

TWO LANGUAGE OF NATURE

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EDITORIAL

We are proud to present you the third issue of Sketchle, which we published the first issue a year ago. At Sketchle we publish two issues per year, each containing 5 articles. We learn lots of things in those issues about the publishing process and the structure of "a sketchle". Our primary concern at the beginning is how an essay could be turned into a more readable and understandable. With each article submitted for the publishing process, we improved our vision about visualising an idea through sketching. In the third issue, we gladly see that the Journal of sketchle is on a proper path. Both professionals and students share our passion for sketching, and most of them submitted their sketches with their sketches; thus, there was a minor job for our illustrators' team.

In this issue, the cover image mentioned the two languages of nature, the language of science and art, where both collaborate in sketchle. Issue 03 consists of five essays from learning through drawing in first-year design students an educational perspective on new materials in architecture "the case of mycelium". Also, a contemporary problem, re-thinking the educational environment in the pandemic conditions, gamification methods in design education, and a sustainable design course proposal presented by authors. Our illustrator team enrich some essays with additional illustrations. Some can be better understood with a sense of humour and fun.

I would like to thank all the authors, co-authors, journal editorial board, referees, graphic design and illustrators team who have contributed and put effort since the first issue of the journal. We hope to be able to publish many more successful issues of Sketcle with widespread impact.

Prof. Dr. Tuncay Döğeroğlu
Rector of Eskisehir Technical University



CONTENT

- Learning by Drawing in First-Year Design Education
- Meaningful Gamification Through Metaphor Generation
- Sustainable Interior Design: A Course Proposal
- How to Design School Furniture for the Pandemic Period?
- The Relationship between Nature and Architecture in Construction and Material Selection (The Case of Mycelium)

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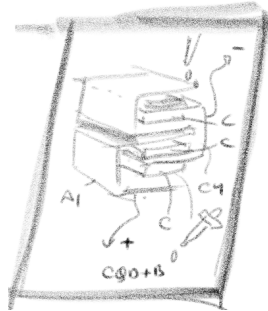
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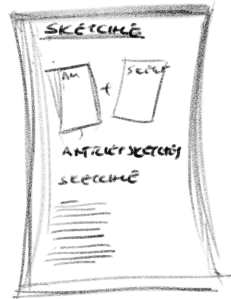
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Artistic, Intuitive*



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SKETCHLE
*Explaining, Creative,
Intuitive, Methodological*

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- Conclusion
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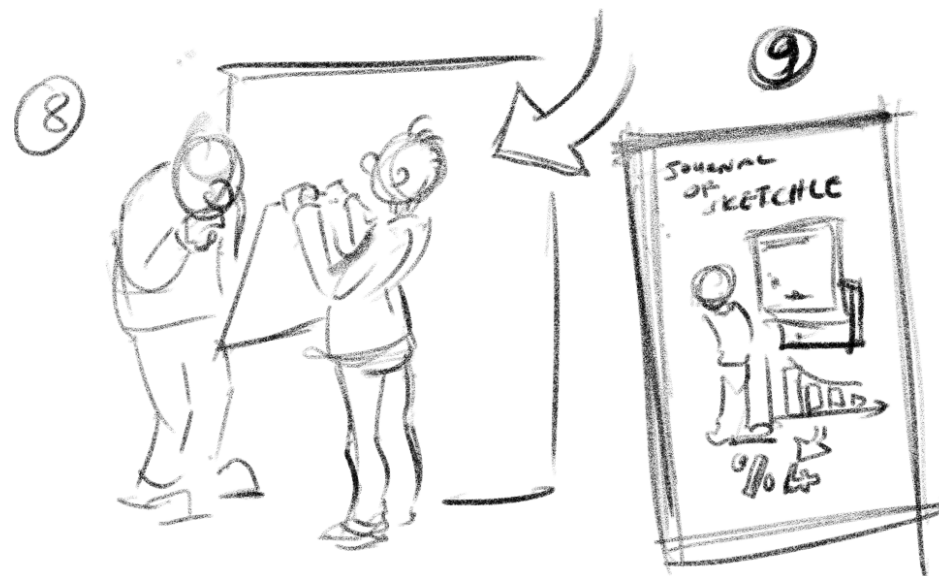
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Learning by Drawing in First-Year Design

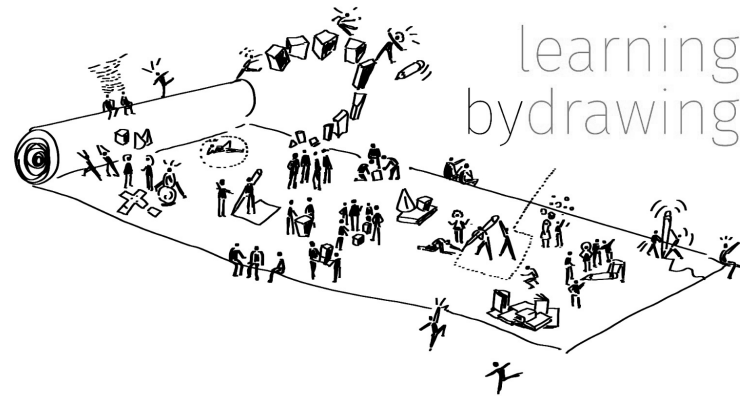
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Keywords: Drawing, Learning, First-Year Design Education, Freshman Student, Design Studio

Abstract Approaching drawings only within the framework of representation and visual language notions may suggest a rather limited scope that emphasises only the internal thinking and representational aspects of drawing. Therefore, within the scope of this study, drawings were handled as a visual and verbal-based education and learning tool where students could approach their ideas critically. On-going dialogue between drawing and students, which includes critical thinking and research, can be defined as a kind of interaction in which students can argue with themselves using lines, and it has content about the individual and the produced representation. Another form of interaction is related to the understanding of design students and instructors as well as the effective communication between them. In this context, the research starts an argument in the light of written and visual data on how drawing can contribute to the education process by revealing some clues about the function of lines in the first-year design studio as a learning tool, and how students perceive, employ and may use the act of drawing.



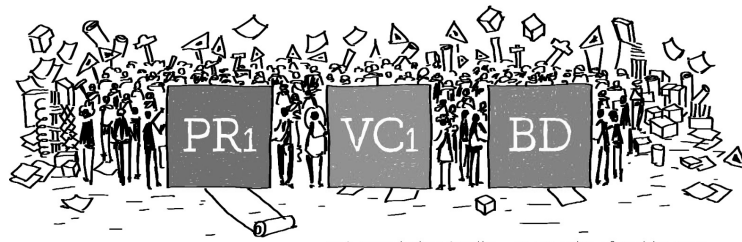
Introduction

It is necessary to provide environments in which students can fulfil their responsibilities, develop autonomous thinking mechanisms, and pose new questions rather than just answering questions, instead of futile attempts to transfer knowledge in the design studio as is the case in the educational field and in the learning activities, which is essentially multi-representational (Brooks & Brooks, 1999: 13; Ainsworth & Scheiter, 2021: 61). For this purpose, this research discusses how the line as a kind of language may be included in first-year design education and how it can contribute to the studio operation and act of learning. Therefore, this paper emphasises the features of drawings that are generally regarded as an integral part of artistic and creative activities, not as tools that directly reveal what is in the mind but that change and transform the ideas and perspectives of learners. In this respect, the research was conducted based on literature reviews, observations conducted in the first-year design studio through authors' field notes, and visually produced discourse aims to discuss how lines can be used to analyse and interpret information in the first-year design studio. Within the scope of this study, the act of drawing is considered an educational tool rather than a description (Edwards, 2008: 7) and brings up a discussion on how to create thinking environments that will enable students to internalise and construct knowledge. Therefore, this research approaches the interactions of students with the design action and process rather than their final products by drawing a visual perspective in the context of thinking and learning.

Method

In addition to the literature reviews on design pedagogy, first-year design studio, and drawing language, this study was carried out based on experience and data obtained through ethnographic approaches, including attitudes of students, discourses, and field notes of researchers taken as a participant-observer in the 2021-2022 fall term Foundation Studio consisting three first-semester studio courses, namely Project I, Visual Communication I: Visualization and Technical Drawing, and Basic Design and Visual Arts in the Faculty of Architecture at Istanbul Technical University (ITU). The research notes and related quotes were visualised by the two researchers that conducted this study, making it possible for them to see how the drawings and perspectives on the same subject differ. Within this methodological framework, this paper aims to reveal the purpose of students in using the drawing in their design and learning processes and how drawings with visual and verbal basis can and may play a role in the design studio.

During the studies that the students have done throughout the term, some titles/themes,

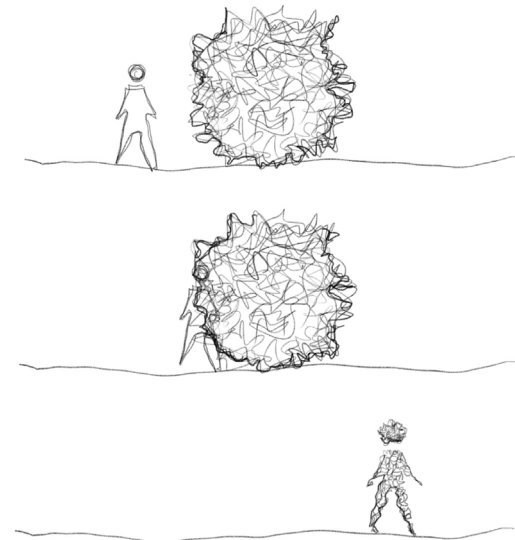


TES Foundation Studio – ITU Faculty of Architecture

in other words, thick descriptions of the design process, learning and drawing action of the students, were obtained through the diary entries, including their views and discourses on the design processes and the drawing action, as well as the dialogues and discourses they have established with the educators and their peers. Instead of proceeding to the analysis process after the obtained observations, the analysis stage was integrated with the observation stage. In this context, conducting field research based on ethnomethodology, which is interpretive and helpful in revealing the relationships among observations as well as the detail of observations (Dourish, 2006: 543), documenting the discourses, attitudes and connotations, and establishing some connections among the data is considered as an analysis phase (Crabtree et al. 2012: 112-130). Within the scope of the study, the analysis was applied not as a final activity after data collection but as a simultaneous step that was carried out by being included in the design studio and penetrated the observations, field notes and reflections of the authors. Therefore, the analysis process was not considered a separate activity from the ethnomethodological fieldwork. The analysis and data synthesis process started in the design studio as an action intertwined with the fieldwork conducted in the studio environment through participant observation four days a week. Thus, comprehensive data sets were able to be revealed during the field research.

First-Year Design Education

The educational process which has two main aspects, namely, psychological and sociological, is a phenomenon based on social progress and reforms. It has meanings beyond being a preliminary preparation for future life or professional career (Dewey, 1897). Within this broad definition, design education includes ambiguous processes with ill-structured rather than clear and infallible truths in which many reasonable solutions and suggestions can be put forward (Goldschmidt, 2017: 77). Hence, the experiences of first-year students and the knowledge they have gained in their past education may be insufficient in generating ideas against the complexity mentioned above and unclear situations. This research which does not aim to question the education they received



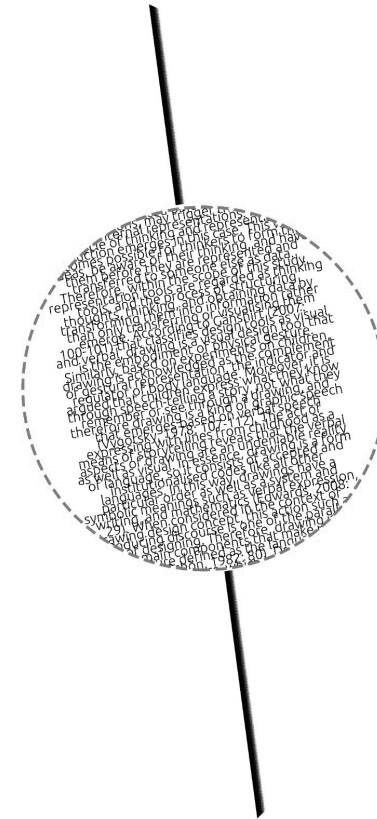


preceding their undergraduate degree or to criticise the problematic situations encountered, analyses the complex situations that arise in design studios and focuses on the perspectives of students on the design action and presents some clues in terms of turning the current phenomena in their favour within the framework of the dialectical connection of tool-thinking and drawing-learning relations.

Students' meeting with the design concept can be defined as chaos, but it need not be forgotten that as Gray and Malins (2004: 97) stated, it is impossible to produce, internalise, and construct knowledge without chaos. The chaos, in other words uncertainty that first-year design students encounter is not only based on some hard-to-solve problems arising from the nature of design but also on learning processes that focus on critical and creative thinking based on design studio function and culture and the challenging processes caused by this situation. At this point, students need various tools and thinking methods to understand the complicated and firstly encountered situations they experience and to offer solutions since the way to solving a problem also determines the content of a solution. In this vein, considering the act of representation which "makes us human" (Fosnot & Perry, 1996: 25) and is accepted as an integral part of human nature, the context of design education can be considered as an essential step for students to comprehend the notions of design and learning.

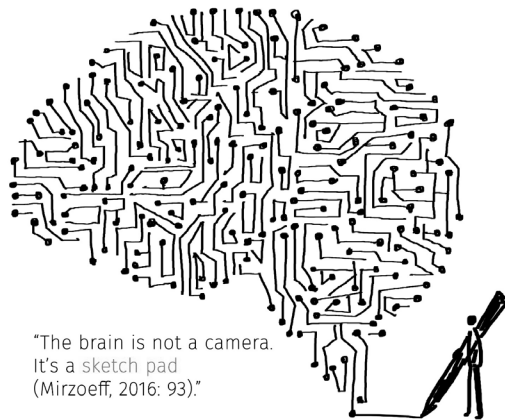
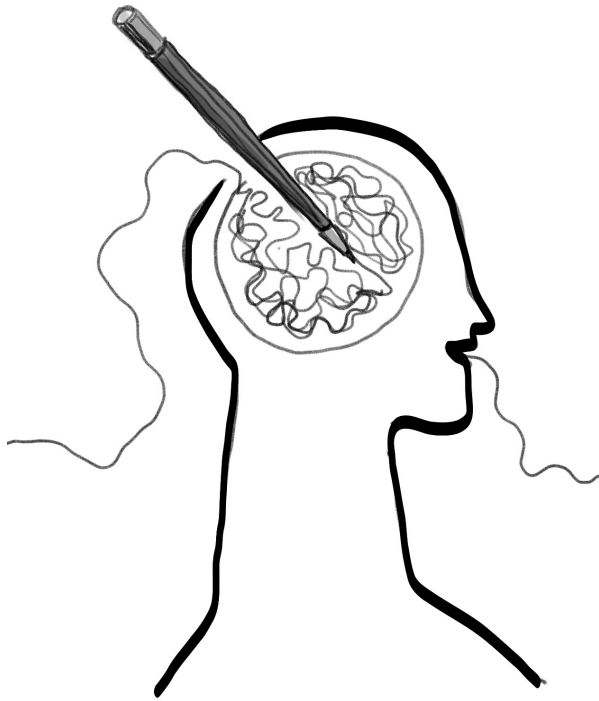
Nature of Drawing in Design Education

Representations are evaluated under two headings as external and internal (Goldschmidt, 2017: 78). Every internal representation can be externalised by using tools. The created objects, or external representations, may trigger the creation of various internal representations. Hence, a vast cycle of thinking and representational production emerges in this case. This way it becomes possible for thinkers to form their ideas, be aware of their thinking, and have them before they are represented and transferred to someone



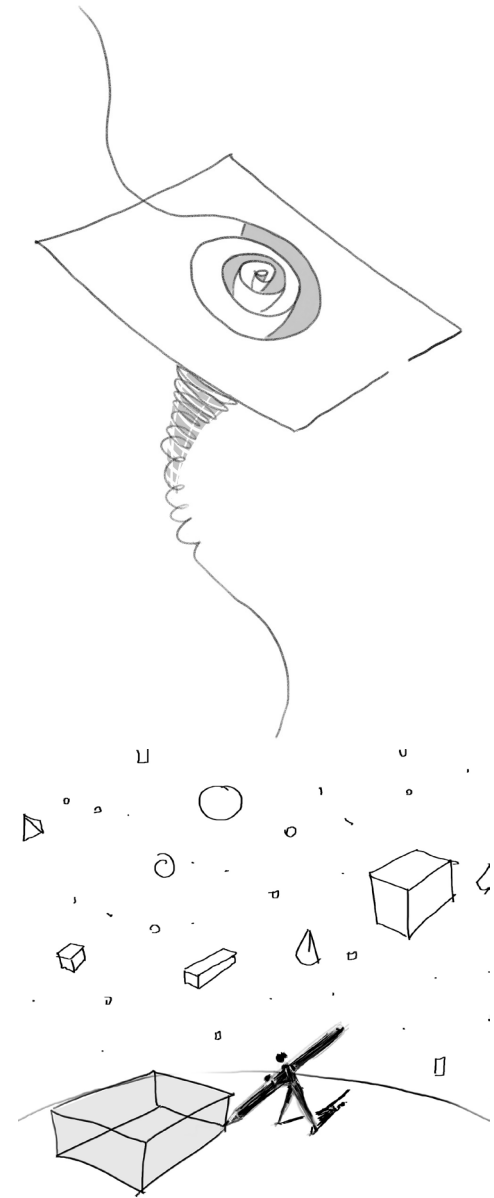
else as data. Therefore, within the scope of this study, representation tools are regarded as thinking tools, and the process of structuring thoughts, thinking, and obtaining data by transforming them into information rather than only transferring or visualising them emerge.

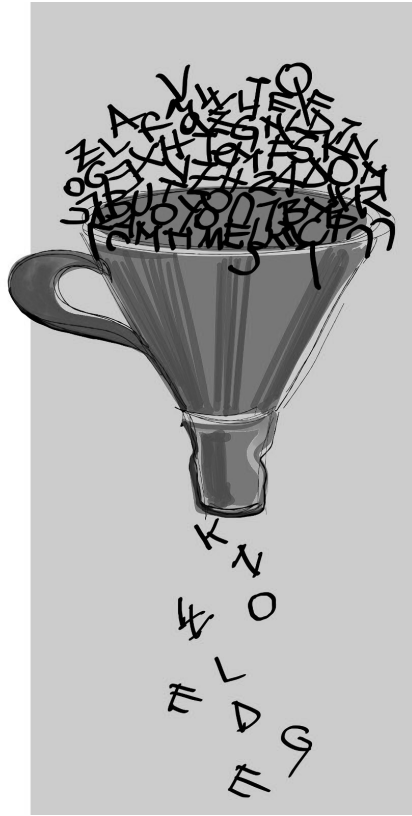
According to Gänshirt (2007: 100-101) that classifies design tools as visual and verbal, drawing is a visual design tool that is the embodiment of physical gesture. Similarly, based on experiments on children, drawing is acknowledged as the complement of gestural representation, the indicator and regulator of body language. Moreover, it is argued that children express what they know through speech-telling a story, not what they remember or see through a drawing, and therefore drawing is a kind of graphic speech that emerges based on verbal speech (Vygotsky, 1978: 107-112). The act of expressing with lines



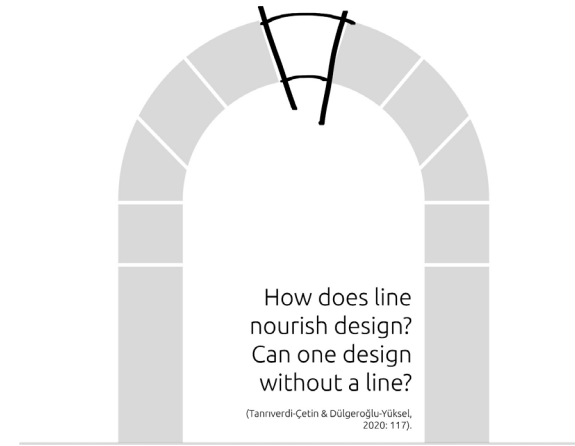
"The brain is not a camera.
It's a sketch pad
(Mirzoeff, 2016: 93)."

from childhood as a means of story-telling reveals that the verbal aspects of drawing are an undeniable reality as well as visual. In essence, drawing is a form of language, so it consists of accepted and institutionalised codes like all other languages. In this way, drawings have a particular order as well as a system and symbolic meanings such as verbal expression, writing, and mathematics (Edwards, 2008: 29). When considered in the context of drawing design concept, this action such as producing discourse is one of the parallel ways of designing. Therefore, drawing is one of the main components that make up the structure defined as the language of designing (Schön, 1983: 80).

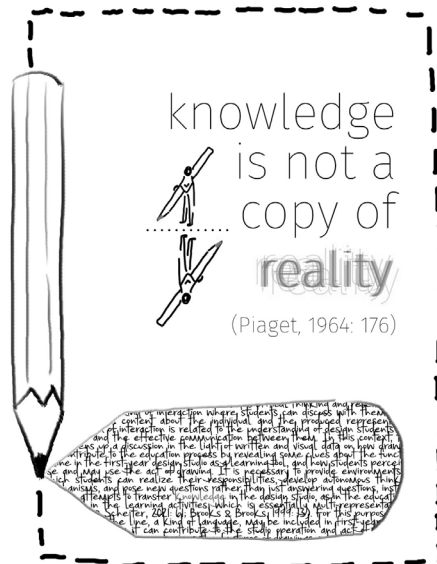




Drawing in the design process, which is not only a problem-solving action and primarily includes various cognitive activities (Lawson, 2005: 285), is considered as a private action state as a fundamental tool for students to produce alternative solutions to design problems and to synthesise the data they have obtained (Goldschmidt, 2017: 83). Thinking and ideas produced on the paper surface allow design students to argue with themselves as a reflection of their point of view because all images produced on paper are open to transformation, not as precise and clear discourses, thanks to the mode of drawing, which makes it possible to grasp and abstract geometry (Gänshirt, 2007: 137) exist as variable and interpretable representations. In this vein, drawing goes beyond being coded or frozen ideas or visual compositions on paper (Tanrıverdi-Çetin & Dülgeroğlu-Yüksel, 2020: 127).



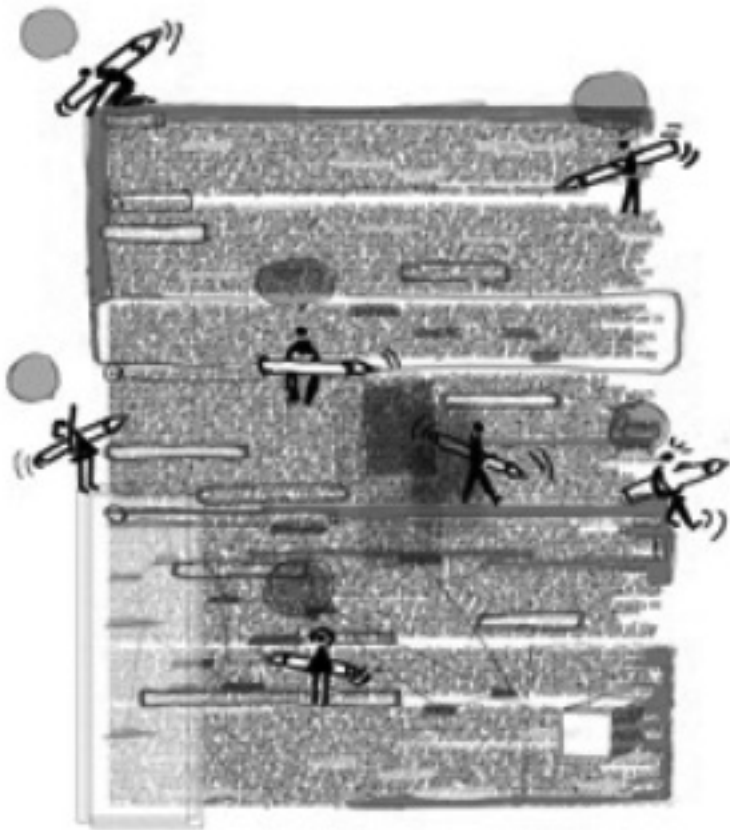
According to Purini (2017: 64), “drawing is much vaster than reality.” Although this view emphasises the unreal, surprising and extraordinary aspect of drawing, it is fundamentally a tool and medium that creates a universe different from reality. Hence, it may be a futile effort to compare drawing with reality since drawing is not a competition with reality but a systematic assumption produced to form reality, action-oriented thinking, and in some cases even speculation. Therefore, just as knowledge is not a copy of reality (Piaget, 1964: 176), drawings are not a copy of reality or a universe larger and superior to it but a series of activities implemented to reform and interpret reality.



The line is an essential issue that needs to be discussed in the context of design education. It provides a critical perspective by supporting the production of ideas for the research, discovery, and interpretation of reality. Thinking and researching using drawing methods in design education enables students to critically approach the issues they want to see or are used to seeing and causes the formation of mental relationships and processes that make (un)expected discovery possible. In this sense, drawing is not a tool used to convey the existing thought directly but essentially a systematic thinking medium based on making, researching, and questioning, in short, generation of ideas. Therefore, considering drawing only as a means of representation in design education might lead design students to the misconception that design is an action based on only visual production.

Relation Between Drawing and Learning

It can be argued that the design language of current practice and education has been predominantly composed of 2D representation since the Renaissance. In this context, it is crucial to address and reveal the close relationship between the concepts of drawing and design that are used interchangeably in some cases under the concepts of education and learning. Although it is an undeniable reality that drawing is at the centre of the action of design, drawing, in essence, does not mean designing because the experience and fluency that students gain in drawing cannot replace having an inquiring and critical thinking mind (Ching, 2016: 199). The insistence on accepting drawing as one of the main subjects in the design studio is not for them to gain fluency in the act of drawing but for the students to construct an inquiring perspective that encompasses their entire life as well as their education life and prioritises research.



Drawing is an action in which the mind, eye, and skin function simultaneously and corresponds to their basic needs such as producing discourse, reacting, and representing. Therefore, this essence of drawing can be argued that it preserves its presence in the act of design, and drawing to design is primarily caused by natural, human, and internal triggers (Ching, 2016: 5). Similarly, design is inextricably linked to the creative activities of the body, craft, intuitive, implicit, sensory and emotional approaches as well as some abstract intellectual processes that take place in the mind (Uluoğlu, 2000: 35). Therefore, drawing can be used to develop, concretise, and reveal data that is difficult to convey verbally or in writing, and it could be considered a fundamental action that enables students to realise, develop and represent their ideas. In this way, students can critically evaluate their ideas by arguing them with themselves and seeing them in several variations, both tangible and intangible. The critiques that students develop on paper about their thoughts and ideas can be defined as a developmental process in which ideas are classified and tested. Compositions created this way serve as external memory which records short-term mental images for design students (Goldschmidt, 2017: 83), and thus, besides recording ideas, they can be developed, and students can create external and internal discourses by rethinking the documented data.

Findings: Experiences and Observations on Drawing in First-Year Design Studio

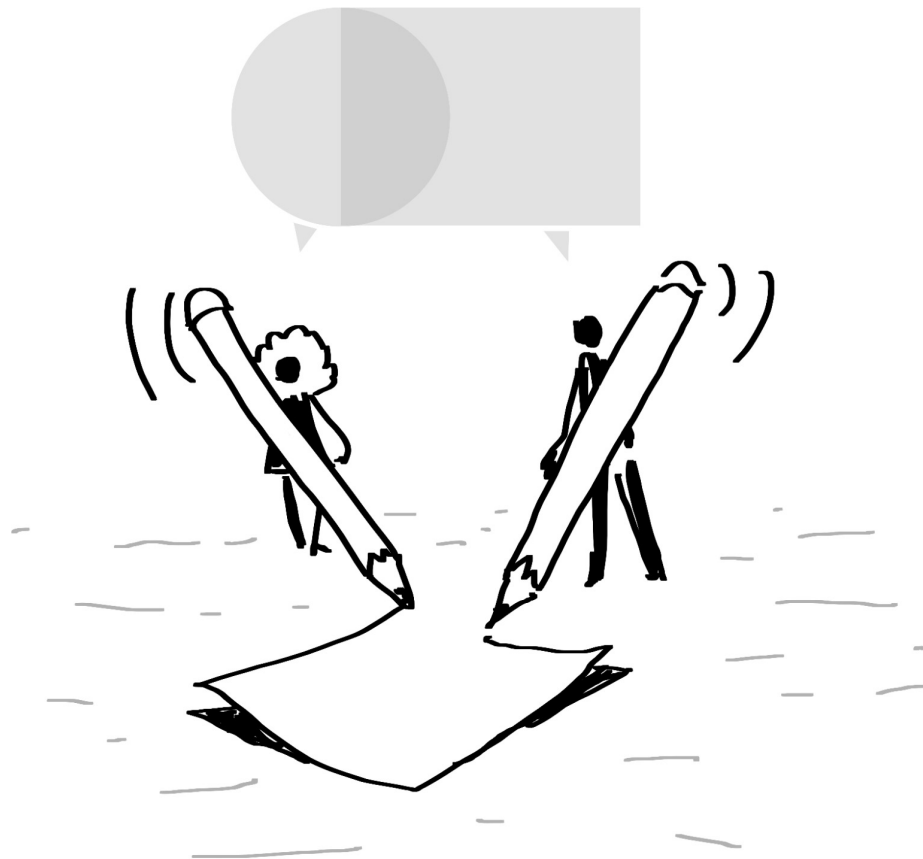
Thanks to the observations made by the researchers in the 2021-2022 fall semester studio and the data transferred to the digital environment in the form of a diary after each lesson, the attitudes of first-year design students towards learning and drawing were classified, and common discourses and perspectives were determined. The analysis of the diaries was handled qualitatively rather than quantitatively to reveal the students' attitudes and views, and a pattern was obtained regarding the drawing experiences of first-year students. Thus, it is aimed to produce unpredictable implicit knowledge by classifying the data documented through the participant-observer role and diaries and to produce a comprehensive framework that refers to actions and interactions rather than attitudes specific to a particular education community (Crabtree et al. 2009: 887; Murphy & Marcus, 2013: 262).

Avoiding “Making a Mistake”

Based on the observations made in the first-year design studio, the first-year design students can be argued to have a general misconception that the project is a phenomenon that begins in mind and is completed as internal thinking and then externalised as it is. The effort of the students to explain and convey their project verbally using their body language includes some intentions such as getting approval and starting production after realising whether they are on the right track or not. The fact that educational backgrounds of students are predominantly successful in the former years before they entered the university system, that they are worried about being successful, and that their products and efforts will be wasted, being afraid of “making mistakes” and the assumptions and concerns they have developed in this direction may be determined as obstacles to thinking as well as producing and applying the logic of trial-and-error with the design tools. In this context, the attempt to get approval from the educators in the first-year design studio without discussing with themselves and without critically approaching their opinions on paper can be considered a reflection of this concern. Therefore, the intention and effort to reach the final product in the first move without experiencing the trial-and-error process and thinking through the line is one of the central attitudes that need to be changed in first-year design education.

Thinking without Tools

It is a very problematic situation, especially within the scope of first-year design education that students think only on their working desks without producing in any way and without being in action during studio work. Indeed, thinking and thinking by using design tools and media, in other words, producing, are two different actions. The act of drawing which is dependent on body movements can be argued that it is an essential intellectual trigger in terms of producing discourse in design and reaching different perspectives through the kinaesthetic properties of the human body. In this vein, students need to realise that their experiments with materials and lines are a kind of thinking action. Therefore, the act of drawing which encourages and paves the way for thinking can be defined and applied as a learning activity in design education in the context of thinking and producing.



Drawing in the Context of Design

Looking at an object and looking at it by drawing are different actions. Similarly, although drawing and drawing for design have similarities in action, they require different cognitive processes because individuals who draw on the paper surface not only reflect what they see but also their perceptions and understandings of what they see (Ching, 2016: 16). Therefore, the intentions and purposes of the design situations naturally make the drawings have a different function. As Goethe puts it, “the eye sees what the mind knows” (Belardi, 2014: 49); addedly, “the eye guides the hand, but the hand has, as it were, a mind of its own (Scheer, 2014: 6).”

That many first-year design students see drawing as a mere talent and manual skill, and that they describe the drawings made during the design process with adjectives such as beautiful, realistic and artistic, and approach the design subject this way can be regarded as a mistake in design education. The fact that Bektaş (2017: 18) thought about his designs only through models for a while in order not to deceive himself due to the immersive effect of drawing is one of the clear examples in this regard. Similarly, to integrate these skills of students that have knowledge and experience in painting and creative activities into design education without hindering their creativity, it is necessary to develop several strategies and studio work related to the unity of design and drawing.

Drawing as Dialogue Between Student and Educator

Acknowledged as a starting point and even a prerequisite for the design action which is defined as an intellectual process (Edwards, 2008: 1) drawing is argued that it expands the discussions, dialogues, and arguments that lead to the emergence of student and educator interaction (Goldschmidt, 2017: 94). The reason for this is that drawing has features that trigger the development of ideas not only of students but also of educators. The data transferred by the students to the paper surface provides essential clues to understand the discourses that they cannot express verbally so that a dialogue environment can be established to determine, expand, and deepen the discussion topics. In a nutshell, drawing in the design studio is suggested to be a common and universal language that constructs the communication between the student and the educator and configures the appropriate environment for the development of their ideas.

Conclusion

According to the findings obtained as a participant-observer, it can be argued that there are some resistances, which can be defined as implicit bias, against the action of learning by drawing by first-year design students. These attitudes are related to the fact that students have some concerns arising from concepts such as right or wrong, the subject of including the body and action in their thinking processes and perceiving the drawings primarily as a means of personal and artistic expression. However, considering drawing only as an action related to the concept of art and creativity or as a way of expressing and embodying personal views and feelings corresponds to only a limited aspect of drawing. Hence, it is understood that in design education, and especially in first-year

design education, drawings need to be considered as a learning tool and medium based on the potentials that trigger inquiry rather than their functions that convey ideas. In this way, it is possible to integrate this fundamental and human activity into the design studio as a way of accessing objective data and constructing knowledge based on learning in the light of basic studio notions such as computation, measurement, evaluation, and critical approach. Therefore, in addition to the features that emphasise creativity, the critical and questioning aspects of line are discussed in the context of first-year design education and included in the design studio which may pave the way for the evaluation and use of this visual language as a medium that enables learning to take place.

Although many researchers and educators agree on drawing features that create and develop thinking, this general acceptance is mainly based on experiential information. Therefore, there is an emerging need for systematically conducted further studies that can reveal the perspectives and experiences of students. That way, it may be possible to reveal the implicit aspects of the drawings in the context of design education and studio culture.

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MEANINGFUL GAMIFICATION THROUGH METAPHOR GENERATION

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Keywords: Meaningful gamification, metaphor generation, intrinsic motivation

Abstract In this paper, a method for meaningful gamification will be introduced. Gamification gives a source objective that encourages people to fulfil a task they are reluctant to and makes people achieve the target. For this, meaningfulness is necessary. While gamifying an experience, external rewards would not replace the transversal objective. Thus, a method for “meaningful gamification” is proposed. According to Nicholson’s (2012, 2015) theoretical framework for meaningful gamification, users who have linked an activity to their personal objectives are more likely to have enhanced internal desire to pursue that activity. Based on this theoretical framework, this study aims to clarify creating comprehensible and aesthetic metaphors for meaningful gamification. Therefore, this method focuses on the meanings that emerged from experiences to be mapped from the target objective from the source objective. For generating meanings, metaphor generation is one of the most adopted approaches by designers. The physical, functional or experiential qualities of a source are mapped onto a target to create a familiar sense in metaphor generation. This method is based on the patterns for the processes of metaphor generation and associates this process to the domain of gamification.



Introduction: Meaningful Gamification

Gamification applies game design elements to other domains of life to improve user experience and user engagement. The study of game design and elements in different contexts is a topic in human-computer interaction based on dialogues between HCI and video games such as design features for enjoyment, motivational psychology, affordances and persuasion (Deterding et al., 2011a). Gamification has been defined as a process of enhancing services with motivational affordances and behavioural outcomes by invoking gameful experiences (Huotari and Hamari, 2012; Hamari, 2013). It refers to using design elements characteristic for games in non-game contexts (Deterding et al., 2011b).

"Meaningfulness" is an essential issue for gamification studies, and meaning is a crucial aspect of engaging gamification (Deterding, 2011c; McGonigal, 2011). When an activity is interwoven inside a narrative, supports users' own aims and interests, or has a purpose that is regarded important by users, it is framed as meaningful (Deterding, 2011c). People desire to belong to and contribute to something that has enduring value beyond our own lives, therefore meaning is an essential incentive (McGonigal, 2011).

Creating an environment where participants may explore and discover meaning is at the heart of the notion of "meaningful gamification." It is a "free and safe area that allows individuals to explore their potentials and eventually devote themselves to study, develop, and grow" (Kolb and Kolb, 2010).

For both physical and virtual spaces, the goal is similar: to create a set of playable mechanisms that assist the participant in finding what is fascinating and meaningful about the underlying non-game context and connect it to their existing experiences, knowledge, and skills. Each participant can take away different things from the gamification experience because they discover what is valuable (Nicholson, 2012).

In order to develop strategies for meaningful gamification, Nicholson (2015) explored six elements of game design:

- "Play: Facilitating the freedom to explore and fail within boundaries.
- Exposition: Creating stories for participants that are integrated with the real-world setting and allowing them to create their own.
- Choice: Developing systems that put the power in the hands of the participants.
- Information: Using game design and game display concepts to allow participants to learn more about the real-world context.



- Engagement: Encouraging participants to discover and learn from others interested in the real-world setting.
- Reflection: Assisting participants in finding other interests and past experiences that can deepen engagement and learning" (Nicholson, 2015, pp. 5).

Although external rewards might be helpful, numerous examples show how incentives can detract from performance. People have grown accustomed to receiving prizes such as grades, gold stars, and money to motivate them, and incentives and punishments are two sides of the same coin. While prizes are practical motivators, it is assisting someone in making their own decisions about their behaviours without the need for an external controlling behaviour that produces superior results (Kohn, 1999).

Virtual prizes, points, scores, badges, and leaderboards are examples of game design components that visualize the task's metric and are a huge concern with gamification. However, putting too much emphasis on these features misses the reality that they are feedback mechanisms, not game mechanics, and that they are the most basic kind of gamification, leading to pointless applications (Marczewski, 2014).

To assist participants find meaning in the underlying task is a powerful aim of meaningful gamification. External rewards should be substituted with engaging play. Since the intended context of gamification is not a gaming platform, the long-term goal of gamification should be a meaningful game-based experience that is well-connected to the underlying non-game environment. In a non-game activity that is relevant to the user, meaningful gamification aims to provide psychological and behavioral consequences (Nicholson, 2012).

Persuasive Aspects of Gamification

Persuasive aspects of gamification are not limited to making activity measures visible. While these are goal-oriented features of the activity, there are other sensations that are not related to objectives. These are experiences that are just not goal-oriented and give people with meaningful encounters (Jensen, 2013). Rather of employing a point system, effective gamification strategies evaluate components of the underlying activity to determine where game elements might be included (Nicholson, 2012).

The self-determination theory is a macro explanation of human motivation and their intrinsic psychological needs developed (Deci and Ryan, 2000). Intrinsically driven activities are those that a person finds fascinating and engages in without any training or conditioning, simply for the joy of doing so. To maintain intrinsic motivation in individuals, it is vital to meet their psychological and social requirements of autonomy, mastery, and relatedness (Aparicio et al., 2012).

Autonomy. When doing a task, autonomy implies a sense of will, and perceived autonomy is substantial when actions are undertaken out of personal interest. Allowing people to make their own decisions without supervising or managing them and avoiding any form of reward for external causation have all been found to increase autonomy and, as a result, intrinsic motivation.

Competence. Competence refers to people's desire to participate in difficulties while also feeling competent and efficient. They are adjusting the objectives of the activities to each user's capabilities by providing optimal challenges that promote the perception of competence and positive feedback, but not at the expense of the perception of autonomy because otherwise, the user will not feel responsible for the actions that have led to this favourable situation.

Relatedness. Another psychological requirement linked to intrinsic motivation is relatedness. We need to make it easier for people to communicate with one another and strengthen interpersonal relationships. We also need to include gaming mechanisms that allow users to express themselves while influencing others (Aparicio et al., 2012).

An experimental study by Chandler and Kapelner (2010) aimed at integrating meaning into a task for assessing how gamification in a meaningful frame would be linked to behavioural and motivational outcomes. For this purpose, they explained to the participants that they would identify tumour cells in an image tagging task. Compared to participants who were instructed to identify "mere items of interest," their experiment resulted in more photographs being labelled and a higher chance of participating in the task. Participants in a similar study by Rogstadius et al. (2011) were told that their efforts would benefit a non-profit organization, resulting in higher-quality work. They were, however, littler in number.

As the example above indicates, using external rewards would not replace the transversal objective and psychologies and social needs such as autonomy, mastery or relatedness. For this, the gamification mechanisms should be decided carefully. The users should intrinsically be guided to achieve the actual task while feeling engaged throughout, fulfilling and satisfied at the end of the process. Therefore, this study proposes a method for meaningful gamification based on metaphor generation.

Product Metaphors

Metaphors help people grasp a new situation by relating it to a familiar experience (Ortony, 1991). Using metaphors to refer to what is already understood to explain the unknown is possible. Metaphors, in essence, are indeed a unique juxtaposition of the familiar and the unfamiliar. They are seen as valuable tools in problem-solving, and they cause the formation of novel connections, which expands the human capacity for interpretation (Lakoff, 1987, 1993). Three key phases are relevant to the use of metaphors in problem-solving (Gentner, Bowdle, Wolff, and Boronat, 2001):

- The first phase is pulling a wide range of foreign notions from the far fields, where potential connections to the topic at hand are often not obvious.
- The second phase is creating a map of the metaphorical concept's deep or high-level links with the situation. Abstractions and generalizations are used to identify correspondences.

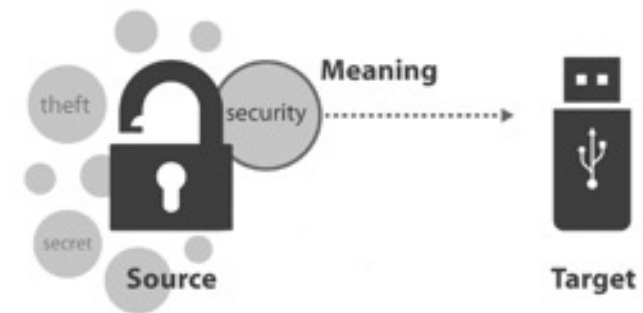


Figure 1. An example of a product metaphor ("Datenschutz" by dialog05, URL-1);
Figure 2. The relationship of the terms used in Cila et al. (2014)

- The last phase transfers and applies structural correspondences from the metaphorical source to the problem at hand, which usually results in a creative solution (Casakin, 2007).
- Cila et al. (2014) proposed a framework for product metaphor creation, which aimed to connect linguistic theories on metaphors to the product design domain and clarify how designers generate meaningful and aesthetic metaphors. According to this framework, designers decide on;
 - The meaning they wish to convey,
 - The source that can convey this meaning,
 - Which attributes of this source they will project onto the target,
 - and how they will execute the mapping." (pp. 25).

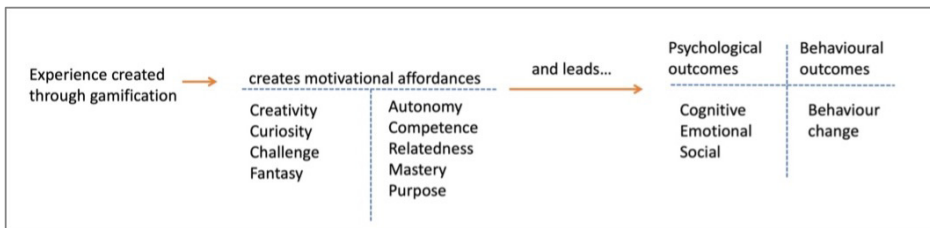


Figure 3. Gamification creates motivational affordanc (adapted from Deterding et al., 2011b; Aparicio et al., 2012).

The designer utilizes a metaphor in a product to modify our traditional way of perceiving things through the metaphor generating process. Product metaphors have a source domain where specific features are appropriated and a target domain where these features are transmitted, similar to verbal metaphors. As a result, the source and the destination share some visually or conceptually relevant mappable elements (Cila and Hekkert, 2009).

Designers create metaphors by transferring one or more attributes from one item to a product they're working on. For example, the designer infers a link between a memory stick and a padlock in the product metaphor (Fig. 1). Rather than creating software into which users may input their passwords, the designer has users use a physical key to unlock the shackle and get access to the data (Cila and Hekkert, 2009). The memory stick is a product that has been given a new meaning and is therefore referred to be the metaphor's target, while the padlock is referred to as the source, the entity that alters the

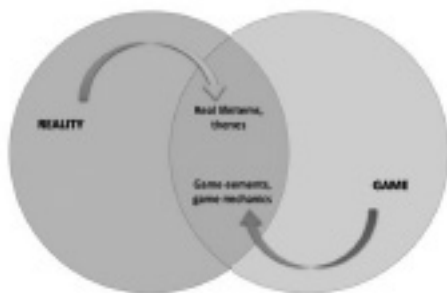


Figure 4. Dynamics of gamification: A two-way relationship between the game and non-game contexts

target to impart that meaning. The significance in question is the USB's "data security," which the designer has underlined by transforming the device into a padlock (Fig. 2). Projecting qualities of the source onto suitable properties of the target, known as mapping, physically create metaphorical relationships between the target and the source (Cila et al., 2014).

Gamification as Metaphor Generation

In non-game contexts in which game elements are situated, we encounter a new kind of experience called gameful experience. These experiences involve transfers of meaning from the original context, a game context, to a non-game context in which the tasks need to be more engaging.

Reality and game meet at a point where they are intertwined, resulting in a new form of experience. Motivational affordance is formed at the intersection of game and reality, and it satisfies motivational demands such as autonomy, competence, and relatedness, as outlined by self-determination theory in psychology (Deci and Ryan, 2000). When these



Figure 5. How designers employ gamification in their designs

requirements are addressed, imagination and motivation are sparked, leading to positive psychological and behavioural outcomes (Fig. 3).

The gamification dynamics in which reality and game interact in a two-way manner, with reality borrowing game aspects and mechanisms from the game. The game, on the other hand, uses real-life goods and themes. There is a two-way trade from different worlds, from reality to game domain and vice-versa. These two domains lend meaning to each other and contribute a whole experience. Designers have to generate meanings that make sense of this relationship and bridge the two worlds. Communication between two domains is established by creating semantic bridges. Designers rely on several meaning generation methods. Metaphor generation is one of them which underlies those meanings for meaningful gamification strategies. These semantic bridges are usually built through metaphors. Metaphors are intermediaries that carry one meaning to another domain. The study will present a method of generating metaphors for meaningful gamification. Its validity for meaningful gamification was investigated by applying it to the

various gamification metaphor samples (Fig. 4).

Aparicio et al. (2012) proposed a primary sequence of activities for the gamification process. The most significant steps of the gamification process involve:

- Identification of the main objective: identifying the main objective of the task to be gamified
- Identification of the transversal objective: specifying underlying objectives that are interesting for people
- Selection of game elements for supporting human motivation needs: Selecting game mechanics that match these objectives; supporting the needs of human motivation such as autonomy, competence, and relation.
- Evaluating the effectiveness of the implementation of gamification is based on fun, satisfaction and service quality

These steps in a gamification process involve similar decision-making steps of the metaphor generation process. Designers generate metaphors by identifying main, transversal objectives and game elements, deciding on the source, target, meaning and mapping. Therefore metaphor generation forms a remarkable framework for constituting means adapted to meaningful gamification (Fig. 5).

Examples from conceptual and commercial products samples are analyzed to clarify how to create understandable and aesthetic metaphors for meaningful gamification. This analysis is enhanced with other product examples, aiming to persuade or engage people to perform complicated tasks by providing them with more engaging tasks. This explor-



Figure 6a. iFloor Project, 2004 (Krogh et al., 2004);
Figure 6b. Analysis of metaphor generation in the example



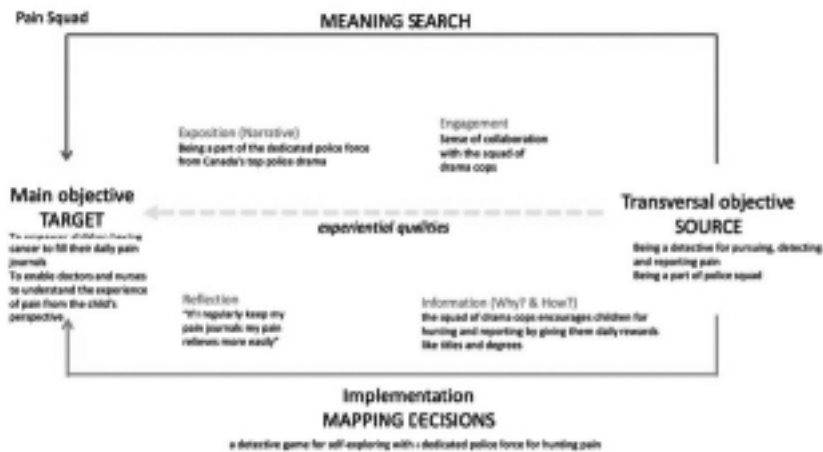
Figure 7a. Odenplan subway, 2009
Source: <https://www.designoftheworld.com/piano-stairs/>;
Figure 7b. Analysis of metaphor generation in the example

tion is based on the gamification process proposed by Aparicio et al. (2012) and refers to the concept of meaningful gamification proposed by Nicholson (2012, 2015). The aim is to identify the significant patterns on how designers employed gamification and to offer a methodological framework for generating meaningful experiences through gamification. To check the validity of the proposed method for meaningful, several samples in which designers used gamification as a design strategy were identified and mapped as metaphor generation. The following four studies illustrate the steps of the method for meaningful gamification through metaphor generation.

Meaningful Gamification: Metaphor Generation Samples

As Jensen (2013) and Nicholson (2012) claim, the given applications of gamification are meaningful for people in the exemplified contexts.

Jensen (2013) describes the iFloor Project, which began in 2004 at the city library in Aar-



hus, Denmark, as a design research project to enhance the library experience. Visitors might transmit their questions to a system via their mobile phones on an interactive floor in the lobby. The user must initiate a discussion with a stranger for the system to project their query on the floor through a projector. The camera watching the users notices that a dialogue has begun and shows the user's query. The initiative's goal was to reintroduce social contact into libraries by encouraging serendipitous encounters with strangers (Fig. 6).

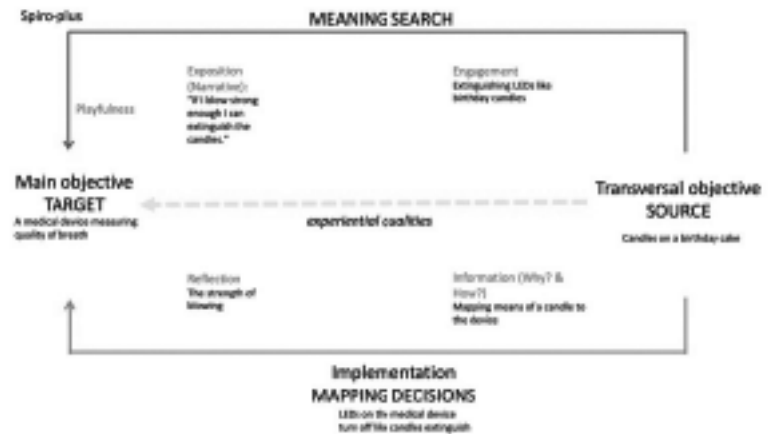


Figure 8a. Pain Squad, 2012, Source: <http://www.cundari.com/cases/pain-squad/>; Figure 8b. Analysis of metaphor generation in the example

Figure 9a. Spiro-plus, 2013, Source: <https://www.berkilhan.com/spiroplus>
Figure 9b. Analysis of metaphor generation in the example

In Sweden's Odenplan Subway, a piano keyboard was installed on the stairwells leading into the subway, encouraging passengers to use the stairs rather than the escalator (Nicholson, 2012). They installed a piano keyboard on the subway steps in the hopes of encouraging more people to utilize the stairs rather than the escalator (Fig. 7, Volkswagen, thefuntheory, 2009).

There are different examples from different domains, such as medical designs. The following examples support the treatment processes of people experiencing difficult health issues.

"Pain Squad" application is directed towards special user groups. This application is designed by a Canada based agency- Cunduri Inc.; to encourage young cancer patients to complete daily reports on their pain with support from Canada's top police dramas by gamifying cancer treatment for sick kids and to give doctors the tools they need to understand the experience of pain from a child's perspective. This application offers these kids a detective game for self-exploring with a dedicated police force for pursuing, detecting and reporting pain. They explore the pain on their body like a detective and reports them to the squad of drama cops who encourages children for reporting by giving them daily rewards like titles and degrees (Fig. 8, Cundary Inc., 2012).

Another example is a medical device, namely "Spiro-drive", designed by Berk İlhan, a pulmonary function testing device that provides patients with interactive feedback. By using "candle" metaphor, Spiro-Plus aims to motivate patients and reduce stress factor in order to increase test efficiency in hospitals. It aims to persuade patients by making the measures visible in an enjoyable way. This medical device is used to detect chest disease by making the patients blow to extinguish the LED candles on the device to obtain effective measures (Fig. 9, URL-2).

These examples show how game features may provide game-like qualities in non-game environments, allowing users to fully immerse themselves in the activity. Another conclusion that can be drawn from these instances is that designers have used metaphor creation as a design technique extensively. For example, meeting with strangers in a library to find out the answer to your questions, stair climbing as if it were a piano, self-exploration as if you were a detective, and blowing to a device that counts breath quality as if they were birthday cake candles, involved scenarios from source domains with a familiar and engaging story are mapped to the target domains.

Conclusion

The relevance of game use and integration necessitates a significant degree of creative decision-making on how to tie game aspects to non-game contexts in a "meaningful" way by emphasizing people's real-life experiences. To better comprehend relevant features of meaningful gamification, it is necessary to approach the word methodically in a design process. It is also important to grasp the tactics used by professional designers that use gamification as a design strategy. This paper proposes a method for meaningful gamification by exploring the significant patterns in designers' strategies. Examples that persuade people to perform main objectives through transversal objectives are selected for discussion. Meaningful gamification examples illustrate that metaphor generation as a design strategy has been employed by designers, as in the samples iFloor, Piano Stairs, Pain Squad and Spiro-plus. These examples provided a significant pattern for a methodological framework for meaningful gamification. However, this method needs to be validated through further explorative studies.

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Sustainable Interior Design: A Course Proposal

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Keywords: Sustainable Design Course, Sustainability Education, Sustainable Interior Architecture, Course Proposal

Abstract Sustainability is an idea that affects every sector, every part of society and that everyone should be aware of. There are a few sectors that perhaps need to act hastily on this issue, and the construction sector is one of them. In order to prevent or minimize the damage caused by the construction industry to nature, a lot of work falls on not only the industry but also the academy. In this sense, interior architecture students who will be responsible for the built environment in their professional life should learn the principles of sustainable design in their undergraduate education. In this study, an elective course proposal was prepared for interior architecture students in the light of the data obtained from the previous study.



Introduction

Sustainability is an idea that affects every sector, every part of society and that everyone should be aware of. There are a few sectors that perhaps need to act hastily on this issue, and the construction sector is one of them. In the analysis made by the IEA (2021), the floor area built in buildings worldwide increased by approximately 65% between 2000 and 2020, reaching 245 billion m². On the other hand, energy use per m² decreased by approximately 25% in 2020. Although this rate is a positive development in terms of energy efficiency, it partially balances the floor area growth. For the world to reach Net Zero by 2050, energy use per square meter needs to be reduced, but more than 3.5 billion m² of buildings were built in 2020 without performance requirements, as nearly two-thirds of countries have not made Net Zero goals a policy priority. (IEA, 2021). The most basic way to achieve the Net Zero goal is to raise awareness of all segments of society about sustainability. In this regard, the United Nations has determined the period of 2005-2014 as "Decade of Education for Sustainable Development" in order to educate the decision makers of the future on this issue and has taken steps in this regard. In the published

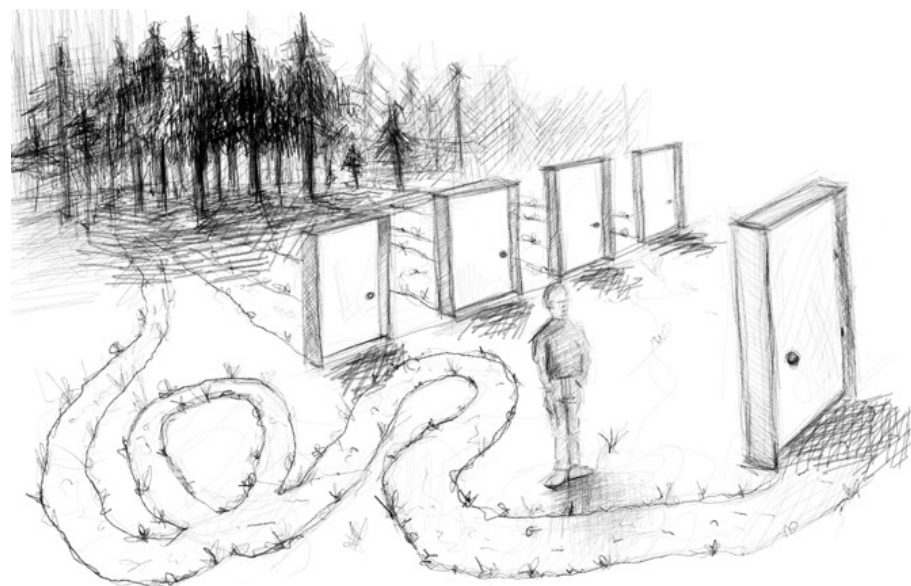


report, there are suggestions for the implementation of this action, such as encouraging quality education, reorganizing education programs, educating the society and practical training. (UN, 2005). This education movement, which was started in 2005, is continued until 2030 with a statement published in 2019 (UNESCO, 2019).

However, in order to prevent or minimize the damage caused by the construction industry to nature, a lot of work falls on not only the industry but also the academy. The key to solving this problem is in sustainable design, the only way to apply the principle of "meeting the needs of today without compromising the future". Designers who know sustainable design principles can provide positive change through their designs (Moxon, 2012). However, in order to achieve this, they need to receive a quality education and learn about sustainable design in all its aspects.

Until recently, interior architects' relationship with sustainability was limited to recyclable local building materials or energy-efficient lighting. Systems based on building performance and strategies for resource conservation were emerging as the domain of architects and engineers (Pilatowicz, 2015). In this process, a certain point has been reached on the basic principles of sustainable design, both academically and professionally, but this basic knowledge needs to be developed. Since sustainability is an approach where many concepts come together, it is difficult to evaluate and teach as much as define it (Stieg, 2006).

In order to implement the sustainable design approach, interior architects must first ask the right questions and know how to eliminate potential problems that may prevent sustainable design. In other words, for the interior design project to be sustainable, the interior architect must understand the principles of sustainable design and the effects of these principles on energy and water systems, building materials and construction methods (Moxon, 2012) For this, it is necessary to include sustainability in interior architecture education and the content taught should be suitable for the definition of the profession that students can use in their professional lives after graduation



Methodology

This study is a two-part study. In the first part, contents that the undergraduate students in interior architecture departments in Turkey are learning about sustainability were examined. The universities examined in the analysis were selected from universities whose weekly course schedules can be accessed online, and as a result, a sample group was formed from 11 universities. In the analysis made in the first part of this study, it was seen that the contents were disconnected from each other in some universities. In addition, it has been observed that passive-active systems are the most taught content in the weekly curriculum of 11 universities. Passive-active systems are followed by thermal comfort and sustainable materials seen in 7 interior architecture departments. Lighting, green building certification systems and water conservation are other topics included in the weekly programs (Table 1). In addition, it has been observed that all of the 11 departments do not include waste management. Based on all these observations, the taught contents were compiled and a weekly course schedule was created. The order of the subjects to be taught in the weekly program was designed by considering the order in the weekly contents of the sample group. At the same time, in this study, publications on the integration of sustainability into the interior architecture curriculum in Turkey were compiled and various additions were made to the proposed curriculum.

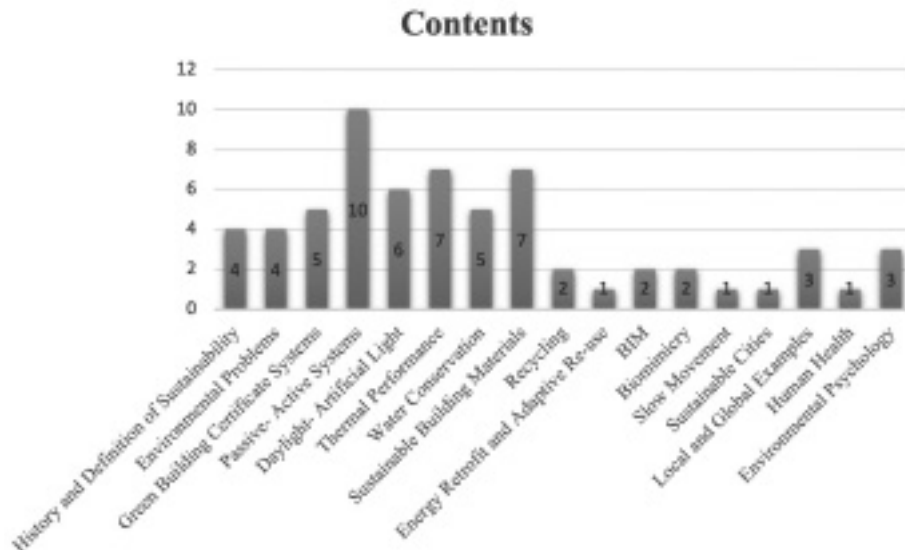


Table 1: The contents of the courses taught to undergraduate students of interior architecture departments at universities included in the sample group analyzed in the previous study (Gökdağ & Özkan, 2021).

Alternative Teaching Methods Tried in Turkish Universities

After an interior architecture studio study organized in partnership with the industry, 73% positive feedback was received in the survey conducted with 98 interior architecture students. In the course, which was planned as 8 weeks of theoretical knowledge and 7 weeks of practical knowledge, experts in the subjects taught as theoretical knowledge were invited as speakers. At the same time, a tour was organized to a building that received LEED Platinum certification. In the application part of the course, it was critical to work with a company one by one. After this study, the findings about whether the students found this study important or not were published as follows; 47% very important, 20% moderately important and 25.5% important (Afacan, 2014). In a cross-cultural study, interior architecture students of both universities learned the course contents through video conference. After learning the theoretical knowledge, the students were expected to form a team with the students of other university and to create a design project together to cover the content they learned. In the evaluation made after the course was over, the knowledge of the students was found to be almost the same and highly positive (Taşlı Pektaş et al., 2015). In another studio study, students were expected to make sustainable design as a designer. In the first weeks of the course, students were asked to gather information about sustainability and make a presentation in the light of the information they gathered. In the second part of the course, students were expected to design by giving a checklist prepared by the instructor and divided into 4 main headings: energy, material, water and health. At the end of the course, it was recorded that 75% of the students who did not have current knowledge about sustainable design were successful (Karlı, 2013).

Sustainability in Interior Design Course

This course is planned as an elective design-oriented lecture/seminar course. The aim of this course (Table 3), which is proposed with the name of "Sustainability in Interior Architecture", is to teach the definition of sustainability, its purpose and its importance in interior design/interior architecture, and to ensure the student to design future projects by considering sustainability criteria. It has been observed that the most preferred contents by the sample group are the definition and history of sustainability, environmental issues, green building certification systems, energy efficient building design, daylight control in interior space, thermal comfort, water conservation, sustainable building materials, local and global building examples, and environmental psychology. These contents were taken into consideration while designing the course proposal.

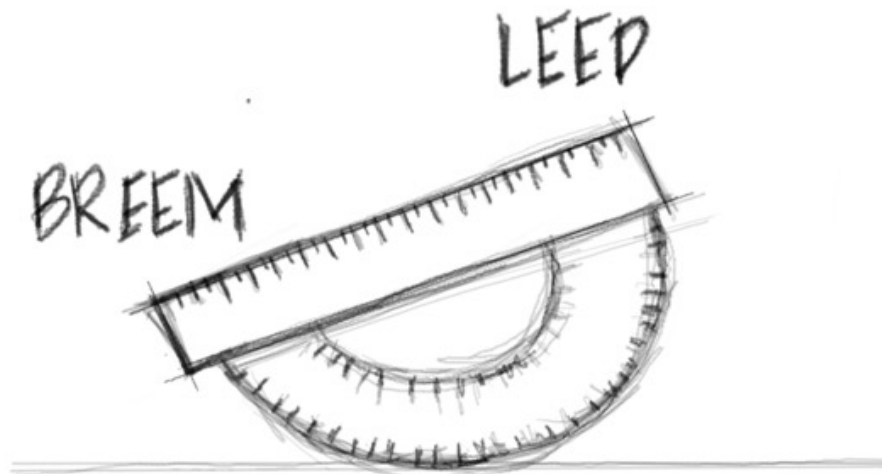
This course is divided into 4 parts. The contents in the first part are environmental issues, the history of sustainability, fossil fuels, renewable energies and certification systems. The second part consists of elements that increase the building performance, materials, local architecture and ways to transform the existing building into an energy efficient building. In the literature review, it was seen that success was achieved in the studios where the students came together with the professionals. Based on this, in the third part, it is important for the students to have information about the industrial equivalent of the theoretical knowledge they learned and the practices made in Turkey, in order to understand the professional dimension of sustainability. There is also an analysis and presentation of a building chosen by the student from Turkey or the world in this part. This work can also be in the form of group work. In the last part, the student is expected to draw the energy retrofit project of the design he/she has planned in the design studio in the 4th semester. The last part of the course is designed to be supported by critiques and then to end with a presentation to the jury.

In the curriculum created by using the teaching method suggested by Stieg (2006), it was

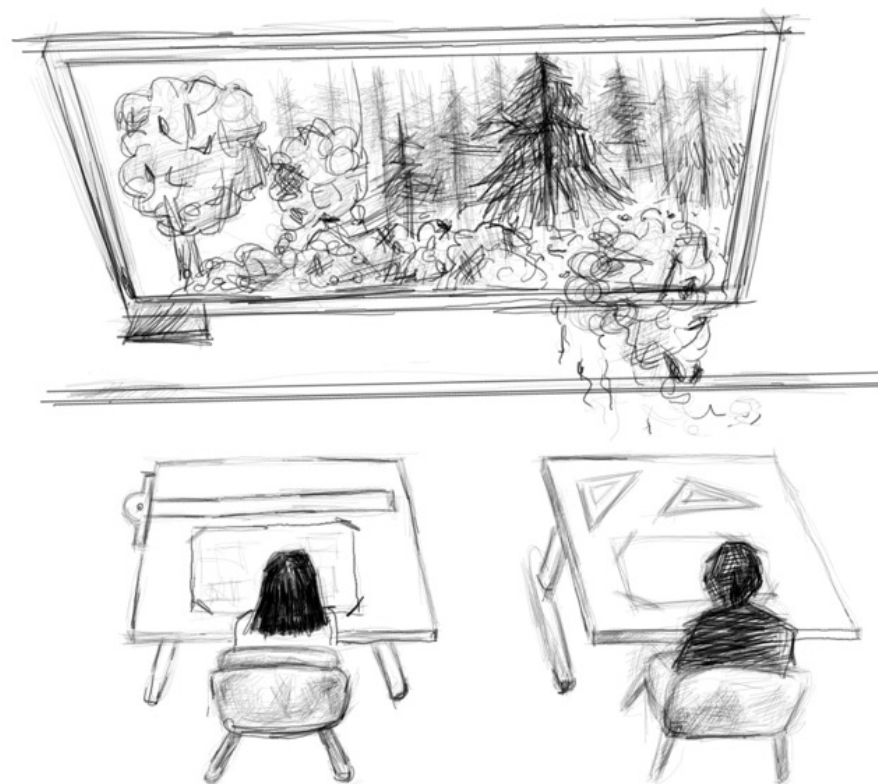
thought that the student's learning about environmental problems first would enable them to establish a logical relationship with the later parts of the course. The first two weeks are divided into four parts, and it is aimed to prepare the student for sustainable building systems. In this sense, in the first week of the course, it is aimed to teach environmental problems, their effects on the ecological order and the history of sustainable development. In the second week, it is planned to provide information about fossil fuels,

their effects on the world and renewable energy sources. In the second week, it is also aimed to explain green building certification systems, especially LEED and BREEAM. Apart from LEED and BREEAM, although there are quite a few certificates used in the world, most of them serve on a local scale. One of the main reasons why especially these two certificates are popular today is that they are quite old, and secondly, they get a lot of applications because they adapt their certificates to different building types. (Vierra, 2019). Since Turkey does not yet have a green building certification system of its own, LEED and BREEAM certificates are generally used for rating sustainable buildings built in the country. BREEAM and LEED also have points where they differ from each other. For example, it is seen that there are more criteria in BREEAM for building materials, which are one of the cornerstones of interior architecture. (Kobaş, 2011). Because of this and many other differences, green building certification systems, especially pioneering certificates, should be included while providing sustainability training to interior architects. In this way, before learning about sustainable building systems, students will have preliminary information about the criteria by which this type of building is evaluated.

Stieg (2006) stated that an interior architect at number 3 of the sustainability training steps should be able to explain to his/her client and business partners why a building should be sustainable. From this point of view, in the second part of the course, it has been seen that it is necessary to show the sustainable building design steps to increase the building performance and user experience. In this sense, the subject of waste management, which is not included in the sample group but is of great importance for sustainable buildings, has been added to the curriculum. The reason for this is the damage caused by the buildings to the environment. Buildings cause environmental pollution by spreading toxic dust and other air pollutants and harmful wastes around them (Amaral et al., 2020). In this sense, it is thought that an interior architect should have an idea about this issue during sustainable interior design education.



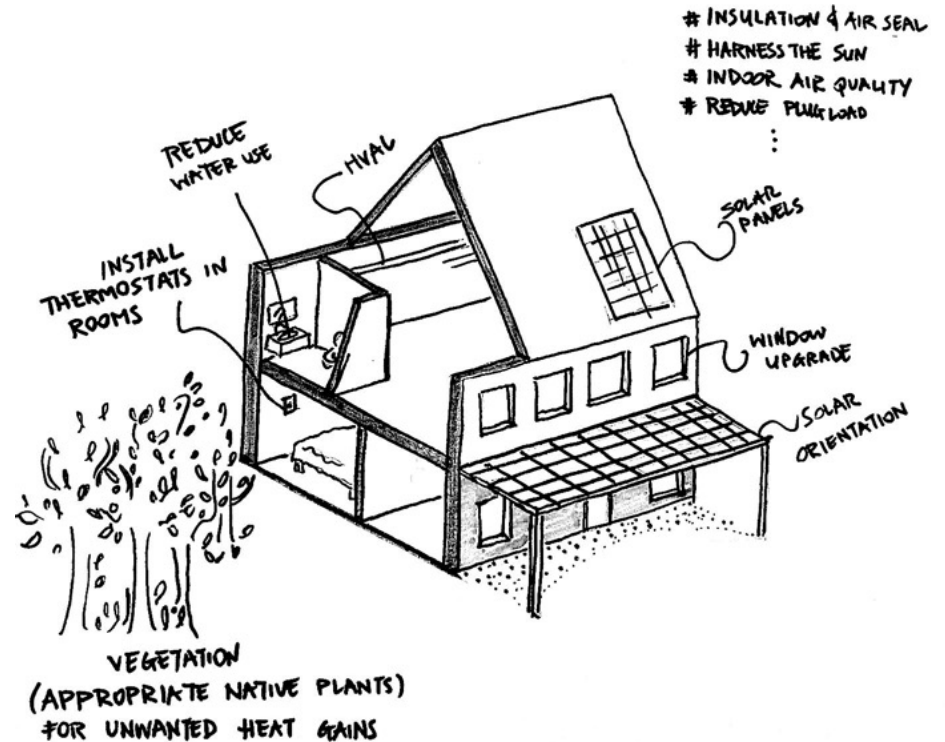
Another step mentioned by Stieg (2006) is the commitment step, which states that sustainability should become a lifestyle. In order to achieve this, students are expected to both participate into industry collaboration lectures and present a green building of their choice with all its components. By examining the buildings that have received green building certificate with their theoretical knowledge, they will have the opportunity to see how the systems they learned are integrated into the buildings. After this step, they are expected to show all the knowledge they have learned so far with an energy retrofit project. Today, considering the building stock, applying an energy retrofit project to existing buildings has come to the fore. It has even been announced that the government will provide financial assistance for energy efficiency and low carbon heating systems to be built in existing houses in the UK. (Gov.uk, 2021). In particular, the UK focuses on and encourages energy retrofitting. Considering the potential of more countries to give importance to this subject in the future, it is thought that students studying interior architecture should learn this subject with both theoretical and practical knowledge in undergraduate education.



For the energy retrofit project, the students are expected to make the project they submitted in the previous semester sustainable with the knowledge they learned after taking sustainability lessons. The main purpose of this course is to inform the students about the systems used and to raise awareness and make them feel the need to learn more about this subject

Course Name	Semester	Theory (Hour/Week)	Application (Hour/Week)	Laboratuary	Local Credit	ECTS
Sustainability in Interior Design	Fall/Spring	2	1	0	3	4
Prerequisites	The student must have passed the 4th semester design course.					
Mode of Delivery	Face to face/Hybrid					
Course Objective	The main purpose of this course is to provide students with both theoretical and practical knowledge about sustainable interior design. From the beginning to the end of the course, basic information about sustainable interior architecture is taught, and in the last part, the student is expected to apply an energy retrofit to the project he/she has designed before.					
Learning Outcomes	Successful completion of this course will bring students to 1. Learn environmental problems, renewable energy sources and their usage areas in building design. 2. Learn the most used green building certificates and the necessary conditions for a building to obtain these certificates. 3. Learn about passive and active building systems and their core principles 4. Learn both ensuring energy management and user comfort in the building through different applications such as daylight control, light, ventilation, thermal comfort, waste management, water conservation, etc. 5. Learn the materials that can be used in the interior, the importance of local architecture and the effects of using local materials, 6. Learn ways of using recyclable materials in furniture design 7. Learn to put into practice all the theoretical knowledge learned about sustainable space design.					
Course Content	Environmental problems and the effects of these problems on the ecological balance, the reason for the idea of sustainability, elements that make a building sustainable, evaluation systems of these elements, definition and advantages of local architecture, energy efficiency of the existing structure and sustainable materials that can be used in both the building and the furniture constitutes the content of this course.					

Table 2: Course Information



Weeks	Topics
1st week	Environmental Problems
	History and Definition of Sustainability
2nd week	An Overview of Fossil Fuels and Renewable Energy Sources
	Green Building Certificate Systems
3rd week	Passive Building Design
4th week	Principles of Building Technology: Light
5th week	Principles of Building Technology: Thermal Performance
6th week	Principles of Building Technology: Waste Management
7th week	Principles of Building Technology: Water Conservation
8th week	Sustainable Building Materials
9th week	Industry collaboration/lectures
10th week	Presentation of Case Studies (Midterm Submission)
11th week	Energy Retrofit Design
12th week	Integrated Design Studio: description of the project and answering questions
13th week	Critic
14th week	Critic
15th week	Critic
16th week	Jury

Table 3: Weekly Course Outline

Conclusion

The main purpose of this course proposal is to provide undergraduate interior architecture students with a holistic knowledge of sustainability. Due to the intensity of the course content and the complexity of sustainable design, it is of course not possible for a student who only passes this course to make a successful sustainable design in the future. However, this course proposal is important for students to have an idea about sustainable design issues, to learn which methods should be applied to make an existing building sustainable, and to learn the responsibilities of the interior architect in this process. It is also important that students who took or are taking basic interior architecture courses such as interior architectural detail, installation, lighting, acoustics meet with the sustainability part of these basic subjects and have awareness in a sustainability manner.

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How to Design School Furniture for the Pandemic Period?

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Keywords: Furniture Design, Classrooms, Pandemic Process, Ergonomics

Abstract With the emergence of the Covid-19 disease in 2019, the education was interrupted, and the online system was started in this process. It has been revealed that the importance of physical school spaces in education and the distance education model are not suitable for secondary education. Many of researchers reported that face-to-face education system more efficient than online education. In this paper we try to find out during pandemic period, how educational interior spaces and furniture could be change or revise? Also, in this paper the furniture design process and formation of ergonomic interiors were investigated. The risk of Covid virus transportation should be reduced with furniture design and interior space suggestions. The purpose of this paper is to identify class layout designs and minimize the contact of virus, bacteria and germs.





1. Introduction

The 2019-2020 Coronavirus (Covid-19) pandemic has affected education systems worldwide, causing widespread closure of schools and universities (Wikipedia, 2020). The education of millions of children around the world has been interrupted for months. The repercussions of this can be felt in economies and societies for decades. Even if children have technology and tools at home, they may not be able to learn remotely through these platforms due to factors such as family pressure to do housework, a poor environment for learning, and lack of support in education (URL1, 2020).

“Education is the most important tool of social and economic structure for the development of our country and for reaching the targeted level of life. In school age education, the most important role acquired. The primary school education is the most important part of school-age education. Primary school buildings have a special importance as the place where unique education programs are given, and the aimed information is taught. (Kose, 2010)

To prevent the interruption of education system, all measures should be taken in school buildings and indoor models suitable for pandemic conditions should be developed. “The long-term effects of the epidemic are uncertain. It is not known whether the new social behavior patterns developed by the individual will be permanent or temporary” (Koca & Tutal, 2021).

In this process, new spatial formation processes are being investigated in school buildings that entered a different formation process. In this context, flexible space formations should be adopted.

Consider that government has invested existing school structures and buildings. It is im-

possible for countries to replace school buildings new structures suitable for pandemic conditions. In this paper, it is aimed, students should continue their education with new interiors and suitable furniture in accordance with the pandemic conditions in the classrooms.

2. Design Principles

Furniture is the item that provides communication and interaction between the user, the designer, and the space (Özül & Ürük, 2021). Learning processes should also trigger interaction and creativity. School structures need to produce flexible solutions. In this context, classroom furniture should be able to adapt to new conditions and be used for this process and beyond. “The new habits and rules brought by the pandemic have created changes in the layout of the common indoor spaces. These changes in spaces have caused the concept of personal distance, which has lost its clarity until today, to reappear in our lives (Doğan, 2021).

Reducing the density of schools and integrating classes accordingly will reduce the transmission route. The buildings should be rearranged to include “social distance” and the hygiene conditions should be provided to the desired extent in the whole place. To meet these determined requirements at the desired level, interior equipment must be placed in accordance with these rules. Monitoring consumer behaviors shows that during pandemic times furniture trades are more popular than other consumer goods (Barcic et al, 2021).

“Space design should move forward with the user focus. Human is a social entity. The psychological effect of the place on the individual can be associated with the distance it establishes with other people. The ability to provide optimum movement and keep away from the feeling of being stuck affects the duration and quality of the time that the person spends in the space. The concept of social distance has been determined as 1.5 meters between people in the society. This situation has also changed the expectation of the individual from the environment and the usual space setup. It can be said that the distance of personal space has biological, physical, and psychological effects on the individual (Dogan, 2021). In pandemic conditions furniture design should obey social distance rules. This process resembles a clear similarity between well-known “Basic Design Cycle” pro-



Figure 1. Protection can be provided by using transparent panels in classroom spaces where distance cannot be maintained (URL3, 2020),

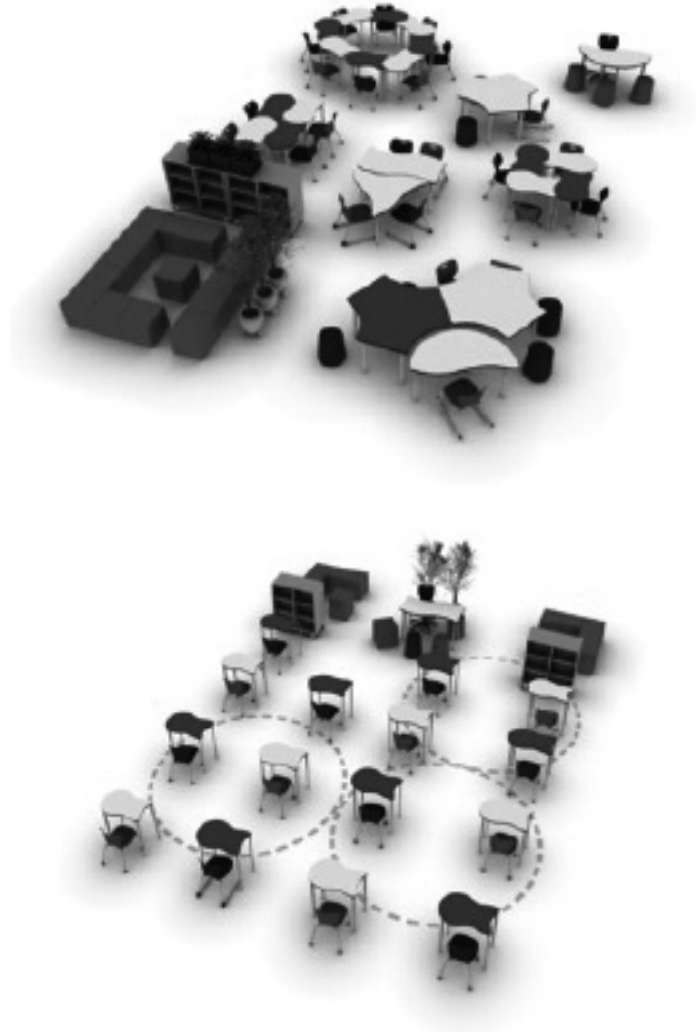


Figure 2. Class system that allows both individual and group work. Transparent dividers can be used between rows in group work.

posed by Roozenburg and Eekels (1995).

Covid-19 has affected and continues to affect many areas with education. As our relationship with the space has changed, so have our contact, interaction, and relations with each other (Koca & Tural, 2021). This measure, which we prefer to call 'personal distance' instead of social distance, is a distance that will create a personal protection area, not an obstacle to socialization during the pandemic period (Tan, 2020).

The most common method of Covid-19 infection is coughing, sneezing and even normal speech, which facilitates direct transmission of droplets. The best way to prevent this in schools is to create distance between students. Urban Architects' plan is to create a diagonal pattern on the classroom floor so that students can be placed in the classrooms safely. Urban Architects' plan aims at hygiene and distance. For example, the plan envisions schools adding prefabricated washing stations in the lobby and corridors to facili-



Figure 3. Haskell Education personal sign board as divider

tate access to regular handwashing (URL2, dezeen, 2020).

However, according to Dr. Zaki, a psychologist at Stanford University: He emphasized that social distance is of vital importance in the spread of Covid-19, but that people must be connected in communication in social life, otherwise it may cause a long-term mental

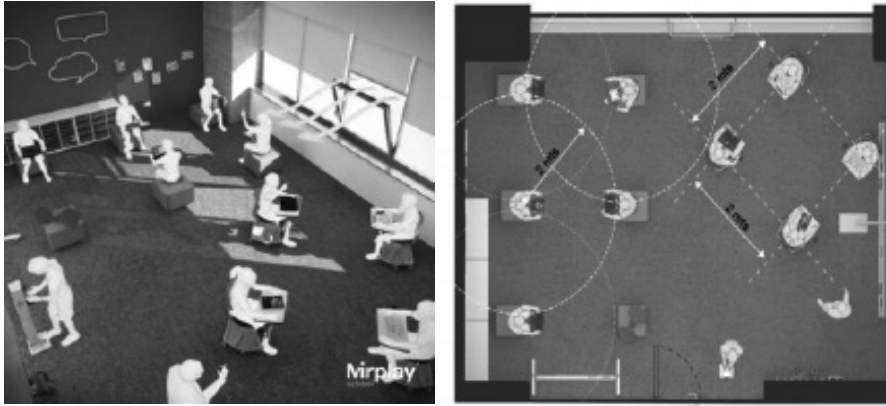


Figure 4. Recommended classes during the pandemic



a) framework of social distance rules to protect the health of students, common areas where students can socialize and engage in group work should be designed. According to Stutsman, "We are also experiencing a mental health crisis. Symptoms of depression and anxiety are increasing. Too much stress can negatively affect a student's

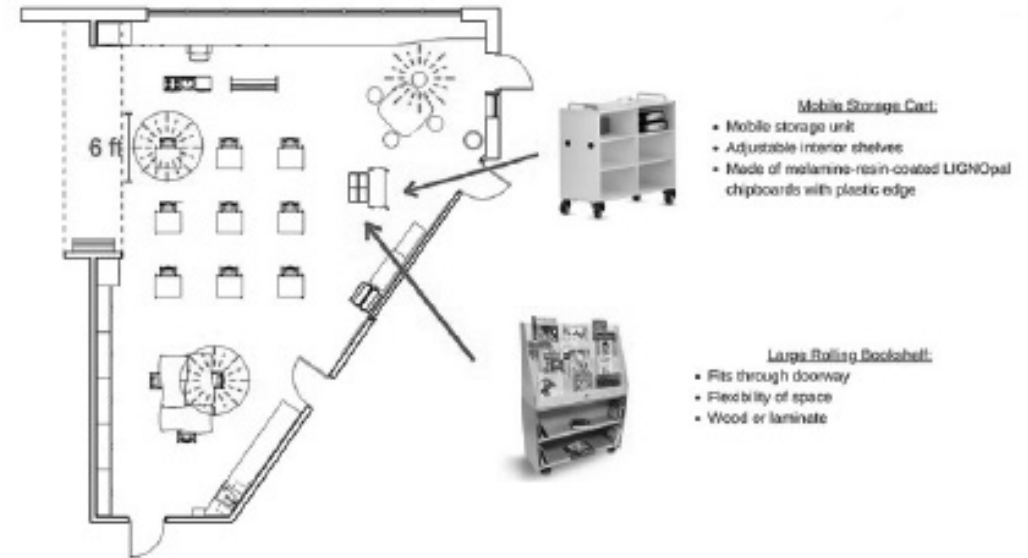
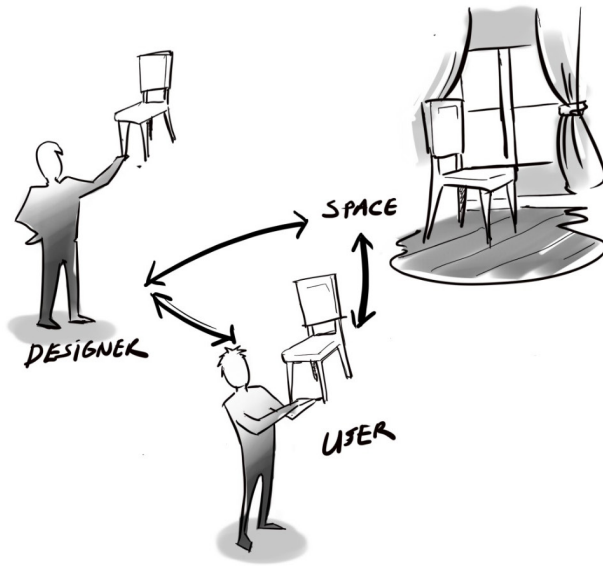


Figure 5. Remenschinder class and furniture design according to Pandemic period (Remenschneider, 2020).

ability to learn. It has never been more important to consider the emotional well-being of the student in the design of learning spaces." As Angie points out, design solutions can help improve mental health throughout the pandemic in learning spaces (URL3, 2020). Flexible models can be created where students can do both individual and group work. Transparent panels (glass) that act as a barrier between rows when coughing and sneezing or plexiglass) can be used.

Educational areas should be reorganized to meet programmed needs while promoting social distancing practices. Flexible furniture can be used as much as possible. Mobile desks, stackable chairs, cleanable individual storage boxes, and mobile training boards can quickly change to create ample space. (URL4, 2021) Interiors can also be designed



with greater flexibility in mind, using elements such as folding walls to offer multi-purpose spaces, as well as movable furniture that doubles as bookcases, for example, and portable dividers.

Flexible furniture trends have been useful to adapt to changing protocols in response to the COVID-19 pandemic. Personal marking board provides a functional divider for sharing ideas while keeping distance, and future scans for individual study or small group activities

There will be no official "front" in the new classes. Instead, floor-to-ceiling interactive whiteboards will dominate. Wireless screens placed throughout the room allow teachers to present information or highlight student projects on the fly. Students will be able to push their desks aside together or completely and work collaboratively in the same place.

On the one hand, individual activities can be carried out by maintaining a minimum safety distance of two meters between students, with a personalized study area that allows for quick and easy disinfection. Healthy Classrooms can also do collective activities with mobile devices.

While students are working on group projects during class hours, they can be encouraged to arrange tables, desks and/or chairs in a circle or semicircle. This arrangement is ideal for collaboration and physical distancing. Cleaning materials and furniture that are easy to transport and store will be an integral part of providing a healthy and hygienic learning environment (Remenschneider, 2020).

Hand washing stations or hand sanitizers can be placed at the entrances and exits so that students can disinfect their hands comfortably. Areas where hygiene is very important and hand washing is required in every classroom should be designed. It is now critical that we integrate handwashing facilities into traditional classroom environments to reduce the spread of germs.

3. Recommended Materials for Classes During Pandemic

Plastic materials, which we encounter in many areas in our daily life, are preferred for their easy cleaning. To give an antimicrobial effect to plastic materials, metal ion-added antimicrobial powder was added to the upper layer called dressing during production and it was tested to be antibacterial (Doğan & Pekşen, 2005, p. 65).

In the use of materials, hygienic surfaces made of HPL, melamine, MDF or metal materials and all furniture should be easy to clean. Some examples of porous surfaces that we commonly use today are drywalls, carpets, wallpapers, acoustic ceilings, tiles, bricks; These surfaces do not seem suitable for use due to their molecular structure that can harbor bacteria and viruses that pose a threat. Non-porous surfaces are denser and do not allow to absorb liquids or air, such as ceramic tiles, metal sinks, glass, metal cabinets, doorknobs and more. Such materials are a healthier option today, as they do not allow dirt and microbes to accumulate on them.

The choice of materials and colors in furniture also plays a role in increasing productivity. Colors with low wavelengths such as blue have a relaxing effect on human psychology above all. The positive motivation that comes with the feeling of relaxation increases the productivity of the employee. According to the studies, it has been observed that those who work with a blue background perform twice as well in terms of developing creative ideas in the professional sense. When blue and green, which represent the peace of nature, are among the colors used in work areas, it can be noticed in a short time how the feeling of peace and spaciousness that emerges turns into high concentration, creativity, and productivity in a short time.

Studies show that being close to nature enhances students' learning abilities, showing that including plants in the classroom improves middle school students' grades and makes students and staff feel more comfortable regardless of age. The integration of plants into the interior can increase the motivation of students and help them reduce anxiety such as depression and anxiety, especially during the pandemic period (Megahed & Gehoneim, 2020).

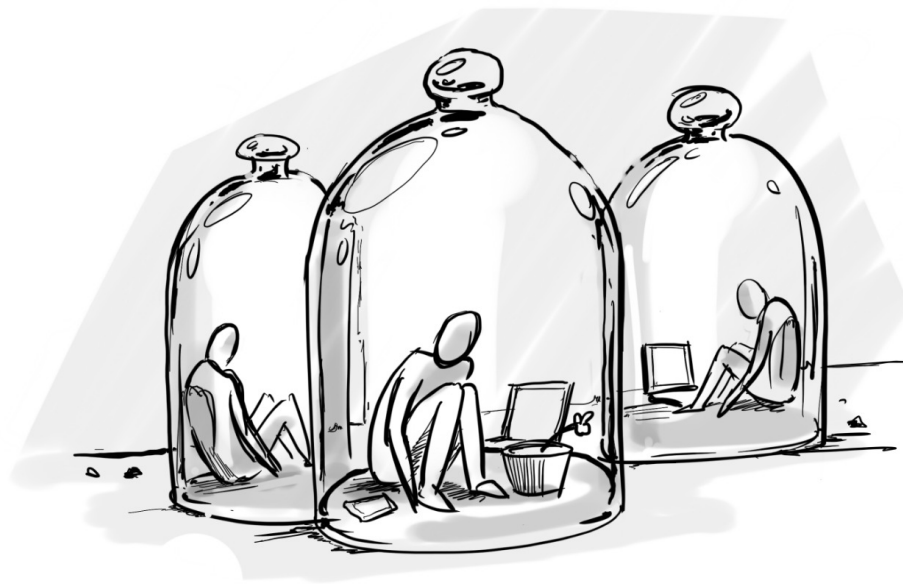
Classroom furniture the main function of a seating element within the framework of human anthropometric measurements should also be shaped to relieve the user's fatigue (Ozel & Uruk, 2021).

4. Conclusion

Classes were started to be rethought during the pandemic period, and a self-sufficient classroom model was tried to be created by creating areas where the student can socialize with his classmates. Social distancing rules of school buildings should be use in ground maps of classrooms and corridors, students should be guided, and circulation areas should be provided. For this, a technological structure that allows the hybrid system should be created by reducing the class density.

As schools, designers must be able to guarantee safety and hygiene measures by maintaining pedagogical recommendations for collaborative work and active methodologies. But most importantly, the essence of education and what the school should do is to ensure that we maintain the relationship and bond between students and educators. In addition,

children need play and physical activity areas in terms of their social and emotional development. During the pandemic period, the distance of students from their peers with distance education caused a decrease in their social ties and negatively affected them psychologically. Furniture placed within the framework of social distance rules should also be integrated in a way that allows group work. Areas for group work should be created. The distance and contact between students can be minimized with the transparent panels positioned on the tables. Individual activities can be carried out by maintaining a safe distance between students. Collective events can also be done with mobile devices. In addition, furniture that can be suitable for working places in the open area can be produced and used both indoors and outdoors.



Nanotechnology plays a vital role in the treatment of anticipated and unexpected infectious diseases caused by bacteria and viruses. Hybrid antimicrobial coatings containing copper, silver and zinc cations show great effects against viruses and microbes (Balasubramaniam, et al., 2020). Antimicrobial coatings that can be produced with nanotechnology can be used on table surfaces. Fixable tables and chairs made of easy-to-clean materials should be placed in accordance with social distance rules. Unnecessary furniture and materials should be removed from the classrooms.

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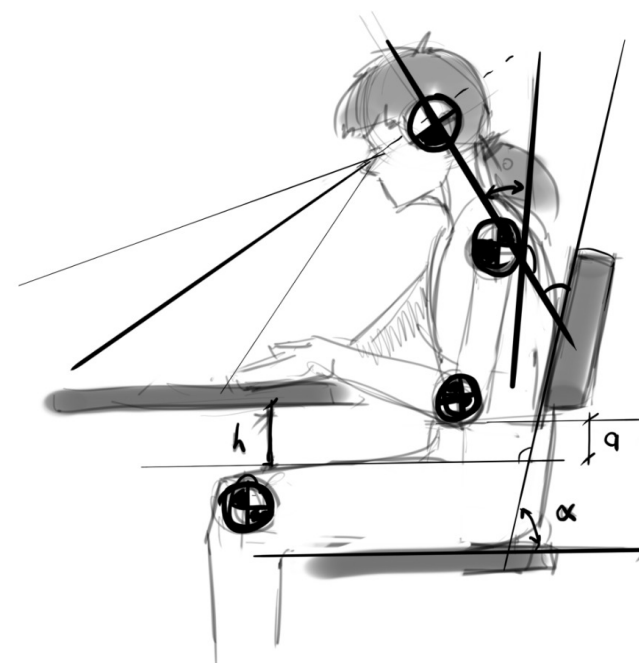
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The Relationship between Nature and Architecture in Construction and Material Selection (The Case of Mycelium)

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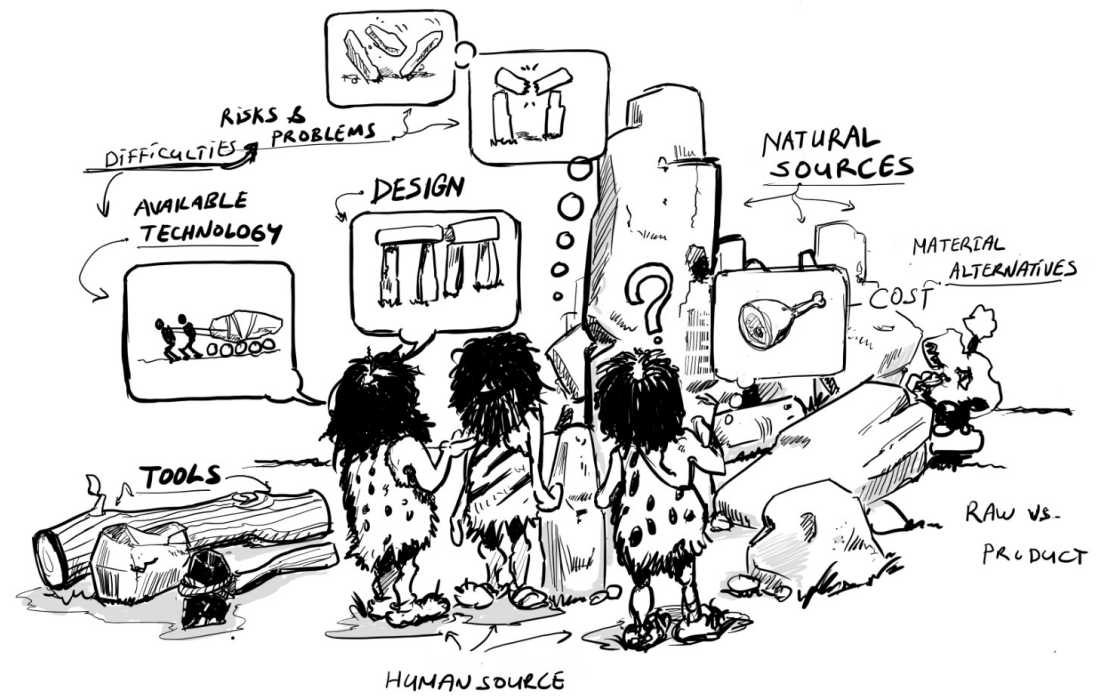
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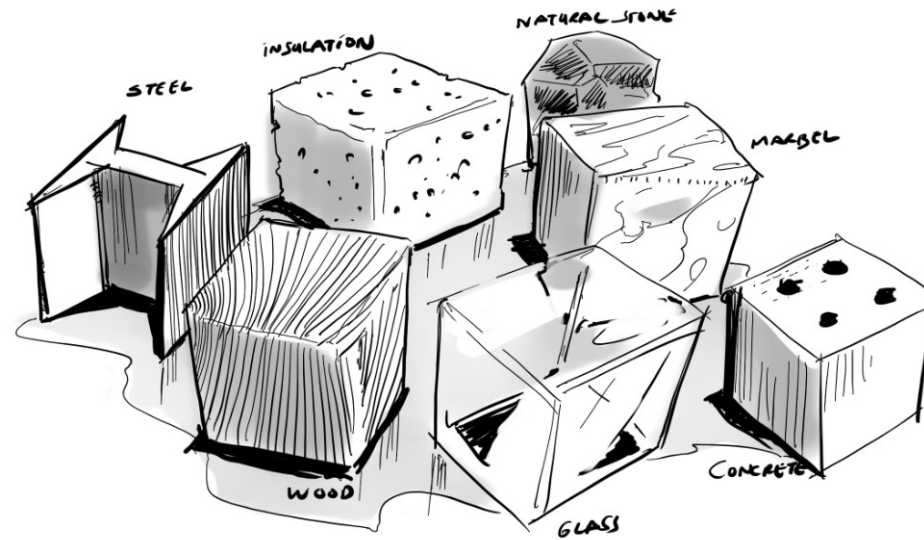
(Illustrations drawn by Levent BURGAZLI)

Keywords: Nature and Architecture, Construction, Material Selection, Mycelium

Abstract Each new structure replaced in the nature dissolved the destroyed nature. This lost space can be an opportunity to establish the relationship between architectural structures and nature. When we discuss about the architecture, one of the first words that comes to our mind is usually clay; but in fact, the nature including the entire structure of human life and architecture, which lies as part of nature in its pronoun. Using bioengineering techniques and material in today's architecture improves the relationship between buildings and nature. This research is qualitative research in terms of objective and descriptive-analytical and descriptive analysis in terms of method which tries to study the relationship between architecture and nature. The data collection method in this research is based on literature review and the study of theoretical foundations. Here, it has been tried to have a short review of relationship between natural materials and design thoughts and focus on mycelium, as natural material case-study of the research. The results show that studying and focusing on natural materials and sciences can help architecture and cities to be more sustainable and fresh.



— THE OLDEST QUESTION "WHICH ONE IS BEST?"



1. Introduction:

All human activities and measures are a manifestation of nature, and this fact has a root and foundation in nature. Accordingly, all human innovations in the field of life sciences and skills are nothing but the discovery of a corner of nature, and there is nothing as an invention. What we call it invention is in fact the same as an actualization of the existing and current macro-concepts and laws in nature, which have existed from the beginning of the universe and are repeated, and only we were unaware of them.

All this is an introduction to illustrating the relationship between components and elements of nature and how they affect the everyday human life and finally, how these factors affect human architecture. Great architectural achievements can be achieved through the precision and exploration of the natural phenomena architecture on the scale of the particle and the macro, including the intricacies, plants, animals, and human existential dimensions in the broader horizons. In fact, architecture can be defined as a new phenomenon which is the achievement of a regular and mutual relationship between human and nature. Ultimately, architecture will have hierarchical and reciprocal relationship with human as its creator and, with nature as its basis. Architectural design is impossible without communicating with humans and their surroundings. Human, nature, and architecture all three form the human life cycle and the movement of this cycle is not possible except through the continuous and regular connection between these three main loops of the human life chain (Golparvar Fard, 2009).

With more deliberation on the technology, we get the clues that lead us to nature. Today, wherever technology is discussed, the image of the same important technological achievements that meets the basic needs for today's and tomorrow's human beings comes to mind, but if we look at the technology path, we are more or less aware of the origin of some phenomena, for example, any industrial or building phenomenon is inspired by a natural pattern (Golabchi and Khorsand Nikoo, 2014).

But today, with the advent of science and technology, every day we understand more

and more, and everyday old beliefs are replaced by newer ones. In this regard, architects with a different look at the fungi have come up with a new idea about the design of their self-healing greenhouses, that, using bio-engineering methods, a special type of porous bricks with mycelium base has been built which will surely be able to transform the practices of the building industry.

The reason for the choice and the main differentiation aspect of mycelium or fungus branches, as the case of this research, is that they have the ability to recover themselves and grow again in the event of injury. Also, the mechanism of making or, more precisely, the cultivation of this material is that the mycelium grows during the vegetative period of the fungus on the agricultural byproducts and they are strapped around like cotton wool, they look like white mildew but in general, they form different structures. The plan uses living organisms that are compatible not only with the environment and nature around them, but also have recycling capabilities and also have high strength. It is from the base of nature and can be restored to nature. In this research, this way has been used to construct temporary and portable housing with different uses in hot and dry areas, using existing plants in the region. So that this method is used in line with nature-friendly architecture, and with a new approach to nature-oriented architecture, as a new human need today, to maintain its own.

2. Nature and Architecture

This research introduces the new technology for the use of natural thoughts and materials in the design and construction as well as the use of them in the creation and construction of buildings in line with nature. The combination of bamboo, straw, palm leaves and other plants in warm and dry areas with mycelium in creating temporary residences with lightweight and portable structures is a new way of using unlimited natural resource-

es, such as proteins and bamboo to maintain resources and energy from the point of view of reducing resource consumption and reducing pollutant production and thus reducing the pressure of the building industry on the environment. Also, this method, produces cheap, affordable, and environmentally compatible materials using modern construction technologies which are considered as acceptable alternatives to existing materials that are in conflict with nature.

One of the American architects David Benjamin, director of the Living Architectural Corporate in New York City, with a different look at the fungi, came up with a new idea about the design of self-healing greenhouses. This American designer developed a special type of mycelium-based porous bricks, using bio-engineering methods. Mycelium or rhizomes are branched and interconnected strands that form the fungus tissue and, the feature of these strands is that they have the ability to heal themselves and grow again in case of injury. The construction mechanism or, more precisely, the cultivation mechanism of these bricks is that the mycelium grows along the straw during the growing period of the fungi, and are strapped around the straw like cotton warps and appear to look like white mildew, but in general form a different structure. The plan uses living organisms that not only are compatible with the environment and nature around them but also have recycling feature, they also have high strength and are green in one word, it is from the base of nature and can be restored to nature (Stott, 2014).

The use of this fungal material will not end here but in another design, the material which had already been introduced to the industry has been able to useful in the architecture and it could definitely evolve the practices of the building industry and especially for places where access to materials is difficult, these bricks, which require only a small amount of early material and some sunlight, can be considered as very good materials (Safae, 2016).

To date, a few small structures have been made of fungi-based building materials, and even there are companies that produce home and industrial furniture. Many other companies also use fungi for designing tiles, boards, foam-replacement materials and bio-

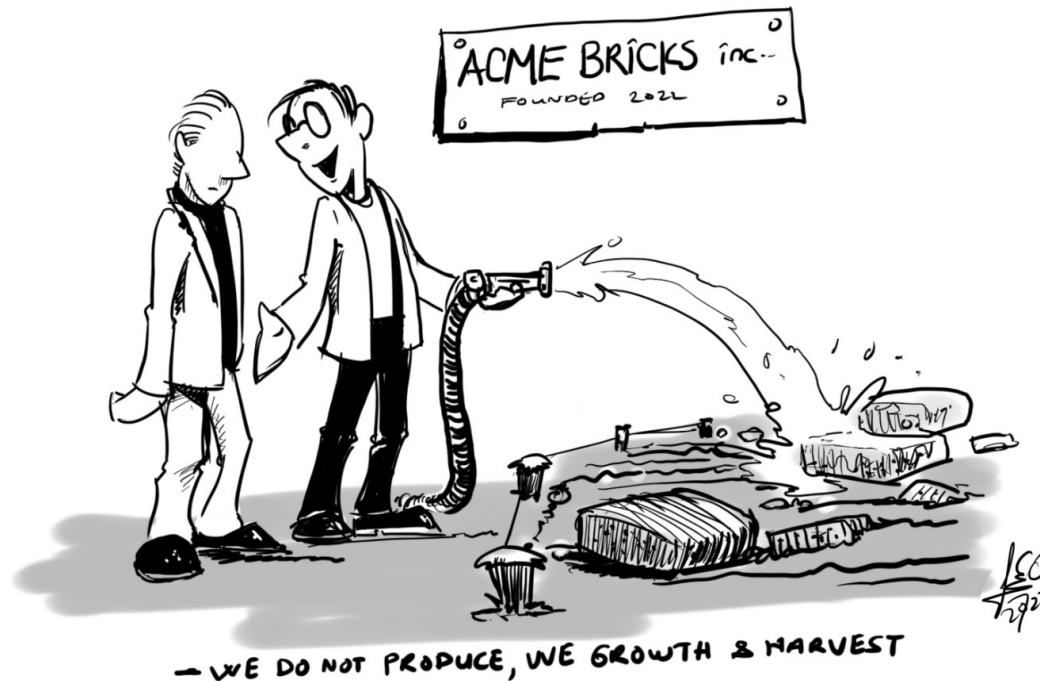
degradable packaging. On the other hand, fungi grow fast and do not produce carbon or waste (Flagel, 2020).

Philippe Ross, one of the co-founders of Myco Vertex Company, has several inventions for the "Mycelium Engineering Process" which builds cheap and lightweight brick. Blocks can then be used to create cheap but durable buildings. The mycelium yarn is a vegetative

part of the fungi, and is used in the process of engineering as a glue. Ross has discovered that due to the proper substrate and growth conditions, a fungal producing strain can be grown in any form and with any volume under sunlight. He made chairs, tables and easy baskets full of parasitic fungi and sawdust. After that, he began to nurture interconnected bricks and complete structures from fungal producing strains and found that he had accidentally faced great issues (Rezaee, 2020).

Ecoatio Company also uses fungus as a binding agent for keeping frame building wood pieces, as well as durable, non-flammable, and lightweight element for packaging. Also, civil engineers at Clemson University are examining and testing fungi-based building materials in terms of strength, fire resistance, and insulation. Eddie Paolo, a member of the Myco Vortex group, has come to the conclusion that these bricks can surprisingly resist the pressure and shear forces. Also, if you put together two bricks at the time when their fungal producing strands are still alive, they will combine together that the connector between them is as strong as the bricks. In fact, it's a fairly soft piece that your finger can press it and so light that floats on the water and is tight

enough to absorb a bullet. It also has a strong thermal and acoustic insulation and can withstand heavy hammering. The fungal tower, Hi-Fi is the first tower made with agricultural products and fungal mycelium. This group has been focusing its experiments on building design with agricultural products for many years and aims to design buildings which is the combination of natural ecosystems, materials, environment, technology and culture. This group has used biological systems, bio-based computers and bio factories to achieve its goal. In this structure, mycelium is used to provide building materials which



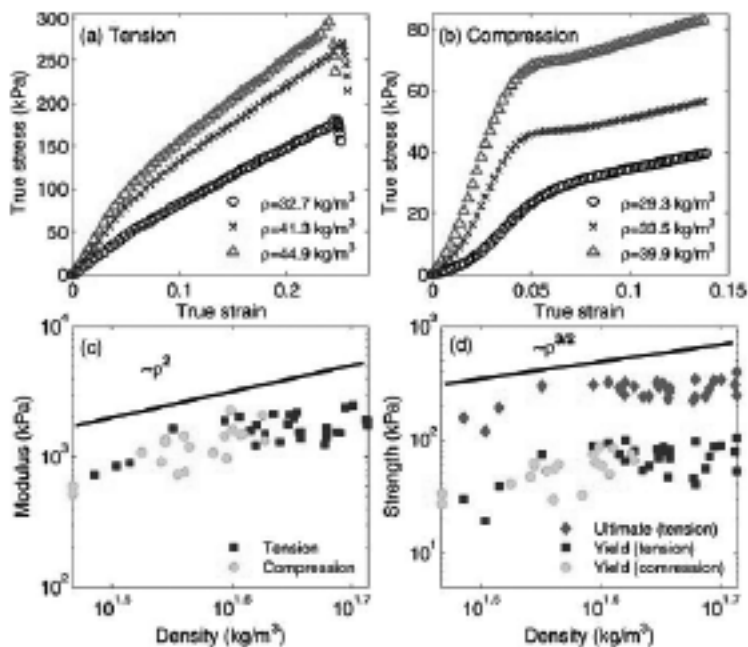


Figure 2 Effect of sample density on the stress-strain response in tension (a) and compression (b); Variation of the elastic modulus (c) and of the yield and ultimate tensile strength (d) with material density. Solid lines in (c,d) indicate the expected scaling for open cell foams. (Source: MacLaren, 2015)

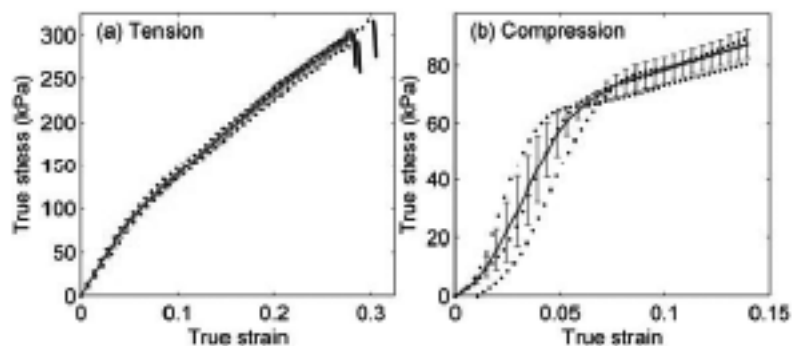
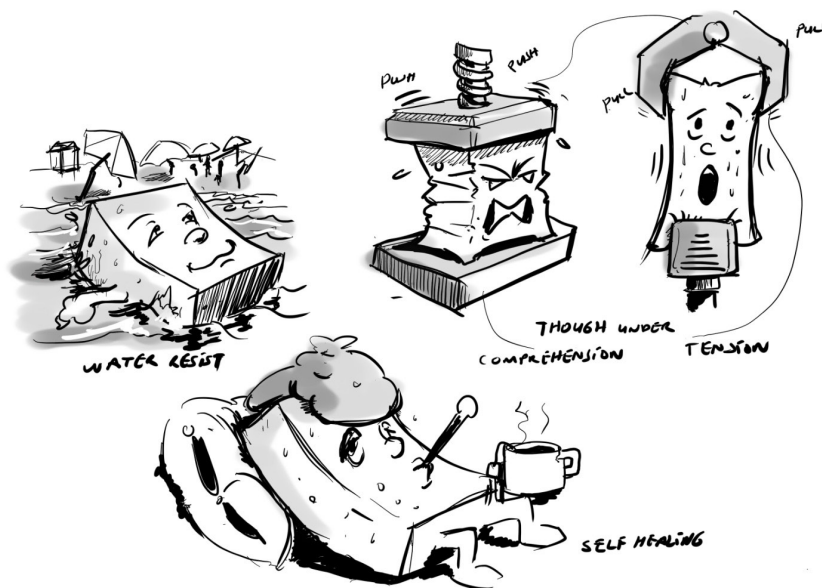


Figure 1 Generic stress-strain behavior of mycelium in (a) uniaxial tension and (b) compression (compressive stresses are shown as positive). The dotted lines (black) represent the range of tests performed on three specimens of comparable densities and the solid lines (blue) represent the corresponding mean responses (Source: MacLaren, 2015).

are involved in the carbon cycle of the earth (McLaren, 2015).

This structure is the first building made from fungi. In fact, we will be able to use natural materials in building construction with a slight change in building materials and considering the structural sustainability. Biological systems have amazing and adaptive features such as self-regulation, self-healing, and correction. These features have made fundamental changes to human life.

As it mentioned, David Benjamin has worked on the subject of biology, design, and computing for several years; he has tested various ways in which living biological systems can be used as bio-based computers or bio-plants. Finally, he found that the materials made from mycelium are the best option. These building materials have a high capacity for healthy interaction with the Earth's carbon cycle. David Benjamin and the Ecoatio company have made bricks with mycelium, which are very sturdy and resistant to water. The compounds of these bricks are stems of cereals, bushes and mycelium. Bricks made will be rigid five days after the installation. This structure is the first building made from



fungi. In fact, we will be able to use natural materials in building with a slight change in building materials and considering the structural sustainability. Biological systems have amazing and adaptive features such as self-regulation, self-healing, and correction. Now imagine the changes created by these properties in the human life. The construction industry is ready to accept these new ideas. Biological systems have significant characteristics, including adaptation, self-organization, rehabilitation and regeneration. Imagine if future buildings have these features, our way of life generally changes (Stott, 2014).

The mechanism of the construction or, more precisely, the cultivation of these bricks is that mycelium grows along the straw during the growing period of the fungi, and are strapped like cotton warps around the straw and appear to look like white mildew. But in general, they form different structures. (Hugo, 2016).

3. Use of Natural Materials in Buildings:

Considering the sustainability theme in recent decades to protect the environment, applied sciences and architecture science to meet the needs of future generations, and consequently, building that can also be risky for the environment and nature and, it also has the ability to be designed and estimated, and be used on the basis of identifying useful climate factors in each region. Sustainability thinking and design attitude are especially important to adapt environmental design to architecture. In other words, sustainable architecture uses design tools and construction methods and creates appropriate relationships between the environment and the building to minimize the negative effects of construction in the environment and causes achieving the goals of sustainable development by meeting the social and psychological needs of individuals.

Nature as a pattern; affects many of the strategies leading to architectural creativity. Nature is always present and indivisible, and is very powerful as a tool for inspiration. Its presence is observed in metaphor, imitation, variability of form, and also in obvious materials and, architects have respected and examined it from time to time, with proper approaches and have considered it as an inspirational tool (Antonius, 2003).

Nature and architecture in conscious co-existence naturally affect the process of each other and they are connected as they keep their unique features protected, and

they are experimenting with interesting and vibrant structures, boundaries and common ground. Hence, the architect sees his structures not in opposition to the forces of nature, not in unconsciously giving to it, but in coordination with the forces, so that the human and nature in his structure appear to be united (Haj Hassan and Ghorbaninia, 2016).

Each new structure replaced in nature dissolves the destroyed nature. This lost space can achieve an opportunity to communicate with nature again. In fact, nature involves the entire structure of human life and architecture, which lies as part of nature in its pronoun, begins to connect closely so that the architecture live and breathes in harmony with the beat of the nature of the surrounding texture.

Considering the belief that there are systems in the nature of both visible and invisible, and their discovery is performed as soon as they begin to be understood, gives meaning to the understanding and accepting the natural guidelines in the structure of architecture. Thus, in this system, there is a thinking that not only does not ignore the geometry of natural structures, but it take advantage of it in time and if does not found it appropriate, with gradual awareness of nature system goes beyond it, look somewhere beyond the horizon of nature (Zamani, 2006).

With a slight change in building materials and considering the structural stability, we will be able to use natural materials in building. Biological systems have amazing and adaptive features such as self-regulation, self-healing, and correction (Ghavampour, 2013).

3.1. Morphological and Mechanical Properties of Mycelium

The morphological and mechanical properties of mycelium have been examined through a combination of microscopic imaging, mechanical testing, and computational modeling. The results show that mycelium compress the non-linear contractile behavior of strain and stress. The mycelium also shows the same mechanical behavior subjected to stress and uniform compression. In Fig. 1, black and white dot lines represent a range of stress responses of three samples of densities comparable to frequent experiments, while the blue lines indicates the corresponding responses. The tensile curve also shows that strain pressure and almost linear hardening to failure occur at low pressure (Abramoff and Magalhães, 2004).



The diagram of strain and bi-directional strain of mycelium depend heavily on the density. Figure 2 shows the stress response of grown mycelium sample strain in slightly different conditions with different densities. For cell solids, and ultimate tensile strength with material density, the expected values for open cellular foams are shown.

Interestingly, the variation of all these quantities with the density is similar to that expected for open cell structures, despite clear differences between the network architecture and that of cellular materials precisely, we observe that the modulus varies with the square of mycelium density and strength varies. Several researchers have reported similar scaling with density for other low density materials such as polymeric foams, cancellous bone and collagen gels. In stress, the linear elastic material reaction is at low pressure, and then the material is produced and falls before the rupture. On the other hand, biopolymer has the same behavior as with cellular open foam, under uniform compression, until the pressure stress curve shows. In addition, when it is subjected to continuous loading and unloading cycles, mycelium can exhibit a foamy behavior as a biologically active material that has a high resistance and strength. Mycelium is composed of thin filaments called hyphae. In fact, a set of masses of the hyphae is called mycelium. The mycelium is a vegetative part of a fungi or colony of fungus-like bacterium, which is made up of a group of branches, called hyphae. Hyphae is sometimes known as syphilis. The fungus is not propagated by seed or energy absorption through photosynthesis. The fungus is also replicated through spores. Mycelium actually begins to grow like the roots of the plant, and it can also move around. The fungi receive nutrients from the environment through the mycelium. In a way that the hyphae will break down the biopolymers into small units such as monomers by enzyme secretion on the wood of rotten trees or other layers. Then, the fungus acquires the ingredients by absorbing monomers. These mycelia are a wide range of species that can grow up to hectares and merge with other mycelium. Also, mycelium is an important source of nutrition for many invertebrates which is very beneficial for the organic part of the soil, which can decompose decaying plant matter (Asefi and Imani, 2012).

4. Conclusion:

Based on mentioned studies of this research, it has been concluded that according to structures and bionic aspects of natural materials, they can be used as the main factors of the buildings to increase the friendly relationship of architecture and nature and can have many other positive effects in eliminating or reducing the use of toxic and nature damaging substances, in the construction industry, reducing the consumption of non-renewable resources and using plants and native tree wastes and availability, energy consumption and less pollution production and when applied has adaptation with the climate and ultimately, trying to maintain the identity of native architecture and adaptation to nature. We presented morphological and mechanical characterization of a novel biomaterial derived from fungal mycelium. Mycelium, as a project case, can be used at the base of the building. The experimental results revealed the most significant characteristics of mycelium under tension and compression. In tension, the material response is linear elastic at low strain, and then the material yields and undergoes strain hardening before rupture. On the other hand, the bio polymer behaves similar to open cell foam under uniaxial compression, where the stress-strain curve shows an initial linear-elastic regime followed by a plateau regime with softened response. Furthermore, when subjected to successive loading and unloading cycles, mycelium exhibits strain dependent hysteresis and stress softening effect from cycle to cycle that by using such kind of natural materials, the relationship between architecture and nature can be improved more and the cities and lives can be more sustainable and fresher.

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