

Extended Reality (xR) Unified Field Theory: Combining the Econometrics of Network, Spatial, and Panel Data, with XR Immersive Experience for XR Futures Foresight to See New Solutions to Global Problems

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Abstract

Solving global problems requires staying *ahead of the curve*. This paper presents a critique of current approaches using spatial, panel, and network data for economic, social, and political decision-making under risk, and develops an alternative model called Cross or Extended Reality (xR) Unified Field Theory. Currently, a single theoretical framework (i.e. an xR unified field theory) does not exist that is flexible enough to account for the fundamental forces of nature and relativity across a continuum of variables at different points in space and time which influence how global problems such as ocean plastic pollution, climate change, or global pandemics like COVID-19 are addressed. This paper describes an xR unified field framework that permits us to use pairs of physical and virtual fields for futures foresight. Physical fields are defined by numeric values where there is a value for each point in space and time as captured in spatial, panel, and network data. Virtual fields are temporary changes around a point in space that can help us to understand relative changes when we change our frame of reference in space and time. Using the global problem of ocean plastic pollution as a proxy, it examines how network, spatial, and panel data can be paired with virtual data under unified field theory. The theory is tested using a proactive XR (virtual, augmented, and mixed reality) futures foresight approach which enables individuals and organizations to examine how reflexive and prepared they are to address alternative futures. This research introduces an XR futures foresight framework which combines virtual, augmented, and mixed reality technology with spatial, panel, and network data. It finds that pairs of physical and virtual fields can allow individuals “not so much to see what nobody has yet seen, as to think what nobody has yet thought, concerning that which everybody sees” [1] relative to their local frame of reference and across a continuum of variables that can be infinitely expanded across space and time. It can enable people to make more informed local agreements and pre-commitments to address complex global problems.

Introduction

How do we stay ahead of the curve? According to the World Economic Forum, “Every minute, one garbage truck of plastic is dumped into our oceans. This has to stop” [2]. Yet, the problem has not stopped. It has continued to grow. Across all fields from economics, business, social policy, public policy, marine ecology, sociology, health policy, inter-cultural sustainability, to marine life, the problem of ocean plastic pollution has widespread impacts. Ocean plastic pollution is a commons problem which also impacts local shared resources such as fisheries contaminated by micro-plastics. It’s generally accepted in normative models of public choice theory that individuals can effectively self-regulate when it comes to managing local shared resources. And indeed they may. Yet, this research finds that when projected globally the problem with applying this theory to practice is the fallacy of composition –the belief that “what is true of each member of a class or part of a whole will be true of all together” [3]. It drives the gap between the theory and the practice of individual and global self-regulation. The present paper describes a single theoretical framework (i.e. a unified field theory) and an applied XR futures foresight framework that permits us to examine pairs of physical and virtual fields proactively to make more informed decisions to address global problems that span space and time.

Methodology

Extended reality (aka X-reality or cross reality) refers to the combining of virtual and real interactions with human and machine. This research uses: Virtual Reality (VR), Mixed Reality (MR), and Augmented Reality (AR) to create XR immersive experiences where people feel that they are transported in space and time. Individuals experience ocean problems from the highly realistic virtual vantage point of being in the depths of the sea or in outer-space looking at the world’s micro-plastic plumes for example. The cross-divisional Oxford Theatre of Transformation (ToT) Methodology, frames the research. It involves four key steps: 1. “Witness what is”, 2. “Awaken what can be: From facing deadlock to Envisaging multiple possibilities”, 3. “Envision Change”, and 4. “Enact Transformation” [4]. In a series of studies we observe the participant’s cognitive and behavioral decision-making responses to immediate and long-term scenarios. Through post experience questionnaires and revealed preference analysis we examine how it ties to the making and keeping of sustainable agreements for the environment and its economic and social ripple effects.

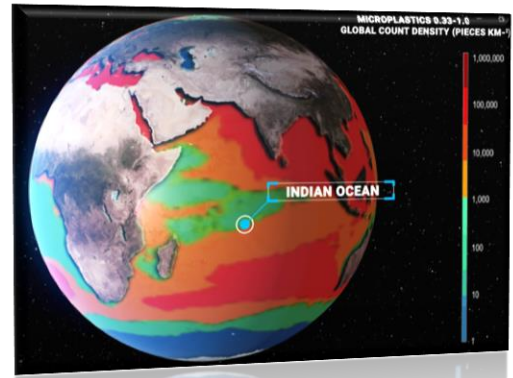


Figure 1. We combine spatial data on global micro-plastics (0.33-1.0 mm) afloat in the sea at global count density (pieces KM^{-2}) from Erikson et al 2014 [5] into a virtual reality frame. Within this virtual frame there is also paired data from multiple datasets containing panel, spatial, and network data related to ocean plastic pollution. The user is able to seamlessly experience these data in a new way and from multiple vantage points in space and time as they explore the world and the data on ocean plastic pollution using XR (virtual, augmented, and mixed reality) technology. 360 interactive visualization (EK,2020).

Results and Discussion

Through a series of studies, we discover that XR futures foresight can impact both near-term thinking and how we think about the future, and may help inspire more effective connections between local solutions and global problem solving.

There are four emergent theories that are relevant:

- *Construal Level Theory* holds that we think about events and objects more concretely and less abstractly when we perceive them to be spatially, socially, temporally, and hypothetically less distant [6]. The ocean is often seen as distant. XR can make ocean problems more proximal and concrete and less abstract.
- *Semantic Prospection* is how the mind simulates future thinking. XR immersive experiences can help people envision events at a future point in time. This may inspire them to change the likelihood of certain outcomes occurring through the making of sustainable agreements.
- *Alternative State Theory* [7]. This theory holds that alternative states of the world (including virtual or counterfactual states that the user experiences) may: (a) have real influences on the making and keeping of agreements, (b) reinforce or alter existing agreements, and (c) produce economic, social, and ecological multipliers or ‘Ripple Effects’ [7].
- *The Paradox of Rational Self-Interest* [8] explains that individuals acting in their own rational self-interest in the transactional environment can cause themselves harm in the larger contextual environment [8]. XR futures foresight helps them recognize this.

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