

An ecological meta-design framework for open learning ecosystems

Abstract:

From last five years, many master courses in Tallinn University, Institute of Informatics have been held as open learning courses using social software. Based on this experience with different learning design experiments, I have generalized the meta-design principles for open learning ecosystems.

My main message is how to overcome the need for the teacher control in self-regulative learning ecosystems by using meta-design principles.

I will start from the analysis of the characteristics of open learning ecosystems, and bring some examples of course designs that follow these characteristics.

As the baseline for the design of the courses in open learning ecosystems I have used the eco-cognitive view of learning. This is based on the ecological psychology foundations defined by Gibson (1977) that focus on the emergent relationships of people with the environment using the affordance concept.

For explaining which affordances each learner perceives and uses when he participates at the open learning courses with his personal learning environment, the activity theory framework developed by Yrjö Engeström (1987) appears useful.

Some central ideas of my approach are borrowed from behavioural ecology, which studies the fitness of individuals to the niches of their species. An eco-cognitive approach explains cognition through distributed representations that are partially offloaded to the ecosystem. I will conceptualize the learning niches and explain how to use them in learning design.

Next, I will introduce some meta-design approaches that involve the end-users to the development of evolving learning designs.

I will explain how the meta-design approach may be used for the course design in open learning ecosystems.

Finally, I will point to some innovative tools that we have used in our open learning master courses, and highlight some existing software limitations for the accumulation and adaptive use of learning niches in meta-design approach.

1. Learning in open learning ecosystem

An open learning ecosystem is a digital (but also a hybrid) learning environment where learners and teachers use personalized social software configurations to organize their learning.

Open learning courses are open to new learners. The learning contents, as well as, the teaching ideas, the design methodologies and infrastructures are jointly developed and openly shared among this community.

This brings variability of tools and approaches to the courses, making the learning environments complex and dynamically changing while learners try to adapt themselves to the course ecosystem.

We use the ecosystem concept, because it allows us to apply the principles of ecology in digital learning environments. If we want to apply the ecology principles in digital systems, we need to find the match between the ecology concepts and the components of digital ecosystems.

Particle and system level views to open learning ecosystems

Learners in open learning ecosystems: <ul style="list-style-type: none">• Self-directing• Networking, PLEs, PLNs • Communities of open education• Co-designing and sharing • Monitoring• Adapting• Navigating	“Ecosystem” not as a metaphor <ul style="list-style-type: none">• Self-regulative• “Connectivist Networks” in open learning ecosystems• “Community” of digital cultures • Open, Dynamic and Evolving• Accumulating• An evolutionary feedback loop
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Ecology as a discipline deals with different levels of structural elements of ecosystems, both biotic and abiotic.

For example, behavioural ecology focuses on the individuals of the species and their fitness to the niche of their species. Etology studies the interrelations of individuals.

In digital ecosystems we have self-directed individual learners who create personal learning networks with other individuals, using social software, people and artifacts. In order to coexist, they need to monitor each other, navigate across their learning environments, and try to adapt themselves to the other individuals’ useful activity preferences within the shared learning niche.

Population ecology studies the variability, the abundance and the distribution of individuals within one species, and how the species adapt to their niches, create and modify these niches. In digital ecosystems we have people with similar ideas, software preferences and behaviours for learning, who may be identified as one community or “species”. They contribute to their learning niche by co-designing and sharing learning contents, and by developing new learning behaviours.

The community ecology focuses on the coexisting communities of species, their composition, interactions, organization and succession, as well as, on the food networks among species. In digital systems we can find similar self-regulative connectivist networks, and communities that co-exist in the same distributed software ecosystems, but using different, partially overlapping niches of it. This makes borrowing and transforming the ideas across community borders possible and creates the learning power in digital ecosystems.

The most important assumption about open learning ecosystems is that the individuals’ self-directed learning behaviour, personal learning environment creation, and open publishing causes the ecosystems to be open, dynamic and evolving. At the ecosystem level the accumulation of contents, useful learning behaviours, and ideas causes the changes in the ecosystem and in the community identities, that serves as an evolutionary feedback loop that impacts on individual learners’ perceptions of their learning ecosystem.

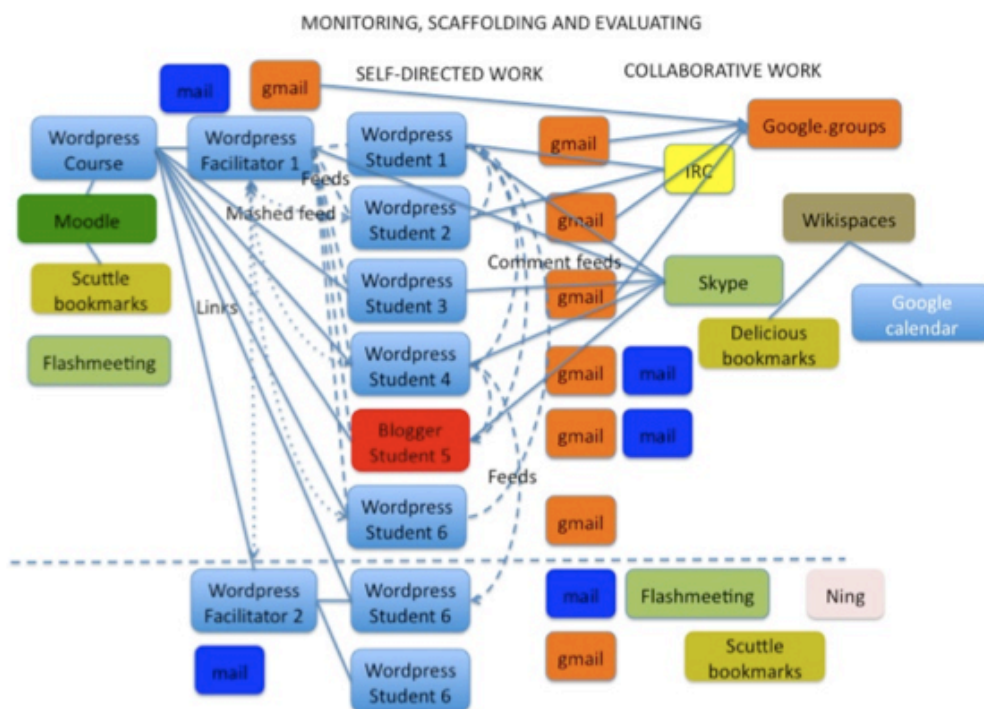
Two pedagogical paradigms have been highlighted in open learning ecosystems. Firstly, the Interpretivist learning principles suggest that students should be guided towards

becoming independent, autonomous and self-directed learners. Their learning must rise from their own interests and situations meaningful for them.

It is important that they are not isolated but interact with other learners, acting also as teachers to the others. The learning contents, and software usage behaviours are not created in advance but are emerging and co-created as network-like structures. Every learner can contribute with its prior knowledge and experiences to the creation of open ecosystem knowledge, everyone has the voice and ability to influence the ecosystem.

This guarantees the self-regulative and evolving nature of open learning ecosystems.

One example of such course design was done in the European 6th framework project iCamp for the course eLearning. The learners and teachers from different European universities created the mixed learning teams, to learn about open learning designs and create the course prototypes and associated learning resources about their design solutions. The course backbone was run in the Moodle environment, from where the suggested learning resources and weekly activities could be found. However, all learners and teachers entered to the course with different sets of personal tools, which were to be connected into the open learning system for conducting individual and joint activities. The changes and evolvments of the course ecosystem appeared in different teams. The biggest challenge was to design and coordinate the course as an evolving open learning ecosystem.



iCamp international eLearning course (Pata & Merisalo, 2010)

Another pedagogical paradigm in open learning ecosystems is Connectivism formulated by George Siemens.

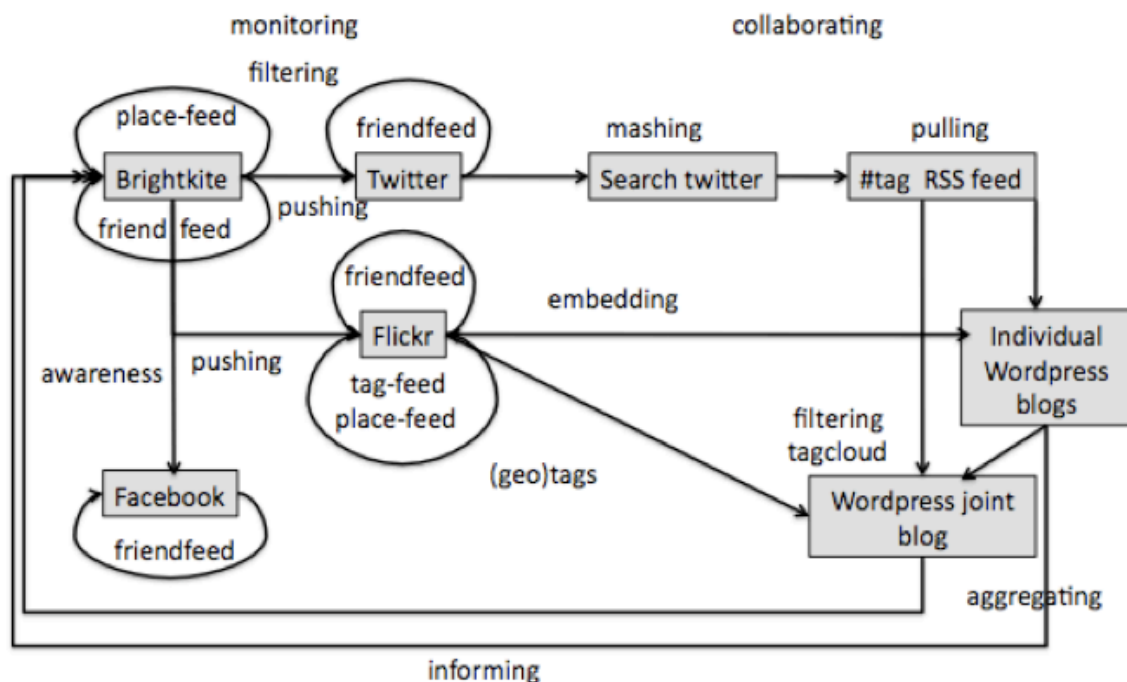
Connectivism assumes that:

Learning is primarily a network-forming process, and the dynamically appearing and changing networks form basis for the learning ecosystems

This approach cultivates the ecosystem view of digital systems. I define open and hybrid

digital ecosystems based on Boley and Chang (2007). It is an open, self-organizing environment binding geographical and web based locations, individuals, social software based information services, network interaction and knowledge sharing tools along with resources that help maintain synergy among people, where each subject is proactive and responsive regarding its own benefit/profit.

One example master course, “Ecology of narratives” that used the Connectivism ideas was run in Tallinn University (Pata & Fuksas, 2009). The learning design approach was built on the idea of initiating the emergent narrative collaboration using only the self-regulated storytelling activities. The main element of this design was to provide learners with some design rules, such as determining shared tags, and restricting the behavioural rules from traditional pre-decided group collaboration to emergent co-construction in networks. The co-construction emerged due to highly connected networks created among course participants who were using friend-feeds, place-feeds and mashed tag-feeds in various interconnected social software environments.



Ecology of narratives course (Pata & Fuksas, 2009)

<http://padis2.uniroma1.it:81/ojs/index.php/cogphil/article/view/4338/4200>

2. Challenges for learning design

These two examples highlight the main problem in the learning design for open learning ecosystems.

We need the learning design approaches that enable teachers to regain some co-control in the learner-initiated activities and in the appearing open ecosystems for learning.

In one hand we do want learners to be self-directed in creating learning goals, developing learning activities with personal tools, and choosing and constructing learning contents. We wish to promote the bottom-up emergence of the learning ecosystems.

On the other hand, we need to coordinate our courses to some extent at the universities, if we want to use the distributed learning environments.

The theoretical background for designing open learning ecosystems comes from ecological psychology. It is assumed that for interacting with the environment, we need some cognitive anchors. Humans constantly delegate cognitive functions to the environment. We may leave these anchors by ourselves, anchors may be left by other people who interacted with these surroundings before, these may be for example culturally defined. By doing so we constrain the action potentialities of the environment and help to focus on certain action- or emotion possibilities. But it must be admitted, that such cognitive functions are not stable design elements in the environment - we cannot assume that everyone would perceive these affordances, or that they would afford the same actions and emotions.

3. An eco-cognitive learning framework

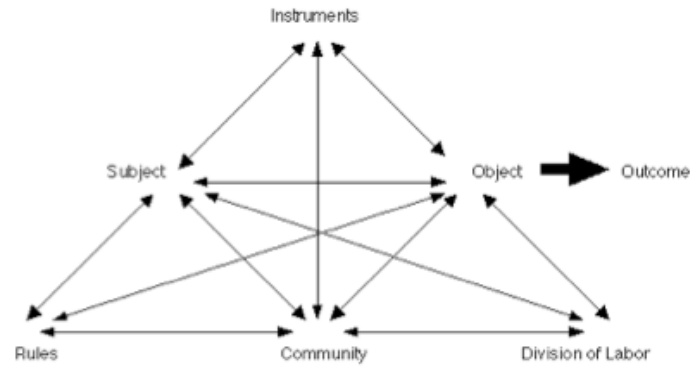
Bardone (2011) emphasizes this ambivalence in developing these cognitive functions. He writes that human cognition is chance-seeking system that is developed within an evolutionary framework based on the notion of cognitive niche construction. We build and manipulate cognitive niches to create additional resources for behavior control. These cognitive niches are determined by affordances.



Cognitive niches are distributed between internal mental spaces and external spaces in the environment. Behavioural/emotional constraints and afforded action/emotion potentialities may appear due to previous action/emotion experiences of the learner in this or in similar environment. Learners' actual goals may highlight and actualize some affordances. Some affordances may be embedded/highlighted by teacher through instructions or may appear due to the presence of other learners' activities. Each learner has a different cognitive niche in certain activity, and it may change in the course of action.

This causes high variability of affordances that may be actualized in open learning ecosystem for same learning goals.

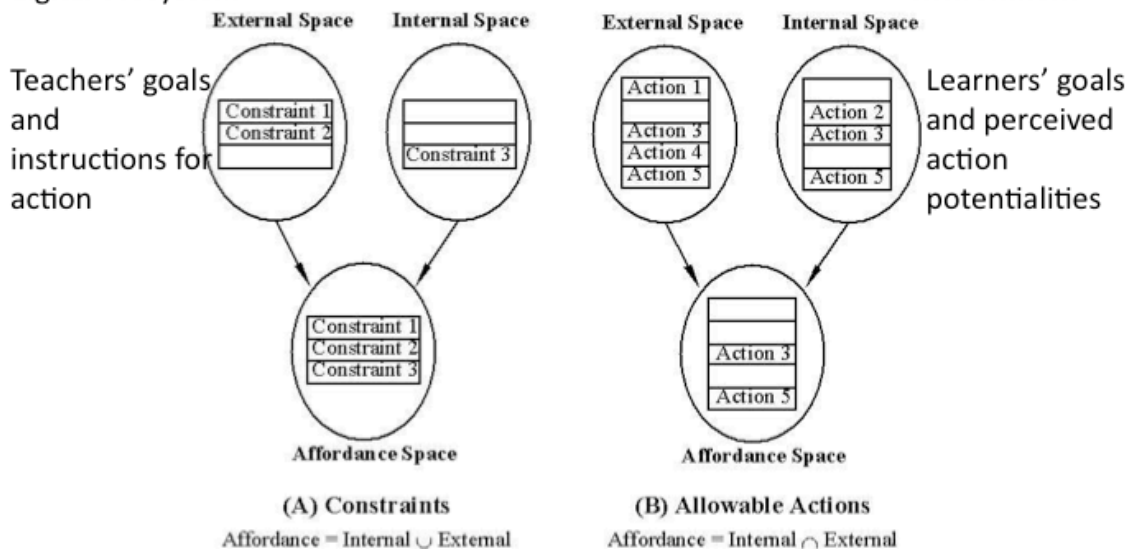
Another standing-point to identify, which affordances might be actualized in a personal learning environment, is using the activity system approach (Engeström, 1987).



PLE is distributed ecologically, integrating our minds with the environment. We may assume that at each moment a different configuration of the activity system is active. To reach our learning goals we need to actualize different mediators, such as cognitive concepts, details from artifacts, software, or rely on some community activities. Rules and distribution of labor, common to the certain community, as well as, their personal learning environments, ideas, and the joint ecosystem structural elements may afford different mediators to be available for achieving certain actions or emotions.

Learning environment as digital ecosystem

Previous action experiences in this environment



A cognitive niche

Schema adopted from Zhang, J., & Patel, V. L. (2006)

Affordances in our cognitive niche form a networked system. They may constrain or actualize each other. Synergy may be arrived from using several affordances simultaneously. Some affordances may need the presence or the co-activation of other affordances to be used effectively.

An interesting aspect from the learning design perspective is that some of the affordances are offloaded to the ecosystem.

While any individual conceptualizes affordances personally, in a community such perceived

and offloaded affordances may accumulate, forming the community's learning niche. This niche conceptualization is closer to the niche concept in biology. Hutchinson (1957) defined a niche as a region (n-dimensional hypervolume) in a multi-dimensional space of environmental factors that affect the welfare of a species. Niches have been conceptualized as the environmental gradients with certain ecological amplitude, where the ecological optimum marks the gradient peaks where the organisms are most abundant.

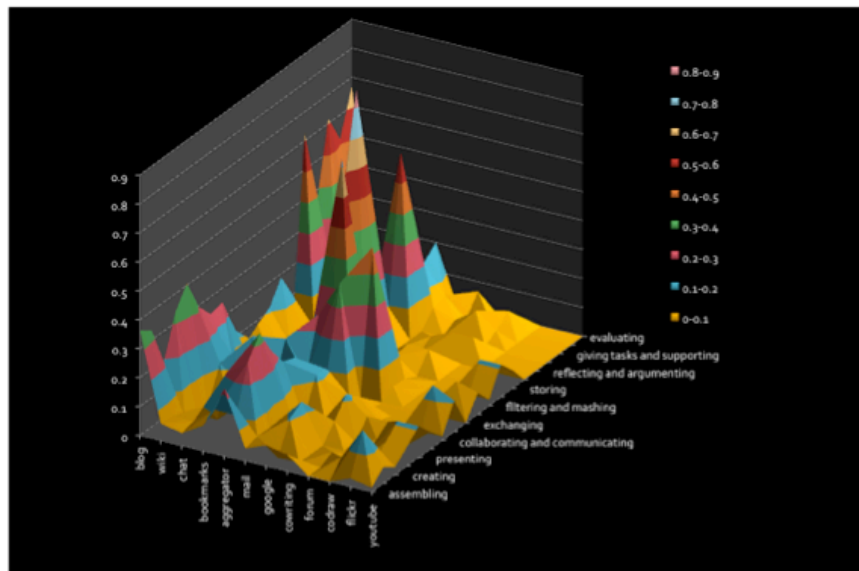
So, niche is not the environment itself, the habitat, but what it affords. For example the range of temperature, the length of daylight, the abundance of certain food form the dimensions for a niche for certain species.

In digital systems these dimensions may associate with the properties of certain activity systems: for example complexity of assembling, accumulating, pulling content; degree of reputation, privacy, security, surveillance, interaction, co-construction in the community etc.

Currently, there are no good tools to monitor these affordances, nevertheless the community members perceive some of the learning niche properties

In one of my open learning ecosystem courses (Pata, 2009) we asked students to associate self-defined affordances with social software. We grouped these affordances under some activity types. As a result we could find what types of affordances were more commonly perceived by everyone, and which appeared to be rare. To make a visualization of the community's learning niche we plotted the niche as the map of affordance "mountains". However, this visualization is also a bit misleading – the real niche should be plotted into an abstract multidimensional space. This visualization does not consider the affordances that appear due to the presence of other affordances. For example, some software functionalities (tagging) may make available other affordances only if a community uses them actively (browsing the community members' resources).

We also found in this study, that at different years the community niche of social software affordances appeared similar. On the other hand, for individual and collaborative assignments the niche dimensions were significantly different.



So I propose that the accumulated community niches for different learning goals may indicate the effective affordances for certain communities. The community's affordances may be interpreted and used by each learner to best adapt to the community niche for certain goal-based action. Adaptation is the adjustment of an organism to its environment in the process

by which it enhances fitness to its niche.

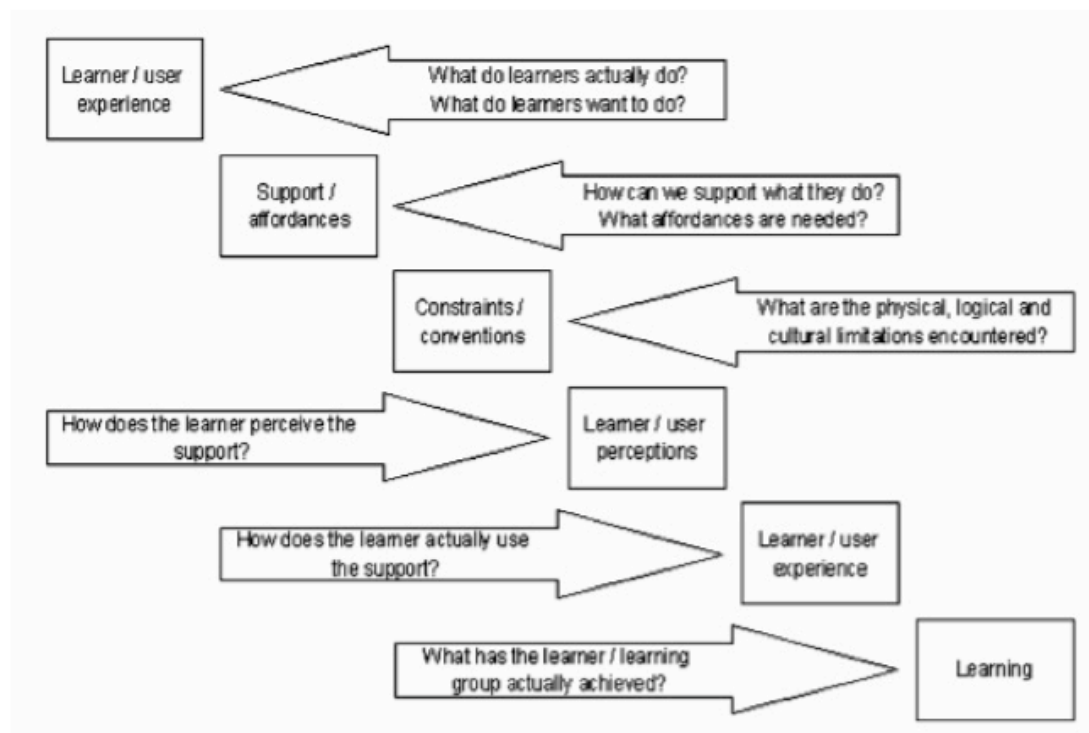
Such interplay in which each individual contributes to the formation of his cognitive niche, but also to the accumulation of the community's niche, and simultaneously adjusts his affordance perception to his community niche is the central idea in dynamic evolving learning ecosystems.

It is one of the key points in meta-design framework as well.

4. Ecological learning designs as meta-designs

There have been some attempts to use the affordance concept in the learning design principles. This model from Kirchner and associates (2004) determines learners' perceived affordances from their behaviour in the learning system, develops supportive and constraining affordances for interacting with the system and monitors the effectiveness of such affordance-based cognitive tools. However, learner's role in this design approach is passive, the design is created by the teacher. Also, the dynamic evolvement of the learning environment is not expected. So, this model has limitations from the open learning ecosystem design perspective.

Figure 3 □ 6-Stage model of interaction design.



Another design approach, that considers adaptive and dynamic nature of the ecosystems is a meta-design framework proposed by Gerhard Fisher (2004) and associates. Meta-design is designing the design process for cultures of participation – creating technical and social conditions for broad participation in design activities. The meta-design approach is directed to the formation and evolution of open learning ecosystems through the end-user design.

The meta-design approach is known as a methodology for collaborative co-design of social, technical and economic infrastructures in interdisciplinary teams in order to achieve synergy similarly to the symbiosis phenomena in natural environments. The meta-design, known from

End User Design in computer science, extends the traditional notion of system development to include users in an ongoing process as co-designers, not only at design time but throughout the entire existence of the system.

Autonomous and self-organized designers in meta-design framework can increase the diversity of design solutions in the system, allowing diversity and variability to emerge within the ecosystem.

Hagen & Robertson visualize in their paper some meta-design models as open, community-driven, emergent and iterative activity sequences that are based on user contribution.

For example:

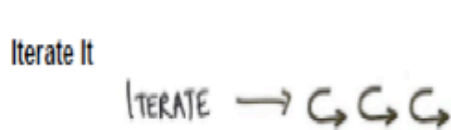


Figure 1. Design is iterated through participation in use



Figure 2. Design emerges through participation



Figure 3. Initial design is (out) sourced to members of the public



Figure 4. Community participates throughout design

Hagen & Robertson (2009)

Figure 1. The design solution is iterated through the participation in use. For example the e-learning course may be run at different years, the affordances may be collected post-activity, as in Kirchner's model, and the revisions of the course ecosystem could be made. If letting the accumulated contents and affordances inside the system, the next round of the course may be able to navigate in the ecosystem better than the first participants.

Figure 2. The design emerges into different directions through participation. Such designs in open learning communities may be validated by individuals, and the best, most actively used solutions will become temporally stable as community niches. This type of design is common in swarming activities.

Figure 3. The initial design may be outsourced to the users, and appears as an assembled collage. This approach is more common in open content creation, for example in wikis.

Figure 4. The design may also be opened to the community participation throughout design, that may gradually shift the perceived niche of affordances. Such design is most common in the stable open learning communities – some affordances will be discovered, others will be

forgotten in time.

Similarly to behavioural ecology principles, in meta-design we can see the interplay between self-directed individual designers (in our case learners), and the niche (the affordances of the design solution) that appears as the result of their activities.

Learning in the cultures of participation may be characterized as the process in which learner and the system (community, culture) detects and corrects errors in order to fit and be responsive.

In this definition, learning and designing process is conceptualized as largely self-organized, adaptive and dynamic.

It may be assumed that such learning and meta-design follows the ecological principles.

Both focuses – the learning ecosystem evolution by end-user design, and nourishing the end-user design process by creating the scaffolds for designing, are equally important aspects of ecological Meta-Design. Such scaffolds may be the visualizations of the emergent community's learning niche.

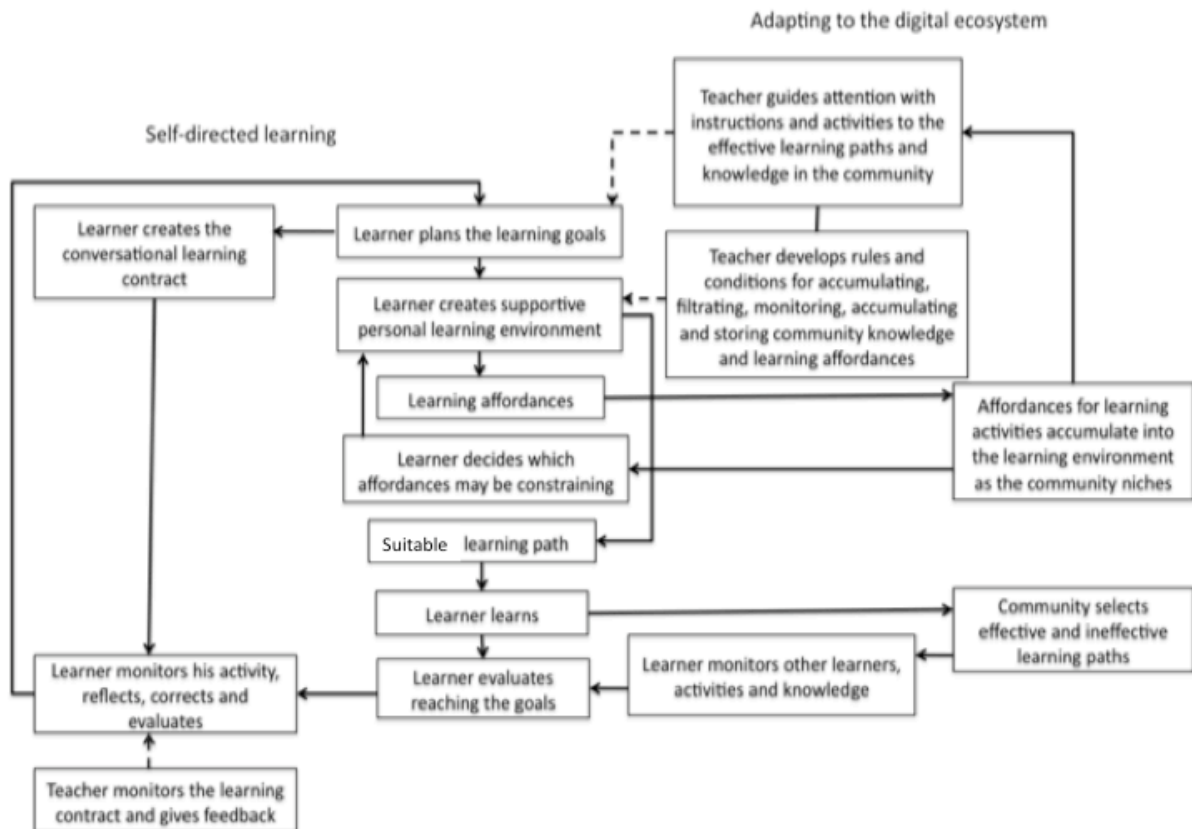
To make some generalizations from our master courses in open learning ecosystems, the following aspects might be important in the meta-design framework

Learners should be facilitated to be self-directed. For this they are required to keep personal conversational learning contracts throughout the learning process. For example they could map their goals, and how they will achieve these goals, what affordances appeared useful in action.

Learners need to dynamically integrate their personal learning environments with the other learner's environments, in order to perform some joint tasks or allow better awareness of each other's activities. The affordances perceived during the course may change depending of their goals.

In order to better adapt to the digital ecosystem, the learners would need meta-level guidance. For example, the rules and conditions (shared tags etc.) that facilitate niche accumulation may be determined by the teacher. The nature of activities may be selected such that supports self-regulation-based collaboration (for example swarming activities).

The learners and the teacher should be able to monitor the state of the niche, and can adjust their learning behaviours to the niche.



The process view to meta-design in open learning ecosystems (Pata, 2010)

So, what would the learners do?

In learning ecosystems autonomous learners continuously develop and dynamically change design solutions to support their learning.

They incorporate into their personal learning environments different Web 2.0 tools, networking partners and artifacts, and monitor the state of the whole learning ecosystem to adapt their design solutions and learning objectives to the system and to other learners.

What is the teacher's role?

The teacher creates rules, scaffolds and incentives for the learners' design activities that would foster the accumulation of learning niches

These include:

Possibilities for monitoring the affordances of the community

Providing learners with the options that enhance and speed up the self-directed network-formation process (e.g. tags, mashups)

Analyzing the emerging affordances within the learning community, and providing analytical guidance for them aiding to make design decisions and selecting learning activities (e.g. social navigation, semantic navigation)

Seeding learning activities into the open learning ecosystem that are based on self-organization (e.g. swarming)

Some of these designs are well supported with suitable software for open learning ecosystems. However, there is the need for dynamic accumulation and monitoring systems for learning niche formation to be used by each learner for benefiting from particular open learning ecosystem and allowing them to participate in the course design

Two options may be used:

The affordance informations should be accumulated dynamically, and this information, if well visualized, would help navigation of individual learners in the learning niches
The real-time awareness of the other learners' perceived affordances may appear in the systems where users are constantly at present (such as facebook wall or twitter), however this is more time-consuming way to deduce the learning ecosystem affordances

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