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Original Research Article

Co-designers' Interaction: A Network Based Approach*

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Abstract

Problem statement: Architectural co-design has been facilitated through the development of digitalism. This has shifted to a new paradigm which has evolved the understanding of design process. As a result, design process has been changed in both technical and philosophical aspects and co-design, consequently, has acknowledged The Other in the design process. Accordingly, design is formed by interaction of at least two simultaneous networks.

Research objectives: This paper aims to focus on design as a socio-technical process by analyzing dimensions of actors, quality of network dialogue and the process of network in co-design.

Research methods: The Actor-Network Theory is applied to study the actors of co-design process. The quality of network dialogues is examined by analyzing texts and different types of networks and their impact on design process are determined by comparing two co-design cases. Thus, the paper is using a qualitative approach to redefine each node in the design process.

Conclusion: Different actors, human and non-human ones, shape the overall interactions of co-designers. Using network approach as a theoretical base for this interaction, revealed four main elements in the design process: acceptability of The Other, criticism-tolerance, sharing personality, and collective intentionality. On the other hand, results from the two co-design case studies demonstrated insights on socio-technical approach of design and its impacts on other co-designer's network relationship.

Keywords: *Architecture, Design Process, Actor-Network Theory, The Other, Dialogism, Co-designers' Network.*

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Introduction

In a general view, design is a technological process to find and solve problems and a critical thinking way that seeks to redefine the design problems and to progress the lacks and needs of human; hence, it rarely has a linear trend (Bazrafkan, 2007, 12). This technology encompasses a concept that provides a technique for Becoming and the experience of Living in the human life. On one hand, by changing the social approaches of the late twentieth century, design methods have been transformed as a function of these social transformations through the use of technology and computational approaches. These changes have provided the simultaneous conditions for collaboration and participation of designers in the project and the design process has changed from an individual act to a collective act. This co-design¹ approach accepts an unlimited number of designers which could be design teams, technology or users. So, it would construct a network of human and machine actors (non-human) in the design process.

Meanwhile, the concept of network could develop various social transformations and at the same time, it transformed the dimensions of place and time in order to fulfil the information society and computational intelligence along with increasing rate of transformations (Tabei, 2014, 191). Therefore, the world has become an integrated network based on data sharing, intelligent technology, freedom of thought and action; a world in which the definition of designer and his/her role has changed and they may have different roles in design process. Therefore, an important issue in design studies is the recognition of the designer's role in encountering the design problems; the relationship of which is not only in the objective-subjective or idea and form duality, but the designer's role in the design problem. The individual-oriented approach to design is often subconscious and internal while in co-design approach, designers face the architectural problems with collective perception and in a different process. This approach, by criticizing the distinguished position of a creative individual, points out to the group activity in design

with a range of different people and arrangements (Erlhoff & Marshall, 2008, 64). In this approach, the design is based on the interaction with The Other to progress design as co-design¹ networks. Encountering co-designers with design problems can develop two networks: one, a network of design actors, and the second one, a complex network of data. The design process in this state can be considered as an interaction between these two networks. In this condition, explaining the role of collaboration, the effects of assemblage, inter-network communication and reaction of designers are important. Therefore, the objective of this research is to find an answer to the following question: in which way a network approach could affect the designer's interaction in the architectural design process?

Due to the expansion of the information technology and its effects on changing design models, an increasing complexity has occurred in the design process. Understanding the role of the designer in such a system needs more research (Buchanan, 2019, 86). In science and technology studies, co-design is a social and political activity that plays a vital role in the formation of beneficiaries' communities. Understanding the range and restrictions of the effective factors in the design process is difficult and as a result, the studies about design need novel tools in order to reflect their changes. Actor-Network Theory (ANT), by criticizing the modern duality and isolation, seeks to build a common world that design and technology are its integral parts (Storni, Binder, Linde & Stuedahl, 2015, 149). Dincer (2020) believes that architecture studies need more research to understand the role of non-human factors in the design process such that to analyze these factors as the active elements of the process, not passive ones.

Research background

The design knowledge consists of three components: design education, design profession and design research (Bazrafkan, 2007, 14). By introducing computer science into the design process, design research studies have expanded and created new

imaginations about how to produce design materials (Jormakka, Schürer & Kuhlmann, 2015, 82). Until recently, design was generally an individual activity, but fundamental changes have occurred by the beginning of 21st century. During this time, many emerging theories have transformed the concepts of collective communication, data sharing and design methods as well as how to encounter with design problems. Since 1920s, designers were more concerned about problems in the design process (Jahnke, 2012, 32). In this decade, the concept of design process was altered to problem-solving. After that, Donald Schon (1992) used the concept of design as a reflective conversation with situation and raised the effect of reflection in action in which the design is an alternative process between designer and the design, itself. By forming the research about design thinking, the concept of design was interpreted via the relationship between the designer and the design position. Based on this, the designer is in the middle of the design problems (Dorst, 2004). In 1960s, researchers have paid special attention to the expertism of the designers and the design methods in order to achieve a good design. Nigel Cross, by raising creativity against rationality in the design process, considered design thinking as a kind of [cognitive] intelligence (Cross, 2018). Emphasizing on the design argument, Dorst (2011) seeks to find a way to have solution for complex problems. Regarding the background of the literature, most design researchers have focused on individual-oriented studies (Reiter-Palmon & Leone, 2018). However, the studies by Lerdahl (2001) and Hatcher et al. (2018) focused on the role of group collaboration, and creative imagination methods and group ideation, respectively. Likewise, Andreasen, Hansen and Cash (2015) studied the role of individual designers in the design teams. They believe design has an interactive nature in which users have participated in teams to form the design space. Boychenko (2019) argues the interactive learning mechanisms and implementation of data to define behavior and analyze design process. Generally, economy and

business schools suggest a managerial attitude toward design processes, which focuses on the individuality of the designers. An important point in this shift is developing some methods to be used by users in the design process (Sanders & Strappers, 2008). The presence of the user in these studies has directed the design process toward the group-oriented approach which is historically originated from participatory design. The main attitude in co-design approach is based on the democracy and admission of that all people have the capability of creative and imaginative experience. Encountering with The Others in design process is the strength point for progressing the discussions and negotiations. The function, number of people and quality of the process in co-design, are of the most concerns of researchers in the design process. Islami and Kamelnia (2014) addressed the relationship between sense of community indicators and users' participation in design process in the city of Bam projects. Mitchell, Ross, May, Sims and Parker (2015) introduced an approach to present new ideas in sustainable development as a machine for idea generation. Britton (2017), in his book titled "co-design and social innovation", discussed the relationship between design and the social context and counted participation rate of people as a vital factor. Pedersen (2020) has used co-design literature in her research to study design as a set of designers and other actors' functions by expanding the understanding of the role of designer in design projects. He emphasized on changing the traditional and linear thinking of design-based on certain structures and argues that the main task of a designer is managing negotiations with other actants.

Various actors play different roles in all co-design approaches. The network approach has created an analytical context to track these actors by focusing on the role of networks. ANT approach, by identifying the actants, has presented interesting concepts to discover the hybrid nature of events in co-design; it also provides an analytical framework for describing and understanding socio-technical aspects of design. Ekomadyo and Riyadi (2020) have used ANT in

reviewing the socio-technical behavior of design and believe that design process is a collaborative action, based on the codified behavior of the actants. Dincer (2020) evaluated the role of human and non-human factors by studying the application of ANT in the construction process and pointed out that not only it can be used as a research method, but also it is a proper tool to understand the role of human and non-human actors in design process. Regarding what mentioned earlier, the main contribution of this research is to study design process as an active network. In this regard, endeavours were put to apply ANT approach in co-design which is not merely prevalent in the research studies in this field. Actor network theory expands the network understanding of actors' interaction in design. It also tries to provide a model for relationships among other actors and the quality of negotiations to indicate the dialogue of design and display the details of co-design approach in network relationships.

Theoretical framework

Design is a technological act and a socio-technical process. The term socio-technical deals with the interaction of humans and non-humans based on actor-network theory. ANT research focuses on the relations of actors and in design studies, by developing the relationships between designers, users, products and other actors like machines, devices and technology, design happens simultaneously with production. The design process is explained by studying the performance and relations of actors in each design step. These relations are displayed one by one and by determining the role of each node (human and non-human). As a result, an integrated image of design is presented that is simultaneous and integrated (Ekomadyo & Riyadi, 2020, 20).

For most architects, achieving the alternative problem-solving methods for providing innovative solutions is very important. The transformation in computational field and the emergence of the new online platforms has changed the role of designers from architectural design to designing a design method. New methods have developed that act like a medium and can be

analyzed (Bazrafkan, 2012, 29). Although most approaches of designers to design are unconscious, but it seems that with network approach, the design method could be determined from inside to outside. By transforming the individuals' understanding of design, designers seek to find a common answer to design problems by interacting in design process. The collaborative approach criticizes the individual role of the designers and refers to the positioning, synergizing and co-designing with different attitudes and seeks to equate people in achieving the common goal. Bradwell and Marr (2008, 17) consider co-design as an umbrella term in which different views integrate to achieve a solution for a problem. The range of people's participation in co-design is very wide. In this study, the term co-design means designing based on collective synergy and is based on accepting the presence of The Other in the design process such that, The Other could occur in three following states:

- A- Simultaneous interaction of designer and design group;
- B- Participation of users as design actants;
- C- Computational technology as design actants.

Therefore, the collective approach to design begins by accepting the presence of The Other in the design process. The Other is the concept that its meaning is determined based on the design school. In post-structuralism school, the identity of each individual is formed by encountering with similarities and differences of The Other one (Fakouhi, 2002, 22). Bakhtin believes that the beginning of community is by presence of The Other and the interaction among them. But, according to Latour, The Other's nature is different because it does not reduce the non-human role to human. In this regard, negotiation occurs by accepting The Other one and the design process is based on the dialogue (Manzini, 2016, 58). Interaction networks form the relationship among others and the role of The Other that is called a node or actor, is defined based on its dependent network. Each network can have different capabilities based on its internal features. The strength of networks in empowering actors indicates a fundamental change

from centralized production, linear production and series production to network and innovative production (Erlhoff & Marshall, 2008, 63-65). In other words, network approach can influence the design process in two levels: 1) the structural model that is used to analyze data; 2) an intellectual-philosophical paradigm that leads studies.

1. The structural model: what is important in the network structure is the value of each node and how it communicates with other nodes (Kozikglu & Dursun, 2015, 71-78). Network-based structure is a very dynamic, complex and expandable system that can integrate the new nodes. Slight changes in a node lead to various changes in the network and each network, based on the number of nodes and their relations, remains strong or destroys. The network can also have a very complex structure as in number of nodes and links (Hu & Liu, 2013). Castells (2010, 500-509) used the concept of network in a society and defined the nature of each node based on the network topology. He writes: In the information age, the dominant functions and processes organize the networks. Networks form new morphology and social formation of communities and the dissemination of network logic essentially changes the function and the results. In the network society, the network gives meaning to human by defining the goals, points of view, structure and plans. Social transformations that are defined in network society can have a profound effect on the culture and power and somehow indicate the qualitative change in human experience. He also provides a new reading of social revolution under network approach in which the technology network is an important node (Castells, 2012, 174).

2. Intellectual-philosophical paradigm: this paradigm encompasses the network-actor theory. In this theory, the network is a homogenous set of equivalent human and non-human actors that prefers the word collective and association to society to show the non-human dimension (Latour, 2005, 14). Based on this theory, each event begins by actors and their connection and continues with change and transformation and then, precedes the conventional

structures and frameworks. In this view, the border between community, environment and technology fades and the relationship between human and non-human action is not a unidirectional relationship, but is a negotiation (Sharifzadeh, 2018, 21-25). This negotiation in co-design approach determines the design process among the actors in the networks. The interaction of nodes is interpreted based on the quality of negotiations and the developed relationship and in each design step a new node can enlarge the whole network. ANT uses new terminologies to study the actors and provides a different language from the previous terminology. For example, actor is a human or non-human who has a work or action (Latour, 2013, 247). Actant develops by the relationship among actors (Sharifzadeh, 2018, 81). Network is a group of unknown relations among actors that does not exist naturally (Erlhoff & Marshall, 2008, 63-65). Negotiation flows in each action and its quality leads to the strength or weakness of the network actors (Sharifzadeh, 2018, 56). Here, translation is an important concept that connects actors (Latour, 1987, 117) and finally, black box is created by previous successful links (Sharifzadeh, 2018, 123).

Therefore, by accepting The Other in the design process, the role of designer changes from the main agent to the actors of co-designer's network. As a result, the design process progresses by interaction of the developed networks based on the quality of actors' negotiation, power relation in the network society and encountering the problems in the complex network (Fig. 1).

Research methods

This research is categorized in design research studies and utilizes the socio-technical point of view and the actor-network theory as its basis. ANT provides analytical methods to observe and deconstruct the function of the actors in the community and can track architects and designers (Stephan, 2015). Network-based research structures are bottom-up such that the research begins from actors and the prefabricated structures are not previously defined. In this research,

the researcher seeks to find the effect of actor’s assemblage on construction or deconstruction of the different structures. The researcher, by emphasizing the entanglement of human, space and any other creature, redefines their relationship and studies the interaction of actors and assemblages in the network (Latour, 2013, 247).

In reviewing the networks formed in the co-design process, each event can be an effective actor in the design process. Therefore, explaining the types of actors, negotiations and the power of assemblage are essential. In this study, texts are equivalent to an action environment in the context of ANT (Sharifzadeh, 2018, 134-140). Therefore, to analyze actors in the design network, first, the qualitative components of dialogism were extracted from literature and data were coded as primary categories. Then the categories were analyzed to form dialogism in co-designers’ network structure. In the second step, two practical scenarios were implemented to analyze networks, co-designers, and different types of assemblage and identification of actants. By mapping networks and comparison of the

list of actions of both scenarios, the position of actors and the role of actants were determined. So, in this research, the data gathering methods are reviewing texts, observation of actants and deconstruction of assemblage in the actor-network of designers.

Findings and discussions

The findings of the research are categorized in theoretical and practical sections. In the theoretical section, the quality of dialogue in co-designer’s network was discussed based on the opinions of Network Society of Castells, Dialogism of Bakhtin and Actor-Network Theory of Latour. In the practical section, the narration of idealization path is presented by tracking actors.

Architecture design has very complex and mixed components. In co-design, the network approach can provide a suitable framework for analyzing the networks with different dimensions. In each design process, various networks play different roles. The life of each network continues until the nodes are assembled and inter-network learning leads to the

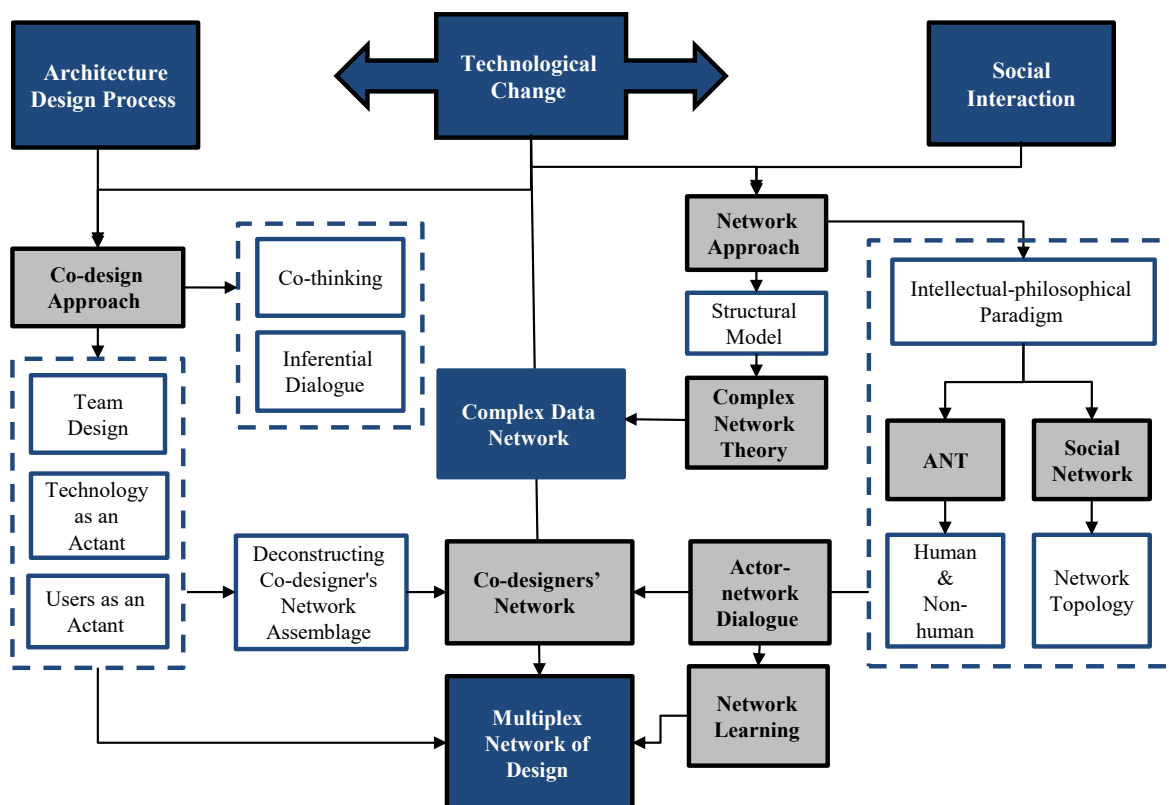


Fig. 1. Theoretical Framework. Source: Authors.

dynamicity of the nodes (Akerkar, 2019, 38). Every connection has a hidden value in the network because each new action with the problem leads to the creation of diverse networks and transforms the design process. In encountering the co-designers' network with the architecture problems, the relation of the problem with the solution (Bazrafkan, 2007, 14) is so mixed that it develops from the unity of different factors. This unity needs to discover the diverse layers, deconstruction of assemblages and accepting the position of all actors (human and non-human). In analyzing the network, there are always questions such as how powerful are the assemblages or which new events may be added to a new process. Therefore, the network approach, by analyzing the design network assemblage, forms the new design model such that the activism narration is unique in each process.

• Activism negotiations in co-designers' network

When forming a design network, negotiation is the first and foremost event. When forming a design

network, dialogue is the first and foremost event. Bakhtin has defined understanding and creation of meaning based on the relationship with The Other; which is formed by inviting other people and forming a different reading matter (Nojoumian, 2006, 218). Negotiation that is formed by the presence of The Others in the design network can visualize a monophony to polyphony and to chorus (i.e a unified group) such that the realization of the network occurs in chorus. Bakhtin (1981, 294) has used the word sound to indicate a network of different beliefs and as a language to present a specific purpose. Dialogue in a design process changes the form and meaning, so that results of the design are transcendental. Dialogue in the co-designers' network develops due to role-taking of The Other in the design process and its quality has direct effect on the design thinking, quality of ideas and organization of data (Horelli, 2002, 633). Figure 2 displays a qualitative dialogism in co-designers' network at four levels:

A. Character: monophony is a dominant ideology

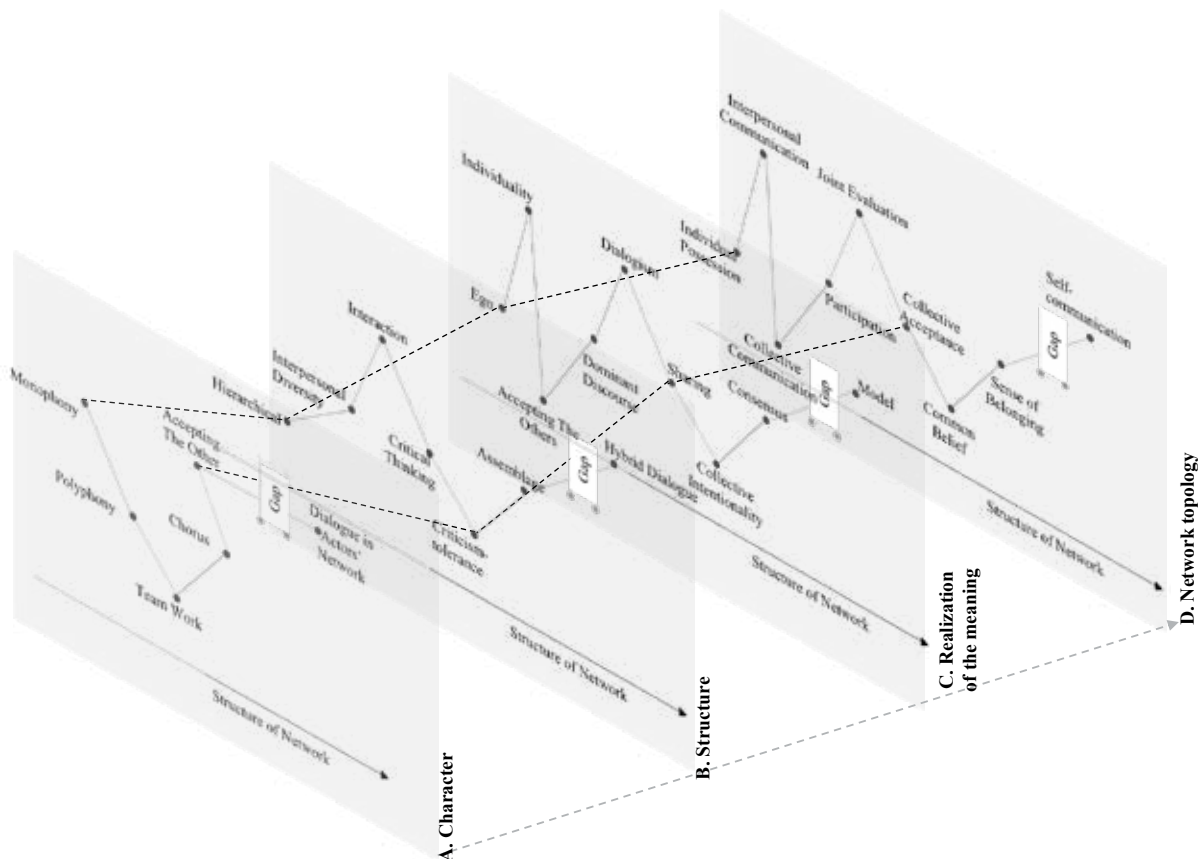


Fig. 2. Dialogism in Co-designers' Network. Source: Authors.

and dialogue often formed by putting homophones to each other and creating polyphony. In analyzing Bakhtin’s dialogism, Todorov (2019, 8) writes: each single voice can only be heard via mixing with a set of choruses. So, the process of discourse starts from monophony and an active process in the network of co-designers, it becomes polyphony and teamwork, and then with the acceptance of another position, the matter of harmony will occur, which is the turning point of the beginning of the network’s dialogue.

B. Structure: discourse has an important role in each design method and is often imposed in hierarchal form. By developing interpersonal diversity and the interaction in the design process, no idea is imposed from up to down. If negotiability continues by assuming the non-humans (as designer), then, we achieve the negotiability in the actor-network that mostly occurs between designers and technology.

C. Realization of the meaning: at the beginning, the meaning starts with ego. With the presence

of The Other in the design process, the meaning of the problem is transformed. By passing the dominant discourse, negotiability, which is the result of polyphony and bilateral actions, develops. In this case, according to Castells (2009), by sharing the hidden meanings in the information, the communication forms and the meaning is realized by society with collective intentionality².

D. Network topology: the possession of individual intentionality belongs only to the individual; while the dialogue is the result of interpersonal relation and the actors survive only when they connect to each other. If these connections are participatory, the collective acceptance occurs. The acceptance of the community in networks is the common belief that complets the development. In self-motivated communications, the meaning is being created in communicative actions.

By analyzing the given components and reflecting the concepts of network action in the design process, four categories are distinguished in negotiability (Fig. 3).

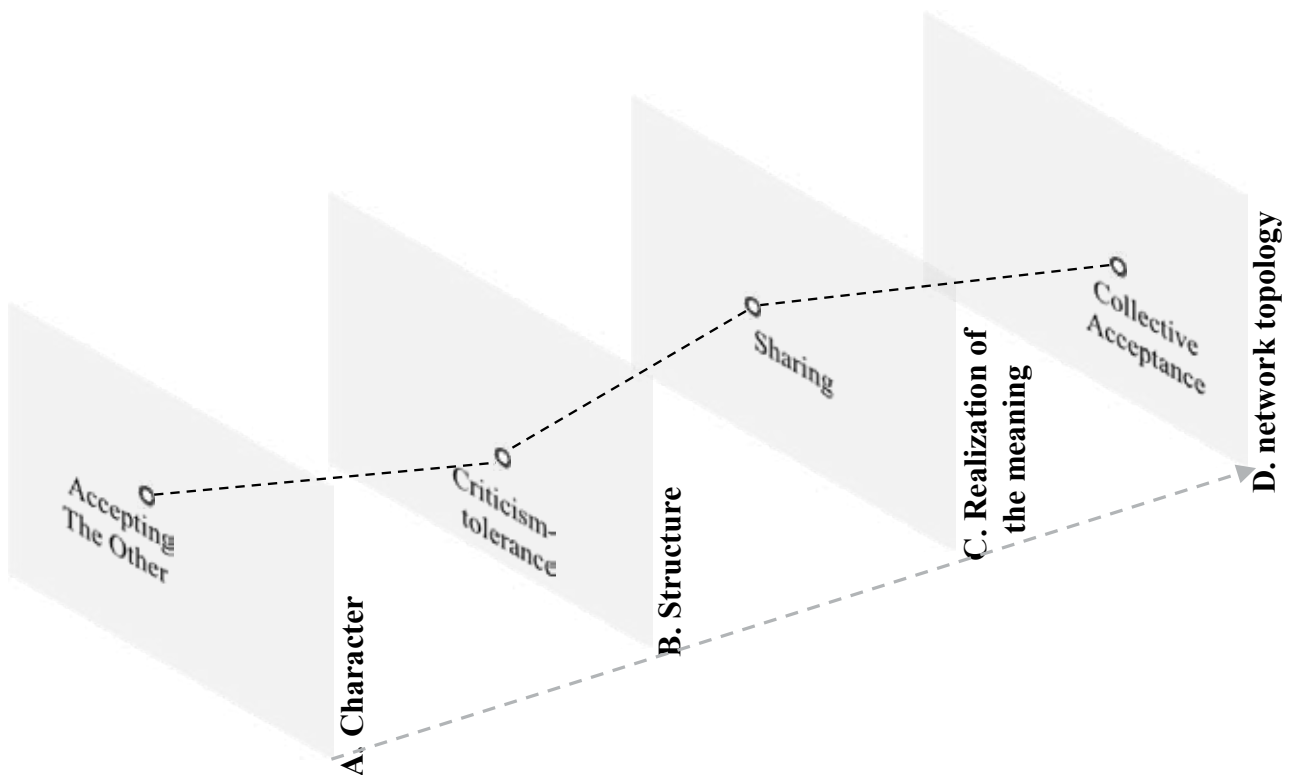


Fig. 3. The main categories of explaining dialogism in co-designers’ network. Source: Authors.

• **Tracking actors: the path of idealization**

As stated earlier, co-design approach is developed by interaction of several networks. In co-designers' network, the actor is not an entity out of the network and it is conceptualized by joining to the network. In such an attitude, the designers transform in the design process by consecutive changes, based on the network dynamics and training the nodes. In each design method, the starting point of activism begins from raising the issue. Therefore, in order to analyze the effect of actions on the design steps, two practical scenarios are implemented and the action routes were observed.

Scenario 1: the design in this scenario was undertaken by the collaboration of bachelor/master students and architects in the design competition titled "social responsibility of an architect". A total number of 164 designers (in 44 teams) selected their mentors and grouped in 6. Teams could process their concepts and designs either in an objective or subjective matter. In this scenario, the researcher (of this study) was the mentor of seven teams (among 44 teams) and is a node in the design process, herself. [Table 1](#) presents the description of design steps, narration of actors and mapping the network in scenario 1.

Scenario 2: this scenario was conducted virtually due to the coronavirus pandemic and city lockdown. Designers (bachelor students with level A) competed in a competition titled "Radical Architecture, Rethinking Future". In this experience, the researcher was out of the design network and had no control on the design process. [Table 2](#) indicates the design steps and narrates the actions of the first team.

Analyzing the data gathered from scenarios indicate that the nature of co-designers' negotiations begins from dominant discourse and reaches to polyphony and chorus (as in scenario 1). Although by using technology as a functional tool, it elevates the quality of dialogue and the interaction between designers and technology. On the other hand, the conditions were such that silent majorities (compared to loud speaking minorities) began the

negotiation and played a key role in the design process. Dincer (2020) considers ANT as a significant view for architecture and emphasises on the role of non-humans in directing the process. In either of the scenarios, technology was used as a tool that took distance from the actant's role. This could be due to the skills level of designers. In comparing the design process of scenarios 1 and 2, despite the abstract nature of both, the designers in scenario 1, selected simple topic (compared to avant-garde ideas) and could attract the attention of referees. One important point was the instant dynamics of the networks and their effect on the design process. By joining each new node, the new networks formed (for example, the action of the citizen in scenario 1) that changed the assemblage of the design process. The superiority of critical thinking was seen from the start point.

In this route, the design process evolved as an internal cycle with mixed assemblage. Based on the instant negotiations in the network, the reading to design complexities became understandable ([Fig. 4](#)). Likewise, Ekomadyo and Riyadi (2020) considered ANT as a framework to solve the complexity of the design.

Conclusion

Many design projects have collective nature and a wide range of actors are involved in. This research, using the actor-network theory as a theoretical framework, maps the co-design assemblage by criticizing the role of a single designer from a creative identity to an actor of designers' network. Considering human and non-human actants, a different reflection of design process with the role of designer as switcher is discussed. Negotiation forms the assemblage and dialogism in the co-designers' network and its quality is discussed in four levels: character, structure, the realization of the meaning, and network topology. Moreover, accepting The Other, criticism-tolerance, sharing, and collective acceptance were salient categories. In the practical scenarios, the collective action of designers in

Table 1. Network approach in design process, scenario 1. Source: Authors.

“Social Responsibility of an Architect”, February 2019	
Description of the steps	<p>a) Forming seven design teams (two to four people in each team);</p> <p>b) Searching critical idea within the subject;</p> <p>c) Rotational elimination of the ideas in each team (with the supervision of mentor);</p> <p>d) Developing plans and helping other team members to progress the other teams’ work (displacing actors among teams);</p> <p>e) Presenting the final design to referees (6 referees);</p> <p>f) Gathering the opinions of the referees and analyzing based on the actions.</p>
Sample narration of actors	<p style="text-align: center;">● Narration by Actors</p> <p style="text-align: center;">■ Idea Started by Changing Our Environment We Opened the Black Curtain of the Class’s Window! Watching The City</p> <p style="text-align: center;">■ We Began with a Word: “Let’s Change”</p> <p style="text-align: center;">■ Selecting a Reactive Element: Recycle Bin</p> <p style="text-align: center;">■ Defining the Scope & Redefining the Bin Identity by Highlighting the Zone and Paining the Bin</p>
Action network in design process	<p style="text-align: center;">Team Members: Amir Pezeshki, Danial Ghelichpour & Sina Kalhori</p>

encountering the architectural problems were first listed, then the connections were deconstructed and the design process network was mapped. Restoring the route and tracking the actors showed that accepting The Other in the design process changes

how to encounter the architecture problem and the design process matures in a rotational route (co-designers' network and complex network of network). We should admit that the given narration of network attitude toward the design process is

Table 2. Using network in design process, scenario 2. Source: Authors.

“Radical architecture: Rethinking future” competition, May 2020	
Description of the steps	<p>a) Forming one, two or three member teams by designers;</p> <p>b) Describing the competition’s regulations: one week for submitting the documents including A2 posters, design process diagrams, description of the concept (500 words);</p> <p>c) Presenting the designs online;</p> <p>d) Judging the designs online (three referees);</p> <p>e) Analyzing the design steps and outputs by experts (12) with an online analytical questionnaire.</p>
Sample narration of actors	
Action network in design process	<p>Team Members: Nazanin Pouladi, Mohammad Moin Sharifzadeh.</p>

unique for each project and in each design process, various networks can be recognized. Comparison of the two implemented scenarios in this research indicated that the negotiations of the co-designer's network in the scenarios start from the dominant discourse, reached to polyphone or even chorus. Giving the same importance level to all actors caused that the design teams enjoy more freedom to act; the negotiations went toward criticizing each other and all had equal opportunity in the design position. In both scenarios, technology was the actor at the level of a tool and couldn't be an actant. In comparison of the two scenarios, in the former, design team considered non-human actor assemblage as the leader of the design process, by using critical thinking, and selected one simple problem to reflect and attract the attention of referees. Instant dynamics were salient in the design process and new networks were formed by joining each new node. The design process in both scenarios was like an internal cycle with a mixed

connection that advanced based on inter-network negotiations and the superiority of critical thinking was observed from the start point of the design to its output.

In conclusion, this research presented a mapping of the actors in the design process by determining an equal position for all human and non-human actors in the co-design process. In this way, network approach, as a new paradigm, has changed the design model from individual action to collective one and facilitated the reading of actors' assemblage in the design process. This approach promotes ideas based on dialogism and mixes the problem and solution, such that all nodes could be studied as an actor until the team reaches the desired output.

Endnote

1. The domain of co-design in this study is based on a network of human and non-human actors.
2. Collective Intentionality means the minds' ability to achieve the values and goals, jointly.

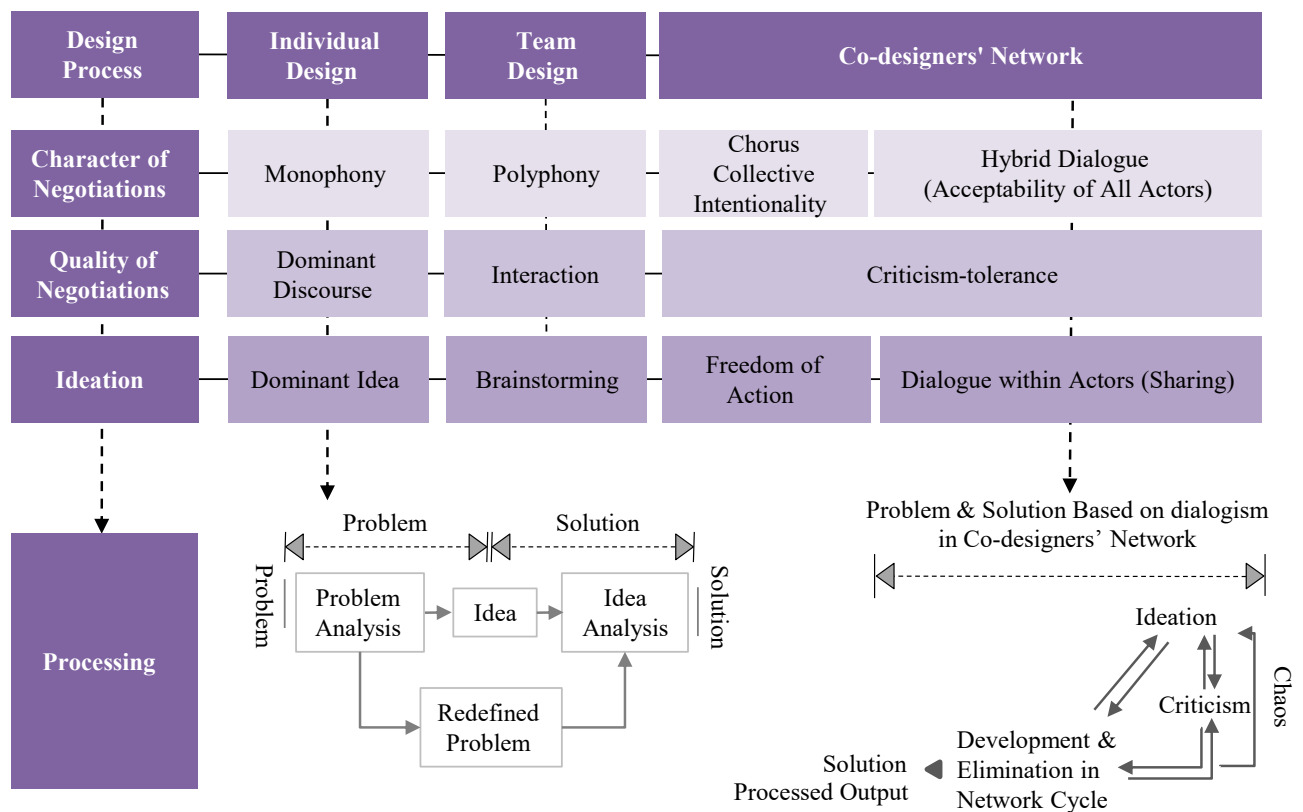


Fig. 4. comparing the design process in individual design, design team, and co-designers' network. Source: Authors.

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