localized in the sphere of physical and chemical formulas» (*ivi*, p. 21).
- We cannot attribute contemporary risks to insufficient development of hygiene and safety technologies. On the contrary, they are the direct or indirect result of excessive industrial production, resource extraction, and exploitation of natural resources. Therefore, it is not a matter of insufficiency, but rather an «undesirable abundance» (*ivi*, p. 26), which we can, according to Beck, eliminate by reducing the volumes of waste and side effects, deny – «the possibility of denying and trivializing that danger grows with its extent», says Beck (*ivi*, p. 75, emphasis in original) – or reinterpreted by rethinking and reprogramming the forms and methods of production, consumption, and waste management, as well as the whole paradigm of modernization.
- Most contemporary risks manifest as “manufactured uncertainties”, i.e. they are side effects produced by society, in the context of mounting modernization driven by technological and scientific progress; they are characterized by their being incalculable, uncontrollable, and ultimately no longer insurable, at least privately (Giddens, 1999; Beck, 2009). The emblematic example mentioned by Beck is climate change.

In risk societies, the division of labour between science, politics and economics breaks apart and must be renegotiated (Beck, 2009). On one

hand, a new degree of risk emerges because the conditions of its calculation and institutional containment fail (*ibidem*). On the other hand, the uncertainty and unpredictability of destructive consequences in the future serve as a «stimulus to action» (Beck, 1992, p. 33). Risks shape new perspectives towards our future and our present. In fact, while they show current observable and quantifiable damages and risks, they anticipate a not-yet-occurred event that could cause irreversible destruction if it occurs. All this forces us to think about how to avoid this possibility and urges us to design an alternative future. In the risk society «the past loses the power to determine the present», while the future takes its place as the “cause” of our experience and action (*ivi*, p. 34). The risk society framework encompasses the reconstructions of OH background into a comprehensive understanding. In continuity with a long history of studies, OH represents the research approach capable of «thinking the separated together» (*ivi*, p. 27). As a new project and intervention perspective, the OH initiative represents the other side of such an issue. Within that integrated framework we can effectively use the network of connections by which we grasp the risks to formulate an integrated strategy able at promoting health from a global and systemic standpoint and preventing the potential for irreversible destruction.

In this perspective OH takes shape as a peculiar form of real (or possible) utopia (Olin Wright, 2010). In addition to envisioning a future improvement, the utopia of One Health offers an alternative not so much to existing conditions, as is the case in classical utopian narratives, but rather to upcoming prospects. In short, «an operational form of utopia in the risk society is that of shaping an alternative future to the (dystopic) one that the current conditions of the relationships between humans, animals, and ecosystems are foreshadowing» (Balduzzi, Favretto, 2023, p. 230).

3. The field of One Health: actors, practices, knowledge, relationships

Beck’s theory of the risk society is implicitly based on evidence that had been investigated and documented some years earlier, among others, by the group of scientists gathered and supported by the Club of Rome. After applying computational models and computer simulations to address the problem of the relationship between the unlimited growth of the consumption of material resources and the physical and environmental limits of the planet, that group of scientists reported the worrying results of their research in the famous report *The Limits of growth* (Meadows *et al.*, 1972).

More recently, scientists around the world have developed the term Anthropocene, which indicates the contemporary geological era that occurs in the Holocene, which began over 10,000 years ago when mammoths and glaciers disappeared, and sea levels rose due to deglaciation (Crutzen, Stoermer, 2000). In the human age the future of the planet, the very possibility of its survival, is in the hands of human beings. The human presence on Earth can be guaranteed in a safe and operational space within which it is necessary to remain without going beyond the planetary boundaries, that is, critical thresholds (tipping points) beyond which the world can move to a different state, hostile, no longer reversible and with unpredictable and uncontrollable consequences for the life of communities. Some of these threshold points beyond which it can become difficult to maintain the stability and resilience of the global ecosystem are extremely close or have already been overcome.

In such a framework, where the health and very survival of human beings depend on the balance of their relations with the non-human entities, other species, and the environment – balances themselves threatened by the consequences of human activities – the social sciences are called to offer a cognitive contribution to a debate increasingly focused on the relationships between humans and non-humans, and the intersection of biological and social realms. This perspective, as exemplified by OH, aims to address research and operational challenges that ensure the survival of both human and other species on the planet, emphasizing their mutual interdependence.

Contributions under OH, mainly biological, epidemiological, and veterinary, sometimes avoid addressing this problem. Nevertheless, the One Health approach, as already highlighted in the previous paragraphs, has a vocation to encourage and enhance contributions from different disciplines, not only from the biomedical or STEM field, but also from the humanistic-social one. This means, for the OH perspective, constantly dealing with a plurality of cultural, scientific, and epistemological systems, sometimes complementary but sometimes also divergent, or even conflicting. Those mentioned above, for example, frame the concepts of the human, the non-human and their relationships differently, using different frames, not always compatible.

In this sense, we can understand and interpret the OH, more than as a clear and defined perspective, as a «field» *à la* Bourdieu (1994; 1998; 2001).

According to the French sociologist a field is an arena in which actors struggle to accumulate, exchange, and monopolize different types of resources. The relationships of the actors derive from the different positions

in the field and from their different dispositions (*habitus*) and are based on the different positions occupied by the actors in the field and their representations, worldviews, definitions, logics of action, etc. The distribution of different types of capital owned by the actors and the “values” that those guys have within the field, in turn, define and redefine the *habitus* and the relationships between the actors. Thus, social fields are contexts of actors and practices that are both structured, and structuring. The “value” associated with the types of capital defines the power structure, hierarchy, and operational logics of the field. The field does not generate all this mechanically, but through conflicts, negotiations, and power struggles between the actors, with the aim of determining what type of capital is legitimate, what is the dominant group, what definitions, rules and logics govern the functioning of the field.

The field of actors and practices of the OH, at the same time structured and structuring, constantly mobilizes resources, knowledge, and relationships with the result of continually building and rebuilding the power relationships and positions of different definitions, disciplines, professional skills, institutional roles, ideas, problems, and solutions.

In this context, the relations between humans and other living species represent at the same time a fundamental element that determines how the constitution of the field (structured structures), but also the content and the stakes of its dynamics (structuring).

We still need to clarify and investigate how different contexts and forums actively approach the relationships between human and non-human actors in the design and implementation of One Health practices, and how these relationships both shape and are shaped by definitions and positions within the field. This is a highly relevant and interesting topic that aims to establish robust theoretical and methodological foundations for research and policy perspectives in this area.

The terms “multidisciplinarity”, “interdisciplinarity”, and “transdisciplinarity”, though sometimes used interchangeably, refer to different patterns of interaction and collaboration.

As proposed by Rosenfield (1992), the distinction between the three categories of research involving multiple disciplines can be illustrated as shown in Table 1.

Each of the three modes reflects a different way of working with various disciplines. These modes vary depending on the subjects, contexts, and specific research contents and objectives, but they follow coherent logics that regulate collaborative work involving multidisciplinary and diverse disciplinary perspectives.

Below, we describe and summarize these modes.

Tab. 1 – Multidisciplinary, interdisciplinary, and transdisciplinary research: characteristics and distinctions.

	<i>Academic programs</i>	<i>Career paths</i>	<i>Contribution to health policies and programs</i>
Multidisciplinary	Within existing disciplines and faculties	Attractive opportunities	Specific short-term problem solving
Interdisciplinary	Between disciplines and faculties, creation of new joint programs	Needs strengthening	New specific programs plus problem solving
Transdisciplinary	Synthesis of departments- new department, new field of inquiry	Does not yet exist	Broadly-based trans-Sectoral programs and actions with longer life; new concepts, methods and policies

Source: Rosenfield (1992).

It is a widespread opinion among scholars that, in order to address the complexity inherent in researching OH issues, researchers must go beyond interdisciplinary research to move into the realm of transdisciplinary research approaches (Zinsstag *et al.*, 2023; Berger-Gonzalez *et al.*, 2020; Min *et al.*, 2013).

Differently from the interdisciplinary approach, which synthesizes and harmonizes links between disciplines into a coordinated and coherent whole, the transdisciplinary approach transcends traditional boundaries by focusing on interactions between, across and beyond disciplines with a shared conceptual framework (Rosenfield, 1992; Choi, Pak, 2006; Alvar-gonzález, 2011).

As pointed out by Zinsstag and coauthors (2023), a transdisciplinary idea of OH on the one hand «cannot be understood and addressed without engagement between scientists and non-academic actors in society and government» (*ivi*, p. 347), on the other hand it integrates academic research with empirical experience and practical knowledge of local stakeholders, administrators, and community members.

5. Navigating the Sea of Knowledge: A Map to Avoid the Reef of Reductionism

By developing some of the previous considerations in more detail, we wish to highlight two potential risks, both epistemological and methodological. In our view, these risks require particular attention when adopting a

OH perspective to conduct research and develop new policies using a transdisciplinary approach.

The first risk is reductionism. It leads us to conceive the OH perspective as a self-evident connection between the environment, humans, and non-human beings that we previously missed, but can now recognize thanks to a more careful scientific approach. The above historical reconstruction shows that such connections were far from unknown in our past. In a broader sense, we note how it is documented that already in the Neolithic, and perhaps even earlier, many populations paid great attention to it. The most recent anthropology and archaeology research (Graeber, Wengrow, 2022) shows that thousands of years ago, in many parts of the globe, large groups of people understood and wisely protected the differentiation and specialization of methods to find balanced resources necessary for survival. They had competent and selective environmental intervention capacities aimed at maintaining balance with survival requirements. The breakdown of balance, already present in some past societies, became increasingly pervasive with the emergence of agriculture and raw material processing, culminating in the modern age. The development models adopted during that era ignored and could not protect the crucial connections we are talking about here. A striking example of this in recent times is the separation between agriculture and livestock. It is well known that the association of the two activities maintained a strong, mutually complementary connection until the early twentieth century, ensuring a virtuous cycle of waste material reuse. The widespread adoption of intensive and far more profitable forms of farming and agriculture, separated from each other, marked the abandonment of the previous model. The separation and specialization of the two production areas imply decoupling between their operational processes. In other words, the separation and specialisation of agriculture and livestock farming are both the prerequisite and the outcome of the introduction of large-scale mechanized production models, with the aim of minimising expenditure and maximising profits, although, as is well known, this triggers major imbalances between humans, non-humans, and the environment and, at the same time, serious threats to global public health. The reflection in historical terms on the knowledge and protection of methods for finding resources in terms of the balance in our past should, therefore, lead us not to consider One Health in a reductionist way as a new and absolute form of “knowledge parthenogenesis”, with the risk of introducing serious distortions in our vision, as it implies not considering that this perspective also arises from political decisions related to the risk management of globalization, as noted by Chien (2013), whose position we have already recalled.

Conversely, we believe that in cognitive terms it is more effective to be aware that the paradigm shift in global risk management – which is the result of health and economic policy decisions taken by major international organizations – may benefit from the awareness of the existence of forms of knowledge and practices aimed at maintaining the balance pre-existing at the present time, erroneously considered the era of the “unveiling of connections”.

Such a reductionism means OH as a new knowledge and exclusive fruit of the “natural” development of scientific knowledge. By avoiding this, it is possible to develop some interesting methodological reflections. The first concerns the construction of the objects of study. As explained above, this is a methodological theme that is challenging because it requires overcoming, according to completely innovative ways of sharing scientific knowledge between different disciplines. With the intention of moving beyond Chien’s (2013) concept of a boundary object, which has been criticized as generic and operationally ineffective, we propose considering Carlile’s (2002; 2004) concept of constructing innovative frontier objects within company organizations as a more promising approach. From the perspective of organizational studies, he emphasized that the cornerstone of interdisciplinary practices is the tendency towards path-dependency in all specialized knowledge. This path-dependency severely damages the creation of conditions for the constant flexibility needed to develop new knowledge and effective operational practices, which are essential for adapting to changing situations and needs. In the production of frontier knowledge, disciplinary content and the methods used to produce or collaboratively rework this content are closely intertwined and mutually dependent. Before being translated into practice, disciplinary content must be addressed in the context of other disciplines involved in the innovation process, requiring complex joint elaboration. In summary, this common work for the creation of new objects of knowledge makes fruitful use of specific disciplinary knowledge only when it makes it available for shared, co-identified, co-constructed, cognitive, and operational purposes, by adopting the methodological contribution of all agreed disciplinary skills.

This methodological reflection highlights another potential risk of reductionism: the belief that constructing new frontier objects is purely a technical act. Rather, this construction encompasses technical aspects as well as precise choices regarding fields, values, and even political considerations. When we refer to the disciplines involved in building new frontier objects from a One Health perspective, we are talking about people and institutions that deliberately choose complexity and globality as their frames

of reference. These actors consciously opt to practice new ways of producing knowledge, which necessarily involves moving beyond disciplinary silos and the mere juxtaposition of scientific work results.

6. Navigating the sea of knowledge: a map to avoid the rock of reification

The second epistemological and methodological risk we face in adopting a OH perspective is the potential reification of the concept itself.

Following Morin (2005), it is advisable to avoid the cognitive distortion due to the understanding of complexity as a given of nature and not our reading of data, our interpretation of the elements that make up the real world.

The aim of avoiding this risk requires not only constantly recognize that One Health is a perspective – a framework for understanding the interconnectedness of our world – but also to integrate the theoretical and methodological approaches inspired by this perspective into scientific work.

Our proposal to construct new knowledge objects in OH within the analysis of “fields” stems from this idea.

However, it is one among many theoretical and methodological proposals that can appear on the stage of knowledge with the aim of exploring and effectively representing the connections that we can grasp in the tangle of natural and social facts, by being aware of the partiality and provisional nature of such representations.

Awareness of the risk of reification leads to broadening the reflection on the knowledge, skills and practices included in the “fields” in question.

As we have noted, one of the pillars of the OH perspective is the incorporation of diverse knowledge domains in both the creation of knowledge objects and the development of operational practices and intervention policies.

The suggestion offered by Carlile in relation to the construction of new frontier objects, applied to OH, seems to be very useful for our purpose.

The extension of the defendants considered as belonging to the “field” explored aims to represent a picture of the connections between the different parts of the increasingly wider reality. This implies the consequence of considering as knowledge-producing actors also the bearers of those forms of practical, secular, experiential knowledge that are generally excluded from the production of scientific knowledge, in addition to the bearers of knowledge and interests of an economic and administrative nature. Another

not secondary implication consists in considering the power differential between the actors involved, as well as the framework of resources and constraints within which the new objects of knowledge take shape.

In this regard, the studies aimed at building good practices according to the OH approach carried out in the veterinary field are illuminating, whereas it is now clear that scientific skills and those of practical knowledge, together with political and administrative considerations, they must necessarily work together in a framework where the power differential between the actors must be carefully studied and understood (see, for example: Berger-González *et al.*, 2020).

In conclusion, the transdisciplinary approach postulates a new dialogue between disciplinary knowledge and other types of practical-experiential knowledge. Furtherly, it opens new perspectives in the relationship between science, culture, and society. Such a scenario could help to build a shared cultural framework to circumscribe new approaches and visions on which is the place in the planet and in the world of “human” and the relations between the latter, other living species, and the environment.

In ultimate analysis, the goal is that of trying to better understand how and in what terms all human beings have the power and responsibility to name and conceive a reason for being to the non-human realm, as it contributes in some way to constituting human one, thereby defining identity and essence in turn.

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