Learning hard or hardly learning?

Exploring processes of experiential, transformative and social learning in an Urban Living Lab.

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Abstract:

Cities will contain 70% of global populations by 2050, signalling the need to pursue solution-oriented approaches for sustainability challenges. Urban Living Labs are emerging as solution-based interventions, and share commonalities with efforts of sustainability science to broaden research for societal change alongside various actor sets. Currently there is a recognised lack of dedicated research that explores learning as a process between context specific and diverse sets of actors in an ULL. Through a literature review, I argue that current ULL research approaches learning inconsistently and without conceptual rigor. Whilst it is not in question that learning can be considered inherently desirable in achieving transformation, there is recognition that thorough commitment on a case-based level is lacking. This paper builds upon this recognition and explores processes that characterise multi-actor learning using a qualitative case-study approach. The Goldmine is an ULL that aims to foster and physically situate user-driven innovation with an explicit focus on experimentation and learning. I conducted semi-structured personal and email interviews in the Goldmine, and employed a predominantly deductive interpretation of experiential, transformative and social learning types. This thesis highlights that the Goldmine facilitates iterative processes of experiential learning, however its extent varies within and across actor sets. One core determinant is the place-based nature of learning-by-doing. Instrumental competencies for transformative learning of Gold-diggers are fostered due to the start-up environment and project development phase, however problem-perspectives have no avenue for discourse. The Goldmine functions as a hub with several aims, official and unofficial. Gold-digger experiences compliment official aims; in theory, social learning is a goal that the municipality has intended to foster. This is operationalised through workshops, meetings, collaboration and diverse skill-sets. Levels of understanding and contesting problem-perspectives are bounded determinants that influence the degree of social learning in the Goldmine. As a result of voluntary participation, and unplanned Gold-digger selection, the Goldmine suffers from disproportionate diversity with a variety of unintended consequences. There is confusion within and across actor-sets, which is influenced by the expectations, visions and motivations of different actors. The role of reflection in the Goldmine has not been formalised, which carries implications for evaluation, contesting perspectives, and advancing transformative learning. This extends across all learning types. By combining experiential, transformative and social learning types, this research advances understanding of intra-lab learning. Further, it provides a platform for broadening or deepening approaches to learning in ULLs.

Keywords: Urban Living Labs, Experimentation, Sustainability Science, Experiential learning, Social Learning, Transformative learning

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1 Introduction

Cities contain more than 50% of global population, with this figure set to rise to 70% by 2050 (UN, 2014). The implications of climate change are central to an ever-urbanising world, and will only increase in significance throughout the 21st century. Urban expansion brings forth a plethora of sustainability related challenges, which situate cities as pivotal in the pursuit of solutions and responses (Bulkeley & Betsill, 2013; Hodson & Marvin, 2007). Whilst operating at different levels of detail and research foci, there is a recent science-practice push to link knowledge, standardise and accelerate city-based low-carbon transitions (Bhagavatula, Garzillo, & Simpson, 2013; McCormick, Anderberg, Coenen, & Neij, 2013). This science-practice convergence is visible in various forms such as local climate change experiments (Harriet Bulkeley & Castán Broto, 2013) and are of interest to transnational municipal climate networks (Bulkeley, 2015; Busch, 2015) Recently, a significant amount of research explores smart-cities (Schaffers et al., 2011), eco-cities (Cugurullo, 2013; Hu, Wadin, Lo, & Huang, 2015; Hu, Wu, & Shih, 2015) and eco-districts (Fitzgerald & Lenhart, 2015) as forms of urban governance. They are suggestive of technological innovation as a catalyst for urban transitions (Hodson & Marvin, 2007), and carry the promise of environmental decoupling. These "win-wins" manifest in various ways and sizes in the urban-fabric, but follow a familiar narrative of experimentation, including the conceptualisation of the city as a laboratory (Evans & Karvonen, 2014).

1.1 Problem Background

As a more recent research topic and drawing from the conceptualisation of cities as labs, Urban Living Labs (ULLs) are proliferating across Europe (Bulkeley, Cast, Hodson, & Marvin, 2010; Juujärvi & Pesso, 2013; McCormick, K., Anderberg, S., Coenen, L. & Neij, 2013; Voytenko, McCormick, Evans, & Schliwa, 2015). ULLs are visible sites that allow multiple users to design, test and learn from innovation, and in so doing, attempt to catalyse societal transformation in the process (Voytenko, McCormick, Evans, & Schliwa, 2015). They endeavour to foster collaboration between universities, governing institutions, private enterprise and civil society and move beyond technology to address a multitude of urban challenges through small-scale transformation (Evans & Karvonen, 2010; Voytenko et al., 2015). As a relatively recent phenomenon, there are knowledge gaps regarding ULL designs, practices and subsequent implications for urban governance (Harriet Bulkeley et al., 2015). One such underdeveloped aspect concerns processes of learning in ULLs.

There is a lack of dedicated research that operationalises and explores learning as a central process between context specific and diverse sets of actors in an urban context (Bulkeley et al., 2015). Whilst socio-technical transition framing in the field of ULLs provides an opportunity for evaluation of outcome success, "it tells us little about the processes through which the vision achieves or fails to achieve 'acceptance' amongst a wide variety of actors and translation into materiality" (Hodson & Marvin, 2010, p. 483). When extended beyond the physical space, ULL caveats align with the findings of Armitage et al. (2008) who, regarding the notion of learning in the field of adaptive management, assert "the value of learning as a goal and process is recognised, yet vague notions of learning are often encouraged in the absence of careful examination of the factors that determine if, who, how, when and what type of learning actually occurs" (2008, p. 87). Learning is becoming widely regarded as an intrinsic property (Armitage et al., 2008), with little attention given to the very distinctive considerations or determinants that affect learning as a process (actor diversity, diverging interests, contingent characteristics, national and regional policies). One possible factor for the lack of thorough investigation in an urban context could relate to the assumption of learning as both an intrinsic goal and a process. Discussions surrounding the roles and responsibilities of different actors, and the dynamics of learning as a fundamental aim of such projects, warrant further investigation. The above twin concerns carry salience for ULLs as learning is a regarded central aim, practice and process to challenge embedded ways of dealing with environmental challenges (Bulkeley et al., 2015).

1.2 Research outline

The aim of this paper is to frame, operationalise and explore processes of learning through the experiences of users in an ULL. I will explore three types of intra-lab learning: 1) experiential, 2) transformational and 3) social learning, with the Goldmine case in Copenhagen providing a localized context. The Goldmine represents an "experimental" prototype, in the form of a waste recycling station in Copenhagen that intends to foster practices of circular economy through innovation. The remainder of the current section, and those that ensue, will aim to satisfy my research via the following exploratory questions:

1. How do learning typologies relate to ULLs in theory?
2. How are experiential, transformative and social types of learning relevant in the Goldmine?
   a. What learning types are evident in the Goldmine?
   b. Do learning types co-exist and, if so, how do they interrelate in the case of Goldmine?

1.3 Contribution within and towards Sustainability Science

Sustainability science strives to explore deep and wicked sustainability problems, and identify viable pathways that are both solution-oriented and prescriptive (Feola, 2014; Jerneck et al., 2010; Kates et al., 2001; Miller, 2013; Miller et al., 2014). Wicked in that they are conditioned through bounded time and resources; masked, intertwined and amplified by system complexity; and normatively divisive (Dentoni & Bitzer, 2015; Farrell & Hooker, 2013). Sustainability science recognises the need to not only catalyse research processes alongside academia, but also move towards participatory and transdisciplinary engagement (Brandt et al., 2013; Kates, 2011; Kates et al., 2001; Lang et al., 2012). Therefore, it bridges nature-society dynamics and employs both a 'real-world' research-practice agenda that fosters social learning, and experimental holistic perspectives that situate the sustainability scientist as an agent of change (Miller et al., 2014; Wiek, Ness, Schweizer-Ries, Brand, & Farioli, 2012).

It is important to locate the contribution that a focus on learning can have. Sustainability science includes an ever-expanding research agenda to address phenomena at various scales (Cash et al., 2006), levels (Ness, Anderberg, & Olsson, 2010), and across timeframes (Jerneck et al., 2010). Miller et al. (2013) and Kates et al. (2001) advocate for social learning and its potential role in strengthening institutional capacity to successfully navigate through the contingent nature of sustainability problems. Sustainability science shares this interest in transformation trajectories, and in particular with use-inspired and community-driven foci (Miller et al., 2014) that ULLs attest. Despite this, cross-disciplinary collaboration and learning as an assumed goal for sustainability must be explored with a higher degree of flexibility than is currently being done so.

Learning itself is a contested concept that attracts scholarly critique due to its almost taken for granted application. Social learning is fused conceptually with potential conditions and outcomes such as participation (Reed et al., 2010), and bundled within sustainable development normatively. Although conceptual muddiness marks the point of conviction where my venture into learning began, it will not be the focus of my research – maybe, another day. My research draws upon novel learning conceptualisations that advance understandings of the relationships that unfold in experimental urban settings. I employ transformative and experiential learning theories in conjunction with social learning, and in doing so aim to widen the theoretical lens to explore the contingent nature of learning, beyond the social or the societal (Clark et al., 2003; Miller, 2013; Ness et al., 2010).

2 Conceptual Framework

In this section I present and combine two concepts that constitute the frame for my research. Firstly, I present dimensions of learning, as examined by Armitage et al. (2008), and highlight components of their framing that establish significance for entry into ULLs. Secondly, I discern central elements and explore the conceptual and practical emergence of ULLs. Following a review of ULL literature, I establish the relevance of learning within this field. In doing so, analytical attentions moves towards experiential, transformative and social types of learning. By presenting, combining and evaluating dimensions of learning from Armitage et al. (2008) and ULLs, I aim to satisfy research question 1: *How do learning typologies relate to ULLs in theory?*

2.1 Armitage's Typology of learning

Before presenting my framework, it is essential to situate learning concepts derived by Armitage et al. (2008). Their discussion of learning rests upon achieving sustainable outcomes through natural resource management within social-ecological systems. Both the authors and the literature they utilise consider social-ecological systems as inherently complex and uncertain in both current and future states. Adaptive governance seeks to manage resources that are characterised by such uncertainty and complexity, and navigate through rapid and often unstable environmental change (Folke, Hahn, Olsson, & Norberg, 2005). Adaptive governance recognises the role of social dynamics and relationships in complex systems and, when operationalised through adaptive co-management, involves innovative approaches to management that harness flexible institutional arrangements (Armitage et al., 2008; Folke et al., 2005). As such, collaboration between different actors, experimentation and learning can be considered pre-requisites for adaptive co-management (Folke et al., 2002, 2005).

In the eyes of Armitage et al. (2008) consensus surrounding inherent benefits of learning as both a goal and a process stand in contrast to the ambiguous nature in which it is being investigated; therefore, a paradox of learning arises. They argue that learning is inconsistently defined in adaptive resource management even within one framing such as social learning. Learning goals, methodologies and evaluation suffer from both terminological and practical abstraction, often resulting in generalised findings (Armitage et al., 2008). As asserted, "a tendency to refer to learning in the abstract can result in analyses that inadequately account for the variety, implications and outcomes of learning" (Armitage et al., 2008, p.83). My research aligns itself with the assumption

that, beyond natural resource management and within efforts to achieve urban transition locally in a world of uncertainty, learning is considered as an intrinsic property.

One subtle assumption from Armitage et al. (2008) is that learning is not situated within a grand theory, but rather ascribed meanings from several mid-theories that can co-exist, each of which claim their own focus. Moreover, they claim that these operate across levels (individual, societal, group-based), are facilitated by various support mechanisms and effect differing types of learning. Therefore, there are specific conditions in resource management that can influence social learning, or experiential learning. Whilst it is important to acknowledge that the conceptual framing of adaptive governance by Armitage et al. (2008) has played a key role in their focus on learning, my research does not aim to provide an evaluative judgment related to adaptive co-management. Rather, it is my assumption that through this framing, Armitage et al. (2008) present a rigorous enquiry into the way in which dimensions of learning are tied to collaborative governance settings. As such, I intend to draw inspiration from this approach by extending dimensions beyond natural resource management scenarios and towards urban local interventions.

2.2 ULLs

ULLs are a contemporary concept, arena and praxis that rest upon tenets of experimentation and innovation in the city (Evans & Karvonen, 2014; Voytenko, McCormick, Evans, & Schliwa, 2015). They share common properties of: 1) embeddedness, 2) experimentation and learning, 3) participation, 4) actor diversity and 5) evaluation (Voytenko et al., 2015). ULLs have an aligned focus on place-based and user-driven experimentation for realisable urban change (Voytenko et al., 2015). With practical and conceptual underpinnings, they can characterise both a physically bounded space, and the way in which this space fosters collaboration amongst different actors (Voytenko et al., 2015). The physical boundary of different ULLs can vary greatly, as can the degree of collaboration within; the approach, however, is explicit and consistent with value on innovation and creative governance to catalyse change (McCormick & Kiss, 2015). Due to the nascent nature of ULL research and application, this field is still developing. Definitions are therefore provisional and serve more as representations of the current state of knowledge, with common qualities that can offer comparison across ULLs.

Open and expansive in nature, it is unsurprising that the ULL concept intersects several converging research paths. Interpretations are broad, and expanding the conceptual and methodological toolbox

at the disposal of social science is encouraged (McCormick et al., 2014). Living lab research traditionally focused on interventions of technological innovation or business models with a particular interest in research infrastructures (Juujärvi & Pesso, 2013; Schaffers et al., 2011; Liedtke et al., 2012). Transition management and multi-level perspective as tools are beginning to engage with and examine the deliberate nature of urban interventions. By enacting heterogeneous actor configurations, transitions studies target the role of ULLs as socio-technical niches, through which sustainable change can be steered (Frantzeskaki, Loorbach, & Meadowcroft, 2012; Geels, 2010; Nevens et al., 2013). Strategic niche management and transition management as modes of protecting and developing niches necessitate inquiry into institutions, practices and cultures that facilitate or impede transformation (Caniëls & Romijn, 2008; Frantzeskaki, Wittmayer, & Loorbach, 2014; Loorbach & Rotmans, 2010). Therefore, by beginning to embrace concepts of governance also, ULL research streams converge to explore movements beyond rigid institutional design that enact transformative political spaces in the city (Bulkeley, 2010; Bulkeley et al., 2015). ULLs in practice are beginning to proliferate beyond research and development projects due to their implications for novel power arrangements (Bulkeley, 2015), and emergent opportunities to transcend hard sustainability solutions in cities (Dieleman, 2013). There are empirical examples that suggest the potential to explore small-scale, socially-oriented sustainability solutions through social innovation (Dieleman, 2013; McCormick & Kiss, 2015).

2.3 How ULL literature approaches learning

In this section I, through the lens of learning, conduct a review within central ULLs contributions. By doing so, I discern common themes and considerations that serve as a basis for discussion. After tracing common conceptualisations of learning in ULLs Literature, I argue for the viability and of three learning types as the basis of my analytical framework in section 2.4. Table 1 comprises the results of this review, which identifies learning as a common across Urban Living Labs (McCormick, K., Anderberg, S., Coenen, L. & Neij, 2013; Voytenko et al., 2015). Until this point, however, thorough examination in the fields of Urban Living Labs is lacking.

This review shows that although ULLs manifest in various forms, accommodate different actor dynamics and intersect sustainability challenges, they are explicit in the centrality placed on learning and its role in navigating transitions. Within ULL literature, conceptualisations of learning do not adhere to an overarching definition or conceptualisation. Rather, sub-conceptualisations are heterogeneous in their definitions and investigation. This occurs as ULLs: 1) target change on

differing levels, 2) mobilise multiple actor sets and 3) seek to address a myriad of sustainability-related challenges. Learning operates across various domains, such as material learning, organisational learning, and learning for success.

Table 1. Review of ULL literature, with definitions, features and academic origins

Author/Year	Focus	Features	Literary root
Nevens et al. (2013)	Transition Labs	**Social Learning** Learning by doing; cycle of reflexivity; learn from success	Kolb, 1984
Voytenko et al. (2015)	ULLs	**Directed Learning** "Experimental Learning" and "Experimentation and learning" at another stage; user-driven innovation	Bulkeley & Castan Broto, 2013
McCormick et al. (2013)	Learning processes	**Learning across multiple levels within cities** Learning as a process; valuable indicator of success, and provider of insights into upscaling	Dieleman, 2013
McCormick & Kiss (2015)	ULLs	**Learning-by-discovering, interacting and experimenting** Aims to contribute to learning across quadruple helix; explicit student based learning - educator and learner divided; pre-defined outcomes to direct actions	Evans & Karnoven, 2010
Dieleman (2013)	Eco-cultural Innovation	**Organisational learning** Reflexive action; learning is not reducible to knowledge and skills; change of mental mapping	Argyris and Schön (1978); Kolb, (1984)
Juujärvi & Pesso (2013)	ULLs	**Collective and interactive learning by doing** Multiple actors; different sources of knowledge; learning by doing and development	No source
Evans & Karvonen (2014)	Urban labs	**Innovation, knowledge and recursive learning** Learning from repetition; conduct, generate, develop; learning and knowledge inseparable; transforming knowledge into facts	No source
Bulkeley et al. (2015)	ULLs	**Experiential learning** Learning from innovation in real-time physical arena; learn from experience; a process; techniques = learning form; learning as a goal; scaling and learning from success	No source

One emergent theme suggests that irrelevant of whether focus rests on cycles for evaluation (Dieleman, 2013) or condition-process-outcome findings (McCormick & Kiss, 2015), learning is typically treated as a social phenomenon that can be embraced in order to upscale. McCormick and Kiss (2015) exemplify this treatment, stating that "Urban living Labs are sites devised to design, test and learn from social and technical innovation in real-time and in urban contexts" (p.45). Although not interchangeable with collaboration, prevalent references to learning tend to touch upon the society, the group or the organisation. In short, the diversity of conceptualisations can be seen as a product and symptom of theory-practice nexus that characterises the ULL concept. Common notions indicate adaptive intentions of living labs that involve value reconfiguration between actors, and primarily discern learning by doing and experimenting (Bulkeley et al., 2015; McCormick & Kiss, 2015; Nevens et al., 2013; Voytenko et al., 2015). Moreover, they are consistent with the claim of Armitage

et al. (2008) that several types of learning can co-exist. Section 2.4 follows along this path, whereby I examine additional crossovers between both concepts uncovered in the review.

2.4 Combining ULLs and learning Typologies

ULL research approaches experiential learning as pivotal in directed, real-time experiments that realise and envision transformation (Bulkeley et al., 2015; McCormick & Kiss, 2015; Nevens et al., 2013; Voytenko et al., 2015). ULLs can therefore be considered learning-oriented strategies. By learning-oriented I mean that, running parallel to the transdisciplinary expansion of ULLs, there is an emphasis on learning as both a goal, process and a directed outcome (McCormick et al., 2014; Voytenko et al., 2015). By adopting three different types of learning that Armitage et al. (2008) present, both individual and collective dimensions of learning in ULLs can be explored. Transformative learning and aspects of social learning specify the way in which practices can support or hinder change, representing a vital condition for societal transformation as a core aspiration of ULLs (Bulkeley et al., 2015). Furthermore, the viability of such change is also conditioned by aligned aims, outcomes, and evaluation, all of which form the crux of the learning paradox (Armitage et al., 2008). These are typically accessories of a wider investigation into ULLs, rather than central to examination in the context of innovation and transitions

As a first step, my research aims to explore intra-lab learning within one specific lab. This warrants deeper engagement in its own right, and provides an opportunity to examine dimensions of learning as more than an intrinsic property of ULLs. This is an important contribution, as literature explicitly touches upon labs for education (McCormick & Kiss, 2015), collective processes of learning (Juujärvi & Pesso, 2013), and can be considered an overarching ambition for ULLs (Voytenko et al., 2015).. Within this section I have presented both ULLs as a concept, and the way in which Armitage et al. (2008) discuss learning as an assumed property in collaborative settings. In ULL literature there is a focus on learning by doing, in a socially embedded context, with the aim to foster change. However at the moment there is a lack of clarity into how learning unfolds within and across ULLs, and the implications it has for various aspects of an ULL. In an attempt to operationalise these qualities by bringing together both concepts, I argue that experiential, social and transformative learning types comprise a suitable framework for ULL analysis as: 1) ULLs establish the primacy of learning, and 2) ULL properties align with learning by doing (experiential learning), collective environments (social learning) and learning as a condition of transformation (transformative learning). In so doing, I establish significance for the continuation of learning typologies for the remainder of this thesis and satisfy research question 1: *How do learning typologies relate to ULLs in theory?*

3 Analytical Framework

Three learning types presented by Armitage et al. (2008) prove particularly telling as they permit the exploration of conditions, motivations and features that typically comprise learning in urban experiments and sustainable transitions. Sub-sections 3.1–3.3 highlights experiential, transformative and social learning type characteristics, before identifying key elements that constitute each. Each subsection also provides greater delineation of these types, and compliments the description to move beyond Armitage et al. (2008). Therefore, I will frequently refer to relevant literature that strengthens understandings of learning types, and in particular experiential and transformative learning, for ULL application .

3.1 Experiential Learning

> "One is called to move back and forth between opposing modes of reflection and action, feeling and thinking – this is a holistic approach that includes thinking, feeling, perceiving, and behaving."
> (Kolb & Kolb, 2005, p. 194)

David Kolb's notion of learning refers to "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p.38). In its simplest form, experiential learning is often defined as learning-by-doing (Ki-Hoon & Schaltegger, 2014), however Kolb & Kolb (2005) dive deeper into cognitive complexity that extend broad definitions. In their eyes, experiential learning follows a cyclical approach of experience through to active experimentation. Reflective observation and abstract conceptualisation are the bridges that allow individuals to learn by doing (Armitage et al. 2008). These four cycles mutually reinforce and occur through what Kolb & Kolb (2005) consider a dialectic process that grasps and transforms experience. Transformation processes occur in different patterns and through various conditions. Experiential learning theory employs tenets of conflict and resolution, whereby knowledge and experience are environmentally influenced. It adapts a constructivist theory of learners and the learned, as a opposed to traditional "transmission" theories (Kolb & Kolb, 2005). Therefore, learning is a holistic process that encompasses human-society and society-nature interaction, is fuelled by conflict and value-laden discourse, through which experience is internalised and externalised (Armitage et al., 2008; Dieleman, 2013; Kolb & Kolb, 2005).

In the context of my analytical framework, I have chosen not to present experiential findings as a solely phase driven cycle, as it might conceal the flexible pattern-process nature that defines

experiential learning. Rather, I interpret the tension-rich and inherently social character of experiential learning and how this can manifest within an ULL. Staying true to its epistemology, my analysis identifies the nature of conflict, differences and disagreement in the Goldmine as properties of experiential learning. I also broadly approach the Goldmine with an interest in learning by doing, in order to accommodate established conceptualisations.

3.2 Transformative learning

Transformative learning belongs to the emergent field of adult education theory (Mezirow, 1995). By critically engaging with a set of assumptions and acting upon individual reflection, Mezirow (1995) labels transformative learning a key facilitator in adapting to change. ULLs aim to foster change on social and economic levels, and therefore target changes in norms, values, cultures, practices and lifestyles (Voytenko et al., 2015). By placing a focus on the way in which transformation and adaptation can occur individually, transformative learning has the potential to directly add value to ULLs. In the eyes of Mezirow (1995) and Armitage et al. (2008), learning occurs when an individual enhances a combination of instrumental and communicative competencies. Instrumental learning relates to: 1) acquiring skills and information, 2) determining cause–effect relationships and 3) task-oriented problem solving. Communicative learning that occurs includes understanding values, concepts, and others points of view (Armitage et al., 2008; Sims & Sinclair, 2008). By changing 'frames of reference'[1] (Sims & Sinclair, 2008), Armitage et al. (2008) argue that transformative learning can function as a tool to enhance critical reflection and in turn, support environmental adaptation. In the context of this research, transformative learning explores instances of skill acquisition, cause-effect relationships, task-oriented problem solving and value/norm contestation in an ULL.

Reed et al. (2010) consider transformative learning comparable to double-looped learning (Argyris & Schön, 1978) in that it relates to reflection of assumptions; I argue for a clear distinction between these conceptualisations. Social learning maintains a distinctively social character in the way that it occurs, whereas transformative learning appreciates social context but occurs through individual competencies and internal reflection. Transformative learning is an active learning process that is rooted within adult education theory (Sims & Sinclair, 2008), whereas social learning draws on

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[1] A frame of reference is a "meaning perspective," and structures assumptions and expectations through which we filter sense impressions (Mezirow, 1995). This is a combination of both instrumental and communicative competencies.

collective conditions (Armitage et al., 2008). These distinctions provide a bridge towards interpretation of social learning as an operational component of my framework.

3.3 Social learning

Broadly speaking, social learning in the context of Armitage et al. (2008) concerns collaboration between different individuals and groups. A theory that carries a corpus of research, social learning carries multifarious definitions within sustainability literature; I have alluded to this at previous stages in this thesis. Following in line with Armitage et al. (2008), I define social learning as a process of iterative deliberation and reflection that can occur on either a group or societal level. This type of learning must extend beyond the individual, and maintain an inherently social character. That is, such learning is produced via social interaction, or within group spaces. Therefore, sharing, experience and participation are considered indicators of such learning (Armitage et al., 2008). In order to analyse qualitative information that I have collected via my research design, Table 2 presents core elements distinctive to selected learning types in Armitage et al. (2008). Further, and in bid to connect with research questions related to the "how" of learning processes, this framework aims to target activities that have fostered learning, through the eyes of respondents.

Table 2. Operationalisation of learning processes and respective conceptual indicators

Learning type	Conceptual Indicators	Comments
Experiential	Learning by doing Learning environment Tension	Related to individual; learning by doing; cyclical; driven by conflict and disagreement
Transformative	Acquiring skills and new information Determining cause-effect relationships Task-oriented problem solving Understanding values and other viewpoints	Allowing views to be challenged by others; changing frames of reference; combination of instrumental and communicative competencies
Social	Sharing Experience Group participation Project participation Broader participation Group reflection	Group or societal related; extends beyond the individual; experiences, collaboration, reflection, sharing, participation

4 Methodology

This thesis harnesses various literature sources, in addition to qualitative exploratory interviews in a case study. Desktop research of both ULL and learning concepts constitutes a first step to advocate for, deconstruct and apply learning types as a tool for intra-lab learning. By doing so, my preliminary argument demonstrates the centrality of learning in urban interventions, and legitimacy of an appropriate tool for operationalising learning. Following this assertion and analytical delineation, the following section presents design, methods and collection that comprise my research strategy. To ensure that my strategy ensures validity and provides a systematic approach to operational dimensions of learning, I engage in an explicit identification of research questions, selection of case study, application of appropriate sampling, and systematic collection and analysis of data (Baxter & Jack, 2008). Furthermore, I consider it important to delineate both the reciprocal relationship between the research and the researcher that ensues in qualitative research (Yin, 2014).

4.1 Research design

I adopt a qualitative single-case study approach, where the city of Copenhagen is not the unit of analysis. Rather, it acts as a spatial backdrop to the research, with the unit of analysis being the individuals in the Goldmine (Yin, 2014). The Goldmine was considered due to the explicitly experimental nature of the project, its focus on a low carbon transition and the explicit aim that it establishes for learning. I consider actors and their experiences within an ULL as central determinants of its transformative potential. In the true spirit of urban experiment research, this case-based practice seeks to represent everyday conditions that attempt to realise actual change (Soria-Lara, Bertolini, & te Brömmelstroet, 2016). Bhagavatula, Garzillo, & Simpson (2013) consider the case study approach as an effective design in aiding the legitimacy of research. Further, experience based case studies not only combine both "soft" and "hard" data generated within the learning process (Dieleman, 2013), but serve to answer the "why" and "how" of the phenomenon (Yin, 2014).

4.2 Research Methods

By implementing data triangulation as a qualitative approach, I provide an account of the phenomenon of learning in the Goldmine in as comprehensive of a manner as possible (Denzin, 1978; Yin, 2014). I employ a deductive interpretation of learning typologies as a structure for

formulating interview questions. In doing so, my analytical framework facilitates data collection in a specific social context - in this case, the Goldmine in Copenhagen (Yin, 2014). After an initial exploratory semi-structured interview with Kathrine Overgaard Rasmussen from Kobenhavn Kommune (KK), all direct actors involved in the project were contacted. These can be categorised as (including Kathrine): 1) academia, 2) municipality and 3) so-called "Gold-digger" entrepreneurs[2] related to the project. This thesis retains the term Gold-diggers for its remainder; individual Gold-diggers are referred to by their name (for which, permission was asked for and agreed upon in advance) and respective enterprise, whereas academic and municipal interviewees are categorised based on their central role. This ensures a consistent and transparent approach to the presentation of my findings, and permits me to aptly tell the story of the Goldmine chiefly through the experiences of Gold-diggers, researchers and municipal actors.

4.3 Data Collection

Interviews encompass the backbone of my data collection, and are complimented by various sources so as to allow for the convergence of findings towards my research questions. These include the Goldmine website and KK Waste Management plan (City of Copenhagen, 2014), personal and email conversations, and an academic paper in progress from Peter Munthe-Kaas (KK/Aalborg University; Munthe-Kaas, upcoming). As little official project information exists, data collection occurred predominantly on site and through the experiences of the Gold-diggers. Furthermore, information initially collected from Kathrine (KK) was corroborated with the Goldmine website and KK waste management plan (City of Copenhagen, 2014) to qualify the Goldmine as an ULL. Such an approach ensures that I collected a wealth of information in a way that ensures substantial description and rich actor perspectives (Baxter & Jack, 2008).

Purposive sampling, through which I strategically examine the perceptions of key actors, enables me to unveil this case in the most comprehensive manner (Yin, 2014). Due to the rapidly evolving nature of the Goldmine, it was difficult to estimate a sample number of possible interviewees, and from this it proved more challenging to determine those who continued to engage with the project. It was established however that core actors include 12 Gold-diggers, one research institute and one

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[2] The Goldmine had been originally planned at another location in Copenhagen, which would have required waste transportation from a different recycling centre. This plan did not materialise; with the help of Danish artist, Thomas Dambo, the recycling project was named the "Goldmine", and participants titled "Gold-diggers" or "Guldgravere" in Danish.

municipality. Interviews were conducted with members from eight of the 12 entities, in addition to an extensive personal interview with core members each from municipality and academia. Furthermore, data collection is also supported by conversations with a further three Gold-diggers, either via email communication or direct personal communication. Comprehensive respondent information can be found in Appendix I.

4.3.1 Interviews

After initial contact and in addition to an exploratory interview with Kathrine, qualitative data collection entails a further six qualitative semi-structured interviews, and three email interviews. Face – to – face and email interviews were conducted between March 15th and April 10th, 2016. Semi-structured interviews were recorded with the permission of all interviewees. They followed a conversational tone and stayed within a basic frame of core questions (see Appendix II), approaching broad themes that related to learning typologies, rather than a scripted approach (Yin, 2014). I want to understand the phenomenon of learning through the perspectives of Gold-diggers and actors in the Goldmine, which necessitates that my role captures this very meaning. Due to the varied nature of Gold-diggers, and staying true to contingency that characterises ULLs, I utilised predominantly open-ended questions, varied the order based on conversation flows and attempted to address individual and collective components. Furthermore, some questions were role-dependent, and varied across academic, municipal and private interviewees. Personal interviews ranged from between 90 and 120 minutes in length and, with the exception of an unrecorded interview with Kathrine (Municipality), generated 680 minutes of audio recordings. Responses from email interviews were gathered via the structured interview guide (see appendix II), and additional discussion questions and prompts. Interview emails were sent after four personal interviews had been conducted, in order to ensure relevant discussion topics were formulated that could retrieve additional information similar to face-to-face interviews. These were transcribed and supported by extensive notes, whereas partial transcription accompanied Kathrine's interview.

4.4 Qualitative Data Analysis

Data analysis in qualitative research is often characterised by overwhelming data and related to a complex social phenomenon (Yin, 2014; Houghton, Murphy, Shaw & Casey, 2015). Transparent data analysis can confront caveats of qualitative research with a concerted effort to identify an approach

as authentic, credible and reproducible (Kuckartz, 2014; Yin, 2014). In the context of this study, all interview-related qualitative data (consolidated notes and transcriptions) were analysed using qualitative data analysis software, MAXQDA. Qualitative analysis comprised both deductive and inductive coding, and can be characterised as a reflexive and iterative process of analysis whereby these stages remained fluid. Moreover, interviews were treated in relation to other data sources, official information, and each interview. By doing so, this thesis engaged in an analysis phase that aimed to capture the full story, and context of the Goldmine, rather than treating qualitative data independently (Baxter & Jack, 2008).

As a first step of analysis, I derived core codes through my application of experiential, transformative and social learning types. Interview segments were identified that related directly to my framework. Text selections varied in size, ranging from individual words (depending on their context) or short phrases, to larger passages. Secondly, open coding was employed to allow for emergent themes to develop both within and outside of previously coded text. Therefore, this extensive analysis produced in excess of 1200 coded segments.

4.5 Limitations

Recognition of limitations establishes an important platform for self-reflection. By doing so, I convey my pre-conceptions, discuss methodological caveats and, in turn, advance understanding of the context that situates my research. Every study has limits, biases and deviates from objectivity (Yin, 2014), and this thesis is no different. In this sense, disclosure of both the destination of the research, and the orientation of the researcher, is important. Appendix IV sheds further light on the relationship between research and the researcher in a self-reflexive manner, and in turn compliments section 4.5. My hope is to provide considerations that one can use to improve or extend future research with a consideration of these delimitations.

Data collection was restricted by the availability of responses, the voluntary approach that characterises Gold-digger involvement, and the evolving nature of the Goldmine. With an official sample of 43 participants, I gathered data from 17 respondents in some form. In addition, five respondents replied that are no longer engaged with the Goldmine. Their names, and the name of others, are included in the contact list although some have had no direct interaction for close to six months. Moreover, it is likely that I also was unable to target individuals or organisations that are not within this contact list and sample, but are active in the project. By conducting purposive sampling as

a strategy to overcome these conditions, my selection criteria remained broad and were shaped directly by my presence in the Goldmine on all days between March 22nd and March 27th. This allowed me to communicate with active gold-miners, probe for critical respondents and explore levels of activity in the project. As my case study results and analysis will highlight, the Goldmine is six months into a two-year project, extends beyond the physical boarder of the warehouse, and even farther beyond Gold-diggers that were in this space. Therefore, ULLs of this nature necessitate research strategies that extend across longer time horizons, and trace spatial networks extensively.

Before I proceed towards results and analysis, it is my opinion that the Goldmine warrants greater depth of description. This case represents an opportunity that I was presented with by chance, and based on my research; I consider it unequivocally important to tell the story the right way. Therefore, the subsequent section is dedicated to the Goldmine, both as a strategy for waste management in Copenhagen, and a learning-centric ULL.

5 Case Study: Goldmine

As mentioned in section 4, the Goldmine serves as my case study for qualitative exploration of learning processes. In this section, I situate the Goldmine project within the wider context of the city of Copenhagen and their waste management strategy. I find it particularly important to clarify the motivations, practices and people that constitute the Goldmine. Finally, I tie together characteristics of ULLs that qualify the Goldmine as an appropriate case for ULL research.

5.1 Waste management in Copenhagen

The Goldmine is a waste recycling facility that functions as a prototype for Copenhagen's waste management strategy. KK aims to "lift waste management as high up the waste hierarchy as possible" (City of Copenhagen, 2014) through four themes of action: 1) less waste, 2) more separation, 3) improved collection and 4) better treatment. Waste re-use strategies will play an integral role in fulfilling the aspiration of 10% reuse by 2018 (City of Copenhagen, 2014), and fall under theme 1: less waste. In order to do so, a flagship project, in the form of an innovative multifunctional recycling centre in Sydhavn, is due for completion in 2018. The Goldmine is an attempt to broaden and deepen waste management knowledge in the city of Copenhagen, which functions as an arena for experimentation of waste re-use in preparation for Sydhavn recycling centre.
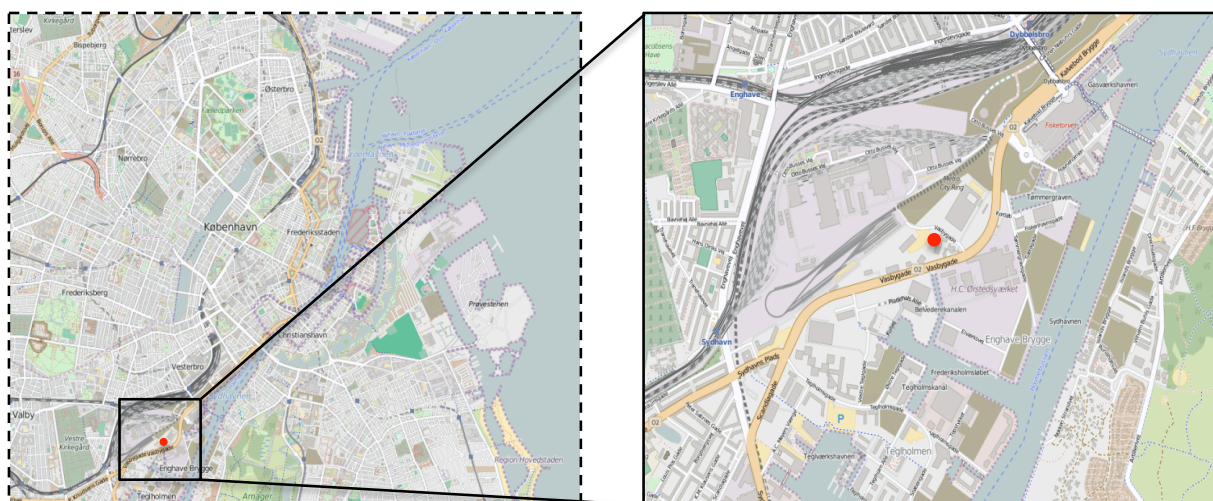

Figure 1: Hybrid map locating Goldmine with red marker in Copenhagen (QGIS Openmaps Plugin).
Map 1 (left). Copenhagen city, where quadrat situates Sydhavn area
Map 2 (right). Zoom of Sydhavn area

5.2 The Goldmine Project

In order to stimulate knowledge for the design and function of Sydhavn Recycling Centre, 12 Gold-diggers have been granted access to all safe waste containers in an operational Amager Resource Centre (ARC) recycling station in Sydhavn for two hours each day. Through co-operation with ARC and KK, Gold-diggers have been provided with an empty warehouse in the recycling centre. All utilities are covered by KK, as is the rent of the physical space. Gold-diggers occupy the space freely, under the condition that they used recycled materials in the containers to physically build their internal space. Further, Gold-diggers are obliged to attend workshops, take part in evaluations and engage in interviews with KK when required. In the eyes of Kathrine (KK), "the Goldmine provides an opportunity for the KK to begin to learn about innovative ways that waste can be used...this is a lab that enables social-entrepreneurs to learn how to re-use waste, enhance their creative skills, and develop long-lasting business solutions to waste".

In essence, KK portrays the Goldmine as a laboratory that can be used to inspire and encourage innovative practices related to waste management. This very diversity in expectations, plus the open call for interest has summoned an eclectic blend of Gold-diggers that embrace the concept. Practices are informed through educational workshops, assisted via up-cycling and repair, and inspired via art and direct re-use initiatives. Some want to create a discourse for sustainability in the city; for others, telling the tale of waste is central to stimulating change through awareness. Some want to inspire children with action stories and re-used materials; others seek inspiration from the very materiality that drives the Goldmine. The diversity is perplexing and inspiring at the same time. It resonates when you visit the ground, and amplifies when within the physical space. It is no surprise that KK state that they "expect discoveries to emerge along the way that we cannot imagine now".

The Goldmine can currently be considered as engaging under either a triple helix or quadruple model of actor partnership. The quadruple helix model commonly characterises ULLs (Voytenko et al, 2015), and refers to the roles and contributions of four broad actor sets in ULLs (Juujärvi & Pesso, 2013). In the context of Goldmine, these are: 1) Aalborg University (academia), (2) Copenhagen Technical and Environmental Administration (KK - TEA; municipality), (3) Gold-Diggers (Private actors) and (4) civil society in Copenhagen. The project is provisionally funded by the TEA and has an initial two-year funding window from November 2015 – November 2017. After this point, official plans for the continuation of the Goldmine as an arena or approach are unclear on all fronts. Therefore, the Goldmine can be considered very much in the development phase.

5.3 The Goldmine as an ULL

Based on the motivations behind the project it can be established that KK and Gold-diggers position the Goldmine as an experimental urban intervention with the hope of enabling learning. The following sub-section will serve to explicitly weave these elements into ULLs in practice, by examining the Goldmine using five key ULL characteristics (Voytenko et al., 2015). Firstly, the Goldmine is bound within Sydhavn in Copenhagen and has a directed physical space; therefore it is a geographically embedded intervention. Secondly, experimentation is explicit in that it takes the form of circular economy prototype with innovative legislative conditions, where learning is a fundamental aim of the project. Thirdly, participation and user-involvement are central within the Goldmine, through the very conceptualisation and everyday practices of the "Gold-diggers". The relationship amongst Gold-diggers and with the municipality is flexible, however there is a sense of direction and leadership; this is the fourth characteristic. Lastly, the impact of the Goldmine and potential evaluation of learning remains to be seen, due to the early stage of the project. In summary, and as a first step to harmonise with ULLs as a concept, the Goldmine aims to foster and physically situate innovation with an explicit focus on experimentation and learning, in a way that is inclusive and user-driven.

6 Processes of learning in the Goldmine

This section draws upon results and analyses that satisfy research question 2: *How are experiential, transformative and social processes of learning relevant in the Goldmine?* Firstly, sections 6.1-6.3 structure results and analysis with respect to learning types in order to investigate sub-question (SRQ) 2a: *What learning types are evident in the Goldmine?* Secondly, I combine empirical data in order to explore the way in which learning processes relate to each other in the Goldmine, and in doing so satisfy SRQ 2b: *Do learning types co-exist and, if so, how do they interrelate in the case of Goldmine?* In the context of experiential learning and as mentioned before, this section will deviate from the cyclical description provided by Kolb & Kolb (2005), and follows a structure underpinned by conceptual indicators of learning by doing, environments, and tension.

6.1 Experiential learning

6.1.1 Learning by doing

Responses collected from respondents suggest the experimental nature of the Goldmine enables varying experiential processes to occur. All respondents highlight the prevalence of learning by doing and learning from experience to some extent; however, value attached is subjective and ranges across respondents. In the initial six months, Goldmine has been focused on creating and doing, with experiential learning processes noticeable for during this time. Figure 2 shows various materials that are collected and used in the Goldmine on a daily basis, highlighting the diversity of design.

Figure 2. Photograph of Small materials stored in the Goldmine. Taken by author

For start-ups that operate from within the Goldmine, their daily experiences are centred on an interaction with waste where experience, reflection and experimentation moves hand-in-hand. Furthermore, the recursive nature of the Goldmine proves salient for experiential processes. Liva (Repos), Adam (Studio Debris), Stefano (Stefano Debris) and Michael (Grave to Cradle) experience material conflict through product defects, and unorthodox material combinations that require internalisation, reflection and experimentation (Kolb & Kolb, 2015). This is evident as Liva (Repos) affirms, "I learn so much from trial and error – I feel that it has so much to do with inspiration and the diversity of materials". Experiential learning in the Goldmine transcends waste and design techniques, and can be considered a product of the organisational structure in the Goldmine. "I have never been in a setting like the Goldmine before – usually, either you are a group negotiating with a landlord, or you are an individual complying with regulations. However the municipality has wanted to run the project with a very flat and unassuming role in the process" (Adam Roigart; Studio Debris). KK bypassed waste management regulations in the city and deliberately employed a horizontal structure in the Goldmine. As Peter (KK/Aalborg University), who holds a hybrid role as a researcher and co-facilitator with KK, states "we have been interested in leaving the ownership of the place. This has been a deliberate effort by us to pull out of the space. If Gold-diggers do not own the space, then they cannot feel that the project will work". Furthermore, this is deliberate as an aim of the Goldmine, and gives Gold-diggers the freedom to experiment, re-create and redesign with a dynamic flow of materials.

6.1.2 Learning Environments

Gold-diggers are not physically bound to the Goldmine and can come and go on a voluntary basis. This combination of a free physical space, and its voluntary character, means that Gold-digger access tends to operate with varying activity levels. With large organisations such as Sydhavn Compagniet, or actors that have full time obligations elsewhere (Sine, Plyssky; Felix, Træstubben), access and recursiveness is less frequent. For Sine (Plyssky), the Goldmine mostly functions as a storage space for up-cycling clothes. Such results therefore do not reveal insights into experiential learning in the Goldmine other than direct instances at the recycling facilities. For Michael (Grave to Cradle) and Liva (Repos), material experimentation was a frequent conversation point and can be considered conditional for learning by doing; for Felix (Træstubben), this was less pronounced. Felix's experiences frequently indicate what Kolb & Kolb (2005) consider dialectic between his individual socialisations and learning environment.

Whilst the concrete practical experience of different material flows allow for reflection and experimentation to occur for some, Felix is disillusioned with the practical space. His responses allude to the fact that the degree of learning by doing is shaped by expectations, values, previous experiences and cognitive preferences of the individual. In short, experiential learning in the Goldmine is implicated by the wants, needs and experiences of the Gold-digger. Felix's opinion, as shown in Figure 3, and expectations prove insightful in shaping his learning style (Kolb & Kolb, 2005).

> "I definitely see value in challenging the system and remaining critical about the system that has created this place [the Goldmine]. ARC runs the burning factory in Copenhagen that will be larger than the mayors building that has decided this, and it. This incineration facility (part of the construction of the Sydhavn recycling facility) will look like a skiing hill. Other than this, we dig big holes for the things that we don't know how to separate. We burn materials that can't be separated, however we know that in some years it will be worth it in money". (Felix, Træstubben)

Figure 3. Prospective plans for Sydhavn Recycling Centre. Source: Bjarke Ingels Group

Felix values intensive dialogue, advocates for systems level thinking and asserts that the Goldmine must "problematize, challenge and re-invent". In addition, his experience as an educationalist in Træstubben influences his expectations of what to learn in the Goldmine. He primarily aims to create enduring relationships with other Gold-diggers, and focuses less on material experimentation. In fact, in contrast to the response of Liva (Repos), Felix (Traæstubben) states, "my approach is that I do not take things out of the container, unless I have a concrete idea about I want to do". Therefore, Felix has a deep interest in people, and has strength in seeing things from different perspectives.

One property of experiential learning in the Goldmine is the place-based nature of these processes. In general, responses indicated that as a result of physically being present in the Goldmine, Gold-

diggers are in a setting that enables the transformation of experience via experimentation. Whilst experiential processes most likely occur amongst all of those that are involved in the project in some form, the value in experiential learning is currently confined to the Goldmine as a physical boundary. Experiential learning processes are also more pronounced for Gold-diggers, and less so for researchers and KK. These findings imply that experiential learning processes are central to Gold-digger practices. In the eyes of Liva (Repos), "physical material creation is not the focus of research".

6.2 Transformative Learning

By combing competencies and presenting the way in which individual assumptions have, or have not, been challenged, this section explores the nature of conflict and potential of value change in contributing towards transformative learning for adaptive individuals (Mezirow, 1995; Armitage et al., 2008).

6.2.1 Instrumental competencies

1. Acquiring skills and new information

Skills and information acquisition are fundamental in the Goldmine. Although the physical space of the Goldmine provides a forum for equal access to information and new skills, the opportunity to visit the space varies greatly. Information and skills largely tend to relate to the specific Gold-digger projects and collaborations, such as design techniques, material combinations. Common skill and information acquisition occurs through the retrieval of materials from waste containers.

2. Determining cause-effect relationships

Respondents consider the Goldmine a catalyst for cause-effect relationships, and largely relate these with aspects of materiality. Instances include production and management practices, however there are signs that the Goldmine can challenge motivations and beliefs to some extent. All Gold-diggers joined optionally, which suggests that they have certain expectations of the benefit of the Goldmine. As a project that places waste material and experimentation at its core, and is in such close proximity to physical containers, it might be of no surprise that Gold-diggers have an interest in this arena. Both Liva (Repos) and Adam (Studio Debris) have previous experiences with used materials, and Ask

(Flydende By) is established in Flydende By in Copenhagen; however direct access to the Goldmine has challenged the expectations of what can be considered a resource. For Liva (Repos), "from a material sense I am very much not surprised anymore [because of the Goldmine] about the things that I can find in the containers". Direct access to containers enables Gold-diggers to experience different material flows in a real-time disposal context. Both Adam and Stefano identify this exposure and access to different forms of material in a no-pressure environment as having a direct impact on their design opportunities.

Liva (Repos) and Sine (Plyssky) mention that the Goldmine reconfigured perspectives of the municipality in a positive manner. Ask (Flydende By) considers the Goldmine a project that has allowed him to interfere with established mechanised modes of production in the waste management sector. The impact of the Goldmine extends even beyond interfering with a process of waste management. As a direct result of his involvement, Ask believes this represents a competing paradigm within the capitalist system. Through the Goldmine, he has learned that this paradigm not only co-exists, but also can be encouraged to do so by the local governing institutions.

> "Because of the Goldmine, we are inside the machine. Before we could work with things, and now we are very much inside of the production and management system. The next step is to prove that this waste system can be humanised, and that changes can be made. If we manage to prove this, I think we can spread this across cities, and on a global level" (Ask; Flydende By).

Cause-effect relationships in the Goldmine can lead to instrumental learning that may not necessarily be positive. As an educationalist for transition, Felix (Træstubben) focuses on core individual values of problematizing, challenging and re-inventing through action. Whilst its practical nature might result in opportunities for action, Felix argues that an absence of systems thinking in the Goldmine conceals some larger social and political processes that determine its very formulation. Adam, Stefano (both Studio Debris), Liva (Repos) and Sine (Plyssky) see value in the Goldmine as an office space, workshop and storage facility; for Felix, this experience in the Goldmine has led him to consider "this value, and the prominent pull-factor of an office space for free, shows the need of place in Copenhagen more than anything". In a nutshell, Gold-diggers do see the effect that the Goldmine is having on other aspects of their life, ranging from design skills and values in waste and extending towards pre-conceived notions of the municipality as project co-ordinators. Whilst predominantly suggestive of positive change, the case of Felix highlights that properties in the project can re-enforce or foster critical cause-effect relationships in the presence of various tensions.

3. Task-oriented problem solving

Mezirow (1995) argues that in order to control and manipulate objective realities in the external world, instrumental competencies are enhanced through task-oriented problem solving. Performativity and productivity-based actions are effective modes to identify instances of instrumental problem solving in this manner. The Goldmine has experienced significant change in the first six months of the project, and Gold-digger responses verify widespread instrumental learning through problem solving during this period. Adam, Stefano (Studio Debris), Liva (Repos), Sine (Plyssky) and Michael (Grave to Cradle) are involved in start-up enterprises, most of who began as a direct result of the Goldmine application. Coupled with access to new materials on a daily basis, constant material flows and the infancy of actor roles leave allow for performance improvement, incremental adjustments and design optimisation. Gold-diggers achieve tasks and in doing so improve their competencies across material sets, fuel economic productivity via feasible products and negotiate through flexible organisational structures in their enterprises. Beyond individual skills, there is consensus amongst Gold-diggers that weekly and monthly meetings are problem solving in their orientation. Ask (Flydende By) asserts "meetings work with practical issues", which complements Stefano's (Studio Debris) impression of meetings as involving "an agenda, which includes a list of issues and problems that need to be resolved".

Responses from the Goldmine suggest that meetings provide an entry point into the assumption of Armitage et al. (2008) that learning processes can co-exist. Within the Goldmine there are properties that can stimulate both individual and group learning processes. This can be categorised as part of an umbrella approach of inclusion in the Goldmine as an ULL. Weekly meetings provide a platform for dialogue that, although associated with task-orientation on an individual level, have broadened discussion at times to include goals and values of different actors. The next section will unpack the implications of such practices, based on respondent interviewees.

6.2.2 Communicative competencies

"The second competency relates to communicative Learning - learning what others mean when they communicate with you. This often involves feelings, intentions, values, and moral issues" (Mezirow, 1995, p.8).

1. Understanding values and other's points of view

Results indicate that, until this point, the Goldmine provides little evidence of challenging the norms or values of individual Gold-diggers, researchers or KK. The decision to gather such an array of private

actors was not a central driving motivation from KK. Peter (KK/Aalborg University) reiterates the focus on a broader interest in waste by stating "it was not a conscious effort from our side to include Gold-diggers of such different backgrounds, nor was it our aim to create a voluntary experiment. This arose more out of pragmatism than anything, as we basically accepted everyone that submitted an application". Although the decision was not directed, it allows for unique findings. Disparate diversity represents a core-determining factor in the Goldmine until this point, and can be considered responsible for a confusing actor collection. This confusion is exhibited through discussions related to whether Gold-diggers represent an "I" or "We", clashes between green growth and systems thinking, and calls into question the underlying values of the Goldmine through different problem-perspectives.

Competition of resources, political influences within the Goldmine, and subsiding interest in non-governmental businesses arise as points of concern amongst interviewees. These concerns in turn shape the experiences of the Goldmine. In tying together contesting perspectives, transformative learning shines a light on the incongruence between the intentions of the ULL creator, and those occupying the space. Numerous Gold-digger experiences convey problem perspectives that inhibit communicative learning. Felix states "In terms of the general problems, the Goldmine and the Sydhavn recycling centre can be seen as a clowning project that makes incineration more palatable". Adam considers the Goldmine a mock-democracy; for Liva (Repos), it is a playground. Ask uses the term "illusion of freedom" and Stefano labels it a quasi social-experiment. In short – the values of Gold-diggers are not being challenged, as this was never the aim of the Goldmine. The presence of such contesting perspectives in the Goldmine can be considered unintentional; that is not to say that implications are inherently negative or problematic.

Experiences from the Goldmine highlight that Gold-diggers carry vastly different degrees of comfort and expertise when approaching waste. Sine (Plyssky) offers an insight into not only the infectious nature of the Goldmine, but also exposure to other Gold-digger perspectives.

> "I work with textiles and know a lot about associated waste. After being introduced to other Gold-diggers knowledge about other types of trash, I think I have changed my values a bit regarding other materials and their potential for reuse. After having seen how the municipality is working with the trash at the site I have also been more engaged in fighting for other and more sustainable solutions – also because I see how much trash there really is." (Sine, Plyssky)

Sine's experience highlights an instance of cause-effect, and the way in which Gold-digger diversity has induced transformative learning. The above results highlight that, whether deliberate or contingent, good or bad, the organisation of the Goldmine can be fundamental in shaping who

learns, and for what purpose. Based on experiences and through the visions of Liva (Repos), Ask (Flydende By), Felix (Træstubben) and Michael (Grave to Cradle), it is clear that Gold-diggers aim to create an environment where lifestyles, norms and values can be challenged within the fourth component of an ULL quadruple helix; civil society. Until this point, however there has been little interaction with actors not actively engaged in waste management, which limits transformative conditions and proves challenging for transformative learning.

My results highlight that instrumental and communicative learning are often disparate in their influence. Whilst instrumental competencies are largely present, and take a variety of different forms, challenging of norms and values of Gold-diggers, academia, and the municipality remain largely absent in practice. Although different problem perspectives seemingly create grounds for discussion that can prompt dispute and trigger internal reflection, this is an unintended consequence of Gold-digger section, rather than a directed property of the Goldmine. There are also examples where experiences in the Goldmine have prompted value and norm change for Gold-diggers that are relatively inexperienced in the field of waste, however this cannot be considered a general trend. In theory, the Goldmine has the potential to foster transformative learning, however due to a variety of reasons that have been outlined above, results are inconclusive as to whether this has transpired on the ground in initial stages.

6.3 Social Learning

In contrast to both transformative and experiential learning theories, social learning is synonymous with collaborative group instances, whereby knowledge generation and learning extends beyond individual. Instances of social learning have been derived from key elements of Armitage's interpretation and coded accordingly based on responses from Gold-diggers, with core codes pertaining to 1) sharing experience, 2) group participation, 3) project participation, 4) broader participation and 5) group reflection. Due to uneven engagement with civil society in this study until this point, this thesis will also rest upon the visions and expectations of the Gold-diggers in order to draw conclusions for learning beyond this research.

6.3.1 Sharing experiences

On a broad level, there is a consensus that amongst respondents that group sharing occurs regarding the transfer of tools, materials and designs. All Gold diggers have access to the physical space, however, as mentioned before, sharing of space as a group is piecemeal and based on different levels of activity. Liva (Repos), Adam, Stefano (both Studio Debris), Ask (Flydende By) and other Gold-Diggers beyond my interview sample share the physical environment on a daily basis, with Studio Debris and Repos using the Goldmine permanently as an office. Liva (Repos) states "between four and seven people are usually here on a full-time basis per day". Felix (Træstubben) on the other hand had not been present in the Goldmine for the month preceding my interview. Studio Debris, Repos, Grave to Cradle, Plyssky and Flydende By share tools within and outside of the Goldmine on a daily basis, seemingly extending across Gold diggers with expertise such as materiality, communication or education. Mostly informal in application, Liva (Repos) reaffirms that "tools and material sharing are an integral component of the learning that can be seen within the Goldmine". This collaborative environment was quite evident within the physical space as depicted in figure 4, which depicts the collective workspace and tools in the Goldmine.

Figure 4. Photograph of communal Gold-digger woodworking station in the Goldmine. Taken by author.

Beyond exchange of physical parts, sharing of ideas and experience occurs in the Goldmine on an informal level, rather reflecting the subtle nature of interactions. As a result, it became difficult to retrieve concrete experiences where sharing has occurred, however respondents identify several formalised sharing events. Such events provide a forum for exchanging experiences or visions, and include an initial visioning workshop at the beginning of the Goldmine. On March 23rd, Studio Debris

and Repos conducted a visioning session with civil society for a project called the "Gold-container". This concept focuses on creating a waste container that allows members of the public that are disposing of waste, to deposit materials in a more directed manner for use within the Goldmine. During this workshop, Gold-diggers and civil society exchanged and shared opinions in order to devise a strategy for the Gold Container development. All respondents recognise that sharing of ideas with civil society will form a central aim of a formalised awareness event on April 30th, 2016.

6.3.2 Group and Project participation

All interviewed Gold-diggers highlight the physical creation process of the Goldmine as a core collaborative experience. Although not monitored, Gold-diggers signed a contract for use of the Goldmine, under the condition that the physical space would be self-built (See figure 5). For Adam, Stefano (both Studio Debris), Liva (Repos), Peter (KK/Aalborg University) and Ask (Flydende By), this represented an initial opportunity to learn via participatory material experimentation.

"We began to learn about how materials can be used together to build a wall or a platform for an office space" (Liva, Repos)

Figure 5. Photograph of Goldmine office space, built fully from waste, and by Gold-diggers. Taken by author

For Studio Debris, learning can be traced to this direct building process as it enabled the start-up to manipulate materials freely, test and evaluate design techniques and formulate a space management strategy for the site. Furthermore, Stefano from Studio Debris identified a group working day in December 2015 as a point where different Gold-diggers contributed to sourcing materials from the recycling facilities in the Goldmine. On a weekly basis, Gold-diggers participate in meetings that

include Kathrine or another member from KK. This meeting facilitates weekly practical issues, whereas larger issues or discussions are reserved for a monthly meeting.

Intra-lab collaborative projects have emerged in the Goldmine, creating a complex web of interactions, most of which have varying degrees of formality and informality. Adam and Stefano (studio Debris), Liva (Repos), Felix (Træstubben) and Michael (Grave to Cradle) mentioned that they actively seek to collaborate with other Gold-diggers on internal projects. Table 3 highlights the interconnected nature of this web, based on empirical evidence.

Table 3. Intra-lab collaborative projects as a result of the Goldmine

Description	Stakeholders involved	Location
FabLab Tag Design	Michael (Grave to Cradle); Plante Guld	Goldmine
Gold Container	Repos; Studio Debris; Civil Society	Goldmine
Greenhouse Design	Liva (Repos); Matthias (Copenhagen Connoisseur)	Goldmine
Guided tours	Liva (Repos); Adam & Martin (Studio Debris)	Sydhavn
High School Education	Liva (Repos); Matthias Copenhagen Connoisseur)	Goldmine
Jultræsfest	Liva (Repos); Felix (Træstubben) from Materialecentralen	Vesterbro
Sign Construction	Michael (Grave to Cradle); Studio Debris	Goldmine
Urban gardening design	Felix (Træetubben) from Materialecentralen; Helle (Plante Guld)	Sydhavn

The nature of the participation in the Goldmine is shaped largely by access, rather than entitlement. All Gold-diggers are entitled to make decisions in meetings, and are free to collaborate. They are, however, constrained by the voluntary nature of the project, and external obligations outside of the Goldmine. Therefore, interest in participation amongst Gold-diggers does not always materialise in practice. For Felix (Traæstubben), his interaction in the Goldmine is limited by external obligations. Likewise for Ask (Flydende By), who participates actively and predominantly within Flydende By (next to the Goldmine), and Sine, who is based on another site with Plyssky. Having said that, all Gold-diggers reflected upon the value of different knowledge and expertise pools in the Goldmine as a space. One core variable seems to be access to this knowledge, which is determined by factors such as interest and motivation of Gold-diggers, willingness to collaborate, and availability to access the Goldmine as a space.

6.3.3 Broader participation

> "I think the amount of workshops with general interest from the public will increase a lot over time of the project. This is a great opportunity to show people how the stuff they throw out and forget about are really a great resource and not just trash." (Michael, Grave to Cradle)

Based on responses, participation in some form extends beyond the Goldmine. All interviewees engage outside of the Goldmine in some manner. Studio Debris has a municipal and private client

base; Flydende By is situated in a warehouse next door; and Træstubben operates as part of KK in another location. Grave to Cradle operates through Copenhagen FabLab with another location. As does Plyssky. Repos exists solely from the Goldmine and, whilst small and under development, actively seeks partnerships outside of the site. Groups operate in different capacities and locations, and thus carry implications for processes of learning outside the Goldmine. This extends beyond Gold-diggers, offering instances of social learning in other contexts such as with civil society. For example, Felix (Træstubben) used materials from the Goldmine, the physical space as a workshop, and the knowledge and expertise of Liva (Repos) to organise a Christmas sustainable event in Copenhagen in December 2015. He aims to educate children on urban transitions and an urban-nature connection via what he calls action stories. Flydende By frequently engages in workshops using materials from the Goldmine and other sites, in order to educate participants on aspects of waste and sustainability. All of these projects, and projects from Table 3, engage with actors outside of the Goldmine. The Gold container streamlines waste flows, provides civil society with an insight into the needs of the Gold-diggers, and establishes a closer connection with employees from ARC.

Based on the visions of the Gold-diggers, the Goldmine can be considered in somewhat of a period of transition. Gold-diggers, and the Goldmine as a project possess visions that draw upon social learning. Emphasis is moving away from physical space preparation (which Gold-diggers recognise as the first phase), and towards direct engagement with civil society under the umbrella of the Goldmine. Felix (Træstubben) has begun to work with the concept of sharing stations across Copenhagen as a direct result of the Goldmine, in a hope to connect material flows in different parts of the city. Liva (Repos) intends to engage more with members of ARC, as in her eyes, "they hold so much knowledge that we can use and learn, but we don't have access to yet". Therefore, for Liva, ARC actors represent undervalued knowledge brokers that, through dialogue and discussion, can foster processes of social learning. For research and municipality, these visions relate almost exclusively monitoring and evaluating learning processes as indicators of success.

6.3.4 Group Reflection

The role of reflection as a central condition of social learning within the Goldmine is fragmented, undefined and seemingly self-organised. 6 of 10 respondents state that there is no formalised role of reflection within the organisational setup of the Goldmine. Weekly matters focus on practical day-to-day tasks, typically resulting in minimal reflection on values, ideas or assumptions of the project. Monthly meeting presents an opportunity for broader discussion, however Felix (Træstubben)

questions the effectiveness of this: "we need to question our own roles and values. This never lasts in the monthly meetings, as they are based on daily problems". Both Ask (Flydende By) and Felix mention that reflective discussion emerges organically from within formal meetings at times, however neither time, nor priority is purposively allocated towards this. Group reflection does tend to occur from within Gold-digger enterprises. For example, Stefano and Adam (Studio Debris) have integrated reflection into their organisational structure. By doing so, they aim to foster critical thinking and collective reflection on each other's projects in Studio Debris. Adam asserts: "we want an organisation where everybody does not have to be involved in all projects, where everyone needs to be informed and willing to provide an input. Therefore, we will have a common knowledge pool".

> "Until now each project mostly reflects about its own role. We have not formalised group efforts of understanding our common goals – yet." (Michael, Grave to Cradle)

Stefano, Liva and Adam commonly identified an instance of group reflection in the Goldmine as a response to modes of communication. Flydende By that comprises a variety of international members as an international organisation, and therefore uses English as an official working language. From the onset of the Goldmine, Gold-diggers communicated informally and formally in Danish, which restricted the degree of interaction with Flydende By. In February 2016, the Goldmine reflected upon the values of the Goldmine and gained consensus collaboratively through a series of interventions and meetings. As an outcome, the project agreed to conduct future communication and meetings in English. Whilst this represents an example of social learning, there remains no formal arena for mediation of conflict or reflection beyond operational aspects of the Goldmine.

Until this point, section 6 identifies experiential, transformative and social processes of learning using a qualitative case study approach. Findings suggest that all three processes of learning are not only evident in some manner, but have also been shaped by contextual qualities in the Goldmine. I divert my attention towards the nature of these processes for the remainder of this section, and by doing so, explore the interrelatedness of learning in the Goldmine.

6.4 Do learning processes co-exist?

The view that learning can manifest in various manners, across different people and for different reasons is assumption that I have carried through both the research process and findings. Before broadening the discussion of learning types for sustainability, this research approaches the crosscutting element of co-existence that shapes my analytical framework and subsequent approach

to learning. In the following section, I aim to discuss aspects and the way in which they interrelate with multiple learning processes in the Goldmine. Analysis will interchange through learning processes; analytical focus is placed on exploring the aims and practices that mutually shape these processes in the Goldmine. In doing so, section 7 comprises the final empirical contribution of my study towards research question 2, specifically targeting research question 2b: *Do learning types co-exist and, if so, how do they interrelate in the case of Goldmine?* As a first step, Figure 6 presents a visualisation of qualitative data pertaining to the multiple determinants of learning in the Goldmine.

Social

Differing locations

Experimental legislation

Intra-lab Participation
Mutual Interest
Different expertise
Shared Visions   Self-organization
Co-production
Provision of space
Learning as an aim

Transformative

Experiential

Trial and Error

Recursive Design

Different problem perspectives
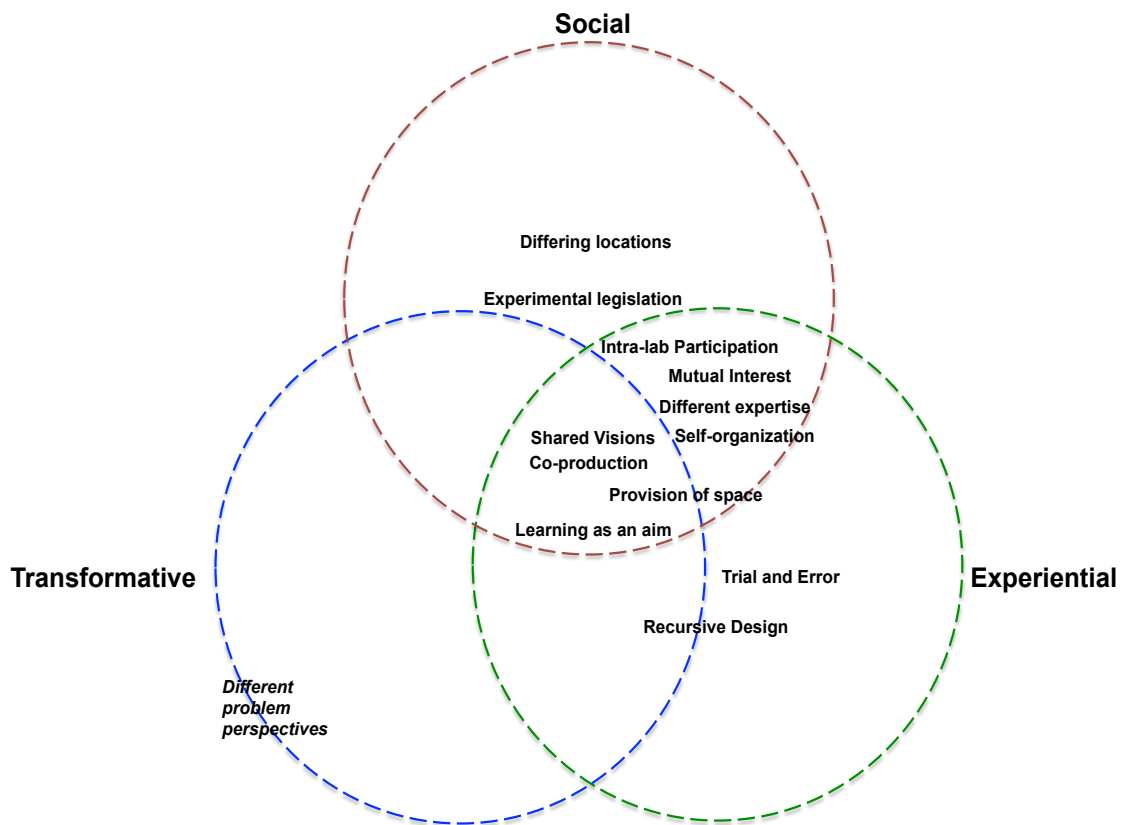
Figure 6. Venn diagram highlighting co-existence of learning processes in the Goldmine.
Proximity towards other circles is dependent on strength of the empirical evidence. Central terms (mutual interest, differing locations and trial and error) are collective trends. Terms at the periphery should influence a learning process, however could not be established empirically. Those that converge with other circles, or are at central edges, vary based on respondent information.

6.4.1 Learning as an aim

Empirical aims for the Goldmine establish relavence for experiential, transformative and social learning. Gold-digger experiences are consistent in suggesting that in theory, experiential learning is a central goal that KK has intended to foster. Goldmine learning ambitions can be broadly grouped into two related goals: 1) learning about creative ways to manage and manipulate waste, both

publicly and privately and 2) learning for Sydhavn recycling Centre. These were agreed upon by all actors and encouraged by ULL organisers (Kathrine and Peter). In order to contribute, Gold-diggers are encouraged to work together, experiment by doing and generate insights that can translate outside of the project. Therefore, the Goldmine is explicit in its role as a prototype to be scaled in 2017. Further, practices in the Goldmine can also be grouped into two broad phases: 1) initial development and building (Nov 2015 – March 2016), and 2) Gold-digger development and citizen engagement (beginning March 2016). Figure 7 conveys the motivations of the Goldmine, through an accumulation of various respondent experiences and perspectives.

Figure 7. Word cloud of Goldmine aims generated from transcripts of interviews. Source: Author/MaxQDA

Across both phases, Goldmine designers have purposively fostered experiential and social learning. An important distinction however, can be drawn towards who will learn. For example, experiential learning is considered unimportant for Peter as a personal aim (KK/Aalborg University), yet signifies a central aim and process for Liva (Repos). Further, actors have vastly different expectations of learning in the Goldmine. This is unsurprising (Armitage et al., 2008), and is consistent with ULL characteristics (Bulkeley et al., 2015). Actors within the Goldmine need not learn equally, nor are they expected to. Having said that, learning is purposively prompted through several key design situations (Armitage et al., 2008; Bulkeley et al., 2016). These include visioning sessions with Gold-

diggers, architects and citizens, practices of co-production in the space, and a formal opening event in April 2016.

6.4.2 From aims to practice

"We are here for a limited time, and this project [Goldmine] is about practical things obviously. We need to get concrete things done; otherwise there is nothing to connect the ideas. This connection needs to be in creation."(Ask, Flydende By)

Gold-diggers perceive shared visions, co-production practices and provision of space in the Goldmine as inducing several learning processes. It is evident that by building the internal space, Gold-diggers have been presented with opportunities to exercise learning by doing. Further, this was an aim, and brought with it a wealth of material combinations, fostered sharing and empowered Gold-diggers to design their reality. Trial and error and recursive design characterise the nature of experiential learning in the Goldmine through interacting, discovering and doing. This co-production process provided a platform for Gold-diggers to collectively harness learning by doing, and negotiate a common perspective of their space. As a result, experiential co-production in the Goldmine is enacted in a way that extends towards social learning situations. Although co-production can support multiple types of learning, processes vary from Gold-digger to Gold-digger. Empirical evidence suggests that time, space, obligations and problem perspectives impact the extent of co-production and intra-lab collaboration.

"I want to use what I learn here in the Goldmine, and be interactive in other parts of the city. It is my hope that knowledge will encourage interaction within the Goldmine, and behavioural change outside."
(Liva, Repos)

Visioning establishes a forum where multiple actors collectively develop perspectives of their reality (Bulkeley et al., 2015). Academia, civil society, the municipality and private actors have engaged in visioning sessions at various stages in the project. Gold-diggers redirect their experiences towards architects to directly influence the design of Sydhavn recycling centre. Civil society was involved in the initial Goldmine design, engage in a multitude of Goldmine workshops and have actively influenced the Gold container. These connections are pivotal in the situated transfer of experience and perspectives, and carry promising implications for transformative learning for civil society. In the eyes of Gold-diggers, transformative processes are apparent amongst citizens that they have directly engaged with.

As illustrated in Figure 6, it is not whether the Goldmine as a multi-user driven intervention fosters social and experiential learning, but rather the degree to which this occurs for actors, and the transformative implications of and for such learning. Conditions facilitating both social and experiential learning processes include daily sharing, access to participatory arenas and diverse interest sets. By circumventing waste management legislation in the city of Copenhagen, the municipalities bypass the external politics that situate the Goldmine. Actor roles and responsibilities are undefined and experimental decision-making is encouraged. Gold-diggers self-organise and communicate freely, and are responsible for the space. Decisions are seemingly egalitarian in formulation, and meetings are open for all actors to participate in; however there are generally no expectations to contest or comply with. By trying to maintain a flat hierarchy, the hope is that Gold-diggers organically organise, communicate and establish rules and norms. By doing so, direct power would dissipate amongst all actors and permit a broadening of waste related knowledge. Gold-diggers, academia and the municipality share a mutual interest in innovative approaches to waste, bring together a wealth of different expertise and skill sets, and operate from various sites stretching beyond the Goldmine and across the city of Copenhagen. Linkages amongst Gold-diggers have formed, relationships have been developed and responses identify first-level social learning.

6.4.3 Transformative learning?

Although empirical evidence suggests that sharing of visions and co-production provide opportunities for various learning processes, the extent to which competencies extend beyond instrumental and towards transforming norms and values remains contested. In theory, differing problems perspectives construct sources of tension that catalyse transformative learning (Mezirow, 1995). In practice, these perspectives unfold through different actors, varied organisation sizes and a wealth of expectations and ambitions that occupy the Goldmine. Whilst they may be evident, differing problem perspectives in the Goldmine in general do not translate into transformative learning in practice.

Whilst perspectives coincide amongst respondents at time in a physical space, they typically can be located across different levels. Instrumental perspectives on design and organisation are relayed via daily meetings, and broader perspectives are exchanged with visioning sessions and consultations with ARC architects. Having said that, one noticeable characteristic is that problem perspectives represented within this Goldmine differ greatly in both orientation and depth. They encompass direct waste-related problems, organisational and financial concerns, and extend towards a systems perspective to waste management in the city, and the nature of sustainability within capitalism. One

central theme relates to space for reflexive action, and modified perspectives. As established before, the beliefs of Gold-diggers, academia or the municipality are not being challenged. This research discerns two factors that contribute to this concept-practice disconnect.

Firstly, norms and values of academia, municipality or private actors have not been altered on a project level, nor has the opportunity to contest or mediate arisen. Potential reasons for this involve the isolated participation of some Gold-diggers in the initial stages, the absence of an arena for critical thinking, and the lack of regulation as both an arena and approach. As the role of reflection in the Goldmine manifests incongruently across Gold-diggers or through informal practices, it has remained largely absent from a collective space. Conceptualisations articulated by Armitage et al. (2008) shed light on the absence of reflection, which is a precondition of social learning and a catalyst for transformative learning (Armitage et al., 2008; Bulkeley et al., 2015; Reed et al., 2010); this absence can be seen as pivotal in shaping the nature of learning in the Goldmine. Secondly, the Goldmine has yet to extensively engage with actors who, in turn, will question their assumptions through various forms of experience. As an ULL, the aim of the Goldmine can be considered a condition for transformative learning, however the "who" of transformative learning processes has yet to be established empirically. Gold-diggers undoubtedly engage beyond the Goldmine, however investigation of external processes exceeds the scope of an intra-lab study. Experiences from civil society have the potential to advance understanding of the nature of transformative learning as a result of the Goldmine.

The section above presents learning aims and practices as themes in the Goldmine to explore co-existent nature of learning processes. Results illustrate these can invariably co-exist, and identify mutual determinants of vision sharing, co-production and provision of space as enabling experiential, transformative and social learning. The remainder of this thesis explores challenges and opportunities for learning in the Goldmine; this is of particular interest as KK positions learning as not only a goal, but also a core evaluative concern moving forward.

6.5 Moving forward in the Goldmine

Bulkeley et al. (2015) argue that numerous learning goals are expected when multiple actors interact in ULLs. This can certainly be seen in the Goldmine, but must not be considered inherently negative. My findings suggest that there may however come a point when diversity exerts limiting properties for learning. Expectations are broader than initially planned, and the range of Gold-digger attributes

have unintended and therefore unplanned consequences for learning processes and learning outcomes. It becomes more challenging to untangle expectations of learning, align them with empirical goals and employ meaningful evaluation approaches. This finding proves salient for a project that is yet to reach maturity, as interviewees express concerns regarding the evaluation of learning.

> "At this moment, the physical amount of waste removed has been the sole indicator, however there are frequent discussions regarding evaluation pathways to pursue. Responses identified a variety of activities that are currently being adopted, or have been discussed, in order to tease out qualitative indicators. These include product photographs, descriptions and reports, developmental workshops and interviews with KK in June 2016, and the public market in April." (Peter, KK/Aalborg Universetet)

Monitoring and evaluation is currently in development, and diversity-challenges are ubiquitous for both Peter and Kathrine. In the eyes of Armitage et al. (2008), narrowly explored learning goals present challenges when compared with conditions in practices, both of which impair evaluation. The goals in the Goldmine remain broad and have not been articulated amongst actors at an early stage of the project. Concerns are evident for Kathrine (KK), who identifies navigating Gold-diggers expectations and harvesting knowledge for up scaling as core concerns for the project. For future use and as an opportunity to operationalise monitoring and evaluation, the role of experiential learning might move towards education, development of teaching materials for core themes of the Goldmine, incremental approaches to learning and dissemination of knowledge. Experiential learning theory could prove valuable for KK or Aalborg University in order to advance learning for those that will begin to occupy the Goldmine frequently, as it identifies several determinants of experience-based learning in the Goldmine. Furthermore, a deeper investigation and application of learning style inventories developed by Kolb and Kolb (2005) on other ULLs, will potentially prove fruitful in order to evaluate Gold-digger learning.

> "By doing workshops and working with volunteers, a hands-on approach to learning becomes an eye-level approach. We as Gold-diggers are more at level with "ordinary people"/citizens than when we approach citizens as a municipality, school or research institution." (Michael, Grave to Cradle)

Insights highlight that with the Goldmine in its current form, experiential learning does not suggest transformative potential, nor is it indicative of empirical value changes. At this moment, findings do not suggest significant transformative processes, as this is yet to extend beyond the local level (Armitage et al., 2008). It is probable that the Goldmine embraces civil society on a more regular basis, extending the scope of learning by discovering and doing. Therefore, experiential learning provides an avenue to develop directed approaches for knowledge dissemination, in a way that has

implications beyond physical spaces. Gold-diggers are pivotal in these processes; through learning by doing and collaborating in the Goldmine, they assume the role of knowledge brokers for civil society. Therefore, as actors, they bridge dimensions and creation and transformation that typify the Goldmine. This project must move beyond only local Gold-diggers in order to guarantee transformative processes and create avenues for dissemination. This can be achieved through a combination of two pathways: 1) extending Gold-digger participation with civil society beyond the physical space, or 2) increasing citizen engagement from within the Goldmine. This process of citizen engagement in urban experiments and context specific experience is consistent with empirical analysis of actor contributions in ULLs (Juujärvi & Pesso, 2013).

7 Conclusion

Due to the intrinsic location of learning and its role in achieving sustainable urban change, the overarching aim of this thesis has been to direct attention towards learning in an ULL. In section 2 I conducted a review of available ULL literature and conceptually tied three learning types to answer the following question: How do learning typologies relate to ULLs in theory? In the context of ULLs, I argue that studies approach learning inconsistently and without conceptual rigor. Whilst it is not in question that learning can be considered inherently desirable in achieving transformative change (Armitage et al., 2008; Bulkeley et al., 2015; Feola, 2014; Voytenko et al., 2015), there is recognition within ULL literature that thorough commitment to learning on a case-based level is lacking (Bulkeley et al., 2015; McCormick et al., 2014). Building upon the assumption that learning is inherently relational, I present learning processes (SRQ2a) and explore the way in which they interact within the Goldmine (SRQ2b) in section 6, thus confronting research question 2: *How are experiential, transformative and social processes of learning relevant in the Goldmine?*

By employing case study analysis using interdisciplinary learning types, findings from the Goldmine represent a tentative first step in advancing consideration of learning for ULLs. They highlight that what, how and by whom learning occurs is underpinned by, amongst a myriad of factors, an alignment of aims and actions within the Goldmine. Experiential processes are largely place based, and unfold through learning by designing, testing and inventing. Gold-diggers largely share tools and experiences, collaborate internally and have equal access to participation. By exchanging visions and co-producing the physical space, bridges between social and experiential learning processes form, and move towards transformative learning. Learning is an official aim of the Goldmine, and has been operationalised in designed learning situations. One striking finding highlights the rarity of transformative learning amongst Gold-diggers.

Although transformative change is a guiding motivation of the Goldmine, it carries connotations for actors at different levels, and is rather directed towards civil society. The complex array of Gold-diggers and voluntary nature of the Goldmine are unintended consequences of project development, and suggest that disproportionate experimentation and diversity can have detrimental impacts on learning. Despite the burgeoning nature of the Goldmine, signs are promising. Gold-diggers informally interact, share and reflect to an extent, even in the absence of formal reflection as an aim, practice or form of evaluation, which yields interesting insights into the flexibility of ULL formations. Findings in the Goldmine offer a glimpse into the way in which learning unfolds inside an ULL. Moreover, by operating under the assumption that learning processes can co-exist and grouping the

Goldmine using ULL characteristics, this thesis can serve to stimulate learning-focused discussion surrounding ULL theory and practice.

Future research opportunities

The Goldmine presents a future research opportunity to investigate processes of engagement with civil society and context specific sources of tension and conflict. As an ULL, engagement and transformative learning will have implications for knowledge dissemination in urban contexts, education approaches and the potential of the project as an agent of change. Typologies of learning represent a first step in separating, categorising and prioritising processes, outcomes and the very conditions that facilitate learning. By extending its application, it is possible to not only avoid conceptual conflation, but also stimulate effective and intended learning processes in practice. Further, the Goldmine has dispersed beyond the physical space, and is beginning to proliferate horizontally and vertically in Copenhagen. The degree of learning, and implications of the Goldmine as part of a broader context were not the focus of this study. The above findings of intra-lab learning however warrant future research that examines processes of experiential, transformative and social learning on broader spatial scales.

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Appendices

Appendix I: Project and Interviewee List

Project	Name	Actor Role	Interview
Kobenhavn Kommune	Kathrine Overgaard Rasmussen	Municipal	March 11th – 13:00
Aalborg Universitet	Peter Munthe-Kaas	Research/Municipal	March 31st – 12:00
Træstubben	Felix Becker	Private/Municipal	March 31st – 10:15am
Flydende By	Ask Holmsgaard	Private	March 31st – 13:00
Plyssky	Sine Sørenson	Private	Email – April 1st
Grave to Cradle	Michael Hviid Nielsen	Private	Email – March 25th
	Hans Parel	Private	Email – March 31st
Studio Debris	Adam Roigart	Private	March 22nd – 13:00
	Stefano Rosselli	Private	March 25th – 10:00
Plante Guld	Helle Haagensen	Private	Email – April 1st
Repos	Liva Bjerg Linnet	Private	March 23rd – 14:00

Appendix II: Semi Structured Interview Guide

Theme	Questions
Goldmine	a) What in your eyes are the aims of Goldmine?
	b) How was this process initiated? How did you become involved?
	c) How would you describe the physical setup of the Goldmine?
	d) Tell me a bit about your current project?
ULL	e) Have you heard of the living lab approach before? Is this something that is familiar to you?
Learning Process	a) How would you describe the learning process in the Goldmine?
	b) What knowledge is generated in the Goldmine?
	c) How would you describe the way in which the Goldmine helps users learn?
Practices	a) Are there any activities that help users share new products, knowledge, and findings?
	b) How would you describe your relationship with other Gold-miners?
	c) How would you describe your projects relationship with Peter-Munthe Kaas or Kathrine?
	d) Does your project interact with/engage with other in/outside of the Goldmine?
	e) In the context of your project, do you think project X is learning as a whole?
	f) Can you tell me a bit about the role of reflection in the Goldmine?
	g) Do you know how decisions are made in the Goldmine?
Outcomes	a) How does your project benefit from the Goldmine?
	b) Were there any clear learning goals set in place when beginning with the Goldmine?
	c) Have learning outcomes been introduced at any stage?
	d) Do you know if there are any plans from within the municipality/your project to evaluate or measure learning?
Other	a) Has there been a situation where the Goldmine's values or policies have been changed?
	b) Do you know of any instances where the values of individuals are beginning to change in the Goldmine?
	c) Have you ever experienced this on an individual level?
	d) What have you learnt/do you hope to learn from the project?
	e) Is there anything in place that allows users to share their experiences in the Goldmine?
	f) What types of everyday challenges do gold diggers face in the Goldmine?
	g) Are there open consultations amongst gold diggers?
Future	a) What will you do with the lessons learned from the goldmine?
	b) What is your vision for the remainder of this project, and beyond?

Appendix III: Word cloud generated from full transcripts of interviews

Source: MaxQDA/author

Appendix IV: Limitations

The diversity of Gold-diggers proved a challenge in gauging the amount of people that were within each specific entity. For example, "Grave to Cradle" initially comprised ten members, nine of whom have now ended their participation. Conversely, Flydende By and Sydhavn Compagniet are both organizations and comprise a large number of members that have been at the Goldmine for different degrees of activity. These companies are physically situated in different locations in Copenhagen and experience independent member and employee flows. As a result of both factors influencing the availability and willingness of participants, my research was limited by a certain degree of bias.

On a personal level, It is my opinion that exploratory research as a sustainability science student carries with it a need to balance curiosity and empiricism with relevance of findings and objectivity. Whilst it is inspiring to conduct interviews with participants that share visions and exude societal idealism, I found this atmosphere consistently demanding when attempting to remain focused on my research aims. As a site that promotes experimentation in all aspects of the word, I had an inherently positive impression. This could possibly have limited the degree of critical consideration from my side. Having said that, one can also argue that a tendency occurs when studying within the field of sustainability science to place seemingly progressive solutions under the microscope of

neoliberalism, market rationality and short-term sustainability approaches. My research aspires to explore the progressive and pragmatic culture and learning within the Goldmine, whilst finding a balance between research focus and critical components of sustainability. Furthermore, the subsequent discussion has provided a forum for elaborating a select few of these components, and engaging in critical exploration of my case study without compromising the essence of my approach.