Systems Theory Archetypes in UX Journey Mapping for Identity Formation, Understanding, and Analysis

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Abstract

Professional identity formation is a complex and developing field of study. Current research work in studying the formation of identity has been explored in a myriad of environments. Such areas as student development, workplace identity, identity within a profession, etc. have been the subject of study for some time now. More intricate inquiries such as how to develop a research identity in doctoral students are being explored. Documenting researcher identity development is critical for designing student-centered doctoral programs. A critical aspect of the development of doctoral students is learning how to become a researcher. Current studies to properly analyze identity development have employed user experience (UX) methods such as journey mapping, which are invaluable in capturing the complexity and richness in this multifaceted landscape. UX mapping methods allow for the development of identity "personas," which are composite descriptors forming a fictional character representative of target users. Personas assist in "framing" a deeper understanding and empathy with the target audience. This UX approach creates several "personas" to capture the sample audience being serviced. Combining UX personas with Systems Theory Archetypes, expands research in this area to better reflect the repeating patterns of user needs, which assists user-focused decisions in the educational curricular design process and mentorship development of the emerging scholar. This research presents the developing work on systemic archetypes for researcher identity personas to assist in doctoral scholars' formation.

Keywords

Researcher Identity Development, Journey Mapping, UX Methods, Systems Theory, BOT Methods.

Introduction and Review of the Current State of the Art

Identity in Engineering and Identity: The concerns and issues revolving around the concept of identity formation have been prevalent in both the general societal narrative as well as the specific research and pedagogical narratives. The engineering field is not void of the impact and influence that is now so prevalent concerning identity and identity formation. Identity, as a concept, is a foundational concern in, philosophical studies specifically being an ontological topic. Identity is of concern to the areas of metaphysics, epistemology, and ethics. Several researchers have placed their efforts into better understanding this elusive, controversial but ultimately important topic that impacts most all areas of society [17]. The complexity of the subject matter requires an understanding of the intricate definitional nuances involved in this area of research and practice.

Being subject matter in philosophy, identity formation touches upon the areas of ontology and epistemology. It must be noted that the area of metaphysics is excluded from this analysis, since a basic assumption here is not questioning the fundamental nature of the reality of identity per se but exploring what is currently known about the study of identity, identity formation, and how industrial engineers concerned with the technical management of organizational complexity might benefit from this analysis. The study of 'being" is the ontological realm. It investigates the nature of being and the common features of all entities classified in the specific "being" under study with the inherent classification of the possible categories.

Epistemology, on the other hand, is concerned with the study of knowledge itself and how it is acquired. Though the ontological and the epistemological overlap, they are certainly not equivalent. Thus, the ontological is concerned with does the entity "exist" and what is its composition? Whereby the epistemological concern is rooted in how we know it exists – how we use our experience and reason to understand and know an entity or concept. To operationalize this interface between the ontological and epistemological critical propositions are explored to balance some known truths and accepted beliefs to reach possible repeatable knowledge (see Figure 1).
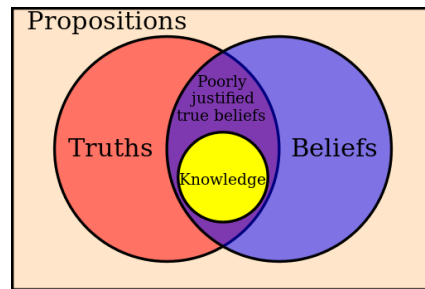
Figure 1. Propositions to Knowledge visualization. [Adapted from 2].

As industrial engineers, the ability to define and map known characteristics and repeatable patterns of systemic behavior of processes, as well as the formulations and concepts allows for the creation of a scientific approach to managing complex technical or socio-technical systems. It was the British philosopher Edwin Locke in his 1690 publication titled *Essay concerning Human Understanding* that the first known link to the exploration of identity was noted [10]. Locke links consciousness to identity, ("consciousness makes personal identity"). He then makes clear that "consciousness makes the same person," observing that identity is evolutionary in individuals over time and that "personal self at one time, may be varied at another," [15]. This conceptually sets the foundations for the mapping of identity characteristics and the temporal nature of identity that can also be mapped (identity formation). This conveys the essence of the study presented in this paper which explores the evolving nature of the current research to better map identity formation and how the merger of the use of UX (User Experience) methods can provide a structured way to better understand and map identity formation. The use of Journey mapping and "persona" construction along with Systems Theory and Dynamics modeling techniques such as BOTs (Behavior-Over-Time graphs), CLDs (Causal Loop Diagrams) incorporating the repeating patterns found in CLDs and Systems Archetypes is presented as a possible avenue to capture the temporal shifts in identity formation.

In addition, it is important to note that the study of identity and identity formation was further developed in the early 20th century (1934) by the work of the American sociologist George H. Mead. In his work, *Mind, Self, and Society*, Mead explored the social characteristics of identity [16]. Specifically noted was that there are differing social factors which form and impact the sense of self in the individual. Tajfel [22] in the late seventies looked at the importance of social belonging in identity and identity formation. He specifically believed that it was of the upmost importance that an individual sees him/herself as belonging to a group because of the enormous influence on identity formation of the individual due to the sense that membership in the group provides. Thus, current concerns with developing specifically such aspects of identity formation to a profession cannot overlook the importance that group dynamics play in that formation. Other critical developments in the research on identity and identity formation are provided in Table 1 summarizing an annotated but not exhaustive review of some impactful work done in this area of research.

To further develop the conceptual foundations presented thus far into a coherent methodological approach for merging UX methodological approaches and Systems Theory mapping structures, several other points must be addressed. Specifically, it is requisite to explore the Intersection of User Experience (UX) & Systems Theory Methods, their specific methodological approaches, and some foundational Systems Theory concepts and approaches to lay the infrastructure of the work being proposed in this current research effort. The following sections address these concerns.

Exploring the Intersection of User Experience (UX) & Systems Theory Methods. The use of integrating UX (user experience) Journey mapping strategies combined with Systems Theory and Dynamics mapping techniques such as Behavior Over Time (BOTs) graphs has been explored [3]. The next logical step in this line of research into UX journey mapping and Systems Theory graphing of temporal behavior of a system is to further explore how each of these well-established areas of research and practice would proceed. UX journey mapping assist researchers and practitioners of the science to then develop persona constructions to better encompass, visualize, and understand the user (customer) being evaluated and designed for. In the Systems world, BOT graphing lays the foundation for developing Causal Loop Diagrams (CLDs) which encapsulate and graphically represent the intricate behaviors found in complex systems (individuals also being seen as systems with intricate and elaborate behavioral patterns and expressions). Through time it was found that the development of differing CLD patterns formed repeating

structures of CLDs known as Systems Archetypes. The ongoing research presented here explores this next level of development in identity and identity formation which is believed will be beneficial to industrial engineers, technical managers, and researchers who are involved in this area of professional practice and research.

Table 1: Abridged Historical Development of Identity and Identity Formation.

Year	Researcher	Contribution	Source/Reference
1956	Erik Erikson	Early definition of identity as "an individual's link with the unique values, fostered by a unique history, of his people"	see [7]
1968	Erik Erikson	Elaborated identity definition describing it as "the awareness of the fact that there is a self […] the style of one's individuality, and […] one's meaning for significant others in the immediate community"	see [8]
2002	K. Evans	Elaborated on the definition of identity by applying specific social constructs the aspect of "being a self" can be fully recognized	see [9]
2012	D.M. Hatmaker	Noted that engineering identity formation for decades was understood and defined as "what it is engineers do, what they know, and what it means to be an engineer"	see [13]
2016	A. Godwin	Noted the consensus from several studies in engineering education, which identified that a strong engineering identity is a "significant indicator of educational and professional persistence" and described engineering identity as a "particular type of role identity that students author during their experiences in engineering, typically in college." She classified engineering student's identity to consist of personal identity, social identity, and engineering identity	see [20]
2017	J.R. Morelock	Presented in a systematic literature review of engineering identity that most of the 46 evaluated journal articles define identity based on a framework such as provided by Godwin.	see [18]
2022	Shell & Hughes	Showed that enlarging diversity of students in engineering and expanding representation in the profession enhances the sense of belonging to the engineering profession among underrepresented students	see [21]

User Experience (UX) Methods & Methodology. The employment of user experience (UX) design and research methods resulted from the convergence of the growth in personal computing and the incredible rise of technological innovation in the last 50 years [12]. To identify how users perceive familiar or new experiences, or how problems are resolved, UX methods allow for the mapping of these experiences to assist in the design of improved future experiences. Collecting user needs, defining user goals and developing desired services or products is the basis for using UX methods for not only human-technology interactions but also for exploring such human experiences through journey mapping and contextual inquiry to capture scenarios or issues that are anticipatory realities of the user's contextual landscape. [17]. These methodological approaches have been employed in such situations as pedagogical development and programmatic design (course modules) as well as the design of learning lessons, activities and mentoring programs [6]. Thus, such tools as journey mapping allow for the documentation of the "end-to-end experiences" of individual interactions with specified products or services over a specified temporal space. This mapping technique provides critical information on user's emotional, motivational, and negatively charged challenges at the variety of phases of the user's interactions [14]. From the description provided on the UX methodology, it is evident that its usefulness in assisting industrial engineers, technical managers, and researchers is clearly evident when addressing issues of professional identity mapping and formation.

Foundations of Systems Theory: Systems Theory developed by the Austrian born biologist Ludwig von Bertalanffy, is in essence a transdisciplinary approach concerned with the understanding, study, analysis and mapping of the

complexity involved in the organization of phenomena which is independent of the phenomena's type, substance, or temporal/spatial actuality or being [5]. The main concern of Systems Theory is that of wholeness. The foundational driving question of the theory of systems is how differing parts or sub-systems work in unison to form a coherent and viable whole. The theory delineates that complex systems both contain and share organizational principles (postulates, assumptions, structures, functions) that can ultimately be discovered and modelled mathematically. The aim of Systems Theory is to discover a "general" theory to explain all systems across a variety of scientific disciplines. Bertalanffy observed that in different systems which at first glance may seem to have no similarities, in fact contain high levels of similitude in "…models, principles, and laws" which govern a plethora of repeating patterns of systemic behaviors which seem wholly unrelated to each other [6, p. 33]]. These repeating patterns of behaviors which he termed isomorphisms, are not simply analogous, but exhibit homological structures (mathematical and/or intrinsic systemic behavior). This iso-morphology enables the transference of knowledge gained from one known system to another system, that though seemingly different but having sameness in homological behavior, permits the modeling of the new system under study using the knowledge of the known system [the usefulness this can be seen in 4, 5, and 14].

Anderson and Johnson [1] provide a workbook for the development of system BOTs (behavior over time graphs), CLDs (causal loop diagramming) which are foundational tools for the mapping and understanding of complex technical systems. The extensive use of these tools led to common recurring stories that cropped up in different settings known as Systems Archetypes. The value of the archetypical recurring causal loop diagram patterns is that they permit the systems analyst to delve below the distracting surface level's potentially confusing details of complex systems behavior to discern the subcutaneous arrangement that conducts the actual systems behavior. The original set of Archetypes fall into eight common patterns: 1- drifting goals; 2-escalation; 3-fixes that fail; 4-growth and underinvestment; 5-limits to success; 6-shifting the burden; 7-success to the successful; and 8-the tragedy of the commons archetypes. For example, the "Escalation" archetype "occurs when one party's actions are perceived by another party to be a threat, and the second party responds in a similar manner, further increasing the threat. The archetype hypothesizes that the two balancing loops will create a reinforcing figure-8 effect, resulting in threatening actions by both parties that grow exponentially over time," [1]. See Figure 2 for a sample diagram of the escalation archetype.
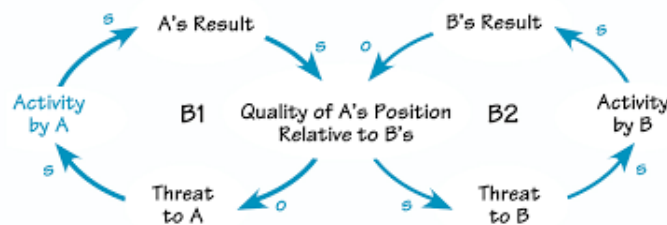

Figure 2. Causal Loop Diagram of the Escalation Archetype [Adapted from 1].

Likewise, the "Fixes that Fail" archetype describes the "situation where a quick fix seemingly solves a problem in the short term, but due to unintended consequences, the underlying issue worsens over time, often requiring even more "fixes" to address the recurring symptoms, essentially creating a vicious cycle; it's like "oiling the squeaky wheel" repeatedly without addressing the root cause of the problem," [1]. See Figure 3 for a sample diagram of the fixes that fail archetype.
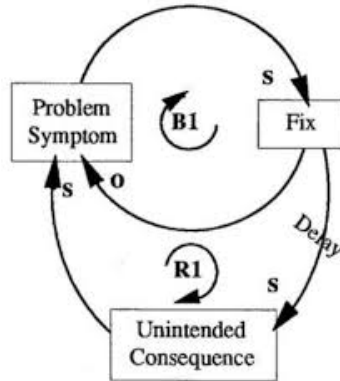
Figure 3. Causal Loop Diagram of the Fixes that Fail Archetype [Adapted from 1].

Challenges to Possible UX to Archetype Patterns in Identity Formation

The initial work in pairing the UX methodology of Journey mapping with the Systems Theory Behavior over Time (BOT) graphs was previously explored [3]. The logical following step to extend the power of these methodological techniques is to look at the succeeding techniques used in each area of study. The creation of "Personas" is the reasonable UX technique to be employed from the work developed in journey mapping. The current research done by the authors is currently completing this step in the work on researcher identity formation of PhD students. To expand on the work and develop further emerging methodologies to enhance the mapping of professional identity formation from the Systems Theory perspective is to convert the existing journey maps and behavior over time graphs to capture from those journey maps and the developed persona descriptors to a compilation of repeating patterns of behavior and to analyze the results to determine possible archetypical patterns surfacing in the development of professional identity formation of individuals. This will require further development and conversion of the UX methodology results into CLDs representative of both successes and failures found in the development process in everyone tested. Already some patterns of identity growth and inhibitor situations have been noted.

Some limitations need to be noted. The work presented here is initial and exploratory. Though it is believed to be beneficial in developing archetypical patterns that can assist both engineering managers in work settings and educators in curriculum development, the work mainly focusses on the individual. Cultural aspects are critical in identity formation which is not addressed in the current research. After a better understanding of the archetypical personas is developed, it will be requisite to explore the cultural aspects that affect identity formation.

Summary and Review

The work presented here is on-going and developmental in nature. The contribution of this research is both the conceptual analysis of the processes encountered in the mapping of the complex systems behavior of professional identity formation as well as the further development of the pairing of the isomorphological structure found in both UX mapping and methodological techniques (Journey Mapping and Persona development) alongside the Systems Theory/Dynamics mapping and methodological techniques (Behavior Over Time graphs and Causal Loop Diagrams). The merger of these methodological techniques has the potential to result in the cataloguing of archetypical patterns in the identity formation of professionals such as engineers which certainly might be extended to other professions. It stands to reason for any technical manager with years of experience that the identity formation of young members into the profession is both critical and assists in getting these individuals up to speed as contributors to the field and their respective organizations. Little to no tools exist to assist technical managers in this endeavor. The development of functional tools and techniques to assist in this venture would be of much practical use and would enhance the industrial engineering profession in practice and theory, specifically in curriculum development for doctoral programs.

Acknowledgement and Disclaimer

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