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A fuzzy AHP model for designing spatial relations in user perspective

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Abstract:
Todays ever-changing information and value systems, make custamization and user become more important day by day. These changes are in a direct relationship with design, therefore with architecture. Since user centred design is becoming more important in architecture, the traditional design processes become inefficient. This research aims to make a model that meets these new needs of users and architectural design.

The first part of the paper describes the methodological and theoretical base of the model. These foundations are drawn from the theory of Fuzzy AHP which is a method used by engineers mostly. This research will use this method to show if a parametric method that is used by engineers can be applied to a non parametric field like user centred architecture. The ability of this method, which is changing non-parametric values into parametric values, has vital importance to architecture, where qualitative values should be used with and quantative values. User needs will be turned into numeric values by help of this method during the research.

Hospitals are one of the most relevent places with user satisfaction. Today healing hospital concept become more and more important, so hospitals are good typologies to make this research over. Hospitals are the places where time, and distances have vital importance. Therefore considering way finding not only in paths but also in spatial connections become a major.

Keywords: *Fuzzy AHP, hospital, polyclinic.*

1. Background

Hospitals are process-driven buildings: Their design depends foremost on the planned work processes that enable them to operate day and night, 365 days a year. Therefore, the process model of such a building constrains the architectural design, which must evolve in close cooperation between process planners and architects. However, such static process descriptions lack the ability to also include aspects that depend on the building layout, such as the transition of users and from one space to the other. In other words,wayfinding of a user.

Way finding, is going from one place to another target place (Ünver, 2006). It includes, knowing where you are, knowing the best route and following it, accesing the target and turning back (Bechtel, Churchman, 2002). The common point of wayfinding research's is their usage of user perception systems and user preferences. They are into, what users saw, what they think, what they percept and what they do when they are accesing some target. A lot of research shows that spatial organisation effect wayfinding directly (Peponis et al., 1990; Zimring & Dalton, 2003). This spatial organisation is related to plan configuration (Arthur and Passini, 1992). Floor plan configuraions are connected with lines (Peponis et al, 1990). This relation contains not only the physically connected places but also the not connected places (Garip, 2003). The distance between two place differs from user to user because of their cognitive maps about a place. So complicated plan configurations could cause the subjective distance increase (Rapoport, 1977).

Focusing on a hospital's polyclinic, wayfinding can cause big problems and can make a first time visitor more stressful. The path starts from entrance and goes through polyclinics and the diagnose units, could turn into a labyrinth for any hospital user. Therefore, spatial organisation for a better wayfinding becomes significantly important in polyclinics.

In the aspect of todays user-centred designs and healing hospital concepts resorting to previous assumptions for hospital design become inadequate. Therefore, a model, which can turn subjective users needs into objective numbers, in architectural spatial design is needed. This kind of a model can be created by using a Fuzzy AHP method, which can cope with uncertainty.

2. Fuzzy AHP

Fuzzy AHP is the improved and synthesized version of AHP method where the fuzziness of the decision-making is expected (Muralidhar, Ravindranath, and Srihari, 2012). The complicated decision-making problems can be stated by ambiguity and uncertainty of the decision elements. So that applying the fuzzy set theory can be seen an inherent way to cope with uncertainty, imprecision, ambiguity and vagueness in decision-making processes (Mikhailov, Didehkhani, and Sadi-Nezhad, 2011). The usage of fuzzy set theory gives a chance to the decision makers to include unquantifiable information, non-finished information, non-obtainable information and partially ignorant facts into decision model. Despite fuzzy AHP requires tedious computations, it is possible to capture a human's assessment of uncertainity when complicated multi-criteria decision making problems are expected (Dağdeviren and Yüksel, 2008). The choices in AHP should necessarily be human judgments, which come from human assessments, thus fuzzy approaches make it possible to do more explicit and true description of the decision-making processes (Ahari et.al., 2011). In addition to the advantages of AHP, fuzzy AHP represent the human thoughts, facilitating of handling qualitative and quantitative information, applying the hierarchical structure, pair-wise comparison, reduced inconsistency, and forms priority vectors. (Ibrahim, Mohamed, and Atwan, 2011).

The word fuzzy means vagueness. Fuzziness occurs when boundary of a piece of information is not clear. Various authors try to develop different fuzzy AHP methods. All these methods can be described as systematic approaches to an alternative selection of the problem by using the fuzzy set theory concept (Zadeh, 1965) and analysis of hierarchical structure. To overcome the vagueness in information and the basic fuzziness of human choices, fuzzy set theory was created by Zadeh in 1965 (Şen, Şen, and Başlıgil, 2010).

The relationship between an element and a set is either 'belong to' or 'not belong to', under a classical crisp set. The function of the membership is either 0 or 1. But, crisp sets may not be sufficient to explain all the inherent phenomena, while the fuzzy set membership function can provide an obvious explanation (Lee and Li, 2011). Although the crisp set has only one membership function; the fuzzy set has unlimited membership functions. In the fuzzy approach, fuzzy data should undergo defuzzification to have explicit characteristics. Defuzzification can be described as a method that converts fuzzy data into explicit data. It does not have a fixed form, and may have different versions according to problems and data. (Che, 2010). Fuzzy sets theory has capability of reflecting real world. They are strong mathematical tools in order to model the ambiguous systems in industry, the nature and humanity; and also the facilitators in decision making at the lack of complete and certain information (Naghadehi, Mikaeil, and Ataei, 2009).

There are a lot of different fuzzy AHP methods that have been developed. In this research for it's simplicity Chang's (1996) model is used.

Chang presented an opinion for handling fuzzy AHP, by using the triangular fuzzy numbers for pairwise comparison scale of fuzzy AHP, and by using the method for the synthetic extent values of the pairwise comparisons (Büyüközkan, Kahraman, and Ruan, 2004). The important sides of Chang method are that the computational needs are relatively low. It uses the steps of crisp AHP. It allows usingonly triangular fuzzy numbers and it does not involve additional operations (Chang, 1996).

Among the various AHP methods pertaining to fuzziness, Chang's extent analysis model is the most famous and chosen one. The steps of this method are similar to the classical AHP and relatively less complex than the other fuzzy AHP methods.

To apply the process depending on this hierarchy, according to the method of Chang's (1996) extent analysis, each criterion is taken and extent analysis for each criterion, gi; is performed on, respectively. Therefore, m extent analysis values for each criterion can be obtained by using following notation (Kahraman et al., 2004):

$$M_{gi}^{1}, M_{gi}^{2}, M_{gi}^{3}, \ldots\ldots\ldots\ldots\ldots.. M_{gi}^{m}$$

where g_i is the goal set (i = 1, 2, 3, 4, 5, ...n) and all the $M_{(gi)}^{1}$ (j = 1, 2, 3, 4, 5, ..., m) are Triangular Fuzzy Numbers (TFNs).

The steps of Chang's analysis can be given as in the following: Step 1: The fuzzy synthetic extent value (S_i) with respect to the i^{th} criterion is defined as equation 1 .

$$S_i = \sum_{j=1}^{m} M_{g_i}^{j} \otimes [\sum_{i=1}^{n} \square \sum_{j=1}^{m} M_{g_i}^{j}\ ]^{-1} \quad (1)$$

To obtain equation 2;

$$\sum_{j=i}^{m} M_{g_i}^{j} \quad (2)$$

perform the “fuzzy addition operation” of m extent analysis values for a particular matrix given in equation 3 below, at the end step of calculation, new (l, m,u) set is obtained and used for the next:

$$\sum_{j=1}^{m} M_{g_i}^{j} = (\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j) \quad (3)$$

Where l is the lower limit value, m is the most promising value and u is the upper limit value. And to obtain equation 4;

$$[\sum_{i=1}^{n} \square \sum_{j=1}^{m} M_{g_i}^{j}]^{-1} \quad (4)$$

perform the “fuzzy addition operation” of M_{gi}^{j} (j = 1, 2, 3, 4, 5, ..., m) values give as equation 5:

$$\sum_{i=1}^{n} \square \sum_{j=1}^{m} M_{g_i}^{j} = (\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i) \quad (5)$$

and then compute the inverse of the vector in the equation (5) equation (6) is then obtained such that

$$[\sum_{i=1}^{n} \square \sum_{j=1}^{m} M_{g_i}^{j}]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i} \right) \quad (6)$$

Step 2: The degree of possibility of $M_2 = (l2, m2, u2) \geq M_1\,(l1, m1, u1)$ is defined as equation 7:

$$V(M_2 \geq M_1) = \sup_{y \geq x} \left[\min\left(\mu_{M_1}(x), \mu_{M_2}(y) \right) \right] \quad (7)$$

and x and y are the values on the axis of membership function of each criterion. This expression can be equivalently written as given in equation 8 below:

$$V(M_2 \geq M_1) \begin{cases} 1, & \text{if } m_2 \geq m_1, \\ 0, & \text{if } l_1 \geq u_2, \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} & \text{otherwise} \end{cases} \quad (8)$$

where d is the highest intersection point μ_{M_1} and μ_{M_2} (Figure 1) (Zhu et al., 1999).

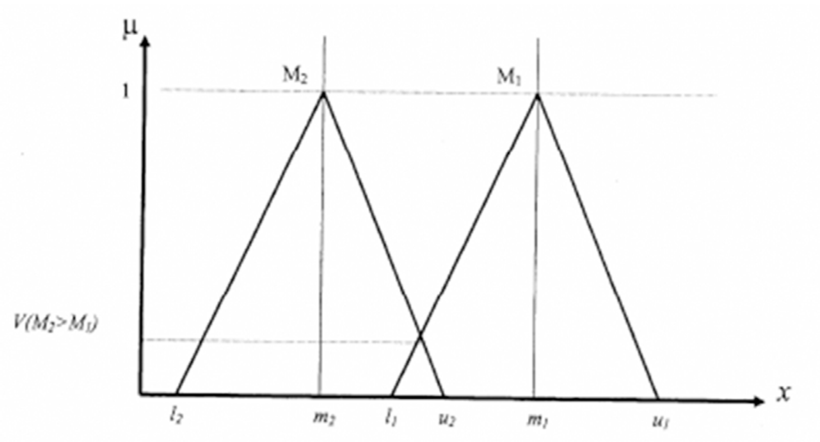


Figure 1. *The intersection Between M1 and M2 (Zhu et al.,1999).*

To compare M1 and M2; we need both the values of V(M2 ≥ M1) and V(M1≥ M2):

Step 3. The degree possibility for a convex fuzzy number to be greater than k convex fuzzy numbers;
M_i (i = 1, 2, 3, 4, 5, ..., k) can be defined by
V(M ≥ M1, M2, M3, M4, M5, M6, ..., Mk) =
V[(M ≥ M1) and (M ≥ M2) and (M ≥ M3) and (M ≥ M4) and ..... and (M ≥ Mk)] =
min V(M ≥ Mi), i = 1, 2, 3, 4, 5, ..., k.

Assume that equation 9 is

$$d^1(Ai) = \min V(Si \geq Sk) \tag{9}$$

For k = 1, 2, 3, 4, 5, ..., n; k ≠ i. Then the weight vector is given by equation 10:

$$W^1 = \left(d^1\left(A_1\right), d^1\left(A_2\right), d^1\left(A_3\right), \ldots\ldots\ldots\ldots\ldots, d^1\left(A_n\right)\right)^T \tag{10}$$

Where Ai (i = 1, 2, 3, 4, 5, 6, …., n) are n elements. Step 4. Via normalization, the normalized weight vectors are given in equation 11:

$$W = \left(d\left(A_1\right), d\left(A_2\right), d\left(A_3\right), \ldots\ldots\ldots\ldots\ldots, d\left(A_n\right)\right)^T \tag{11}$$

where W is a non-fuzzy number.

3. The model

This paper aims to create a fuzzy AHP model for designing spatial relations in user perspective, by looking at the hospitals polyclinics for the reasons mentioned before.

With the transformation of Fuzzy AHP stages to this research spesifically, the steps for the model would become;

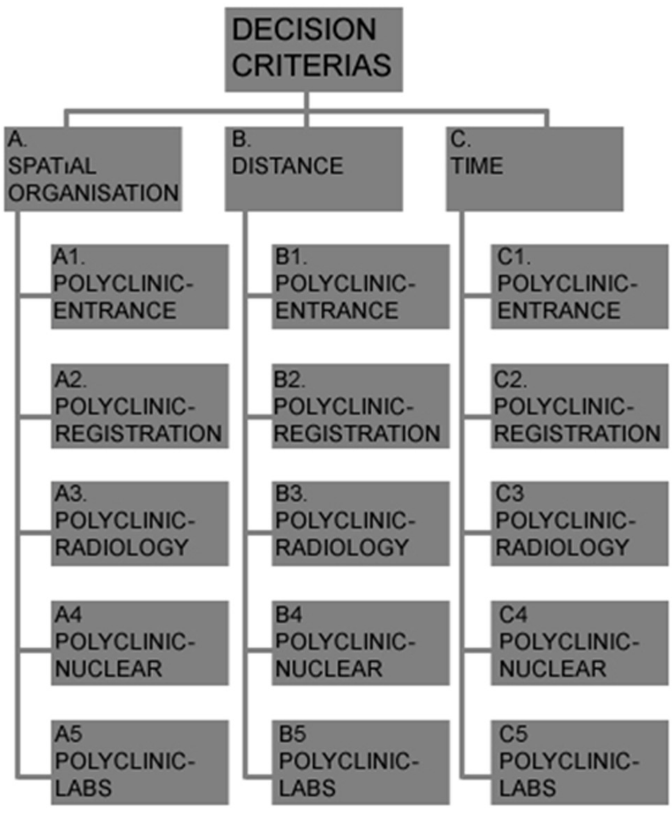
- Defining the users
- Defining crtiterias

- Making the hierarchical organisation of the criterias
- Preparing the survey
- Application of survey
- Calculating the results
- Making assumptions over the results.

Hospitals have a large variety of users. This research focuses on only patients and patient callers, who have information about the hospital's polyclinic or not. Polyclinics are in a primary relationship with diagnose units, labotarories and entrances (Hacıhasanoğlu,1990). So in the model, these relationships between polyclinics and the other units will be examined. In this relationship, since the subject is wayfinding, the most important topics are time, distance and spatial organisation.

The evaluation criterias and sub-criterias of the model, which consists values from the surveys will be applied to make a comparison, as shown at Table 1.

Table 1. *Criterias for the wayfinding of users for polyclinics.*



For the pairwise comparisons of Chang (1996), each criteria must be compared to each other as values, that will turn into triangular fuzzy numbers. So, from the evaluation criterias a pairwise comparision survey (Figure 2) is prepared.

Chang's extent analysis on fuzzy AHP depends on the degree of possibilities of each criterion. According to the responses on the question form, the corresponding triangular fuzzy values for the linguistic variables are placed and for a particular level on the hierarchy the pairwise comparison matrix is constructed. Sub totals are calculated for each row of the matrix and new (l, m, u) set is obtained, from the numbers in Table 2. ;then in order to find the overall triangular fuzzy values for each criterion, $l_i/\Sigma l$, $m_i/\Sigma m_i$, $u_i/\Sigma u_i$, $(i=1,2,..., n)$ values are found and used as the latest $M_i(l_i, m_i, u_i)$ set for criterion M_i in the rest of the process. In the next step, membership functions are constructed for the each criterion and intersections are determined by comparing each couple. In fuzzy logic approach, for each comparison the intersection point is found, and then the membership values of the point correspond to the weight of that point. This membership value can also be defined as the degree of possibility of the value. For a particular criterion, the minimum degree of possibility of the situations, where the value is greater than the others, is also the weight of this criterion before normalization. After obtaining the weights for each criterion, they are normalized and called the final importance degrees or weights for the hierarchy level.

	excellent	very good	good	normal	equally goo		very bad	poor	
spatial organisation									distance
spatial organisation									time
distance									time

spatial organisation	excellent	very good	good	normal	equally good	bad	very bad	poor	
polyclinic-enrtance relation									polyclinic-registration desk relation
polyclinic-enrtance relation									polyclinic-radiology relation
polyclinic-enrtance relation									polyclinic-nuclear medicine relation
polyclinic-enrtance relation									polyclinic-laboratory relation
polyclinic-registration desk relation									polyclinic-radiology relation
polyclinic-registration desk relation									polyclinic-nuclear medicine relation
polyclinic-registration desk relation									polyclinic-laboratory relation
polyclinic-radiology relation									polyclinic-nuclear medicine relation
polyclinic-radiology relation									polyclinic-laboratory relation
polyclinic-nuclear medicine relation									polyclinic-laboratory relation

distance	excellent	very good	good	normal	equally good	bad	very bad	poor	
polyclinic-enrtance relation									polyclinic-registration desk relation
polyclinic-enrtance relation									polyclinic-radiology relation
polyclinic-enrtance relation									polyclinic-nuclear medicine relation
polyclinic-enrtance relation									polyclinic-laboratory relation
polyclinic-registration desk relation									polyclinic-radiology relation
polyclinic-registration desk relation									polyclinic-nuclear medicine relation
polyclinic-registration desk relation									polyclinic-laboratory relation
polyclinic-radiology relation									polyclinic-nuclear medicine relation
polyclinic-radiology relation									polyclinic-laboratory relation
polyclinic-nuclear medicine relation									polyclinic-laboratory relation

time	excellent	very good	good	normal	equally good	bad	very bad	poor	
polyclinic-enrtance relation									polyclinic-registration desk relation
polyclinic-enrtance relation									polyclinic-radiology relation
polyclinic-enrtance relation									polyclinic-nuclear medicine relation
polyclinic-enrtance relation									polyclinic-laboratory relation
polyclinic-registration desk relation									polyclinic-radiology relation
polyclinic-registration desk relation									polyclinic-nuclear medicine relation
polyclinic-registration desk relation									polyclinic-laboratory relation
polyclinic-radiology relation									polyclinic-nuclear medicine relation
polyclinic-radiology relation									polyclinic-laboratory relation
polyclinic-nuclear medicine relation									polyclinic-laboratory relation

Figure 2. *Pairwise comparison survey.*

Table 2. *Triangular fuzzy numbers (l,m,u) Chang, 1996.*

values	triangular fuzzy values (l,m,u)
1	1, 1, 3
2	1, 2, 4
3	1, 3, 5
4	2, 4, 6
5	3, 5, 7
6	4, 6, 8
7	5, 7, 9
8	6, 8, 10
9	7, 9, 11
1	0,33, 1, 1
0,5	0,25, 0,5, 1
0,33	0,2, 0,33, 1
0,25	0,16, 0,25, 0,125
0,2	0,14, 0,2, 0,33
0,16	0,125, 0,16, 0,25
0,14	0,11, 0,14, 0,2

These final importance degrees of the hierarchy level can lead us to make assumptions over the spatial relations of the project in the perspective of it's users.

4. Case Study

Two research hospitals,with similar density of usage in different areas and with different plan configurations, were chosen for the appliance of the model. After the observation of users, from each hospital 20 people were chosen for the survey.

First hospital is, Sivas Cumhuriyet University Hospital. Diagnose units, entrances, laboratories and polyclinics are stated in 3 floors. Diagnose units are in ground floor and first floor. Polyclinics are in 1st,2nd, and 3rd floors (Figure 3).

Other hospital is Bursa Şevket Yılmaz Hospital Diagnose units, entrances, laboratories and polyclinics are stated in 5 floors. Each floor has different diagnose units and laboratories. Policlinics are in 1st and 2nd floors (Figure 4).

In general it can be said that Cumhuriyet University has a more compact plan scheme for spatial organisation than Şevket Yılmaz Hospital.

With the application of the model, we can observe user satisfaction over accesibility, so that in general lots of assumptions can be made for a compact or more complicated plan schemes.

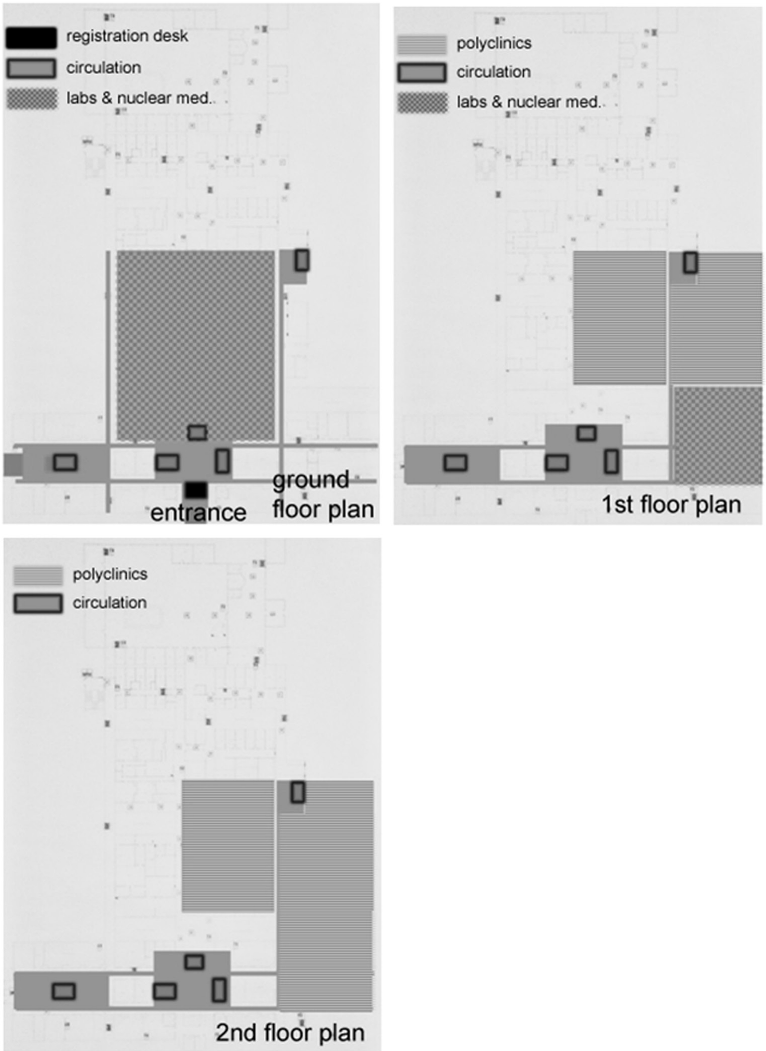


Figure 3. *Sivas Cumhuriyet University Hospital plan schemes.*

According to the responses on the pairwise comparision question form (Fig. 2), each criteria had it's own value. Triangular fuzzy values for each value are placed and for a particular level on the hierarchy the pairwise comparison matrix is constructed. Sub totals are calculated for each row of the matrix and new (l, m, u) set is obtained, from the numbers in Table 2. ;then in order to find the overall triangular fuzzy values for each criterion, li/Σl, mi/Σmi, ui/Σui, (i=1,2,..., n) values are found and used as the latest Mi(li, mi, ui) set for criterion Mi in the rest of the process. After the construction of membership functions for the each criterion and determination of the intersecrions intersections of each couple, for each comparison the intersection point is found, and then the membership values of the point correspond to the weight of that point. After obtaining the weights for each criterion, they are normalized and the final importance degrees for each criteria are obtained of the hierarchy level.

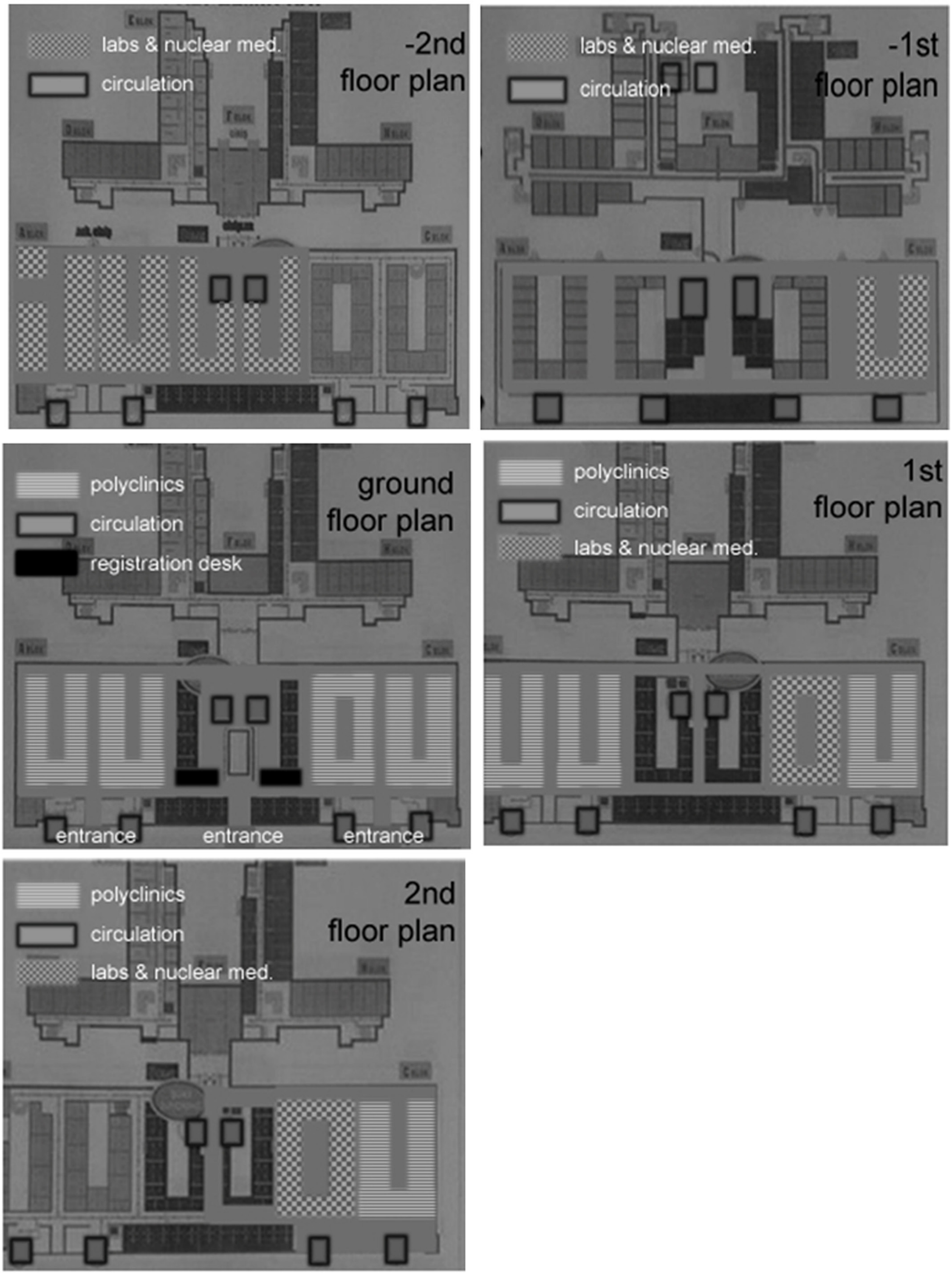
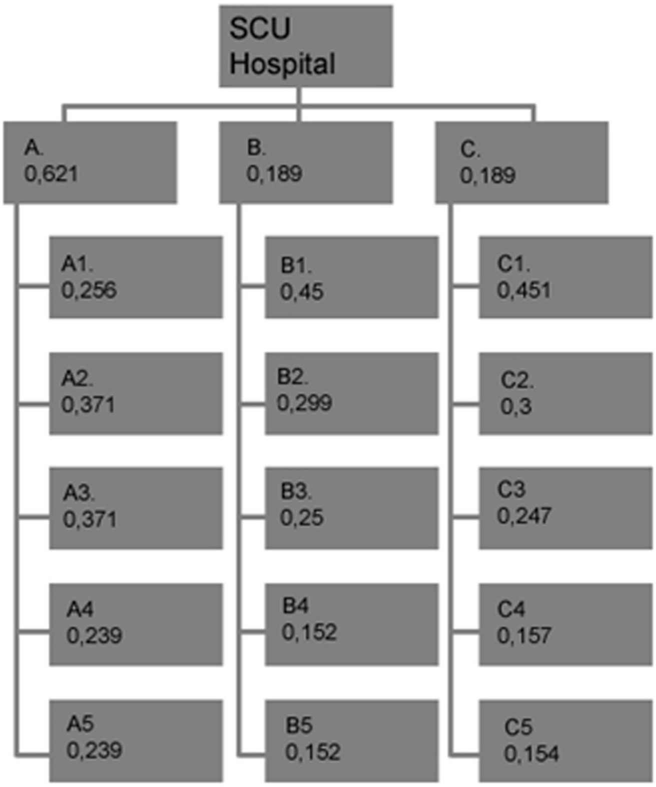
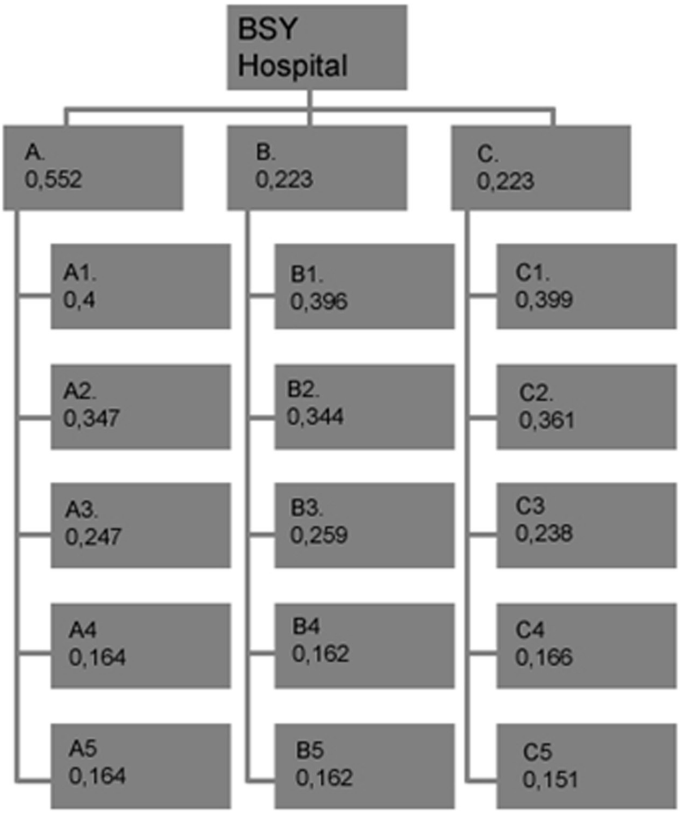


Figure 4. *Bursa Şevket Yılmaz Hospital Plan Schemes.*

These values for each hospital are shown in Table 3.

Table 3. *Importance degrees of the criteria's of each hospital.*





By analysing these values results that are obtained are shown at Table 4.

Table 4. *Interpratation of importance degrees for each criteria.*

SİVAS CUMHURİYET UNIVERSITY HOSPITAL (SCU)
A SCU > B SCU = C SCU
Spatial organization of SCU has a better value than time and distance values.
A2 SCU = A3 SCU > A1 SCU > A4 SCU = A5 SC
Registration desk and radiology units has the best spatial organisation value in SCU
B1 SCU > B2 SCU > B3 SCU > B4 SCU =B5 SCU
Entrance and polyclinic relation has the best distance value in SCU
C1 SCU > C2 SCU > C3 SCU > C4 SCU > C5 SCU
Entrance and polyclinic relation has the best time value in SCU
BURSA ŞEVKET YILMAZ HOSPITAL (BSY)
A BSY > B BSY = C BSY
Spatial organization of BSY has a better value than time and distance values.
A1 BSY > A2 BSY > A3 BSY > A4 BSY = A5 SC
Entrance and polyclinic relation has the best spatial organisation value in BSY
B1 BSY > B2 BSY > B3 BSY > B4 BSY =B5 BSY
Entrance and polyclinic relation has the best distance value in BSY
C1 BSY > C2 BSY > C3 BSY > C4 BSY > C5 BSY
Entrance and polyclinic relation has the best time value in BSY
Comparision of SCU and BSY
A SCU > A BSY
SCU has a better spatial organisation value than BSY
B BSY > B SCU
BSY has a better distance value than SCU
C BSY > C SCU
BSY has a better time value than SCU
A1 BSY > A1 SCU
BSY has a better entrance-polyclinic relation value in spatial organisation than SCU
A2 SCU > A2 BSY
SCU has a better registration-polyclinic relation value in spatial organisation than BSY
A3 SCU > A3 BSY
SCU has a better radiology-polyclinic relation value in spatial organisation than BSY
A4 SCU > A4 BSY
SCU has a better nuclear medicine-polyclinic relation value in spatial organisation than BSY
A5 SCU > A5 BSY
SCU has a better laboratory-polyclinic relation value in spatial organisation than BSY
B1 SCU > B1 BSY
SCU has a entrance-polyclinic relation value in distance than BSY
B2 BSY > B2 SCU
BSY has a better registration-polyclinic relation value in distance than SCU
B3 BSY > B3 SCU
BSY has a better radiology-polyclinic relation value in distance than SCU
B4 BSY > B4 SCU
BSY has a better nuclear medicine-polyclinic relation value in distance than SCU
B5 BSY > B5 SCU
BSY has a better laboratory-polyclinic relation value in distance than SCU
C1 SCU > C1 BSY
SCU has a entrance-polyclinic relation value in time than BSY
C2 BSY > C2 SCU
BSY has a better registration-polyclinic relation value in time than SCU
C3 BSY > C3 SCU
BSY has a better radiology-polyclinic relation value in time than SCU
C4 BSY > C4 SCU
BSY has a better nuclear medicine-polyclinic relation value in time than SCU
C5 SCU > C5 BSY
BSY has a better laboratory-polyclinic relation value in time than SCU

From all these results these assumptions can be made:

• SCU has a more succesfull spatial organisation than BSU. So users prefer horizontal spatial relations as It is in SCU than vertical spatial relations.

• Time and distance values of BSY is higher. So users prefer vertical plan schemes when it comes to time and distance.

• Although the time and distance values for each criteria and sub criteria are better in BSY and spatial values are better in SCU, just the entrance-polyclinic relation has a difference from all the other criterias. SCU has a lower spatial relation in entrance-polyclinic relations and BSY has lower time and distance values. When we look back at the plan schemes at Figure 3 and 4, it is seen that SCU has only one entrance and BSY has three. So the increase in number of entrances makes users more comfortable when entering the building but It makes them using time and may be losing their way.

• SCU's sub criteria values are higher in spatial relations as well (except entrance values). BSY's suc criteria values are higher in time and distance values (except entrance values). So, the overall relation of A-B and C for each hospital corrects Itself.

• In general from these two hospitals, we can understand that patients and patient callers are more comfortable in vertical spatial organisations where they can reach each place easily. But on the other hand, they prefer to use vertical sirculation than walking long distances.

• These assumptions can be used to make changes in the hospitals that are revieved or can be used for further polyclinic designs for a better user satisfaction.

5. Conclusion

In this research a fuzzy AHP model was developed for evaluation of user centred design process. After investigating the potentials of it within polyclinics through users wayfinding over spatial relations-time and distance, the following assumptions can be made for the model:

• Model is successful in choosing the best alternative, through a lot of criteria. In the research model showed the positive and negative ways of two different plan schemes. In another research, by changing the criteria's, or adding new criteria's, this model can help any designer to design user centred.

• Model is successful in changing subjective-non parametric values into objective-parametric values. It has always been an unsolved problem in architecture, to find the optimum solution for subjective need and It generally depends on designers idea. This model gives the designers to find the optimum solution for subjective needs, even they are not experienced enough to find the best solution by their own judgement.

• Model is successful in creating desired areas, either they are built or not. In already built projects, model is able to show where the problems are directly. So the designer can make the right choices to re design and correct a project's performance. In design stage projects, model gives the designer the chance of testing the design and make corrections if needed, before it is built. Additionally, researches made with this model can show the designer a path through the projects they have never built before. This precaution side of the model, would cause lot of savings before and after the building process.

• This model was applied in a very basic Ms Excel program but, for further investigations, it can lead for a computer program for user centred design.

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Kullanıcı Odaklı Tasarımda Bulanık AHP ile bir Model Önerisi

Hızla değişen bilgi ve değer sistemleri, gün geçtikçe bireyi, kişiselleştirmeyi ve kullanıcıyı daha da önemli kılmaktadır. Özellikle tasarım alanında görülen bu değişimler, mimari ile de yakın bir ilişki içindedir. Söz konusu bu hızla değişen ve kullanıcı beklentilerinin arttığı ortamda geleneksel tasarım yaklaşımları ile mimari tasarım üretmek, merkezinde kullanıcı olan mimarlık için artık yetersiz kalmaktadır. Dolayısı ile insanları memnun edecek bir yapılı çevrenin oluşturulmasında yeni tasarım yöntemlerine ihtiyaç duyulmaktadır.

Çalışmanın ana hedefi bahsedilen tipte yeni bir kulanıcı odaklı tasarım modeli geliştirilmesidir.

Çalışmanın ilk kısmında metodolojik ve teorik içerik açıklanmıştır. Modelde kullanılan Bulanık AHS yöntemi genellikle mühendislik uygulama ve araştırmalarında kullanılan bir yöntem olup, yöntemin nitel ve nicel verilerin birlikte doğru yorumlanıp sentezlenmesinin büyük önem taşıdığı mimarlık alanında büyük fayda sağlayacağı düşünülmektedir. Programın nesnel veriler kadar öznel verileri de rakamsal verilere dönüştürebilme yeteneğinin, kulanıcı istekleri istikametinde şekillecenek bir konuda katkısı incelenecektir. Kullanıcı yoğunluğu ve istekleri söz konusu olduğunda süphesiz en önemli yapı tiplerinden biri hastanelerdir. Hastanede verilen sağlık hizmetlerinin kalitesi ve sağlık yapılarının tasarımı, kullanıcı memnuniyetini etkileyen faktörler olarak birlikte düşünülmektedir. Bu nedenle kullanıcılar söz konusu olduğunda, gerek fonksiyonel gerekse konfor şartları için önem taşıyan yön bulma kavramı ve mekansal erişilebilirlik, öne çıkan parametrelerden olmaktadır.

Kullanıcıların mekansal erişilebilirliğin kullanıcı istekleri doğrultusunda analiz edilmesi, özellikle iyileştiren mekanlar oluşturulması birinci dereceden önemli olan hastane yapılarında, sadece yön bulma performansını arttırmayacak, aynı zamanda konfor şartlarının da artmasını sağlayacaktır. Bu analize dayalı geliştirilecek bir çalışma gerek ön tasarım gerekse tasarım değerlendirme aşamasında mimarlık alanına katkı sağlayacaktır.

Sonraki bölümde model açıklanmış ve bir alan çalışması ile model uygulanmıştır. Geliştirilen model hastane poliklinikleri ile diğer tanı birimleri arasındaki ilişki üzerinden test edilmiştir. Türkiye'nin iki farklı bölgesinden seçilen, benzer kullanıcı yoğunlupuna sahip, farklı plan şemalarıyla tasarlanmış iki hastanede yapılan çalışmada, bulanık AHP verileri elde etmeye uygun olarak hazırlanmış anket uygulanmış, veriler modelde işlenerek, hastanelere ilişkin sonuç değerlere ulaşılmıştır. Daha sonra uygulamanın sonuçları yorumlanarak modelin faydaları tartışılmıştır.

Alan çalışması ile hastanelerin poliklinik bölümlerinin kendi iç ilişkileri ve diğer hastane bölümleri ile olan yön bulma ilişkilerini analiz ederek, kullanıcı odaklı hastane tasarımı bağlamında optimize edilmiş tasarıma dair yorumlarda bulunulmasına yardımcı bir model elde etmek amaçlanmaktadır.

Böyle bir model ile,
• Henüz tasarlanmamış yapılar için kullanıcı odaklı tasarıma yönelik bir araştırma yöntemi geliştirerek, mekansal organizasyonu bu yönde düzenlenecek binalar yaratılmasına temel oluşturmak,
• Tasarlanmış yapıların test edilmesini sağlayarak, onları kullanıcı odaklı tasarım doğrultusunda iyileştirebilecek öneriler ortaya koyabilen bir model yaratmak amaçlanmaktadır.Bu sayede ister uygulanmış, isterse tasarlanma aşamasında olsun, tüm yapıların mekansal organizasyon ilişkilerinin yeniden gözden geçirilerek iyileştirilebilmesini sağlayacak bir yol gösterici yöntem yaratmak hedeflenmektedir.