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SPECIAL FEATURE: ORIGINAL ARTICLE

Leverage Points for Sustainability Transformations

# Towards an integral perspective on leveraging sustainability transformations using the theory of modal aspects

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## Abstract

Engaging appropriately with sustainability transformations requires adopting an integral perspective on related system dynamics. This view underpins the sustainable development goals. Informing policy and decision making from a consistently integral perspective, however, remains a key challenge. To some extent, the leverage points approach has proved useful in doing so in terms of providing an encompassing view on related options for intervening in systems. There are, however, a number of points in which it needs to be complemented by other approaches to better address the need for an integral perspective on sustainability transformations as well as to better address the need for being able to articulate normative perspectives on transformation processes and outcomes. We argue that the theory of modal aspects is a good candidate for doing so. To illustrate its potential, we explore its characteristics, we illustrate its application opportunities in the analysis of sustainability in food systems transitions, we systematically compare leverage points and modal aspects, and close with an exploration of ways in which the leverage points approach and theory of modal aspects can be considered complementary perspectives. The authors conclude that the theory of modal aspects offers opportunities for enriching both the leverage points approach and wider approaches in sustainability transformations by offering a consistently integral perspective across scale levels, and by offering a number of ways of engaging with normativity in related processes without resorting to fixed political views. This articulates its potential for playing a useful role in related multi-stakeholder processes and sustainability governance.

**Keywords** Systems thinking · Leverage points · Integrated approaches · Transitions · Multi-aspectual analysis · Normative perspectives

## Introduction

Merely reducing $CO_2$ emissions is not going to secure the future sustainability of society. We also face the impact of other human activity such as the environmental effects of poisons (from industry and agriculture), plastics, and profits obtained to the detriment of (other) people (e.g., Gaberell and Hoinkes 2019; Thompson et al. 2009). This involves intertwined, interacting, and (partly) overlapping causes and implications (Ekins et al. 2019; Gliedt and Larson 2018; Hoolohan et al. 2019). Sustainability transformations, therefore, need to be approached from an integral perspective and cannot be reduced to single-issue projects (such as reducing $CO_2$ emissions) as if the Sustainable Development Goals (SDGs) can be addressed effectively separated from each other (McGowan et al. 2019). It involves addressing challenges simultaneously and interactively, moving away from problem-solving approaches towards a deeper and more

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long-term engagement with system change and related complexities. This perspective has motivated increased attention for the leverage points approach (Meadows 1999). The benefits of applying this approach to sustainability science have been discussed before (e.g., Abson et al. 2017). In this paper, we focus on how its limitations might be addressed by the theory of modal aspects (e.g., Basden 2011) particularly with respect to needs in sustainability transformation research and governance.

## Issues in integral perspectives on sustainability transformations

Adopting an integral perspective on sustainability transformations requires knowing what needs to be part of such a perspective. Popular reference to the economic, the social, and the environmental as core categories fosters reductionist views on reality since, as categories, they are far too big (Ekardt 2020). Several authors have pointed to a variety of aspects not given due attention in sustainability research (e.g., Kampelmann et al. 2018; Weiser et al. 2017; Avelino 2017; Folke et al. 2019). Others reflect on the contested nature of relevant dimensions (Constance et al. 2018). Political views may become packed in sustainability rhetoric (Adloff and Neckel 2019; Blühdorn 2017). Related literature, such as on planetary boundaries (e.g., Ekins et al. 2019; Raworth 2017) and on integrated perspectives on food system transformations (e.g., FAO 2019) identifies even broader ranges of relevant factors to be considered. However, whether those factors are really the very ones we need to consider tends to be decided on the basis of subjective experience, not on a systematic and encompassing ontology. This means that categories may shift over time, which is at odds with the need for long-term engagement with system change guided by a consistent integrated approach (Marchese et al. 2018; Pouw and Gupte 2017). The SDGs are helpful in this, but securing the integrated philosophy underpinning the SDGs requires a consistent and coherent perspective on reality and cannot be self-referential (McGowan et al. 2019; see also TWI2050 2018). Therefore, despite the argument that the field of sustainability (transitions) research has produced a broad theoretical and empirical basis, including strategies and instruments (Loorbach et al. 2017; Daedlow et al. 2016), we would argue that a satisfying theoretical foundation is still lacking. Not only does this affect sustainability research and approaches, but it also limits possibilities for having constructive debates on contested approaches.

## The potential and limitations of the leverage points approach

The leverage points approach[1] addresses the need for integral perspectives on sustainability transformations by providing an encompassing view on system change. Meadows wrote much more on systems than on leverage points for intervening in systems (e.g., Mandl 2019; Meadows 2008), but the leverage points remain the most popular element of her work (e.g., Abson et al. 2017; Fischer and Riechers 2019; Kieft et al. 2018). The application of her work, therefore, remains generally limited to the leverage points perspective, which presents a number of challenges and limitations. First, as repeatedly observed during the conference at Leuphana University early 2019 (Leventon et al. 2019), the leverage points perspective can be applied from an overly instrumental or even mechanistic view on system change (cf. Haxeltine et al. 2017) and on sustainability transformations (inviting critiques such as e.g., Blühdorn 2017; Foster 2017). A simplistic logic following such view would be: find the right lever, adjust it, and then the system will produce better outcomes. Second, the leverage points focus on how systems change, but do not elaborate a view on the substance of the system: what exactly is changing? Understanding this is needed to be able to compare implications of different ways of intervening in systems, including in terms of related trade-offs. This connects to discourses on the possible incompatibility between certain views of sustainability, and development guided by economic growth, as is allegedly the case in certain SDG-related policy making (Hannis 2017). The third issue is that the leverage points approach does not provide a normative perspective in relation to intervening in the system, while sustainability transformations are inherently normative in nature. Intervening in systems is not merely about 'how to make systems change'. In sustainability transformations, it is critical to agree on what sustainability is about and what does and does not make for such sustainability, both in relation to transition processes as such as well as in terms of their outcomes. In addition, related to the idea of trade-offs, normativity plays out in change processes where one good may come at the expense of another good (e.g., functionality without beauty) provoking the question on the grounds of such priority. Therefore, normative perspectives will always be involved in deciding how and where to intervene in the context of sustainability transformations (Blythe et al. 2018; Bui et al. 2019; de Vries and Jochemsen 2019; Jochemsen 2018; Schlaile et al. 2017; Scoones et al. 2018) stressing the need for a consistent, coherent, and transparent reference

[1] We assume that the reader is already acquainted with Donella Meadow's leverage points perspective and we will therefore not elaborate on its features in this paper.

framework to guide related debates and decision making (Kibert et al. 2012).

The leverage points approach has been applied against the backdrop of the Multi-Level Perspective (MLP) to sustainability transitions (MLP) (e.g., Göpel 2016, 2017) and wider transitions thinking (e.g., Schot and Kanger 2018) to articulate the dynamic system context. This enhances the efficacy of the leverage points approach but does not adequately address the above issues, particularly not the third one.

### The potential contribution of the theory of modal aspects

This paper explores the theory of modal aspects as an approach which can help address issues regarding the need for an integral approach to sustainability transformations, as well as complement the leverage points approach and wider transitions thinking regarding the three limitations discussed above. The core of the approach predates Meadows' leverage points approach. The theory of modal aspects involves a framework of 15 modal aspects of experienced reality. It was developed originally by Herman Dooyeweerd (1894–1977), and later slightly adapted and applied in a wide range of fields related to systems approaches (e.g., Basden 2011, 2017). This includes valuation in relation to ecosystem services (Gunton et al. 2017), evaluating sustainable development in the built environment (Brandon and Lombardi 2010), evaluating enterprise resource planning (Jahanyan et al. 2012), creating systemic perspectives on scaling innovations (Wigboldus et al. 2016), and planning and designing smart grids (Ribeiro et al. 2012). It is a theory which has turned out to be surprisingly practical (de Vries and Jochemsen, 2019). Just like Meadows wrote much more on systems (behaviour) than only on leverage points for intervening in systems, Dooyeweerd developed a much broader theoretical approach than the fifteen modal aspects. His theory of modal aspects remains the most popular element of his work because of the practical application opportunities it offers. Another similarity between Meadows and Dooyeweerd is that both their approaches are considered very useful because of being supported by a (less well-known) wider theoretical backing, and thereby marry simplicity with profoundness. Due to these common traits, we consider the two approaches a good match for a comparison and exploration of possibilities for mutual enrichment. There are, however, additional reasons for considering the theory of modal aspects (TOMA) in view of current debates on sustainability transformations, a matter to which we will return in the discussion section.

### Outline of this paper

Our methodological approach is to first clarify in "The theory of modal aspects and its view on sustainability" what TOMA is about, and to then illustrate in "Illustrating the theory of modal aspects as analytical framework: the case of food system transitions to sustainability" what the application in a specific context can look like. For this, we use the case of food system transitions to sustainability as a representative of wider perspectives on sustainability transformations. Having presented TOMA and its opportunities for application, in "Comparison and identifying opportunities for mutual enrichment of leverage points and modal aspects" we then systematically explore connections between the leverage points approach and TOMA, and the potential this holds for complementarity. "Discussion" revisits the ambition of this paper as outlined above, discussing ways in which TOMA can play a useful role in the context of sustainability transformation perspectives and approaches. "Discussion" closes with a summary overview of what TOMA has to offer for those engaging with sustainability transformations and what this adds to what the leverage points approach (LPA) already offers.

## The theory of modal aspects and its view on sustainability

The scope of this paper does not allow for a full presentation and apology of TOMA and its underpinning philosophy (Basden 2020 and https://dooy.info/aspects.html are good sources for this). Here, we accept the theory as it is presented and used in literature and use it as a tool for an integral approach of things, events and processes. Hence, we focus on providing a relevant summary, using the format of tables and pictures to present a range of examples within limited space.

### Essential features of the theory of modal aspects

Dooyeweerd's initial ideas on modal aspects emerged from the observation of consistent order and patterns across spheres and scales in everyday experienced reality. This concerns a qualification of the word "reality". Basden (2011) also uses the term temporal reality. Dooyeweerd was emphatic about considering everyday experience as the basis for his theory, grounding his thinking primarily in what people can intuitively, in their everyday life and in their on-the-ground realities, engage with and makes sense of, rather than in lofty ideas. Though everyday experience is characterized by diversity and embeddedness, he realised that everything functions in all modal aspects—albeit in different ways—and can be evaluated from the perspective of each

**Table 1** Aspects of the reality of everyday experience ( adapted from Basden 2011)

| Aspect | What it is about (simplified) | Illustration of application (for salt-tolerant crops) |
|---|---|---|
| Quantitative | Discrete amount | How many are there? |
| Spatial | Continuous extension; dimension | Where do they grow? |
| Kinematic/kinetic | Movement | How do they spread? |
| Physical | Energy; material | What minerals are involved in salt tolerance? What soils exactly? |
| Biotic | Life; organism | How do they do it? |
| Sensitive/psychic | Perception; emotion | How do farmers feel about related options? |
| Analytical | Distinction | How much do we know about it? |
| Formative | Formative power; (to) structure; give function | What products can be produced from it? |
| Lingual/symbolic | Signification; symbolising | How is it framed in communication (e.g., as 'solution') |
| Social | Company/community; relationships | What collaboration is needed to explore opportunities? |
| Economic | Frugality; managing | What does appropriate management entail? |
| Aesthetic | Delight, enjoyment | Who is interested in/fascinated by this? |
| Jural | Appropriateness; legal justice | What legal frameworks and policies are relevant? |
| Ethical | Loving, attitude, moral justice | Can this be considered responsible innovation? Is there willingness to bear related costs? |
| Pistic/fiduciary | Belief, faith, commitment, aspiration | To what extent is it in line with fundamental beliefs and aspirations? |

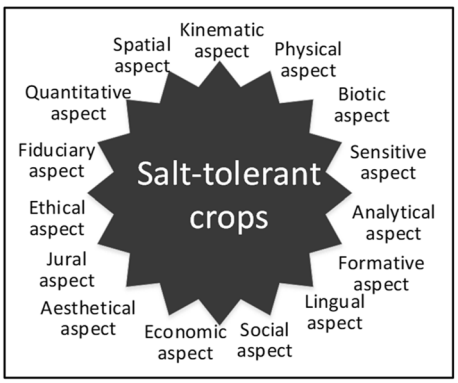


**Fig. 1** Illustration of the assertion that all things function in all aspects

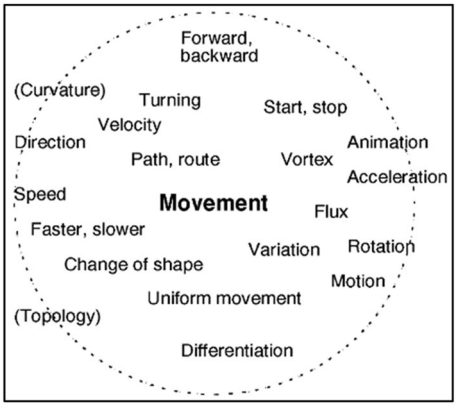


**Fig. 2** Illustrating for the kinetic aspect how modal aspects can be defined by a "kernel" while pertaining to a wider aspect constellation. Used with permission from The Dooyeweerd Pages https://dooy.info/aspects.smy.html

of the aspects (Table 1 and Fig. 1) (Basden 2020). Modal aspects are understood as distinct ways in which things can exist or come into existence, as distinct ways of knowing. This implies that each aspect has a distinct epistemology and distinct criteria for scientific validity, where scientific disciplines such as physics, psychology, sociology or theology centre on specific aspects (Basden and Wood-Harper 2006: 73). They are referred to as modal aspects because they relate to a category (modality) which cannot be described by a single word (see Fig. 2). For the sake of brevity, we will not always add the word modal from this point onward.

Distinguishing aspects serves to order our perception of reality and helps to identify ways in which things do or do not make sense (Basden 2009). Whether formal or informal, all analytical thinking presumes a set of aspects (Basden 2011) and in sustainability research we come across many sets, which are usually subsets of what Dooyeweerd developed (e.g., Fazey et al. 2018). This way of understanding the world is conducive in particular to the various scientific disciplines that tend to take a particular aspect of everyday experience as their focus of study.

Each aspect pertains to a normativity sphere, which means that the functioning of an entity in a particular aspect can be discussed in terms of aspectual normativity (Box 1). For example, clarity may be considered an inherent norm in the lingual aspect; (self-giving) love an inherent norm in

the ethical aspect; and stewardship in the economic aspect.[2] What exactly is defined as inherent norm in each of the aspects may be up for discussion, but that does not preclude that such norm can be established and agreed on (e.g. in a group of stakeholders). We will expand on this and other specifications after presenting the set of aspects. We like to emphasize that also if one is not inclined to accept this theory as an ontology, it can still be used fruitfully as a set of perspectives from which things and events can be evaluated to develop an integral view.

The 15 aspects follow a particular order that build up gradually from first (quantitative) to last (pistic). Each aspect is unequivocally distinct from all others, precluding reductionism, yet each aspect coheres with the others in various ways (Basden 2020). Things (entities, processes) function in all aspects simultaneously. No aspect undermines any of the others and they are considered equally important. The aspects are so interdependent that each depends on earlier aspects to enable its own functioning, and on later aspects to attain its full potential. The aspects are defined by this interdependency. This brings us to what Dooyeweerd considered as the ground of all aspects: meaningfulness. He argued that modal aspects are ways of being meaningful and in that sense represent spheres of meaningfulness (Basden 2020). As a metaphor, we may compare this to the way in which graphics software combines layers to form a picture. Modal aspects may be understood as representing layers of meaning which together, in an integrated and interactive way, express the meaningfulness of entities. In the same way that leaving out one layer of graphics distorts the complete picture, neglecting how a particular entity functions in one or more aspects will create a distorted perspective on that entity. Like meaningfulness, modal aspects can be framed in positive terms (good, value), and in negative terms (not good, detrimental). For example, the meaning of the social aspect in positive terms is about the good company or good social interaction; in negative terms, it is about the poor company or poor social interaction. TOMA's integrated view on fifteen ways in which entities harbour meaning, positively or negatively, can help reveal reductionist perspectives on entities, such as considering a farm to be only about food production.

A further specification of aspects helps to distinguish between different ways in which things, also called entities, function through the interplay of the aspects. We already noted that all things we encounter in everyday experience function in all 15 aspects, but not in the same way. The qualifying aspect of an entity is the aspect that characterizes most that class of entities. For example, the qualifying aspect of a machine is formative. The founding aspect is important in the coming into being of the entity. For example, a machine is founded in the physical aspect; it is made of physical matter. Systems (unless it concerns physical systems such as a computer system) cannot be observed directly, yet analysing them through the lens of the 15 aspects can give a comprehensive account of them. The same applies to themes and topics such as climate change or food loss and waste.

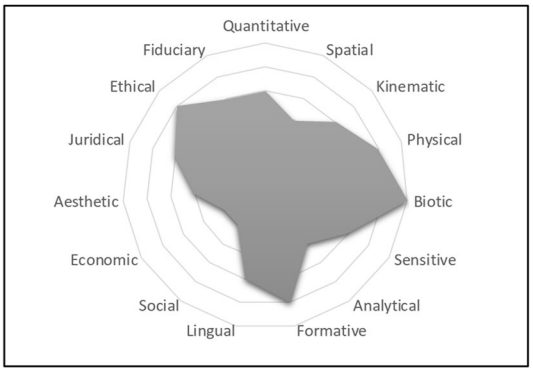


**Fig. 3** Illustration of the option of scoring aspects in a spider diagram in relation to particular questions

**Box 1: How a view of reality informs a view of normativity**

In Dooyeweerd's cosmology (view of reality), a view of reality as being value-neutral to which human subjects attribute value is rejected. He, and those in the philosophical school that he initiated, argue that reality in itself harbours meaning and value. Hence, in this view the aspects and their meaning kernels, or core values, are both descriptive and normative. This normativity does not have the character of moral directives but requires interpretation of concrete situations and the way the core values of the aspects should be observed. Ethics, then, is not so much the application of ethical principles to value-neutral situations but rather an evaluation of the way in which the core values of all the aspects simultaneously can be brought to fruition.

## The theory of modal aspects as an analytical approach

Multi-aspectual analysis offers a basis for meaningful dialogue and discourse by enabling stakeholders (including in interdisciplinary research) to systematically compare and articulate their views and preferences in relation to one and the same framework (Winfield and Basden 2006). What it reveals in relation to other modal aspects can help stakeholders broaden the horizons of their focus. Assessments may

[2] Interestingly, this is a concept regaining attention in recent literature, such as Folke et al. (2019) and Mathevet et al. (2018)

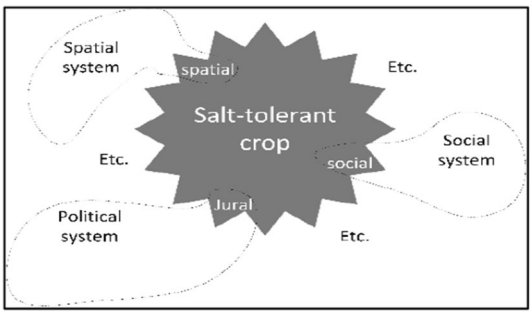


**Fig. 4** Illustrating how entities relate to multiple systems and not just one

involve giving relative scores in view of the extent to which a particular aspect is being addressed or not in a particular intervention (Fig. 3). It also offers ways of constructively supporting critical thinking, since it allows for focusing attention as much on the positive as on the (potential) negative (Basden 2009).

The aspectual approach offers a perspective on system boundaries which involves distinguishing such boundaries in relation to each of the modal aspects (Fig. 4). For example, the physical boundary around a system might be different from the biotic boundary, psychological boundary, economic boundary or legal boundary (Basden and Wood-Harper 2006: 79). However, the system boundary that is so important in systems theory was of little interest as such to Dooyeweerd. "This is because the existence of a thing (system) is not constituted in its component parts and emergent properties but in the aspects themselves; a poem, for example, does not exist as a poem by virtue of 'emerging' from its component words, but it exists by virtue of the poet functioning in the aesthetic and lingual aspects" (Basden and Wood-Harper 2006: 79). Dooyeweerd focuses more on the intertwinement of—observable!—(constellations of) entities. This ensures taking the individual entity seriously in its own right, without reducing it to being mere subcomponents of a system. Systems are shaped by interacting entities and processes, and each of these function in all 15 modal aspects. We cannot change an entire system immediately, but we can bring about change by influencing entities and processes involved in it. This means that intervening in systems happens through intervening in entities and processes.

Table 2 illustrates further ways in which the aspects enable the development of integrated perspectives on everyday experienced reality. There are many more options for structuring things along the lines of the aspects. For example different perspectives on time/temporal (quantitative: point in time; physical: 'clock' time; biotic: aging, biological clock; sensitive: cultural perceptions of time; formative: history; economic/aesthetic: timing; economic: time as resource; etc.), as well as on types of power, types of capabilities, and types of assets. Multi-aspectual analysis can also help develop coherent perspectives on specific topic areas. This includes systematic (comparative) analysis of (implications of) different scenarios, of different actors (focus of interest; potential role to play; etc.), and before-after studies. "Illustrating the theory of modal aspects as analytical framework: the case of food system transitions to sustainability" provides an idea of what this may render in terms of overview and insights.

## An integrated perspective on sustainability

Defining an integrated approach to leveraging sustainability transformations can be informed by the fifteen modal aspects presented in TOMA. Table 3 explores the aspects in relation to sustainability and sustainable development. Gunton et al. (2017, p 257) discussed how "each of the United Nations' 17 sustainable development goals (SDGs) may be characterised by one or more of the [modal] aspects, and many map largely onto a single aspect (e.g., those concerning energy and climate, hunger, well-being, education, communities, justice and the various economic goals)." Taking this a step further reveals how TOMA offers an integral perspective on sustainability—even though instead of framing his theory in sustainability language, Dooyeweerd used the word Shalom for a situation in which due respect is paid to all aspects (see Box 2). Shalom thus refers to situations characterised by harmony, i.e. sustainability as a harmonious system functioning well in all aspects. In this perspective, sustainability can be understood as the outcome of the way in which a (e.g., food) system functions in all fifteen aspects.

There will be differences in terms of the extent to which any given modal aspect contributes to sustainability, but in a long-term perspective, all modal aspects need to be paid due attention. For example, not having valid theories may not have a direct effect on the sustainability of the system, but in the long run will have some effect. This provides a 'checklist' for considering what makes for responsible practice in view of sustainability aspirations.

### Box 2: Deepening the meaning of sustainability

Dooyeweerd suggested the Hebrew word (noun) *shalom* for situations in which due respect is paid to all aspects. It is a more-encompassing word than *sustainability*. It can be translated across a broad spectrum of related meanings: health, security, tranquillity, welfare, good condition, comfort, peace(ful), whole(ness), happy, friendly, sound(ness), safe(ty), concord, friendship, full number (fullness), harmony of soul and mind, prosperous relationship, completeness, fulfilment, unconcerned

**Table 2** The modal aspects help organise a coherent outlook on entities, processes, issues, and systems

| Aspects | Related basic questions | Associated negative | System perspectives | How we think change happens through change in e.g., … |
|---|---|---|---|---|
| Quantitative | How many? | Discontinuity | Numbering systems | … numbers and amounts |
| Spatial | Where? How big? | Disproportionate | Spatial systems; landscape systems | … locations, scales, and patterns of spreading |
| Kinematic/kinetic | How fast? What direction? | Inaction, lock-in | Computer system | … flows and networks |
| Physical | What substance, what energy levels? | Corruption, exhaustion | Thermodynamic systems; water systems | … levels of energy and effort |
| Biotic | Is it thriving, flourishing? | Depletion, impoverishment | Biological systems; Health systems, Ecosystems, agricultural systems | … growth rates, yields |
| Sensitive/psychic | How perceived? | Ignorance | Behavioural systems | … perceptions and observations |
| Analytical | How to make distinctions? | Confusion | Cognitive systems, knowledge systems | … ways of analysis, type of questions being asked |
| Formative | What are the ways of developing, creating? | Malfunction | Innovation systems; technology systems; educational systems | … ways of construction |
| Lingual/symbolic | What are the ways of symbolising, signifying? | Misunderstanding | Cultural systems, linguistic systems; | … ways of framing, communication |
| Social | What social interaction/communion? | Disconnect | Social systems | … social relationships, participation |
| Economic | What are the ways of providing & managing? | Mismanagement, carelessness | Economic systems, governance systems | … way of managing, provisioning |
| Aesthetic | What is enjoyed, cherished? | Offensive, unattractive | Systems of art, architecture, sports | … what is enjoyed, appreciated |
| Jural | What laws, regulations and how are they applied? | Anarchy, injustice | Judicial systems | …. regulations, laws |
| Ethical | What is considered good? | Negligence, indifference | Ethical systems, value systems | … sense of responsibility, accountability |
| Pistic/fiduciary | What are the beliefs, the values? | Uncertainty, apathy | Belief systems (world views) | … core motivation |

state of peacefulness. It is derived from the Hebrew verb *shalam* (the Arabic *salam* is related to this Hebrew word). It carries meanings of meeting one's obligation in full and coming to a desirable state of wholeness in which relationships are restored (as the outcome of *good stewardship*), to be safe and sound, to live in harmony with people, creation, and God; and in response to the question "how are you?" the answer of *shalom!* means, "Everything's fine!". (Zodhiates 2008).

Alternatively, we may suggest a new term, "holotelity", from the Greek *holoteles,* which may be rendered as "completely and in every part living up to the goal/purpose". It is formed by the Greek words of *holos* (whole) and *telos/teleo* and, therefore, goes beyond the word derived from *holos*, which is *holistic* (based on Greek dictionary in Zodhiates 2008).

## Illustrating the theory of modal aspects as an analytical framework: the case of food system transitions to sustainability

In this section, we illustrate what aspectual analysis may bring particularly to the case of food system transitions, to connect to one of the currently topical fields of study in sustainability transformation approaches in development policy and practice. This includes connecting to the sustainable development goals (SDGs) as a way of activating the 15 modal aspects in relevant policy frameworks. Many food system-related policies and agendas focus on SDG2, leaving other SDGs outside the picture; TOMA can help support the integrative approach originally underpinning the SDGs (Raworth 2019; Wigboldus et al. 2019: 6).

### Expanding views on sustainable food systems

Three interrelated and overlapping dimensions or spheres, the Triple Bottom Line, are often used to indicate what

**Table 3** A multi-aspectual exploration of sustainability concerns

| Aspects | SDG link in terms of qualifying aspect | A multi-aspectual view on sustainability (indicative examples) | If aspect is made an absolute (reductionisms) | Characterising reductionist societal change processes (also see Adloff and Neckel 2019 and Wigboldus 2018) |
|---|---|---|---|---|
| Quantitative | | Sufficient | Number fetishism | Statistification |
| Spatial | | Proportionate | Geometrism | Globalisation |
| Kinematic/kinetic | | Circular | Progressivism | |
| Physical | 6, 7, 11, 13 | Secure | Materialism | Chemicalisation; Commodification; Carbonization |
| Biotic | 2, 3, 12, 14, 15 | Resilient | Ethnocentrism; social darwinism | |
| Sensitive/psychic | | Sensible | Emotionalism; Consumerism | Psychologization; Erotization |
| Analytical | | Valid | Rationalism; scientism | Scientisation |
| Formative | 9, 12, 13 | Functional | Technicism, Utilitarianism, Functionalism; pro-innovation bias | Technologization; modernization; industrialization |
| Lingual/symbolic | 4 | Understandable | Symbolism | Westernization; linguistic purism |
| Social | 5, 10, 11 | Inclusive, equitable | Socialism | McDonaldization |
| Economic | 1, 8 | Affordable, prudent, frugal | Economism, capitalism | Economization; Financialization |
| Aesthetic | | Appealing | Hedonism | |
| Jural | 16 | Legal, legitimate | Libertarianism, legalism | Bureaucratisation |
| Ethical | 17 | Justifiable, right, expressing love | Moralism | Brutalisation |
| Pistic/fiduciary | | Reliable, trustworthy | Idealism, fundamentalism | Secularization; radicalization |

**Table 4** A multi-aspectual exploration of food system approaches

| Aspects | Food (system) connections | Food system related entities/actors (founding aspect) | Leveraging (food systems) change: possible focus of (retro) innovation |
|---|---|---|---|
| Quantitative | Food amounts | Bureau of (food) statistics | Changing numbers |
| Spatial | Food geographies, food sovereignty area | Spatial land use planning | Changing location, size |
| Kinematic/kinetic | Food chains | Food consumption trends; food chains | Changing speed, connection |
| Physical | Food calories, nutrition | Agricultural energy input in food production, | Changing energy/nutrition (e.g., fortification) |
| Biotic | Food growth, safety, security, health | Nutritional food package, Health institutions, | Changing consumption patterns |
| Sensitive/psychic | Food preferences | Food niches marketing, Mental health institutions | Changing perceptions, attitudes |
| Analytical | Food systems thinking | Knowledge institutions | Changing concepts, theories |
| Formative | Food production and provision | Factories, supermarkets | Changing ways of production, intervention |
| Lingual | Food cultures, food framing | Food messages, schools | Changing symbols and framing, cultures |
| Social | Food democracy | Eating together | Changing social interactions |
| Economic | Food economy | Farms, Food production system | Changing management, changing food system |
| Aesthetic | Food art, food appeal | Food contests; recipes for meals | Changing recipes, food presentation |
| Jural | Food regulations | Food quality authorities | Changing laws and regulations |
| Ethical | Food justice, food equity, food ethics | NGOs, philosophers | Influencing ethical dispositions |
| Pistic/fiduciary | Food as source of trust and hope | Science, religious institutions | Influencing mind-sets, paradigms |

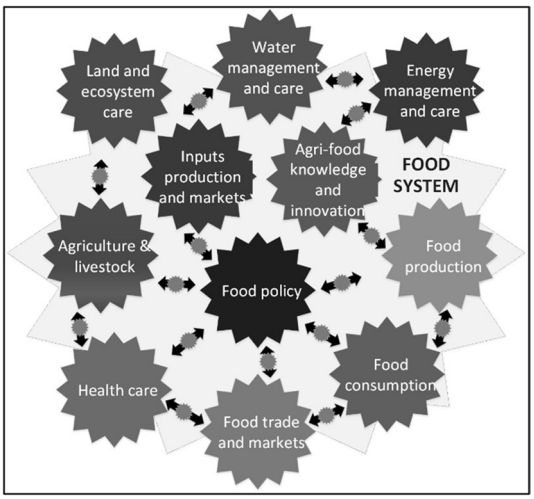


**Fig. 5** Illustrating the possibility of aspectual analysis of core entities and processes which shape (performance and outcomes of) food systems

shapes sustainability (of food systems): economy, society, environment, or economic, social, environmental. It is important to understand that in TOMA the economic aspect is not the same as the above reference to the economic or the economy. Such reference to economy or the economic tends to reduce economic and the economy to the monetary economy. From the perspective of TOMA, (1) an economy (an entity) functions in all fifteen aspects, and (2) an economic aspect can be distinguished in all entities—the economic aspect is then characterised by its core value of 'efficient provision', in which the word provision should be understood in a broad way, including management and taking care of things (Jochemsen and Rademaker 2019: 264). The same goes for a society which is not adequately characterized by just the social aspect, and for the environment which is not adequately characterized by the physical and biotic aspect. In other words, aspectual analysis gives a more refined account of sustainability than the Triple Bottom Line perspective.

## Organising food system elements through the theory of modal aspects

A first way of organising perspectives on food systems is to systematically connect categories to the modal aspects (Table 4). Another way of organising perspectives is to unpack what is behind the food system concept. Dooyeweerd was interested in connecting his thinking to everyday life experience which can be observed. A food system as such cannot be observed, leaving much of it at an inconveniently abstract level. Considering how a food system (as a whole) functions in all aspects can, therefore, only be done in indirect ways, i.e. by looking at entities, such as practices, and processes which form and shape the food system and interactively lead to outcomes which may be framed as system outcomes (Fig. 5) (cf. Jochemsen and Rademaker 2019). The modal aspects form a helpful framework for assessing how harmoniously the core entities and processes in food systems are performing on all relevant scales and levels.

This means that aspectual (dis)harmony at a food-system level can be understood as the emergent outcome of aspectual (dis)harmony within and/or between related entities and processes. For example, in the context of climate change adaptation, salt-tolerant crops can play a role, but this role should not come at the expense of harmony within salt-tolerant crop breeding practices or else it will be(come) a source of disharmony in the long run. It is important to emphasize that any practice within the system will need to respond to its own typical normativity and cannot be reduced to a goal-rational contributing factor to system functioning.

In this perspective, sustainability transformations (and related leverage options) will need to be explored in relation to concrete entities, practices, and processes. The aim will be to achieve better harmony in the way all parts (of what is framed as a (food) system) function in the modal aspects. As discussed in the previous section, this involves considering the extent to which practices and processes are responsible in the sense that they promote aspectual harmony: responsible markets, responsible pest control, responsible policies, responsible banking, etc. This involves a perspective on both internal harmony (within, e.g., practices) and external harmony (between e.g., different practices and across levels and scales). This means that everything and everyone becomes relevant for food system transformations since contributing to internal harmony is within reach. It may not be fully achieved in all instances, but it does provide a clear sense of direction and orients us with respect to the principles of good practice. In the following, we zoom in on the way in which aspectual analysis can help elucidate relevant questions and issues for a particular subject area.

In Table 5 we explore the case of food fortification (e.g., Lawrence 2013; Neufeld et al. 2017) as an example to further illustrate how TOMA can support systematic analysis. This example demonstrates how simple application of the set of modal aspects can prompt many relevant questions for research and for policy preparation and shows how 'chemical' food fortification demonstrates a typical technical (formative) approach to the problem.

It may also be applied in contemplating policy options in a systematic way: Bilali et al. (2018) would have benefited from the application of the set of modal aspects in their comparison of four pathways in agricultural (policy) development: The conventional agriculture pathway, ecotechnical pathway, the agroecological pathway, and the organic agriculture pathway. Systematically characterizing those pathways in relation to the modal aspects would have helped compare those in a more integrated (also looking beyond

**Table 5** A multi-aspectual exploration of food fortification issues

| Aspects | Relevant topics to be discussed | Potential issues | Critically considering the case made for food fortification |
|---|---|---|---|
| | Integrative: are we asking the right questions and are we connecting to relevant issues? | | |
| Quantitative | Amounts to be introduced | Too much; wrong proportions | Do people not get sufficient amounts of food? |
| Spatial | Where produced, bought, consumed | Inappropriate place; too many places | Can the area not produce sufficient nutritional food? |
| Kinematic/kinetic | Speed of introduction | Trade limitations | Does the good food not reach certain (parts of) the population? |
| Physical | What it means in terms of chemistry | Instable composition over time | Is it about fortification of food from elsewhere or improving production of good food? |
| Biotic | How it affects health | Reduced food diversity intake | Is the available food nutritional for the population? |
| Sensitive | How it connects to food preferences | People dislike it | Are there psychological barriers to sufficient intake of nutrition? |
| Analytical | What is the underlying theory which supports the good of this | Fallacies underpinning the intervention | Should we opt for a technical solution (fortification) or a socio-cultural (helping people to produce sufficient good food in the area)? |
| Formative | How it will be produced | Wrong production processes | What kind of agriculture and crops are needed for food and nutrition security? |
| Lingual | How a related campaign is framed | Mere rhetoric claiming good effects; product becomes more of a commodity | How is the problem framed and communicated to the target population? |
| Social | Who decides on/benefits from this | Who benefits? Who decides? Social exclusion? | Does the insufficiency apply to the whole population or just to certain subgroups? |
| Economic | How much it costs (in comparison with non-fortified food) | Too expensive; improper management? | Can the population largely be made self-supporting for their food, using regional resources and markets; do markets impose unhealthy food on the population? |
| Aesthetic | How enjoyed in terms of taste, colour, texture, etc | People don't like the taste/colour of it | To what extent is food items' ideal image influenced by marketing purposes? |
| Jural | Related laws and regulations | Not in line with (emerging) policies and related legal frameworks | Could better regulation (legal incentives) promote the production and consumption of healthier food? |
| Ethical | What is considered good practice | Certain groups in society oppose the essential idea of food fortification | Would food fortification not make the population more dependent on foreign aid and market power? |
| Pistic/fiduciary | The extent to which it require trust? | Certain groups in society do not trust (the scheming behind) the endeavour to promote food fortification | How can people be supported to become stronger agents of their own development? |

technical differences) way, both in terms of their orientations and their implications. It may, for example, suggest that the first two approaches focus on agriculture's functioning in the technical (formative) and economic aspect, whereas the other two approaches call for the need to pay more attention to the biotic, sensitive, and social aspects.

Those two examples illustrate how application opportunities of multi-aspectual analysis are not limited to any scale, level or type of subject matter.

## Comparison and identifying opportunities for mutual enrichment of leverage points and modal aspects

LPA and TOMA share a focus on fundamental structures and processes in systems as well as in wider society. They both do so through a relatively limited set of core categories embedded in a wider philosophy which loads the categories with meaning. We may see this as a way of taking complexity seriously while offering relatively simple, yet profound ways of navigating it. But they do so in different

**Table 6** Systematic comparison of modal aspects and leverage points

| Dooyeweerd's modal aspects | Meadows' leverage points for intervening in systems (indicative only in relation to qualifying aspect) | Abson et al. 2017 (clustering of leverage points) | Robinson, 2019 (adapted rendering in reverse order) |
|---|---|---|---|
| Quantitative | 12. Constants, parameters, numbers (such as subsidies, taxes, standards) | | |
| Spatial | 11. The sizes of buffers and other stabilizing stocks, relative to their flows | Parameters | |
| Kinematic/kinetic | 9. The length of delays, relative to the rate of system change | | |
| Physical | 10. The structure of material stocks and flows, such as transport networks, population age structures<br>(may also considered to be founded in the formative) | | |
| Biotic | | | |
| Sensitive | 7. The gain around driving positive feedback loops (Only in terms of how this is perceived) | | |
| Analytical | | | 7. Add feedback loops |
| Formative | 4. The power to add, change, evolve, or self-organize system structure<br>Only in terms of formative power | Feedbacks | 2. Build skills<br>4. Provide service<br>6. Build infrastructure<br>16. Innovation |
| Lingual/symbolic | | | 1. Communicate facts |
| Social | 6. The structure of information flows (who does and who does not have access to information) | Design | 8. Include less powerful voices<br>9. Create diverse partnerships<br>13. Organising |
| Economic | 8. The strength of negative feedback loops, relative to the impacts that they are trying to correct against (only if considered to be more or less managed) | | 3. Provide resources<br>5. Provide buffers<br>12. Full cost pricing |
| Aesthetic | | Intent | |
| Jural | 5. Rules of the system (such as incentives, punishment, constraints) | | 11. Level playing field<br>14. Change the rules |
| Ethical | 3. The goals of the system | | 10. Accountability<br>15. Build/defend institutions |
| Pistic/fiduciary | 2. The mindset or paradigm out of which the system—it's goals, structures, rules, delays, parameters—arises<br>1. The power to transcend paradigms | | 17. Pivot the purpose<br>18. Change the paradigm |

ways: LPA focuses on systems and system change whereas modal aspects pertain to entities and processes in everyday life experience. This means they take rather a different perspective on systems, which may be a reason for incompatibility and/or complementarity. We focus here on the latter, doing so by comparing categories systematically, as well as by comparing their orientation (what they pertain to) Basden and Wood-Harper (2006) have systematically compared TOMA and the CATWOE analysis from the soft systems methodology (Checkland and Scholes 1999) before, and this articulated TOMA's potential for complementing existing systems approaches.

## Comparing leverage points and modal aspects

In Table 6 we put the modal aspects and leverage points side by side (column one and two), exploring the extent to which there is a similarity in terms of categories and the extent to which there is alignment in the order of categories. We also explore links between adapted categories of leverage points which have been developed (Abson et al. 2017; O'Brian 2018; Robinson 2019). Since O'Brian's categories of practical, political, and personal each relate in the same way to all modal aspects, we do not consider it useful to explore this further. Robinson's adaptation and expansion on LPA are already very much applied to social action, which gives a specific twist to the leverage points, turning them into something which may be more appropriately framed as entry points for intervention.

It becomes clear that the modal aspects and leverage points are not interchangeable, though there is similarity at the head and tail of the lists. Interesting about the observed similarity is that apparently both Dooyeweerd and Meadows at a particular point in time intuitively grasped a certain

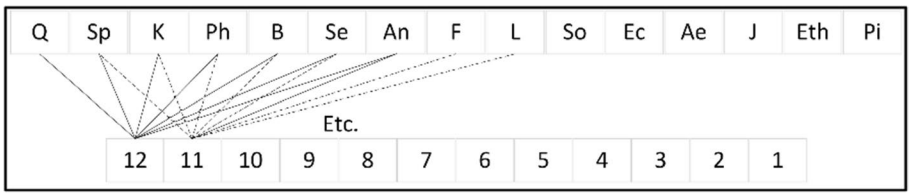


**Fig. 6** An alternative view on the relation between leverage points and the modal aspects

order which formed the basis for what they later presented and further developed. For Dooyeweerd, this was the notion of modal aspects and their order which he observed in entities, and for Meadows it was the leverage points and how they connected to system change. Since they approached reality in a very different way, the similarity between the categories of the modal aspects and the leverage points may be a confirmation that they were on to something foundational (fundamental) for understanding our experienced reality.

Because Meadows was considering action perspectives (i.e. how systems change) her categories appear to remain more intuitive, lacking a further systemization of an underpinning order of things. That is exactly what Dooyeweerd did do, however, thus providing a way of interpreting the leverage points in a more systematic way. For example, Table 6 shows how the leverage points seem not to connect to a number of modal aspects, which means it may not link to particular spheres of life and thus may not be adequate in exploring system change opportunities in relation to particular types of systems.

In the comparison presented in Table 6 we have connected the leverage points to various modal aspects that could be seen as qualifying for those factors. A different way of relating the modal aspects to the leverage points is to consider how the leverage points since they are about intervention processes (i.e. entities), function in all modal aspects (Fig. 6). One may argue that LPA as such is qualified by the formative aspect and founded in the analytical aspect, while leverage points themselves carry the connotations of the quantitative aspect. This focus on points may actually be considered inappropriate in view of system dynamics—it may be more appropriate to consider leverage pathways involving a certain number of leverage points addressed in a particular order. That involves a process of leveraging, observing effects, responding, further leveraging, etc. This helps to better connect to theories of change (ToCs), which are widely used in the planning and design of interventions and in relation to perspectives on system change. Alternatively, we may also consider each of the modal aspects to characterize leverage spheres.

The difference in the approach underpinning modal aspects and leverage points also needs to be highlighted. LPA suggests options for intervention. It leaves choices open as regards what leverage point will be considered appropriate (hence its limitations in providing normative perspectives). Furthermore, the meaning and value of leverage points are connected to their ability to influence system change. The modal aspects, however, are not entities, but aspects; they do not refer to options and they have an intrinsic value and meaning which is not related to their functioning; they are all equally important. They are not meant to be considered separately, but interactively and in their coherence. In addition, they are not about intervention (to influence system change) as much as they serve to describe system integrity, system coherence, and system qualities. In terms of providing integral views on what sustainability transformations involve, the modal aspects may, therefore, provide a broader basis than the leverage points. The other way around, since the theory of modal aspect is not providing clear perspectives on system dynamics, its usefulness can be improved using it together with the leverage points approach.

## Opportunities for complementarity and mutual enrichment

As argued above, LPA informs about how system change can be leveraged. It provides suggestions for intervening in systems based on an articulated view on system dynamics. That is something which TOMA does not provide a good basis for. However, TOMA can complement LPA in five ways:

In the first place, by helping us think systematically about which transformations are appropriate and which are not in view of the extent to which all the modal aspects and their normative imperatives are taken into account. We may frame this as responsible leveraging of sustainability transformations. LPA is meant to help identify 'places to intervene in systems', but it does not offer any grounds for considering what would make for a good systems transformation or a marked improvement. As a consequence, the focus may tend to revolve too much around what makes for change and too little on what exactly changes, why, and what would be wider implications.

In the second place, Dooyeweerd's framework and its underpinning philosophy provide a foundation for grounding LPA better in relation to what sustainability and sustainability transformations entail.

In the third place, LPA focus on intervening in systems. TOMA provides a stronger basis for articulating and comparing different actor perspectives, as well as for considering

**Table 7** Modal aspects in relation to categories of MLP and wider transitions thinking

| Modal aspects | MLP categories | | | Types of transitions (e.g., Loorbach et al.) | | | Complementary idea |
|---|---|---|---|---|---|---|---|
| | Niche | Regime | Landscape | | | | |
| Numeric<br>Spatial<br>Kinematic/kinetic<br>Physical<br>Biotic<br>Sensitive<br>Analytical<br>Formative<br>Lingual<br>Social<br>Economic<br>Aesthetic<br>Jural<br>Ethical<br>Pistic/ fiduciary | Considering leverage points across modal aspects | Considering leverage points across modal aspects | Considering leverage points across modal aspects | Socio-ecological | Socio-technical | Socio-institutional | Socio-visionary |

implications of transformation processes for their lives from an integral perspective.

In the fourth place, Meadows ordered the leverage points according to the amount of leverage they have. She assigned the largest leverage to leverage points corresponding to the ethical and pistic aspects of Dooyeweerd's suite. This accords well with Dooyeweerd's idea of retrocipation, in which functioning in later aspects affects that in earlier aspects by opening up their meaning. The later aspects, especially pistic and ethical, have the potential to make the largest impact since they retrocipate more aspects. Thus, TOMA can contribute to a useful philosophical basis on which to understand leveraging.

Lastly, we have noted how several aspects are not matched by LP (as shown in Table 6). This presents an opportunity to enrich or complement LPA with a view on leverage points related to issues (aspects) that may tend to be overlooked.

Based on this brief exploration, we conclude that the leverage points approach takes systems thinking and system change as its point of departure, whereas TOMA involves a more fundamental approach: it identifies modal aspects that can be distinguished consistently and systematically in all entities and processes of everyday experience. Considering similarities and differences, TOMA and LPA together may be understood as providing a rich map with two complementary layers of understanding, leaving choices regarding navigation to the ones using the map, while accommodating diversity in perspectives and preferences among stakeholders in sustainability transformations. Multi-aspectual analysis is, therefore, not a competing approach to LPA, but rather provides a complementary perspective on what exactly changes, what is meant to change for what reason, and how we may systematically consider contributions to sustainability (transformations) at all levels and scales ranging from individual practices to world systems.

## Discussion

In "The theory of modal aspects and its view on sustainability" and "Illustrating the theory of modal aspects as analytical framework: the case of food system transitions to sustainability", we briefly presented TOMA and an example of multi-aspectual analysis, and subsequently explored connections between TOMA and (a broader view on) LPA in "Comparison and identifying opportunities for mutual enrichment of leverage points and modal aspects". In "Comparison and identifying opportunities for mutual enrichment of leverage points and modal aspects" we considered how one may complement the other, providing opportunities for enhancing an integral approach to leveraging sustainability transformations. In this section, we discuss what we may deduce from this regarding what TOMA offers with respect to the needs of sustainability transformation research, policy, governance, and interventions.

### Responding to the need for consistently integral perspectives

TOMA appears to respond well to what Luederitz et al. (2017) are looking for in terms of an integrative approach to "potentially help bridge different intervention types and connect fragmented actors at multiple levels and across multiple phases of transition processes" (Luederitz et al. 2017, 393).

TOMA presents an approach which helps to load 'sustainability' with deeper meaning while providing a consistently integrated and systematic perspective on every day experienced reality (cf. Theos 2010). It can be applied consistently across scales, levels, and subjects, which presents an opportunity to serve as a shared reference in research and debate. Table 7 explores the connection between TOMA, MLP and wider transitions thinking as a broader context for applying LPA. Wigboldus et al. (2016) have made an initial attempt to make such connection useful in analysis. TOMA may also be useful for developing appropriate indicators of food system (transitions to) sustainability to evaluate and inform related propositions such as put forward by Béné et al. (2019), IFPRI (2016), and Murray and Koehring (2018). By doing so TOMA can contribute to the operationalisation of sustainability (Osmundson et al. 2020).

### A way to engage with complexity without getting lost in it

TOMA is about clearly distinguished modal aspects, but the way in which they can be used in analysis and for organising perspectives is quite flexible. This is because it is grounded in everyday life experience and not in a particular approach to systems or wider complexity. The modal aspects are meant to make sense intuitively to those observing things in everyday life (Basden 2011). The similarities between TOMA and the leverage points and their similar way of intuitive conceptualisation as referred to in 4.1 appear to support this claim. Moreover, they are not specific to a particular level or scale of application: it is the same set of modal aspects that applies to a thing, a process, a system, or even issue (e.g., climate change). Once you know the modal aspects in their particular order, and the basic philosophy underpinning this set, it can be applied in any analytical and sense-making process. It does not require one to grasp complex models or diagrams. Many have used it simply as a checklist for quick assessment (e.g., Wigboldus 2016), but it can be used in the comprehensive assessment as well (e.g., Brandon and Lombardi 2010; Brandon et al. 2017). As discussed in "Comparison and identifying opportunities for mutual enrichment of leverage points and modal aspects", TOMA enhances opportunities for engaging with system complexity by offering opportunities for using it side-by-side with approaches such as LPA.

### A way to engage with normativity in transition processes

Sustainability transformations and (food) system performance are inherently political and involve different views and visions, requiring 'systemic ethics', as Bui et al. (2019) argue. We suggest that LPA does not provide a sufficient basis for systematically exploring related normative perspectives at all relevant levels and scales. A multi-aspectual analysis can help identify and articulate normativity issues at different levels and scales, inform monitoring and evaluation frameworks, and thus enable picking up warning signals earlier, before effects of (emerging) disharmony at the level of concrete entities and processes affect wider system performance and outcomes (Gee et al. 2013). As such, it may inform the application of the precautionary principle in concrete cases (Steel 2015). This also applies to real-time evaluation of how alleged sustainability transformations are working out. Though TOMA provides a framework for considering what needs to be included and addressed in a normative perspective on practices, it is not prescriptive in the sense that it does not provide a one-and-only normative perspective on a particular situation or process, leaving room for specification (of what the aspects relate to) and application (in terms of interpretation).

### A way to foster constructive debate

In a multi-aspectual perspective, unsustainability in one place (or entity) cannot be compensated for by having more sustainability somewhere else, even though in actual practices, we have to accept trade-offs born of prioritising certain aspects (e.g., respect for animal welfare (biotic and sensitive) versus efficient animal production). This directly relates to debates on ecological footprints (e.g., Rees and Wackernagel 2013), foodprints (e.g., van Dooren and Bosschaert 2013), and carbon credits (Anderson 2012). There can be no leveraging of sustainability transformations in isolated pockets, nor can it be achieved at any 'systems level' without being grounded in sustainability in all its constituent parts. As Rockström et al. (2020: 3) argue, "gone are the days when it was enough to 'think global and act local'. All our actions aggregate and are interconnected with the global commons and the Earth system". TOMA is not political in the sense that it does not favour any particular political agenda. All agendas will be assessed in the same way with respect to the modal aspects. Such an assessment can, however, have political implications if it reveals a reductionist approach or exposes implications of a rhetoric of providing "solutions" (usually technologies) by articulating what it does and does not solve, potentially showing how it may be solving one issue, but simultaneously be creating another.

TOMA can complement systems thinking in an age in which people embrace systems thinking as a paradigm without considering its wider implications (Basden 2018). In systems thinking, the danger of machine-thinking (with its mechanistic view on change processes) always lurks around the corner. TOMA can help move away from a deterministic and constraining system perspective.

**Table 8** The modal aspects as framework in support of interdisciplinary work

| Modal aspects | Examples of related literature on sustainability and sustainable development in general |
|---|---|
| Quantitative | "From goals to joules: a quantitative approach to interlinkages between energy and the Sustainable Development Goals" (Santika et al. 2019) |
| Spatial | "The geography of sustainability transitions: review, synthesis and reflections on an emergent research field" (Hansen and Coenen 2015); "Toward a spatial perspective on sustainability transitions" (Coenen et al. 2012) |
| Kinematic/kinetic | "Impacts embodied in global trade flows" (Wiedmann 2016) |
| Physical | "Evaluating sustainable development in the built environment" (Brandon and Lombardi 2010) |
| Biotic | "Monocropping cultures into ruin: the loss of food varieties and cultural diversity" (Jacques and Jacques 2012) |
| Sensitive | "Psychology of sustainability. An applied perspective" (Jones 2014) |
| Analytical | "Transition to sustainability: a change in thinking about food systems change?" (Hinrichs 2014) |
| Formative | "Transforming innovation for sustainability" (Leach et al. 2012) |
| Lingual | "Framing in sustainability science" (Mino and Kudo 2020); "the end of sustainability" (Benson and Craig 2014) |
| Social | "Shifting power relations in sustainability transitions: a multi-actor perspective" (Avelino and Wittmayer 2016) |
| Economic | "The concept of stewardship in sustainability science and conservation biology" (Mathevet et al. 2018) |
| Aesthetic | "Beyond green: the arts as a catalyst for sustainability" (Sidford and Frasz 2016) |
| Jural | "The justice dimension of sustainability: a systematic and general conceptual framework" (Stumpf et al. 2015) |
| Ethical | "Working towards sustainability: ethical decision-making in a technological world" (Kibert et al. 2011) |
| Pistic/fiduciary | "Towards a theology of sustainability" (Bookless 2007); "Rethinking science for sustainable development: reflexive interaction for a paradigm transformation" (Kläy et al. 2015) |

## Towards consistently integral guidance in sustainability governance

It will often not be possible to reach full harmony in everything and at every scale and level by sheer human effort. However, the modal aspects provide a consistent perspective on what to take into account when engaging with sustainability transformations. In comparison, Sachs et al. (2019) consider six areas of transformation and provide helpful translations to responsibilities of different government institutions, thus enabling a way of keeping an integrated perspective on the SDGs active. This effort would be helped by a systematic perspective on interrelationships among domains of change related to the 17 SDGs—otherwise it will merely be a grouping of the 17 SDGs into six SDG-areas. Similarly, Fazey et al. (2018) propose "ten essentials for action-oriented and second order energy transitions, transformations and climate change research". Again, this is not built on a consistent and integral perspective on reality. Though intuitively making sense, the categories remain arbitrary for that reason. TOMA offers consistently integral guidance in considering what promotes sustainability (harmony) at all levels and scales. This does not solve all differences in opinion (including as regards what is considered to be qualified by what modal aspect) (Freeth and Caniglia 2019), but it does foster an appreciation for different angles represented by different participants in partnerships, including in interdisciplinary research (see Table 8, which illustrates how different literature on sustainability and sustainable development can be grouped in relation to different modal aspects). This is also relevant for models, simulations and statistics, which play a major role in sustainability governance. It is critical to understand what is and is not taken into account in their design and interpretation. A consistently integral perspective across scale levels such as the modal aspects offers can help guide model development and interpretation.

In short, TOMA responds to the challenge posed by Patterson et al (2017) regarding fragmented approaches to societal transition/transformation processes and the need for a stronger foundation for future research on transformations to sustainability. TOMA provides a coherent and consistent view on sustainability transformations as "multiple transformations that intersect, overlap and conflict" (Scoones et al. 2015: 15), which allows for "[considering] change in multiple interconnected areas (e.g., social, institutional, political, ecological, technological, cultural) in contextually relevant ways" (Patterson et al. 2017: 12).

## Conclusions

The name 'theory of modal aspects' may give the impression of being for theorists and philosophers only, but nothing could be farther from the truth. Kurt Lewin's maxim—"there is nothing as practical as a good theory" (Lamond 2015)—applies to TOMA. It is a good theory because it supports the development of practical insights, and also because it is both profound and elegant in its structure and in the application options it offers. We demonstrated how it can complement LPA and wider approaches to sustainability transformations, strengthening their efficacy. Its fundamental orientation to everyday experience rather than to systems is a refreshing

perspective that balances system approaches with an appreciation of the particular, where each practice, each entity, etc. matters. It takes individual practices and entities as the point of departure and from there allows for building an image of entanglements, constellations and interactions, which may be expressed in systems terms. The same goes for action perspectives: entities and processes are the interfaces for interventions in relation to changing numbers, rules, or paradigms. It thereby complements systems thinking and helps to avoid possible pitfalls of reductionist perspectives on systems.

We have shown examples of ways in which TOMA can be applied in the context of sustainability transformations, and this may inspire the exploration of further options for specific contexts. There is a need for developing more practical tools and processes in facilitating multi-aspectual analysis and related sense-making processes. The simplest way of using it is as a checklist, and scientists from sociologists to astronomers have found it to be very helpful as such. It is a framework that is sustainable in the analytical sense because it could be applied 50 years ago as well as it can be applied today. This makes it particularly useful in the context of sustainability transformations, which concern longer-term processes.

We demonstrated its usefulness for sustainability governance, e.g., by shedding light on the SDGs, supporting its underpinning integrated perspective and helping to see coherence among the 17 goals. This makes it a good candidate for guiding the governance of the SDGs backing up a SDG-0 proposition (Raworth 2019), which is about activating an integral perspective in all efforts framed as contributions to specific SDGs. Finally, we demonstrated the value of TOMA for interdisciplinary work, which often lacks an integral framework and a clear, consistent, and coherent perspective on the complementarity of scientific disciplines and areas of research. The same applies to opportunities for using TOMA as a shared reference framework in debates on (contested) approaches to sustainability transformations. We also concluded that it has its own limitations, which may be addressed using it interactively with complementing approaches such as LPA and MLP. This has been explored to some extent earlier in relation to scaling innovations for sustainable development (Wigboldus et al. 2016) and it would be good to further explore (methodological) options and opportunities in the context of sustainability transformations.

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