

User behaviour and circulation in an Indonesian student communal housing facility: Combining space syntax and Actor Network Theory

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Abstract

This paper analyses space syntax and Actor Network Theory (ANT) as explanations of socio-spatial phenomena and presents a case study of an Indonesian *indekos*. Space syntax theory describes the impacts of spatial configurations and spatial quality on social settings. Methodologies derived from this theory utilise the integration of space for analysis. However, since space syntax fails to take into account key factors such as how objects in a given space impacts human use of space, we argue that ANT can serve as a ‘complimentary’ theory, as it takes up temporal aspects and the presence of such objects. Relying only on space syntax fails to explain socio-spatial phenomena holistically, while using ANT and space syntax together offers a more complete view by presenting space not as just a single entity but a system of user, objects, activity and time. The study will show how an architect can design a more strategic and efficient space arrangement by considering the spatial program along with the system of the objects involved in the space.

Keywords

Socio-spatial Theory, Space syntax, Actor Network Theory.

1. Introduction

The intangibility and complexity of social relations bring about a debate on the spatiality of the subject. Not only is the debate stirred by the nature of social relations, but it is further broadened due to the fact that: 1) people and goods today have high mobility, presenting the idea of de-territorialisation and 2) social relations are currently fragmented and, in a way, 'loose' (Osti, 2015). However, social relations themselves, according to some theories, can be derived to explain the mechanism process in which they occur in a more rational, logical way.

Space syntax emerged for the first time in the 1980s as an attempt to explain the socio-spatial phenomenon (Netto, 2016). It developed as a systematic explanation of the social dimension of space (Netto, 2016) and vice versa, that is, the spatial dimension of human social life (Magda, 2003). The explanations were based on the ideas of Hillier and Hanson (1984) who looked for 'the social content of spatial patterns and the spatial content of social patterns' (p.2). The theory is now widely used to analyse the social implications of spatial configuration, ranging from the scope of a built environment to a larger one as seen in urban planning. However, the theory is criticised as being too 'deterministic' (Racu, 2016: p. 1) since it tends to overlook other aspects of human social life. Space syntax theory and its analytical basis are useful ways to determine the social outcomes of design and planning. Nevertheless, the interpretation of results must be done in consideration of social processes as well as human behaviour (Nes, 2014: p. 238).

Actor Network Theory (ANT), on the other hand, revolutionises the way we look at humans' social constructions. Its insistence on seeing non-human agency in social relations pushes the traditional ideas of social composition (Matthewman, 2011). In other words, the theory challenges the traditional view of human relations. Initiated by figures such as Michel Callon, Bruno Latour and John Law. ANT considers both humans and non-humans to be the participants of interaction, and the two have equal capacities to initiate such relations.

The aim of this paper is to discuss these two theories, space syntax and ANT, focusing on the idea that using one in addition to the other helps explain social phenomena within the framework of spatial matter. Space syntax revealed that spatial configuration affects human encounter with others which then affect human interaction in that system of space. ANT on the other hand, revealed that space can also be a system of network. Combining these two raised a deeper and greater look on how space works within and with other spaces as well in initiating human interaction. The structure of the paper is as follows. First, it will explain space syntax as both theory and methodology. Second, it will point out some criticisms and limitations of space syntax. Third, it will discuss how ANT can complement space syntax.

The theoretical studies of combining the two theory is needed as Kärrholm (2010) stated, "the expansive and somewhat paradigmatically space syntax research has seldom been integrated with these theoretical discussions of what is sometimes called 'the spatial turn' of the social sciences" (p. 251). Practically, the discussion in relating space syntax with theory like ANT can make space and its materiality some sense in explaining its effects on human's social interaction. Combining space syntax and ANT can be done in the study of architecture to urban studies, even geography and social science, as these studies often consider role of space in social phenomenon. This study then can help raise the discourse among disciplines that sees material and space as the main research topics.

This paper is limited to only evaluate one case study of the use of space syntax and ANT. It will make a better study if an attempt on evaluate several cases to get a better understanding of the utilization of these two theories. That being said, this paper is not an attempt to formulate a new socio-spatial theory. Instead, we will discuss the advantages and limitations of space syntax and argue that ANT can serve as complementary theory to help fill in the gaps in explaining socio-spatial matters. The analysis of socio-spatial matter using space syntax theory will be discussed

to extract the gist of the theory and to extrapolate the disadvantages of using one theory alone. A case study of designed space will also be presented as an example of how space syntax explains one thing but fails to explain another. Incorporating ANT into the analysis will constitute a new step towards understanding socio-spatial matters that space syntax does not account for.

2. Literature study

2.1. Space syntax

Space syntax theory discusses space in terms of physical built environments and architectural and urban spaces (Magda, 2003). It uses a comprehensive approach to understanding society (and all its matters) through space. The theory begins by detecting the social logic of space and then continues on to explain the relation of society to that space. These concepts are used to develop methods for analysing a given space by applying space syntax.

Information planted in a space can further be read by analysing the configuration of that space (Magda, 2003). This information is obtained by 'reading' the plan of the architectural system that shows the relationship among spaces in the system, including both interior and exterior spaces (Thomsen, 2008). Furthermore, social information retrieved from spatial configurations can tell us the social relations of the system's user; their customs and even traditions to a certain level can be understood just by understanding the spatial organisation of a built environment.

Given space's ability to carry information—which further influences social relations—and humans' ability to use this information to draw mental connections, a series of analytical methods have been developed under space syntax theory. In short, space syntax is also 'a set of techniques for the representation, quantification and interpretation of spatial configuration in buildings and settlements' (Hillier, Hanson & Graham, 2006). Configuration seems to be the central notion in research that follows space syntax as an approach. As in social interaction theory, it is said that space configuration, on a scale of built environ-

ments to urban planning, might have an impact on social relations (Magda, 2003).

On the methodological side, space syntax has yielded techniques to represent, quantify and interpret spatial configuration. Since its development in the early 1990s, the theory has developed into an extensive research programme and has even inspired computer software combining space syntax theory-based analytic tools with graphical representations. One of the most significant software developments related to space syntax, according to the initiator of the theory, was the one from University College London. Alasdair Turner developed a software called Depthmap to model and run visibility graphs developed from the theory. The software can also perform segment-based axial analysis with angular, metric and topological weightings of the space, and it relies mainly on the spatially guided nature of human movement (Hillier, 2004).

Hillier (2004) constructed this concept by looking at space-to-space permeability and visibility, believing that the analysis of the two could form a basis for a quantitative and statistical analysis of built environments. Observing a space's permeability and visibility, in relation to its integration, can help one understand how a certain function in an environment is 'spatialised'. We should be able to tell how a given space is 'embedded' in a spatial configuration.

The representation used in Depthmap can be broken down into key points that are layered on top of each other. One key point is the use of architectural system modelling. The architectural system is drawn to show space borders and openings, simplified to clarify how one can access a point in the space. Another key point is the use of a grid of a specific size to divide the spatial system into points (Turner, 2004). The size of a square on the grid is usually the size of the individuals that move across the space. The grid is later filled with colours to show the scale of integration value across the system. The colours range from blue to red, reflecting a scale of low to high integration, respectively.

2.2. Actor Network Theory

When space syntax sees social interaction as a product of human movement in a systems of spaces or spatial configuration. A theory called ANT (Actor Network Theory) sees social interaction as a network of actors. In his criticism of experts who only see social interaction as simply interaction between humans, Cerulo (2009) saw ANT as a theory to explain the essence of a society. By looking at the network of social relations, human relationships and various information exchanges that occur in society, the originators of ANT offer a new view of social interactions and who (or what) can participate in them.

The main component that must be identified in an analysis that uses ANT is the actant. Actants are generally divided into two groups, human and non-human actors. Human actors are individuals who are connected directly when interacting or associating in the network with each other at a certain time. Non-human actors are artefacts or objects that cause or are used when interaction takes place. Artefacts that are used as examples by Latour (1991) in his case of returning hotel keys include objects such as hotel keys, cameras and doors. Kärholm (2013) in Fallan (2008) adds another

artefact that is more important and influential in the interaction. He mentioned objects such as crossing roads, markets, parking lots and hotel grounds, which he later calls spatial artefacts.

Furthermore, spatial artefacts in the form of space can act as two components, actant as well as the network itself (Fallan, 2008). Space as an actant can be observed by paying attention to what the artefacts do and their relationship with other actants. Space as a network is observed by looking at space as a result of associations, alliances or translations carried out by actants. This association, alliance and translation is what Callon (1986) called 'action'. The results of the actions that occur between several actions are what is meant by 'network'.

In practice, space syntax has not been able to fully explain social phenomena in the spatial dimension. This is due to the limitations found in the application of the theory (Racu, 2016). Racu (2016) said that there might be other aspects that determine the atmosphere of space and, hence, have impacts on human activities in a given place. Time and meaning of objects are one of the aspects of space that Space syntax seems to neglect (Netto, 2016).

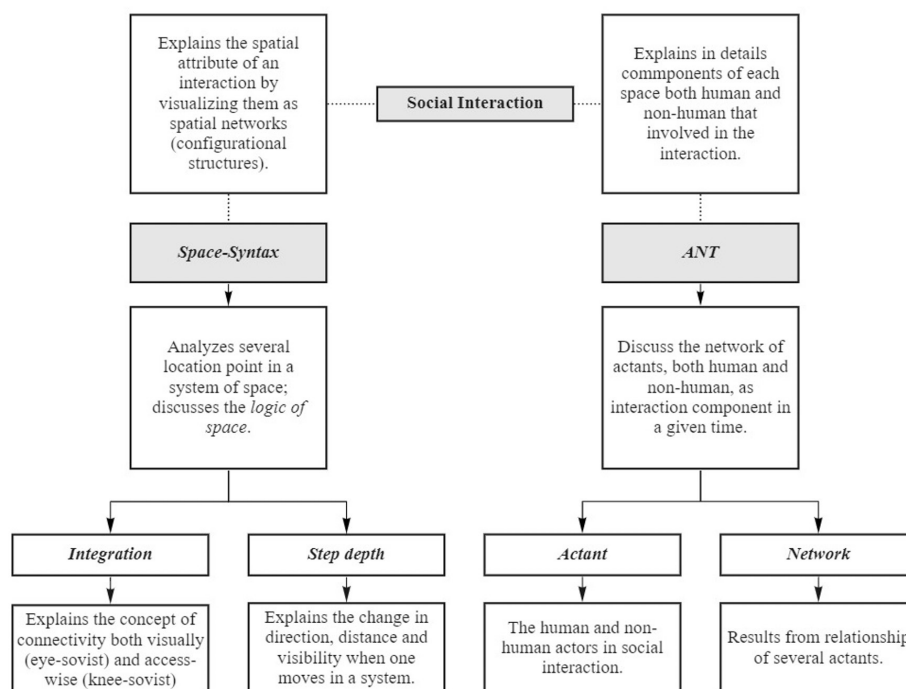


Figure 1. Relationship between space syntax and ANT.

2.3. Complementing space syntax with ANT

Therefore, although space syntax is a promising theory to explain the physical or spatial aspects of social interaction, the interpretation of the explanation must still be complemented by an understanding of a more comprehensive social processes and human behaviour (Nes, 2014). Netto (2016) questions how do we link syntactic space with the webs of presence-based interaction and the webs of interaction produced or mediated by networks of objects and tools such as long-distance communication technologies or other non-human entity that facilitates those interaction? (Netto, 2016: p. 25). ANT on the other hand emphasises the role of non-human objects and interaction between humans and objects, including space as a whole (Fallan, 2008). This helps us to understand social phenomena that space syntax has not been able to explain. In other words, ANT can fill in the gaps left by space syntax, which only pays attention to configurational spaces and their connectivity. ANT adds important insights into the process of interaction and the superficial role in space (Law 1991).

Space syntax look at space as a single entity that connects with one another to create a configuration and failed to see that space itself is a network constituted of various individuals. This gap of information in space syntax can seems to be filled by ANT.

3. Methods

The issue of how space syntax ignored the role of objects and their meaning in human interaction is tested with this case study. We then also

tested ANT in complementing space syntax in this matter. We carried out a case study that focused on the spatiality of social interaction in a typical Indonesian student communal housing facility called an *indekos*. The *indekos* had a number of communal areas including a parking lot, mini mosque, kitchen, pond, gazebo, study and dining room, guest room and little garden. Located very close to a national university, Universitas Indonesia, the housing facility consisted of 100 rooms, spread evenly among three buildings, out of which 67 were occupied. One building (Building A) was for female students, and the other two (Buildings B and C) were for male students. Typical layouts for these buildings are in Figure 2.

A series of questionnaires was given to 56 participants to obtain information on the socio-spatial conditions of the housing facility. The 56 participants were equally but randomly chosen from each floor from across the three building the questions were actually four groups question. One is to identify respondent, one is to learn the interaction habit of the respondent, one is to learn respondent's perception of the communal space provided in the case, and another one is to learn how respondents perceive space's potential as a place for interaction. The interaction habit was learned by asking frequency of their interaction and their relationship with fellow kos-mate. Respondent's perception of communal space was learned by asking them to rate the quality of the space that includes privacy, safety, crowd, comfort, size, accessibility



Figure 2. Typical layout for (from left to right) Buildings A, B and C.

and facilities provided. Respondent's perception on space potential were learned by asking them where in *indekos* they are most likely interact other than the communal space. Among the respondents, 57.9% were male and the rest were female. Then, a series of qualitative observations was made on the basis of space syntax and ANT. These series of qualitative observations include an observation on the movement and circulation of a student in a given range of time: in the morning, noon, afternoon, evening and at dawn

Depthmap was used to examine access to the communal places, taking into consideration three points: angular changes, distance changes and visibility changes. These three points, in space syntax terms, are called step-depth: a measure of change when one is accessing a room. The way *indekos'* inhabitant perceive access to a room can be analysed with this method. A network of activity then drawn by observing the case to see how the interaction constituted.

For the case study, we applied both space syntax theory and ANT. From space syntax, we used integration and the step-depth analysis method to study the spatial configuration of the *indekos*. The analysis was done using Depthmap to break down the architectural system (represented by a plan) into points on a grid. Every point integration was measured and indicated with a distinct colour. Integration measures the connectivity of each point in the space. The analysis also included a step-depth measurement of how many turns one has to undergo in attempting to reach a place.

The second method was derived from Cvetinovic, Nedovic-Budic and Bolay (2017). This was not a method per se, but instead a visualisation of the network. The visualisation was used to depict the complexity of actors, events or artefacts in the *indekos* as patterns of relationships between nodes that can be understood visually (Cvetinovic et al., 2017). Another thing this diagram tried to describe was the active role of non-human objects—an attempt to view interaction

in housing as a relationship and an attempt to categorise the network of interaction in a comprehensive category for space and time coverage (Cvetinovic et al., 2017). In addition, visualisation can provide a depiction of the distribution of activities that allow interaction. This is because the ANT analysis only looks at the case as a product of interaction of various actors at only one range of time (Cvetinovic et al., 2017). That said, there is a dynamic in social interaction and space for social interactions that is not captured with the visualisation.

4. Findings

With the help of DepthmapX we visualize the spatial analysis of *indekos*. For the time being, we focus on some of the spaces that provide us information on designed communal space (or the space that is expected to be communal) and the one that is not designed specifically to be one but manage to hold a potential. First we will take a look at the kitchen. Kitchen as one of designated communal space is arguably is spatially poor for interaction. Findings from spatial analysis with space syntax are as follow:

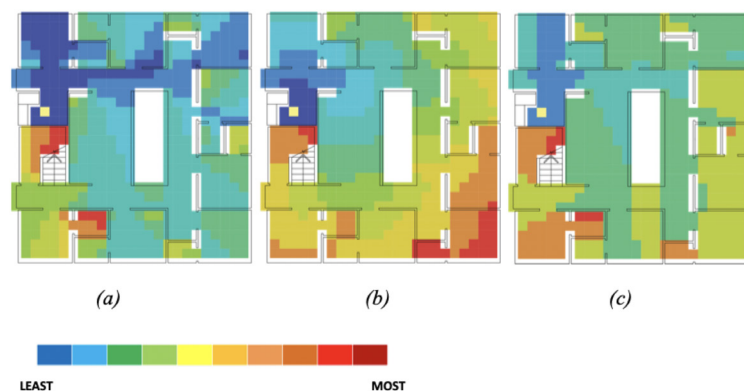


Figure 3. Angular, metric and visibility step-depth analysis of the space configuration in Building B.

Take the analysis of step-depth to a kitchen in Building B as an example. Figure 3(a) presents the angular analysis, which shows how many turns one has to do to reach the kitchen. There is a room where a person has to make at least seven turns to go from the yellowish green area to the dark blue area. Figure 3(b) presents the metric step-depth analysis, which shows how

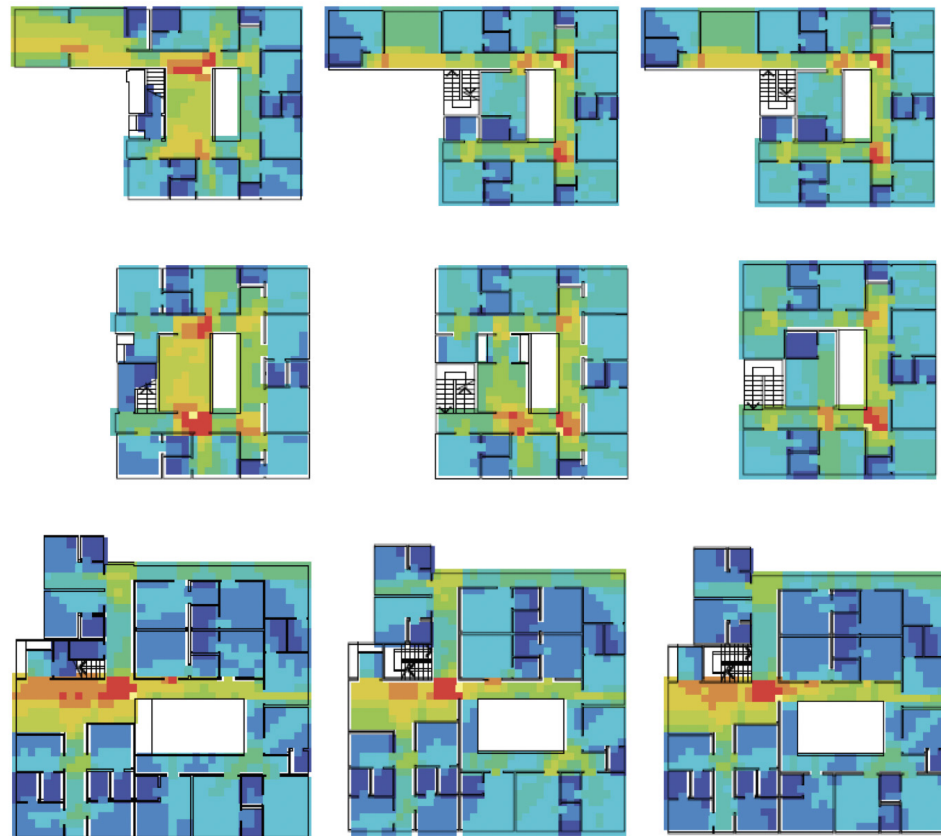


Figure 4. Integration Analysis of indekos. From left to right is first to third floor. From top to bottom is Building A, B and C consecutively.

far (in metres, hence the name metric) one has to go to reach the kitchen. There is a room where one has to walk for at least 10 metres to go from the red area to the dark blue area. Figure 3(c) shows the visibility step-depth analysis, where one has to walk a number of distances to be able to see the kitchen. There is a room where one has to undergo five changes in visibility, that is, from the orange area to the blue one. From the integration perspective, the kitchen is indeed poorly integrated in the building as can be seen in Figure 4. Kitchen is coloured blue in all buildings in all buildings which shows low integration.

Concerning the frequency of the use of spaces, 59.65% of respondents claimed to use the kitchen often and 21.05% said they did so with a medium level of frequency. In addition, 47.4% of respondents reported that they used the common room often, and 26.3% said they used it at a medium level of frequency. This finding shows that despite kitchen is poorly

integrated spatially and that it takes a little more effort to access it, it is still frequently visited—showing that other aspects than spatial configuration influence user to use and hence interact in it.

Other interesting finding includes the fact that circulation space is the most well integrated space. This can be observed in Figure 4 where in all floor of all buildings, circulation space is coloured in a range of yellow to red, which means these spaces are well integrated. This seems very obvious as the circulation space really is where people are passing and hence potentially meet one another. This corresponds well with 80.7% of respondents that see hallways as a potential place of interaction.

Going back and forth from space syntax analysis and questionnaire. We finally come to observe with Actor Network Theory to settle some contradicting finding or else confirm the corresponding finding. We develop this visualization from from Cvetinovic, Nedovic-Budic and Bolay (2017) as follow:

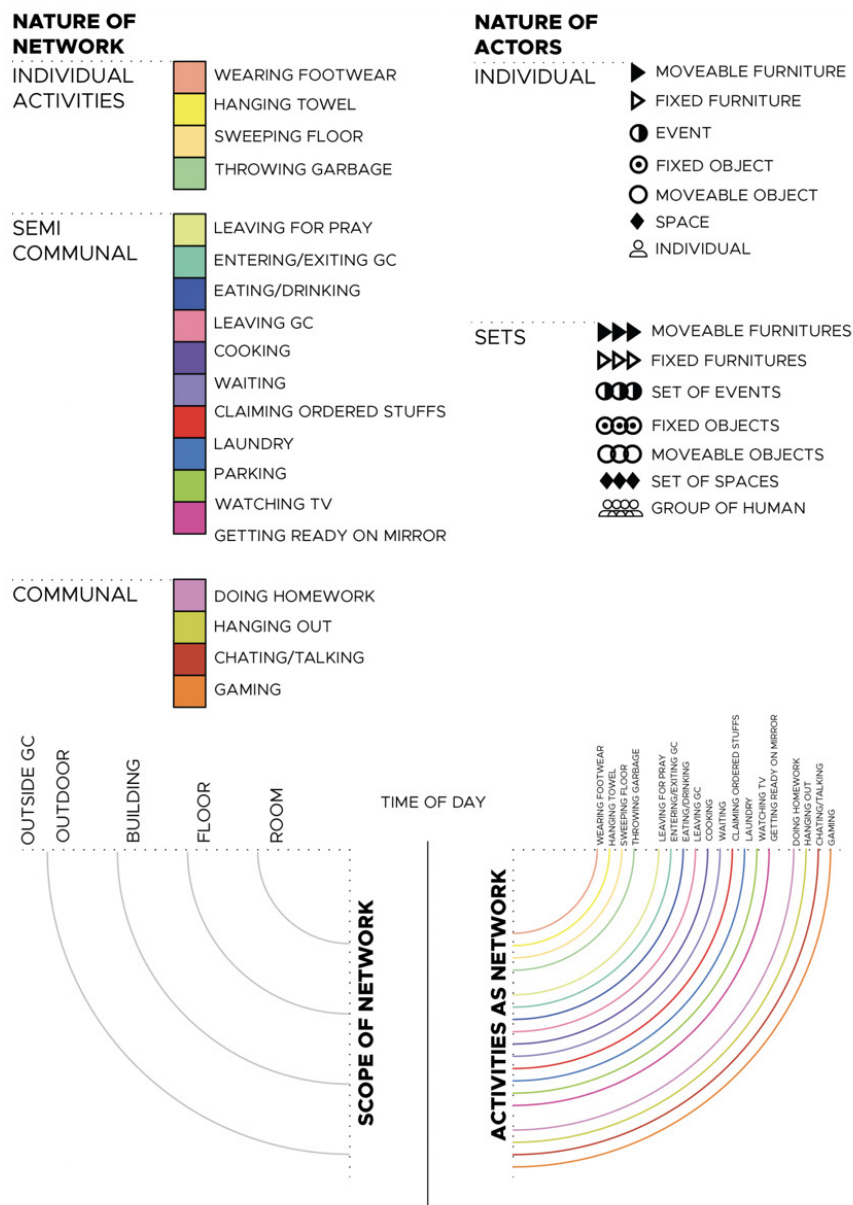


Figure 5. Actor-Network dimension in indekos.

In Figure 5, the nature of the network and the actors of the network were determined based on our qualitative measure on activities that occurs in *indekos*. A network can happen in a nature of individual activities, semi communal activities and communal activities. The actors were also determined as to see which and how the actors involved in the network. These network were also examined as to how far the interaction happened: in a scope of a room, inter-room, inter-floor, inter-building or outside.

Figure 6 shows a complete and over-all network that happened in *indekos* in a day. The colored lines are the network of the activities as men-

tioned in Figure 5. From the smaller circle to the larger one shows the scope of the network. These circles were then divided into six quadrans, showing the time when the network of activities happen.

However we will focusing on some parts of the diagram to confirm the previous findings. We created a network representation as follows (Figure 7) for activity of cooking: an activity taking place mainly in the kitchen. Figure 7 shows the location spread of the actors. Within the scope of a 'room', which in this case is a kitchen, there are cooking utensils, water dispenser, wastafel, gas, fridge and stove. The individual inhabitant and trash



Figure 8. ANT analysis of some activities that happen in the indekos hallways.

5. Discussion

Analysis with ANT revealed that non-human objects played a significant role in human interaction. In general, there are certain objects in the space that 'attract' student residents. This means the spaces, despite their poor integration, are still used and traversed and, hence, are potential spaces of social interaction. The objects are non-human artefacts, which, according to ANT, play an equally important role as humans in the social context. Moreover, certain activities can only be done in spaces that contain these non-human artefacts, and these activities form a network of social relations. This encourages communal activities (i.e. interaction) in the spaces.

For example, the facility's only stove is located in the kitchen, meaning that the kitchen is the only place where one can cook. The stove connects residents who want to cook because it brings them to a shared place and, hence, prompts interaction. There is a net-

work of interaction with the stove as the focal actant. This explains why the kitchen is used as often, despite the fact that the kitchen is rather poorly integrated according to the space syntax, as the user from the unit across on the other side of the kitchen might not intuitively know or might have to walk a little further to reach the kitchen.

Furthermore, according to space syntax, the circulation space is obviously well integrated. The spaces are well traversed by residents. ANT further explains that shared objects like hangers and shoe racks encourage people to interact in the spaces, in addition to the fact that people frequently circulate in the space. As seen in Figure 4, three different activities are connected with the same actant, creating a network. Confirming the finding from the questionnaire on how inhabitants might see the circulation space as a potential place of interaction.

Interesting finding that can be found only through ANT observation but not

space syntax is variety of interaction in different time. ANT can address the individuality of the user and it acknowledges that interaction dynamically changing across time. The complexity of interaction can vary but space syntax seems to address this variety based on only the spatial quality of the interaction. Space syntax don't take the specificity of the time of which the interaction happen into account because the nature of the theory to generalized space and its users.

Space syntax has managed to explain how spatial configuration does have an impact on human interaction. By managing space in certain configuration, one can set where people will encounter other people. This can be seen in the findings of *indekos's* circulation space. It also gives a logical and arguably objective reasoning of how a certain configuration can alter one perception of a space. Space syntax is able to give a whole explaining on how one point in a space can be perceived as distant or closed, as well as how it can be perceived as public or private. All explained by giving a systematic evaluation on metric distance, angular distance and also visibility.

ANT on the other hand focus more on what is in and what happen in the space. This allows us to understand the space better by understanding what the space accommodates and hence the functionality of the space which space syntax somewhat ignore. Moreover, ANT sees space as another network or part of a network rather than a single entity that only connect with other entity of space. Interestingly enough, ANT allows a more subjective interpretation of human interaction, which is contrast in comparison to space syntax but instead of opposing it, it completes it. As seen how in the case study how a phenomenon can be explained by these two theories altogether.

So combining the two theories really is a wise move to bridge the materiality of space with abstract concept like social interaction. The spatial-turn of social science needs an integration of such material and physical perspective of space syntax (Kärholm, 2010) with a more conceptual network approach of ANT (Sailer and Penn, 2010). This

study really sit well with previous studies on combining such two theories. The attempt done by Brien and Psarra (2015) in "synthesizing physical and conceptual artefacts into urban community forms" can be done in a building scale as seen in *indekos* case study. This further confirms that this study is then a possible beginning of a new meta-theory as proposed by Kärholm (2010).

6. Conclusion

To conclude, both space syntax and ANT are needed as a basis for socio-spatial analysis, to create a more holistic approach in understanding the matter. As the case study illustrated, space syntax theory can explain how space and its configuration, whether consciously or not, affect the behaviour and interactions of space users. This is typically done by altering one movement in space. However, this theory has not been able to explain certain social phenomena occurring in a space other than spatial-configuration framework. ANT can explain how space is used or not used by reviewing the existence of objects that allow social interaction to occur. In addition, ANT can explain the temporary aspects of social interactions that are ignored in space syntax. An overview of temporary aspects in our case study shows that interaction and use of space only occur at certain times. This means that at different times, there may be different findings, for every social relation is unique to its temporality.

Combining space syntax with ANT can make a more holistic socio-spatial analysis by not only looking at space as a place where interaction happen but also as a system of individual function that has role in shaping interaction itself. Understanding that these two theories can be combined should allow a discourse of inter-discipline study—from a discipline of physical and materiality like architecture or urban studies with a more conceptual studies like social science. This also brings us to a realization that architect and designers alike should also now consider not only the configuration of space but also the meaning they want to impose on the objects and subjects occupying the space.

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