Visualize sustainability

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The debate on definitions of sustainability and sustainable development continues is alive and well after fifty years. What the debate reveals is that there are multiple perspectives, ideologies and projections involved, and that these concepts of hybrid ones. This hybridity is also reflected in the long tradition of representing these concepts, as triangles, circles, systems diagrams and living organisms, among others. In the same way that the definitions of sustainability and sustainable development have been organized by typology, these representations can also be grouped according to similar features, characteristics and etiologies. A typology of visual representations of these concepts is important for two reasons. The first is that it supports reflexive processes in education and communication. The second is that it reveals the complexity and hybridity of these contested concepts.

Keywords: visual representations ; sustainability ; sustainable development

1. The concept of sustainable development

Sustainable development and sustainability are concepts that can be understood from different perspectives and approaches. They are also contemporary metanarratives in that they are widely used to reflect particular worldviews. To be clear from the outset, our understanding of the concepts is as follows. Sustainability is a dynamic condition of an inhabited or uninhabited place or space, which reflects the ways in which different material and immaterial elements are interrelated. This concept is closely related to common interpretations of the homeostatic nature of socio-ecological systems (SES). All places and spaces can be understood to have a condition of sustainability, which may range from very weak, where one dimension is emphasized to the detriment of others—to very strong, where there is a balance between, rather than a substitution of, these dimensions that enable society and nature to co-exist and thrive ^{[1][2][3][4]}. Sustainability is a positive concept, as it reveals 'what is'. However, sustainable development is the process by which there is an actor-driven transformation in this condition ^[5]. It is a normative concept, teleological, projected, and planned, revealing 'the production of what might be'. Based on this same distinction, institutional or governance aspects are often lacking in the former, and should always be present in the latter since the agents of change have to be clearly identified. What we know from the literature, however, is that our definition or understanding of these concepts is not unique. They are hybrid concepts with multiple definitions.

Broadly speaking, there is no consensus on the definition of sustainable development, although the widespread use of the World Commission on Environment and Development definition in *Our Common Future* suggests that this is the de facto choice within this polysemic textscape ^[6]. What is clear, however, is that there is considerable skepticism associated with the concept, especially as it has evolved out of postwar multilateralism and alongside neoliberalism since the 1980s. Critical voices note that a leopard never changes its spots. This skepticism has also been part of the production of diverse conceptualizations of sustainable development, as competing definitions and associated narratives have been devised to challenge core values, principles, drivers, and responsibilities in transformation processes ^[Z]. This in turn has led to considerable 'noise' in the debate, and a general perception that sustainable development is such a malleable concept that it serves each to their own.

A principal element of this 'noise' is the challenge of simplifying SES and their development (understood here as transformation), through time. The essence of communication is clarity through reduction ^[B] or, in mathematical education terms, a 'didactical transposition' ^[D] or process through which "knowledge inexorably undergoes when it is adapted from its scientific/academic character to the knowledge as it is to be taught" ^[10] (p. 236). However, regarding the political background and roots of sustainability and sustainable development, understandings and the portrayals of knowledge—as socio-ecological change—are neither neutral nor easily reduced ^[11], due to the interrelatedness of phenomena, diversity of knowledges and experiences involved, and the interlocking scales and temporal dimensions. The simplification of a universal consensus of an abstract model of sustainability and sustainable development is political in essence since a message is being delivered. The diversity of messages that have emerged have explicit or implicit indications of causality and responsibility, and new pathways of transition or transformation.

2. Visual concept of sustainable development

Visual representations support these messages as a means of supporting explanation and improving communication. These representations (images, figures, and models) are presented in diverse numeric, symbolic, causal, and artistic constructions, as they seek to communicate with different audiences. A picture may be better than a thousand words to communicate a concept, or it may fail miserably, leaving the receiver with little or nothing in terms of understanding. The word hybrid is highly appropriate in this context, both for understanding, definition, visualization, and communication. It is precisely this hybridity that is important, in order to explore the different attributes for envisioning a concept: triggering the external memory and long-term memory; reorganization of information in the working memory; and the links between concept and tangible elements ^[12].

There can be little doubt that visual representations have evolved alongside definitions of sustainable development, and that they are mutually reinforcing. From the flow diagrams of the 1970s to the building blocks of the Sustainable Development Goals in 2015, via Venn and Euler diagrams, 'environmental space' ^{[13][14]}, prisms ^[15], hexagons ^[16], and metaphorical visual allusions, e.g., of sustainable development as a tree ^[127], visualizations have all influenced how the concept has been communicated over time. Some are diagnoses (of the order, hierarchy, and relationships between variables), while others are idealized states (indicating expectations from development processes), but they are rarely compared or analyzed. A typology can be constructed that compares and contrasts alternatives that have been circulating over the past fifty years, based on etiology and intention. This typology provides a means of classifying current and future representations, recognizing the diversity of organizing ideas and representations of SES and their transformation. The methodology for constructing this typology is based primarily on designing a categorization of common features in these representations in order to recognise the dominant forms. The typology in the paper by Barton and Gutiérrez titled 'Towards a visual typology of sustainability and sustainable development' is an example of this process. It is exploratory in nature, and descriptions of the principal features of each are provided in order to support future categorizations as new representations emerge. The examples are drawn from a search of representations in academic literature and also from collections of images that have been brought together in online sites.

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