Reinterpreting Procedural Utility in Land Use Frameworks: A Quantitative Approach

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Reinterpreting Procedural Utility in Land Use Frameworks: A Quantitative Approach

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The notion of complexity brought about the systems theory's ontology as a set of components within a system, and it brought about the chaos's theory temporal view of change from simple to complicated (Roo, 2010a, 2010b). This put forward the potential of looking into the tangibles and intangibles within the city as interactive components (Hillier, 2012); such components change the city from a simple to a more complicated state. In fact, the tangible changes within a city are reflected as the complex process of spatial urban transformation and growth while the intangible changes are a set of complex socio-economic processes (Hillier, 2012; Roo, 2010a). Hereby, the urban growth or land use transformation (spatial), from a complexity point of view, is connected with multiple land market processes (socio-economic) that lead to transforming the city to a more complex state. Despite such view, the analysis of land markets using land use simulations have been dependent the modeler's decision of choosing a theoretical framework that fits the modelling purpose (Lee, 1973, 1994) which may or may not comply to the multiplicity of socio-economic and spatial complexity. In most cases, this confined land use models to a defined set of interactions based on one, or more, chosen framework(s) such as bid rent theory (Magliocca, Safirova, Mcconnell, & Walls, 2011), location theory (Chen, Gong, He, & Luo, 2002; Lee, 1973; Mitsova, Shuster, & Wang, 2011; Ward, Murray, & Phinn, 2000), gravity modelling (Lee, 1973) and hedonic price estimation (Filatova, 2015; Xiao, 2017). In fact, each land use simulation model uses a framework for one land market process and approach land plots instrumentally (examples; Evans & Kelley, 2004; Honghui, Yongnian, Ling, & Xijun, 2010; Magliocca et al., 2011; Mena, Walsh, Frizzelle, Xiaozheng, & Malanson, 2011; Salvini & Miller, 2005). In other words, the models are designed so that land use change occurs due to decisions made in a land market in which land plots are assigned a set of instrumental attributes, such as spatial location and expected price (example for hedonic spatial price estimations; Filatova, 2015). In most cases, these attributes are weighed differently to compensate for the subjective view of users in the land market where a decision of acquiring a land is made if the degree of benefit gained exceeds the price's value (random weights example; Salvini & Miller, 2005). The simulation models define such benefit as an instrumental utility as calculated preferences of the users and make a decision. However, these models do not take into account the possibility of the presence of multiple land market processes that can be valued differently; i.e. procedural utility (Frey, Benz, & Stutzer, 2004; Frey, 2008) is not taken into consideration. In other words, by analyzing the land use transformation using one market mechanism based simulation models (examples include as previously mentioned, 1) bid rent, 2) auction and 3) hedonics price market), such models and theoretical frameworks provide a limited view of the city as a complex system with multiple processes of change.

Based on the presence such gap, this paper proposes an alternative approach to analyzing spatial changes in cities by taking into consideration the presence of multiple land market institutionalized processes which users (actors) value differently. In fact, the literature defines the concept of procedural utility as the notion that people value the process of reaching the end goal along with

the goal itself (Frey, 2008). Such understanding of utility defines it as the happiness and well-being achieved by processes rather than instrumental outputs (Frey, 2008). However, such concept does not completely fit to a land use framework since on the one hand, the procedural utility concept is indicated or measured through the well-being and happiness provided due to the fairness of a process (Frey & Stutzer, 2005); democracy is an example of such fairness aiming processes (Frey, 2008; Frey & Stutzer, 2005). On the other hand, market processes include competitiveness and is highly tied to price and materialistic gains.

Hence, this paper focuses on reinterpreting procedural definition to fit within land market frameworks and focuses on providing a quantitative approach for calculating such utility supported with empirical methods of measuring it. To do so, it provides 1) a framework for identifying the mathematical relations between the procedural utility and the output utility based on different land attributes, and 2) a simplified hypothetical case in which procedural utility is equated numerically based on a land market of buyers, processes and land plots with attributes. By reaching such quantitative approach, this paper showcases the potential of applying procedural utility in process based land use simulation models either by adding a temporal factor to simulate changes in land use, land market and procedural utility, or by coupling the procedural utility calculation model for process choice with an agent based land use simulation model.

KEYWORDS

Land Use Transformations / Procedural Utility / Land Market Processes / Complexity / Agent Based Model