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Decompartmentalizing knowledge on food

Jean-Marc Louvin and Marie Walser

Food is a multidimensional issue. Together, the perspectives of different scientific disciplines have converged to achieve a shared understanding of this research topic and its associated issues.

This chapter represents the first step towards an 'ecological approach to food' – the decompartmentalization of knowledge to enable us to grasp the complexity of food and associated sustainability issues. After introducing the concept of holism, the chapter illustrates how three disciplines – nutrition, the humanities and social sciences (HSS) and agronomy – have shifted their respective research lenses to work towards a multidimensional approach to food. The chapter then considers the recent formalization of a new interdisciplinary research topic, 'sustainable food systems', in connection with the advent of the systemic approach and the growing sustainability issues of the late twentieth century. It concludes with a discussion on the vital role of disciplinary interfaces in decompartmentalizing knowledge both within and beyond the boundaries of science and fostering transformative interaction.

Holism

An ecological approach to food calls for a holistic perspective so as to gain an overarching understanding of food without reducing it to any one of its dimensions. While the idea of holism (from the Greek *hólos*: 'whole, entire') can be attributed to the writings of Plato (*Meno*) and Aristotle (*Politics*), the term itself is a neologism first coined by the South African philosopher and statesman Jan Christiaan Smuts in his book *Holism and Evolution* (1926), in which he defined it as a 'fundamental factor operative towards the creation of wholes in

the universe'. In other words, holism was initially seen as an entity in itself. This meaning, however, was not the one that attracted the attention of twentieth-century scientists, for whom the concept primarily referred to the idea that the whole is greater than (or at least different from) the sum of its parts. Holism is thus at variance with reductionist theory, which posits the whole as reducible to its constituent parts.

Food is at the crossroads of a range of individual, societal and global issues (Parts 1 and 2) and is a 'total human reality' (Poulain, 2017). It affects all aspects of life and, in turn, can be understood in terms of the material and symbolic features of the context in which it occurs. In academic circles, however, food has long been investigated following a segmented approach, with scientists studying individual aspects of food through the lens of their specific disciplines. At a time when sustainability issues are becoming increasingly globalized and interconnected, it is vital to break down the barriers between different areas of food-related knowledge so as to offer appropriate guidance for food system transformation initiatives. Several scientific disciplines have, each in their own way, taken a chance on decompartmentalization and adopted paths towards a more holistic – and one might even say more ecological – approach to food.

Holistic approaches to nutrition

The origins of nutrition date back to Ancient Greek dietetics. As a science and everyday practice, dietetics placed food within the realm of life (work, physical exercise etc.), with health interpreted as a balance between bodily humours (fluids) and food properties (Montanari, 1993; Shapin, 2014). Following the rise of modern science in the sixteenth century, the qualitative approach to people's state of health gave way to a quantitative approach based on the study of food compounds and their impact on the body. In 1875, with the advent of the chemically biased nutrition paradigm (Hall, 1974), nutrition research became even more focused on the study of the various biochemical components and processes underlying the connection between diet and health. This prompted scientists in the late nineteenth century to identify all macronutrients (proteins, carbohydrates and lipids), followed by micronutrients (vitamins, minerals and trace elements) in the second half of the twentieth century and to distinguish between healthy and less healthy components. The discovery of DNA marked the beginning of nutritionists' interest in how diet influences genetic expression.

In the nineteenth and twentieth centuries, this scientific approach – segmenting humans and their diet into ever smaller components so as to condense the functioning of living organisms into laws – gained momentum with the success of its societal applications,[1] to the extent that nutrition became trapped in a nutritionist paradigm (Scrinis, 2008, 2013). This paradigm was rooted in a biological reductionism that reduced food and health to nutritional compounds and quantifiable physiological processes respectively. Moreover, the many scientific advances in nutrition contributed to the gradual 'nutritionalization of food' (Dixon, 2009) – that is, the adoption by society as a whole of a reductive understanding of food, limited solely to its role as a means of ensuring health. The latter is thus central to the nutritionist paradigm.

This nutritionist ideology (Pollan, 2008; Scrinis, 2008) has been the focus of substantial epistemological, methodological, social and moral criticism while also potentially stalling advances in nutrition research (Burlingame, 2004). This approach is reproached for being unable to propose solutions to meet current challenges (be they health, social or ecological) (Cannon and Leitzmann, 2005) and is claimed to be a source of often ineffective and even counterproductive technological solutions (Dixon et al., 2009). This is exemplified by medicinal foods, with controversy surrounding their effect on people who already have an adequate diet (Poulain, 2017). Finally, from a moral perspective, nutritionism is one of the drivers contributing to excessive responsibility being placed at the feet of eaters (Coveney, 1999; Fischler, 2011) and even to stigmatizing anyone who deviates from the norm, such as people with anorexia, bulimia or obesity (Poulain, 2009).

Nutritionists have developed a range of approaches to overcome these failings. We present them here from the perspective of their holistic dimension. For clarity, we distinguish three different categories: intranutritional approaches – in other words, those which adopt a holistic perspective within the framework of the science of nutrition itself; nutritional approaches, which strive to integrate knowledge from other disciplines to shed light on their object of study; and extra-nutritional approaches, which go so far as to overhaul the conceptual, methodological and axiological foundations of nutrition.

Intranutritional approaches have been applied in research carried out by the nutritionists Colin Campbell and Thomas Campbell (2006) and Colin Campbell and Howard Jacobson (2013) in the United States and Anthony Fardet (2017) in France. These approaches take a fresh look at nutritional analysis by considering

[1] For instance, the discovery that food could prevent scurvy.

the whole as an entity that cannot be reduced to its parts (Fardet and Rock, 2014), particularly through the concepts of food synergy (Jacobs and Steffen, 2003; Jacobs et al., 2009) and the food matrix (Fardet et al., 2013; Aguilera, 2019) (see Box 9.1). Unlike nutritionism, which focuses specifically on studying the effects of individual chemical compounds on health in a decontextualized framework, this research highlights the need to study the health effects of interactions between different nutrients at the individual food, meal and even diet level.

Nutritional approaches are distinguished by the fact that they take food dimensions other than purely biological aspects into account. They have a public health orientation, studying food consumption from the perspective of the relationships between biological, psychological, economic and sociological

Box 9.1 Food matrices

Claire Mouquet-Rivier

The food matrix concept goes beyond merely considering nutritional compounds (macro- and micronutrients) and bioactive compounds (polyphenols, phytates, saponins, fibres etc.) together – it captures the complex arrangement of these compounds, which are subject to multiple interactions, thereby forming microstructures. Compound arrangements and interactions in food matrices give foods novel nutritional or organoleptic properties that individual compounds alone cannot provide. The properties of these microstructures are the outcome of physical interactions involving the size, spatial conformation and plasticity of the molecules, as well as chemical interactions involving pH, different energy bonds, oxidation-reduction phenomena and solubility. They may be modified over time in the process of food processing – for example, under the effect of pressure or heat – or during digestion as a result of the action of mastication, digestive fluids, gut microbiota and so on. Food should therefore be understood in kinetic terms, with the availability of matrix components – including nutrients and aromatic compounds, as well as any heavy metals and other compounds with harmful health effects – being shaped by these temporal dynamics. The food matrix thus has a major regulatory impact on intestinal absorption.

Find out more: Aguilera J.M., 2019. The food matrix: implications in processing, nutrition and health. *Critical Reviews in Food Science and Nutrition*, 59(22): 3612–3629.

factors (Fattore and Agostoni, 2016). These approaches incorporate knowledge and methods from other disciplines such as the social sciences and agronomy. The 'sociology of nutrition', for instance, studies the impact of macrosocial forces on eating practices (Glass and McAtee, 2006; Traverso-Yepez and Hunter, 2016); nutritional anthropology focuses on the impact of culture on these practices (Calandre, 2002); and nutrition economics analyses the impact of eaters' economic status on their nutritional well-being (Perignon et al., 2017). Finally, cross-sectoral health and agricultural approaches shed light on how agricultural developments can affect people's nutritional status (Frison et al., 2006; Hawkes and Ruel, 2007; Dury et al., 2014). The journal *Ecology of Food and Nutrition* showcases these cross-cutting perspectives, which shed light on contemporary nutritional issues shaped by a range of challenges.

Lastly, extra-nutritional approaches involve the reorganization of the conceptual framework of nutrition – individual health here encompasses public health, while the health concept incorporates environmental health and social well-being. The French nutritionist Jean Trémolières was one of the first to pave the way for these approaches by fostering dialogue between the so-called hard sciences and the social sciences and humanities with the publication of his Cahiers de nutrition et de diététique in 1965. Recognizing the one-sided bias of the nutritional approach, which 'when it focuses on everyday life [. . .] only sheds light on one aspect of it' (1975), Trémolières proposed approaching food from the more holistic perspective of diaita (dietetics), which also takes into account the social, cultural and hedonic dimensions of food.

Over the last forty years, the rise of sustainability issues has led to a renewal of the science of nutrition. Nutritional ecology, for instance, embraces an interdisciplinary approach that takes into account interactions between physiological, social, cultural and environmental factors (Gussow, 1978; Schneider and Hoffmann, 2011). Cannon and Leitzmann (2005) proposed a new conceptual framework through the New Nutrition Science Project, which led to the signing of the Giessen Declaration.[2] This project brought together scientists from different disciplinary backgrounds with a view to overhauling the foundations and principles of nutrition (Beauman et al., 2005). Guided by a 'philosophy of co-responsibility' towards non-human living beings (Meyer-Abich, 2005), these scientists sought to shed light on the network of real and symbolic relationships that connect humans, non-humans and their biophysical environment.

[2] The Giessen Declaration. Public Health Nutrition, 8(6A), pp. 783–6.

More recently, in the wake of the ecological crisis, the scope of nutrition has broadened to include its environmental dimension. Eco-nutrition (Wahlqvist and Specht, 1998) thus incorporates health and environmental issues in the study of diets that contribute to meeting nutritional needs as well as safeguarding biodiversity and the environment (Frison et al., 2006; Marlow et al., 2009; Chappell and Lavalle, 2011; Perignon et al., 2016). In line with this approach, the French nutritionist Christian Rémésy (2020) has drawn up a charter for 'nutriecology' – 'a discipline that aims to fulfil human nutritional needs while preserving the Earth's ecological resources and enhancing its nutritional potential'.

Holistic approaches in the social sciences and humanities

Both in Europe and across the Atlantic, food has struggled to prevail as a research object in its own right in the social sciences and humanities (Montanari, 1993; Poulain, 2017). Food has either been deemed trivial due to its ordinary nature or illegitimate because of its biological dimension and has therefore not been seen as a relevant prism for shedding light on the functioning of societies. In the nineteenth century, sociology was a nascent discipline still carving out a space of its own and considered food solely in terms of its most 'sociologically amenable' aspects, such as the role of meals in family life (Halbwachs, 1912). Up until the mid-1960s, the issue of food was merely considered as a point of entry to investigate other anthropological and sociological issues deemed more important, such as health, family and rural life (Poulain, 2017).

Despite these epistemological roadblocks, interest in food within the social sciences and humanities grew in the second half of the twentieth century. Claude Lévi-Strauss's (1969) structuralist perspective played a key role in consolidating the anthropological status of food and cooking through the identification of structures such as the so-called culinary triangle. This model of relationships between different forms of cuisine based on the way in which food is cooked (raw-roasted, rotted-fermented, cooked-smoked) was believed to reflect how societies function. Moreover, the study of consumption patterns in Europe (Moulin, 1975) and in France (Lambert, 1986; Herpin, 1988) provided sociologists and socio-economists with a gateway to food research.

At the same time, the social sciences and humanities developed a more holistic approach to food. Four different approaches are presented here: interdisciplinarity and food studies, followed by a biocultural approach and finally what we call a multi-scalar approach.

First, the decompartmentalization of perspectives can involve the sharing of knowledge and/or methods specific to several social sciences and humanities disciplines. In France, for example, an interdisciplinary approach to food developed through cross-disciplinary hybridizations such as socio-anthropology (Serra-Mallol, 2010; Tibère, 2013), psychosociology (Barthes, 1961) and even a form of historical sociology of food (Depecker et al., 2013). In the Americas, another type of holistic approach emerged in the 1990s, inspired by cultural studies: food studies, which amounts to a food metadiscipline combining a number of sciences (history, literature, philosophy, sociology, anthropology etc.).

Second, one particular approach transcends the barriers between the hard and social sciences insofar as it focuses on the articulations between the biological, psychological and social facets of food. This so-called biocultural approach, inspired by the complexity approach proposed by Edgar Morin in the 1970s, was exemplified through the collaboration between the nutritionist Elsie May Widdowson and the anthropologist Audrey Richards in a study of Bemba communities in southern Africa (de Garine, 1988). It was promoted thereafter by the anthropologist Igor de Garine (de Garine, 1972, 1979; Froment et al., 1996) and further conceptualized by Claude Fischler in Issue 31 of the journal Communications (1979) and in his book *L'Homnivore* (1990). Fischler acknowledged food as a 'truly transdisciplinary theme' and laid the foundations for a sociology of eaters, taking a holistic approach by exploring disciplinary interfaces. This drive to articulate the natural and the cultural is also found in Jean-Pierre Poulain's theorization of the 'food social space' concept, which allows for thinking about food cultures in terms of an organism's biological limitations as well as environmental constraints in connection with eaters' ways of relating to nature (Poulain, 2017).

Finally, the multi-scalar approach to food – that is, considering food on several levels – offers another way for the social sciences to investigate food from a holistic perspective. This approach, borrowed from geography, articulates different levels of observation (individual, family, social group etc.) to gain a comprehensive understanding of the research object and capture the complexity of reality. In relation to food, this involves the articulation of knowledge produced at the macrosocial, meso-social, micro-social (Germov and Williams, 2016) and biological (Desjeux, 1996) levels to fully grasp all the dimensions of food.

Although this is beyond the scope of this chapter, it is important to note that alongside this focus on eaters, social science studies on topics such as rurality, health, organizations and economic networks also contribute to our understanding of food as an 'all-encompassing human reality'.

Holistic approaches in agronomy

While agronomy largely studies food from the perspective of agricultural production, a number of French researchers – often agronomists and sometimes technologists – have been drawn to a more holistic approach. Within the framework of their discipline, they have gradually developed a passion for their research object, namely a plant or a food product, to the point of ultimately becoming encyclopaedic specialists able to connect its origins, agronomic features, processing methods, uses and symbolic dimensions. Some publications have thus endeavoured to articulate previously fragmented knowledge on products such as yams (Degras, 1993; Dumont and Marti, 1997), oil palm (Jacquemard, 1995), fonio (Cruz et al., 2016) and even beer (Hébert and Griffon, 2010, 2012) in the form of large integrative syntheses.

Given the systemic nature of its subject matter, agronomy is intrinsically multidisciplinary. It encompasses a range of disciplines, including hard sciences – for example, ecophysiology, bioclimatology and soil science – as well as the social sciences and humanities, such as economics, geography, sociology and management science, to investigate production systems from a broader perspective. Scientific knowledge is always articulated with farmers' empirical knowledge, which existed long before the advent of the academic discipline (Perret, 2005). In particular, agroecological knowledge – which aims to leverage biological processes to fulfil both production needs and a range of ecosystem services – initially emerged on the fringes of the scientific sphere.

Agroecology has now been institutionalized as a discipline (Wezel and Soldat, 2009), which posits the agricultural production space as a complex adaptive system encompassing biodiversity, humans, their social structures and their representations (Hubert and Couvet, 2021). Some scientists have broadened the scope of agroecology to encompass the entire food system. Francis and colleagues (2003) thus describe agroecology as 'the integrative study of the ecology of the entire food system' while advocating the need to 'build bridges and connections among and beyond our disciplines in production agriculture, as well as beyond the farm gate into the rural landscape and community'. Stephen Gliessman (2016) describes agroecology as a stepwise approach to transforming food systems, from agricultural production to downstream activities. This understanding of agroecology, which seeks to connect the environmental, economic and social dimensions of the food system with its different stages, provides an integrative approach that is relevant for addressing sustainability issues.

A systems-based approach to food

The systems paradigm emerged in Western scientific thinking in the second half of the twentieth century. It partially eclipsed the analytical rationale of explaining the whole by studying its parts, which had prevailed since the seventeenth century but had struggled to account for the complexity of the world. Systems thinking – based on the work of neurobiologists, mathematicians and cyberneticians – is characterized by a global or holistic approach to complex phenomena, grounded in the study of a 'set of dynamically interacting elements' (Cambien, 2007) that are treated as a system in order to meet a specific research objective. The systems-based approach is therefore an epistemological choice. Given the complex nature of its objects of study, this approach is cross- and interdisciplinary. It strives not to replace conventional disciplines but to foster 'synergy and synthesis between them' (Cambien, 2007).

The systems paradigm has broadened the horizons in many scientific and societal fields, including that of food. The application of this approach to food systems has radically reshaped the way in which food is understood, which was previously fragmented across different disciplinary silos or sectors of activity. In its early definitions (Collins, 1963; Marion, 1986; Malassis, 1994), a food system was understood to refer to all or part of the food chain, 'from land to mouth' (Kneen, 1993), including production, processing, distribution, transport and consumption. The study of the key dimensions of the food system thus became driven by the need to gain a comprehensive understanding of food at a time when there was a vital need to feed a growing population (Béné et al., 2019b). In 1998, Jeffery Sobal and colleagues proposed one of the first integrated models of the 'food and nutrition system', a tool 'depicting the extent of the system and outlining the processes, transformations and interactions involved in food systems'. Since the food system was first recognized as a subject of scientific and societal interest, a number of conceptual models have been proposed to define and explain its functioning. Integrating spatiotemporal scales, disciplines, stakeholders, practices and customs is becoming central to part of the research on agriculture and food (Chevassus-au-Louis et al., 2008).

The rise of environmental and social issues has challenged the prevailing modes of food production and consumption and has markedly altered the purpose of food systems. The primary concern is still guaranteeing food security,[3] but the

[3] 'Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life' (FAO World Food Summit Declaration, 1996).

sustainability of food systems has now been identified as a major challenge (Eakin et al., 2017). A new research area is emerging: 'sustainable food systems' (Blay-Palmer, 2010; Marsden and Morley, 2014; FAO, 2018; Willett et al., 2019). It articulates so-called integrated, systems-based, holistic or multidimensional approaches to study the conditions required for a food system transition that takes into account both the complexity of the system and the multidimensional nature of sustainability[4] (Foran et al., 2014; Moscatelli et al., 2016; Horton et al., 2017; Blay-Palmer et al., 2019). Interdisciplinarity is pivotal to these approaches, since monodisciplinary strategies are unable to cope with the complexity of the issues inherent in food system sustainability (IPES-Food, 2015). The food system is often depicted as 'socio-ecological'. In many fields, this new approach brings together the hard and social sciences (Schoon and van der Leeuw, 2015) and calls for fully taking into account the interdependence between human and natural systems – here in relation to food issues (Ericksen, 2008; Allen and Prosperi, 2016). This approach allows for considering the interdependence of food security, environmental integrity and social well-being and for exploring the concept of food system resilience (Hodbod and Eakin, 2015; Tendall et al., 2015; Schipanski et al., 2016; Doherty et al., 2019).

The food system may be a unified object of study for experts in different disciplines, but perspectives on sustainability issues and the resulting transition scenarios that are proposed can vary widely across diverse knowledge communities (Eakin et al., 2017; Béné et al., 2019a). Thus while there is consensus on the need for a sustainable food system, the proposed pathways to achieve such a system differ. While these divergences reflect how sustainability is narrowed down to only some of its dimensions, they also highlight profound antagonisms surrounding the pathways of transition. Developing a complex approach to food helps (among other things) to make these antagonisms more explicit. By suggesting that the environmental, economic, social, health and political dimensions of diets be considered on an equal footing, the sustainable diets approach developed by Pamela Mason and Tim Lang (2017) offers a tool for the multidimensional food governance.

[4] According to Béné and colleagues (2019a), 'sustainability, in its most universal sense, is a multi-dimensional concept that incorporates three fundamental elements: the pursuit of social equity, the creation of human welfare (often presented as an economic dimension), and the maintenance of the environmental integrity of the resource-base on which the economic and social dimensions are built. A fourth dimension is often superimposed on these three, one that involves time and the idea that the sustainability of today should not be achieved at the cost of the sustainability of tomorrow' (Brundtland, 1987).

People as keystones in food ecology

The food ecology approach advocates the dissemination and articulation of the scientific approaches presented above, which to varying extents seek to decompartmentalize perspectives on food so as to address the multidimensional nature of both food and its associated issues. Furthermore, food ecology is also geared towards developing inter- and even transdisciplinary approaches, whereby scientists come together to share their perspectives on food (Chapter 21).

The key idea underpinning this approach is that of a 'return to the subject' in science (Gosselin, 1987) – that is, establishing dialogue between scientists rather than between scientific disciplines, through and beyond their diverse disciplinary horizons. Any discipline, prior to becoming a framework for the production of knowledge, is ultimately a group of men and women who 'play the role of scientists' (Bourdieu, 2000, 2004). This role essentially consists in applying the paradigms, methods and analyses of a given discipline, and all actors must play it with 'full awareness' (Morin, 1982). Insofar as 'all knowledge stems from our worldview' (Hubert et al., 2015), the main challenge with this approach is no longer to produce a highly integrated body of knowledge but rather to encourage actors to become more reflexive as a first step towards grasping the complexity of the subject at hand. While food ecology recognizes the need to maintain disciplinary fields, it also advocates the creation of interfaces – in other words, spaces for dialogue, exchange and experimentation – in which to articulate knowledge, debate controversies, interrogate representations, compare research programmes and collectively recognize the grey areas and antagonisms involved in their articulation. These so-called interface spaces are many and varied and may include anything from symposia and seminars to scientific journals and interdisciplinary research projects. They enable researchers to keep abreast of what is happening in the field of food beyond their specialist area, to question their personal viewpoints and to experience moments of collective awareness regarding food issues.

Food ecology also recognizes the need to transcend the limits of the scientific community and foster 'the cohabitation of disciplinary and generalist knowledge' (Poulain, 2017) or even their interaction as part of an 'ecology of knowledge' (Santos, 2016). Without falling into the trap of relativism, this involves the scientific method not having primacy over other forms of relationship to reality (Mormont, 2015), insofar as knowledge is equally intellectual on the one hand and practical and emotional on the other. Food must be approached as a perceived object and a lived experience, which structures sensitive relationships and practices between individuals, society and the biosphere. Interaction between

scientific and non-scientific actors is essential to address sustainability issues in food systems: 'cross-knowledge dialogue' (Santos, 2016) and the co-construction of research problems afford a shared understanding of what transition can involve (Lamine et al., 2019), catalyse change by drawing on the knowledge specific to each actor (IPES-Food, 2015) and allow for the development of improved practices. Transdisciplinary interfaces foster a sense of belonging to a 'community of fate', rallied to build shared values. These shared values in turn inform reflection on, and the organization of, solutions that incorporate the multidimensional nature of food and grasp the complexity of the issues involved.

Conclusion

Food ecology promotes the decompartmentalization of food knowledge and thereby fosters a complex understanding of food (Morin, 2008). It is therefore essential to make explicit the antagonisms (the simultaneous expression of positive and negative effects), feedbacks (an action triggered in response to one's own) and recursiveness (repetition of a fact that induces a consequence which in turn induces the fact) involved in the different dimensions of food (Morin, 1990). Thus, it is clear that although certain watchwords pointing the way to achieving food sustainability have their role to play (Part 4), there are no straightforward answers to the multidimensional challenges raised by our contemporary eating habits.

Articulating focused approaches and openness to interdisciplinarity – in other words 'distinguishing between' and 'connecting' these approaches' different perspectives – better equips food-related sciences to identify relevant pathways for change towards sustainable food systems. Inter- and transdisciplinary approaches – as spaces for interaction and co-construction – not only help strengthen ties between researchers in pursuit of a common goal, but they also anchor the search for solutions in everyday life by linking them to the actors, processes and institutions involved in food systems (Chapter 21). The ecology of food thus calls for dialogue between scientific disciplines and between science and society.

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