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Research Article

The Degrees of Separation in Turkish Cinema: The Sühely Eğriboz Number

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Abstract

We live in a small-world where a person can reach another person via -on average- six steps by knowing a friend of a friend and with digitalization. One of the important questions in small-world research is about which node being in the center of the small-world. In here, with the central node definition, we refer to the node that can connect to all other nodes in the small-world by the shortest paths. In this study, we analyze the connection among actors/actresses of the Turkish Cinema and aim to define the center node in it. We use a graph analysis method that creates an Actor-Movie bipartite graph and projects it into a one-mode Actor-Actor graph to find the center node in the Turkish Cinema. Our results show that actor Sühely Eğriboz is the center node of Turkish Cinema graph with the lowest closeness centrality and average actor number value. Although there are paths that are longer than six steps, Sühely Eğriboz can reach any given actor/actress with an average 3.142 steps.

Keywords: Cinema, Network, Degree, Separation, Graph, Cinema.

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Araştırma Makalesi

Türk Sinemasında Ayrılma Dereceleri: Sühely Eğriboz Sayısı

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Öz

Bir bireyin bir başka bireye, dijitalleşme ve kişisel bağlantılar aracılığıyla (arkadaşımın arkadaşı) ortalama altı adımda ulaşabileceği küçük bir dünyada yaşıyoruz. Küçük dünya olgusunun ele alındığı araştırmalarda önemli bir soru da hangi düğümün (birey, nesne vb.), mevcut yapının merkezinde yer aldığıdır. Burada, merkez düğüm tanımıyla küçük dünya yapısı içinde yer alan tüm diğer düğümlere en kısa bağlantı yoluna sahip olan düğümü ifade ediyoruz. Bu çalışmada; Türk Sinemasında yer alan aktörler/aktrisler arasında var olan bağlantıların analiz edilmesiyle birlikte, merkez düğümün tanımlanması amaçlanmıştır. Türk Sinemasındaki merkez düğümü bulmak için; Aktör-Film iki taraflı çizgesini oluşturan ve bunu tek taraflı Aktör-Aktör çizgesine indirgeyen çizge analiz yöntemi kullanılmıştır. Çalışma sonuçları, Süheyl Eğriboz'un en düşük yakınlık merkeziliği ve ortalama aktör sayısı değerleri ile merkezi düğüm olduğunu ortaya koymuştur. Altı adımdan daha uzun yolların var olmasına rağmen, Sühely Eğriboz çizge içinde verilen herhangi bir aktöre/aktriste ortalama 3.142 adımda ulaşabilmektedir.

Anahtar Kelimeler: Sinema, Ağ, Derece, Ayrım, Çizge, Sinema.

Introduction

Graph analysis is a method that has been used in social sciences, biology and mathematics for a long time and it provides a snapshot of interconnectedness of nodes that can be different type of data such as people, genes, and objects. This snapshot reveals some features that can't be seen otherwise, in reference to structure and relationships between nodes. Graph analysis helps define the flow of information, ideas and diseases in a group whose members are connected to each other. The size, speed and effect of flow depend on node's connectivity attribute. Node, which has the greatest connectivity in a group, provides a better diffusion role. The greatest connectivity in a graph doesn't mean that it will have the highest number of connections. The center node that has the shortest distance to all other nodes in a graph, can have a better connectivity function than a node that has the highest connections number in the same graph. Distance is an important property in a graph and there are different studies to define the distance of a node and relationships among nodes according it. One of the well-known examples is from the mathematics field, *The Erdős Number* describes the distance between Paul Erdős who was a renowned Hungarian mathematician and other mathematician according collaborative in a paper (Barabási, 2002; Easley & Kleinberg, 2010). Another well-known example is from Hollywood, *The Kevin Bacon Number* shows the collaboration distance between any movie actor or actresses in the world and Kevin Bacon, an American actor. Both cases explain the so-called small-world phenomenon that claims that there is a short distance among the people in the world. Generally, this concept is also called as the six degrees of separation -which is defined as everyone on earth is on average six steps away from each other. In this paper, we examine this concept, the collaboration distance between actors/actresses, and define the best-connected actor/actress in Turkish Cinema, via the use of the graph analysis.

The first film in Turkish Cinema was *The Demolition of the Russian Monument at St. Stephen* (1914), a documentary made by Fuat Uzkınay -a reserve army officer. Since then, the Turkish Cinema has evolved and has now a long history in which one can see numerous productions and thus many actors/actresses' establishment in it. We collect our data from the Internet Movie Database (IMDB) and apply the graph analysis to find answer for "Which actor/actress is in the center of the Turkish Cinema graph?" and "How many steps are needed to reach from the center actor/actress to all other actors/actresses in it?"

Six Degrees of Separation

The term *six degrees of separation* defines the interconnections in the network theory. In the social context, it means that each individual is connected to each other with a chain that has six or fewer steps. The idea was first described by Frigyes Karinthy (1929) in *Chains,* a short story inside a collection of fifty-two short stories book that is titled *Everything is Different*. In this story, Karinthy refers to the fact that people on earth are much closer to each other today than ever and a test would prove his theory right. He claimed that we should select any person from the 1.5 billion inhabitants of the Earth and through using no more than *five* other individuals, one of whom is a personal acquaintance, we could reach this person (Karinthy, 1929). Karinthy's fictional character immediately links a Nobel prizewinner to himself via King Gustav, the Swedish monarch who hands out the Nobel prize, and a tennis champion, also happens to be a tennis player buddy and a good friend of Karinthy's character (Barabási, 2002; Newman, Barabási, & Watts, 2006). Even though it was a fictional story, the idea of reaching any person through less than six steps

that are made via least one personal acquaintance was really important to understand the logic of the largest network structure: The humankind. This story shows that in spite of the presence of the (physical) long distances among individuals in our modern world, the growing human networks have shortened social distances (friendship, acquaintance type of networks) between each individual. In short, long distances are less likely to become an issue when it comes to creating networks of friendships or other types of professional relationships regardless of how far one can be to another person in the world. This idea both directly and indirectly influenced many scholars who worked on social networks.

The concept of six degrees of separation was rediscovered by Stanley Milgram, a Harvard professor who turned the concept into a much groundbreaking study on our interconnectivity, in 1967 (Barabási, 2002; Easley & Kleinberg, 2010). Milgram published several papers (Milgram, 1967; Travers & Milgram, 1969) that were related to this phenomenon and he called them as *small-word experiments*. Milgram's aim to find the distance between any two people in real world and answer other main questions in these researches were based on how many acquaintances it would need to connect the two randomly selected persons in United States. For this, Milgram chose two random people who lived in Sharon and Boston, Massachusetts. After he had decided target persons, Milgram sent 160 letters to random selected people in Wichita, Kansas and Omaha, Nebraska and asked them to send this letter to targeted people via forwarding the letter to an acquaintance who should send it to another acquaintance, followed by his instructions. Eventually 42 letters made it back and the median number of intermediate persons was 5.5 (Barabási, 2002, p. 29). Stanley Milgram has never used the phrase six degrees of separation. John Guare, an American playwright, originated the term by using it in the title of his play.

Searching for how close people are in our real world, which is showed in the *small-world* phenomenon, has gotten huge amount of attention from all different fields. One of the most important examples for this is called *the Kevin Bacon Game* which has explained the high level of interconnections in film industry, especially in Hollywood. The Kevin Bacon Game was invented by a group of students at Albright College in early 1994 (Easley & Kleinberg, 2010). They were apparently movie buffs of some note and had come to the conclusion that Kevin Bacon was the true center of the movie universe (Watts, 2003). When the small-world phenomenon is applied into film industry, nodes (which represent the fundamental units in the network) are actors and edges (which present the relation between nodes in network) are corresponding that two actors have appeared together in one or more feature films. According to IMDB, between the years 1898 and 2000, roughly half a million people have acted in over two hundred thousand feature films (Watts, 2003, p. 94). Even though Kevin Bacon has been over 60 films with co-staring many other actors, which is a very small number when considering other actors who appeared in more than 120 films such as Christopher Lee, Ernest Borgnine and Donald Sutherland (gordonm888, 2015); Kevin Bacon himself has had much more coverage/range than other actors. Approximately %98 percent actors on IMDB can easily be linked with Kevin Bacon within the reach of 4 steps (via 3 other actors in general). In addition to this, another important indicator in the graph is about which actor is best connected on average. This number means that a randomly chosen actor is within (which degree) how many steps to the starting actor. The average number for Kevin Bacon of all linkable 1,911,760 actors currently listed in the IMDB is around 3 (Hautz, Krummrey, Exadaktylos, & Hautz, 2016).

In the Kevin Bacon Game, if an actor has Bacon number of one so it means that this actor has been in a film with Kevin Bacon (Kevin Bacon himself has a Bacon number of zero). If an actor has Bacon number of 2 then this actor has not been in a film with Kevin Bacon, but he has been in the same film as someone with Bacon number of one. For example, Marilyn Monroe was in *Niagara* (1953) with George Ives, and George Ives was in *Stir of Echoes* (1999) with Kevin Bacon, so Marilyn has a Bacon number of two (Watts, 2003, p. 94).

Method

We use a *bipartite graph* to find the six degrees of separation and the center actor of Turkish Cinema. A bipartite graph G is a graph that its node set V can be split into two disjoint sets such as V_1 and V_2 so that each edge of G joins V_1 with V_2 (Harary, 1969; Wilson, 1996; West, 2000; Kleinberg & Tardos, 2006; Barrat, Barthelemy, & Vespignani, 2008; Barabási, 2016). For example, we have a bipartite graph that is made up of four movies and twelve actors in Figure 1 Panel A. The edges between actors and movies represent that actors appeared in the same movie such as Actors 1 to 4 played in Movie A and Actor 10 to 12 take part in Movie D. As can be seen in Figure 1 Panel A, some actors can appear in more than one movie in some cases. For example, Actor 1 and 2 have roles in Movie A and B, in the same way Actor 5 take part in Movie B and C. As mentioned before, a bipartite graph should be made up of two disjoint sets that can be split into two pieces. A movie-Actor bipartite graph that is in Figure 1 Panel A, can be shown as a Movie-Movie graph in Panel B or an Actor-Actor graph in Panel C based on the connectivity with the other side of nodes. This technique is called as the *one-mode projection* (Zweig & Kaufmann, 2011). In Panel B, the nodes are movies and edges between nodes are actors who appeared in both films. In Panel C, the nodes are actors and edges are the movies that actors take part in them together. In many cases, a graph can have more than one component which is a set of nodes and edges that only are connected to each other and don't have any connection to other components. When there is more than one component in a graph, there will be a giant component that is containing a macroscopic fraction of the graph's nodes (Barrat et al., 2008). In Figure 1 Panel C, the Actor-Actor graph has two components and both nodes of two components don't have any connection to each other. The giant component has all the nodes of Actor-Actor graph excluding Actor 10, 11 and 12 who haven't been in any movie with other actors in the graph. Because of that there is no connection between components in a graph. It is impossible to calculate the shortest path between any given nodes in any two components. Thus, the giant component in a graph is defined and only shortest path between nodes of giant component is calculated.

In some cases, edges in one-mode projected graph can be assigned with a number, usually representing a physical property of the edge: capacity, bandwidth, traffic, interaction and such as edge is called the *weighted edge*, in this case this kind of graph is titled as a *weighted graph* (Wilson, 1996; Barrat et al., 2008). As it is shown in Panel C, the weight of the edge between Actor 1 and Actor 2 is 2 because both actors performed together in Movie A and B. The weight of the edge in graph affects the way of finding the shortest path between any given nodes in graph thus it is an important attribute for our research. The algorithm for the shortest path follows this logic: If there is more than one connection between any given two nodes, then it defines the shortest path through the path that has a lower edge weight. After we calculate the weighted value for each edge, we normalize the value by dividing the total weighted value by 1 so the weighted value becomes between

0 and 1. For example; in Figure 1 Panel C; the weighted value is 2 between Actor 1 and Actor 2. After the normalization process, its value turns into 0,5.

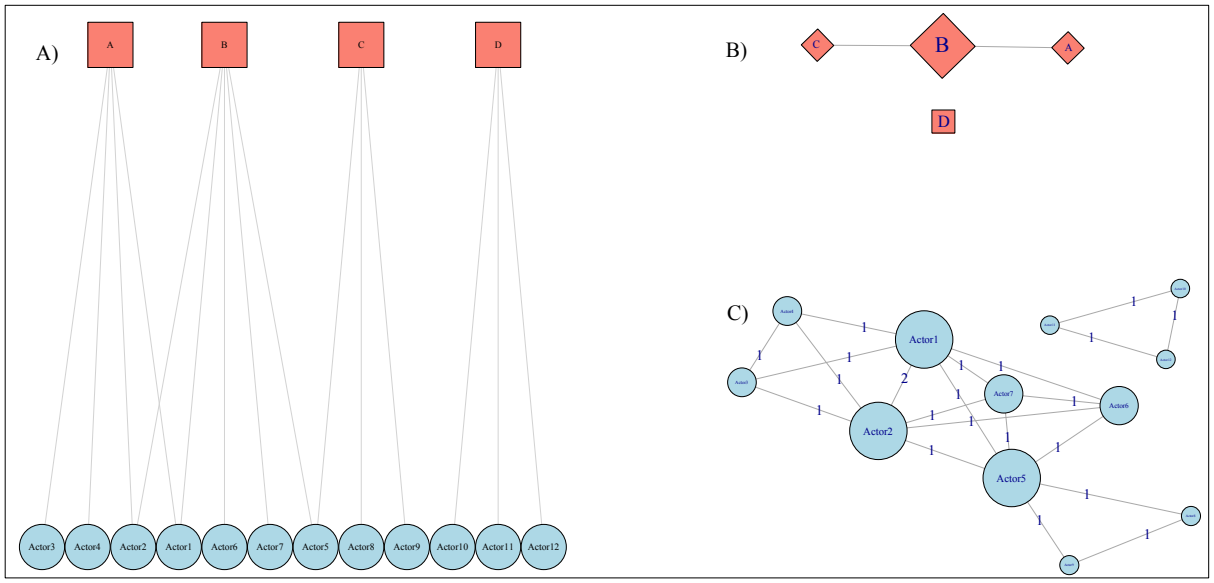

Figure 1: *The example of a bipartite network that is based on movie-actor relation and its one-mode projections.*

Note: *The circle size of nodes is proportional to the number of edges of given actor. The numbers that are shown on edges in Panel C stand for the weight between two nodes.*

In this research, first we create a Movie-Actor bipartite graph that is based on our data then we turn it into an Actor-Actor one-mode projected in the graph. On this one-mode projected graph, we find the giant component and calculate the shortest paths between any given nodes in relation to all other nodes. Our graph is an undirected weighted graph and because of these attributes we use Dijkstra's algorithm to find the shortest paths from any given node to all other nodes in graph (Cormen, 2009; Kleinberg & Tardos, 2006; West, 2000).

When we talk about the concept to assess the center node in a graph, we should clearly define what we mean with it. If a node is close to all others node in a graph, he or she is able to make connections or share information more easily (Aylward, Odar, Kessler, Canter, & Roberts, 2012). There are different centrality values to find center node in a graph and the center node of a graph may change depending on the measure chosen (Hautz et al., 2016). We use the *closeness centrality* that measures how many steps on average it takes from a node to all other nodes in a graph (Pattison, 1993; Wasserman & Faust, 1994; Newman, 2010; Abraham, Hassanien, & Snášel, 2010; Jackson, 2010). When a node has high closeness centrality value, it will easily and efficiently be able to connect to other nodes. We then calculate closeness centrality value for each node from and to all other nodes in graph and find the average *Actor Number* for top three actors who have the highest closeness centrality value. We compute the average Actor Number as follows: Multiply the degrees of separation and the reachable number of nodes at this value, find the total value of the degrees of separation and then divide this value by the total number of nodes in graph.

The data that is used in this study is collected from IMDB. We used advanced search option on the IMDB website, by only selecting Turkey from the country option. We subset data according to the year option and have only kept movies that have only four-digit number structure in their titles such as 1890, 1991, 2017, Thus, actors who take part in

TV Movies, TV Series and Short Films have been removed from our data set. Research query provided more than 14,200 titles and this number is obtained by June 2018. We collect them with a Python (2018) web scraping script. As a result of this process, we collect actors from 9,441 unique movies that are produced between 1914 and 2018.

Results

Although the movies produced in Turkish Cinema, which has a history of more than 100 years, are perceived as few in number, it still has a significant amount when considering the socio-economic development of the country. With the acceleration of urbanization in 1950s, Turkish Cinema started to produce many films and this era is called *Yeşilçam* (literally means The Green Pine), the effect of this era on Turkish Cinema can be easily seen in Figure 2.

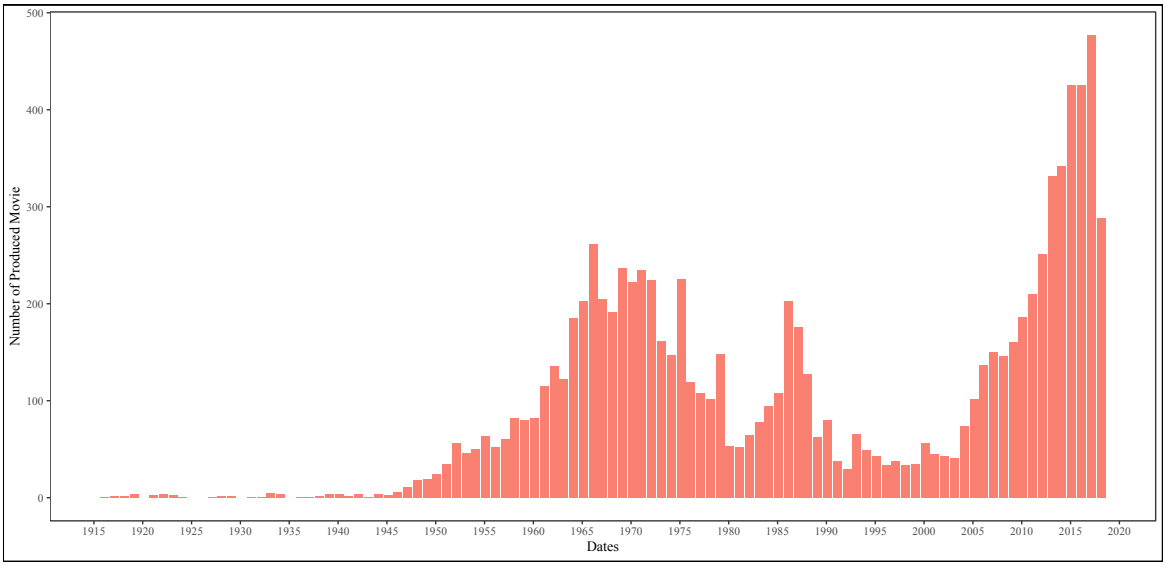

Figure 2: *Distribution of movies produced in Turkish Cinema between 1914 and 2018.*

The number of produced movies in Turkish Cinema has an upward trend from beginning of 1950s and it has exceeded 200 movies for the first time in 1965. A similar trend is observed from the beginning of 2003. With this trend in Turkish Cinema, 400 movies had been produced in 2015- a record number in the country. There are different factors that affect these trends such as socioeconomic conditions, regulations, funding and capital inflow to cinema industry. These factors are beyond the scope of this paper.

We use R (2017) programing language and *igraph* (Csardi & Nepusz, 2006) package to create a bipartite graph from the IMDB dataset. The attributes of one-mode projected Actor-Actor graph can be seen in Table 1.

Table 1: *Graph statistics for one-mode projected Actor-Actor graph.*

N	***M***	***<k>***	***<w>***	***d***	***l***	***c***
21,113	314,862	29.82	1.37	13	3.52	900

The one-mode projected Actor-Actor graph has 21,113 nodes (*N*) and 314,862 edges (*M*) between these nodes. The average degree number (<*k*>) in graph represents how many times an actor take place in movies and according this graph, the average appearance number of an actor is more than 29 movies. The average edge weight (<*w*>) denotes how many times two actors act together in the same movie and the average number of acting together is less than two. When we see that our dataset is made up of movies whose time

span is more than 100 years, actors (considering how long/short their careers can be) are thus less likely to take part together within no more than 2 films. The diameter (*d*) of a graph represents how many steps are needed to pass between the outermost two nodes in a graph. This distance is mostly calculated in the giant component of a graph. Because of that, it always has the largest distance. In this graph, it is needed to have the network of 13 actors to create a path that can connect these two outermost nodes (the two actors who seem to be the most distant from each other). The average path length (*l*) shows how many actors are needed to pass for reaching from a node to other one in a graph. This measurement is also based on the giant component in a graph. In this graph, we can reach from one actor to another, one average less than four steps. There are 900 detached components (c) in this graph, and it shows that some actors only appeared in few movies with a few actors together. The giant component in this graph has 17,521 actors which is %82.98 of all actors in the graph and the second largest component is made up of only 50 actors.

The top three actors in the giant component according the total shortest path (*Pi*) and closeness centrality (*CCi*) value are in the Table 2. According to value, Süheyl Eğriboz has the lowest total shortest path value with 24,444.68. Süheyl Eğriboz can reach more nodes in the graph with a short chain. Nubar Terziyan (24,509.46) and Renan Fosforoğlu (24,561.42) respectively follow Sühely Eğriboz as a possible center node of the graph. Even though Nubar Terziyan has lower total shortest path value than Renan Fosforoğlu, the *CCi* value of Renan Fosforoğlu is higher. This result indicates that if a node has a better total average shortest path value, it will not guarantee that it also has a better position in the graph. Another actor, Ali Şen has a better *CCi* value than Nubar Terziyan in the graph and he takes the third place in this measurement. According these values Süheyl Eğriboz is the best candidate for the center node in this graph.

Table 2: *Top three actors according the total shortest path (Pi) value and closeness centrality (CCi).*

Actor Name	**Süheyl Eğriboz**	**Nubar Terziyan**	**Renan Fosforoğlu**
Pi	24,444.68	24,509.46	24,561.42
Actor Name	**Süheyl Eğriboz**	**Renan Fosforoğlu**	**Ali Şen**
CCi	3.530423e-05	3.509311e-05	3.485004e-05

We can easily find out about how many actors can be covered by these four actors in every degrees of separation so we can precisely define the center node of graph. For this purpose, these four actors are separately considered as a singular starting point and the degrees of separation from each of them to all other actors in the graph is calculated. The degrees of separation and the numbers of linkable actors in every degrees of separation for four actors are in Table 3.

Table 3: *The degrees of separation in graph and the number of linkable actors in each degree.*

	The number of reachable actors			
The degrees of separation	**Süheyl Eğriboz**	**Renan Fosforoğlu**	**Ali Şen**	**Nubar Terziyan**
0	1	1	1	1
1	535	417	289	295
2	5229	3697	3694	4481
3	5663	5869	6184	5525
4	4022	4766	4642	4155
5	1569	2119	2113	2217

	The number of reachable actors			
The degrees of separation	**Süheyl Eğriboz**	**Renan Fosforoğlu**	**Ali Şen**	**Nubar Terziyan**
6	390	510	461	698
7	95	125	111	141
8	17	13	22	8
9	-	4	4	-
The Average Actor Number	3.142	3.376	3.374	3.354

The Average Actor Number shows that an actor can reach other actors in a graph within how many steps. Süheyl Eğriboz has the lowest value. In average, he can reach any given node in graph within 3.142 steps thus he has a better center position than other actors in the graph. Nubar Terziyan has the second lowest average actor number but his *CCi* valueis lower than other three actors. Ali Şen and Renan Fosforoğlu also have higher average actor numbers.

Süheyl Eğriboz (25 June 1927 - 10 January 2014), had made his film debut in 1940 with the movie titled *Akasya Palas* and the last appearance of him in a movie was in 2005, the title of movies is *Maskeli Beşler: İntikam Peşinde*. According to the IMDB, he had 425 credits in movies, TV series and so on. He often portrayed villains in movies and his acting style suited this kind of roles very well. As a result of this, he had chance to act in various kinds of movies as a villain. As one of the Veteran actors, Egriboz was involved in a lot of fight scenes and this was an important feature for him in Yeşilçam movies.

Our study focuses on the one-mode projected graph. Multiple edges, which represent movies, are converted into numbers and as a result of this process showing name of movies between any two actors is impossible. We need to turn back in the bipartite graph to show actor-movie relation in degrees of separation, by using Sühely Eğriboz as a starting node. We look at the relationship between him and four other actors. The two of them had roles 10 years before his debut and two of them had roles 10 years after his last movie appearance. We select one leading actor and one supporting actor for each section to clearly see the steps between Sühely Eğriboz and them.

Table 4: *Actor and movie steps between Sühely Eğriboz and other four actors in the graph.*

Sühely Eğriboz	**Sühely Eğriboz**	**Sühely Eğriboz**	**Sühely Eğriboz**
in	in	in	in
Akasya Palas (1940)	Ankara Casusu Çiçero (1951)	Silahların Kanunu (1966)	Ömrümün Tek Gecesi (1968)
with	with	with	with
Vasfi Riza Zobu	Kemal Emin Bara	Tuncel Kurtiz	Ediz Hun
in	in	in	in
Boğaziçi Esrarı (1922)	Himmet Ağa'nın İzdivacı (1916)	Gereksiz Sansür (2014)	Arif v 216 (2018)
with	with	with	with
Muhsin Ertuğrul	Rozali Benliyan	Kıvanç Tatlıtuğ	Seda Bakan

We select Muhsin Ertuğrul and Rozali Benliyan as a leading and supporting actor and actress from 1920s to see how many steps are needed to connect them to Sühely Eğriboz. Muhsin Ertuğrul (28 February 1892 – 29 April 1979) was a director, writer and actor. He had important contributions to Turkish Cinema. Because of that, we select him as a

leading actor to see the steps between him and Sühely Eğriboz. In the same time period, we select Rozali Benliyan as a supporting actress. Both of them have The Eğriboz Number of two. This means that neither of them has taken part in a movie with Sühely Eğriboz.

We select Kıvanç Tatlıtuğ and Seda Bakan as a leading and supporting actors and actress from 2010s. Kıvanç Tatlıtuğ (27 October 1983-) is a model and actor. He is one of the highest-paid actors in Turkey. Seda Bakan (10 October 1985-) is best known for comedy film roles and she takes part in movies as a supporting actress. Both of them have The Eğriboz Number of two. These four examples show that the average path distance is less than three for any given nodes in Turkish Cinema graph.

Conclusion

The purpose of this research is to provide an initial analysis of graph of actors and actor relationships in Turkish Cinema. Based on this graph, our aim in this study is to identify the structure of interconnectedness, in which there is the center node that has the total shortest path value compared to all other nodes in the graph.

Although there are many actors who contribute to the presence and success of the Turkish Cinema, our results show it as part of small-world phenomenon with its lower intermediate number between any two nodes. %83.71 of the actors are connected to each other with a very short chain (path).

In this study, we conclude that the actor Süheyl Eğriboz who has the lowest closeness centrality, total shortest path and average actor number values is the center node of Turkish Cinema graph. The resulting of Süheyl Eğriboz as the center node in Turkish Cinema graph is an expected outcome. We compare his attributes with Kevin Bacon who is defined as the center node of Hollywood. Both of them have appeared as supporting actors in many movies and have a low appearance number when they are compared with other actors in Turkish Cinema and Hollywood. Süheyl Eğriboz appeared in 401 unique movies and it is %4.24 of all movies in our data sets. At this point, it is important to note that becoming the center node of any movie graph is not related to taking part in many films with same actors. The important point is that an actor needs to get roles in significant number of films with different actors, as many as possible.

In the past, many studies focused on the historical and conceptual development of Turkish cinema through films that shine on its director, screenwriter, and featured actor. This study aims to bring a new perspective to Turkish Cinema by shedding a light on the relationships (of different players) that were not revealed before. In addition to this, it provides a method that gives the opportunity to examine Turkish Cinema and its actors from a wider perspective: Establishment of the relationship -network- between these films and their actors (those who acted within the same film vs those who acted in other films). For example, the leading actresses/actors are one of the main elements that attract the attention of the audience while the co-stars and extras are there to ensure the integrity of the movie. This study will give a different perspective to the process of understanding the contribution of these elements in Turkish Cinema.

It should be kept in mind that the results and approach in this study have some limitations. We only collected data from IMDB and subset our total data according to type. So, our data does not have actors who appeared in TV series. This could result in changing the center node of graph, but we only would like to focus on cinema movies and actors who had roles in them. This study represents a current status of Actor-Actor interconnectedness

in Turkish Cinema. We collected data of actors and films that were available on the IMDB site up until June 2018. Currently, our graph shows that the actor that is in the center (center node) of these is Süheyl Eğriboz.

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Türk Sinemasında Ayrılma Dereceleri: Sühely Eğriboz Sayısı

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Genişletilmiş Özet

Çizge analizi; sosyal bilimlerde, biyolojide ve matematikte uzun süredir kullanılan bir yöntemdir ve insanlar, genler ve nesneler gibi farklı veri türleri olabilen düğümlerin birbirine bağlılığının anlık bir görüntüsünü sağlar. Bu anlık görüntü, düğümler arasındaki yapı ve ilişkiler hakkında başka türlü görülemeyen bazı özellikleri ortaya çıkarır. Böylece çizge analizi; üyeleri birbirine bağlı olan bir gruptaki bilgi, fikir ve hastalık gibi hareketliliğin yayılımını tanımlamaya yardımcı olur. Bu süreçte önemli olan unsurlardan biri de merkez düğüm olarak adlandırılan ve bir çizge içindeki tüm diğer düğümlere en kısa mesafeye sahip olan düğümü bulmaktır. Merkez düğüm; yayılım konusunda bir çizge içinde en yüksek bağlantı sayısına sahip düğümden daha fazla etkiye sahiptir. Bu konuda yapılan çalışmalardan biri de Hollywood'un merkezinde bulunan aktörü tanımlamayı amaçlayan ve Amerikalı aktör Kevin Bacon'ı merkezde yer aldığı *Kevin Bacon Sayısı* adlı çalışmadır. Çalışma ile birlikte, aktör Kevin Bacon'ın dünya üzerindeki herhangi bir aktöre ortalamada altı adımdan daha kısa bir mesafede erişim sağlayabildiği görülmüştür. Genel olarak, bu kavram *Ayrılığın Altı Derecesi* olarak adlandırılır- ki bu yeryüzündeki herkesin birbirinden ortalama altı adım uzakta olduğunu ifade eder. Bu çalışma; çizge kavramını ve analiz yöntemlerini kullanarak, Türk Sineması'nda rol almış aktörler/aktrisler arasındaki ilişki üzerinden merkez düğümü bulmayı amaçlamaktadır.

Ayrılığın Altı Derecesi terimi, çizge teorisindeki bağlantılı olmayı tanımlar. Sosyal bağlamda, her bireyin birbirine altı veya daha az adımdan oluşan bir zincirle bağlı olduğu anlamına gelir. Bu düşünce ilk olarak Frigyes Karinthy (1929) tarafından; *Her Şey Farklı* adlı 52 kısa hikâyeden oluşan kitap içindeki *Zincirler* adlı kısa hikâyede tarif edilmiştir. Bu hikâyede Karinthy, yeryüzündeki insanların bugün her zamankinden çok daha yakın olduklarını ve bir testin teorisini doğrulayacağı gerçeğini ifade etmektedir. Dünya üzerindeki 1,5 milyar insandan herhangi birini seçilmesi durumunda, biri kişisel bir tanıdık olan *beşten az* insan aracılığıyla seçilen kişiye ulaşabileceğimizi iddia etmektedir (Karinthy, 1929). Kurgusal bir hikâye olmasına rağmen, herhangi bir kişiye en az bir kişisel tanıdık aracılığıyla altı adımdan daha az bir yol ile ulaşma fikri, en büyük ağ yapısının mantığını anlamak için gerçekten önemliydi: İnsanlık. Bu hikâye, modern dünyamızdaki bireyler arasındaki (fiziksel) uzun mesafelerin varlığına rağmen, büyüyen insan ağlarının her bir birey arasındaki sosyal mesafeleri (dostluk, tanıdık tipi ağlar) kısalttığını göstermektedir.

İnsanların; gerçek dünyada birbirlerine ne kadar yakın olduklarını -küçük dünya fenomeni olarak adlandırılan yapıyı- göstermeyi amaçlayan araştırmalar, birçok farklı disiplinden kişinin ilgisini çekmektedir. Bu ilgiliye örnek olarak *Kevin Bacon Oyunu* olarak tanımlanan ve film endüstrisinde, özellikle de Hollywood'da aktörler arasındaki yüksek düzeyde bağlantılı olmayı açıklayan çalışma gösterilebilir. Küçük dünya fenomeni film endüstrisine uygulandığında; düğümler (ağdaki temel birimleri temsil eden) aktörler ve kenarlar (ağdaki düğümler arasındaki ilişkiyi gösteren) iki aktörün bir veya daha fazla filmde birlikte rol aldığı anlamına gelmektedir. IMDB'ye göre, 1898 ve 2000 yılları arasında yaklaşık iki yüz binden fazla uzun metrajlı filmde yaklaşık yarım milyon insan rol aldı (Watts, 2003, s. 94). Kevin Bacon sadece 60 filmde rol almasına –Hollywood için az bir sayı– rağmen, IMDB'de yer alan aktör ve aktrislerin yaklaşık %98'ine ortalama dört adımda erişebilmektedir.

Türk Sinemasında ayrılığın altı derecesini ve merkezi aktörünü bulmak için *iki taraflı çizge* kullandık. İki taraflı çizge *G*; düğüm kümesi *V*'nin V_1 ve V_2 gibi iki ayrık kümeye ayrılabildiği bir çizgedir, böylece *G* çizgesi içindeki her bir bağlantı V_1 ve V_2 düğümlerini birbirine bağlar (Harary, 1969; Wilson, 1996; West, 2000; Kleinberg & Tardos, 2006; Barrat, Barthelemy, & Vespignani, 2008; Barabási, 2016). Bu çalışmada, IMDB'de yer alan Türk Sineması'na ait veriler ile Aktör-Film iki taraflı çizgesi elde edilmiş, daha sonra bu çizgeden Aktör-Aktör tek taraflı çizgesi oluşturulmuştur. Bu çizgede; düğümler aktör/aktrisi temsil ederken, bağlantılar filmleri temsil etmektedir. Böylece, aynı filmde rol alan aktör/aktris arasında bir bağlantı kurulmuştur. Elde edilen çizgenin yönlendirilmemiş ağırlıklı bir çizge olmasından dolayı, bir düğümden çizge içindeki tüm diğer düğümlere olan en kısa yolu hesaplamak için Dijkstra algoritması kullanılmıştır (Cormen, 2009; Kleinberg & Tardos, 2006; West, 2000).

Bu çalışma kapsamındaki veri; IMDB sitesinde, film üretim yeri seçeneğinden Türkiye seçilmek suretiyle elde edilen ileri düzey arama sonuçlarındaki bilgilerin ağ kazıma yöntemiyle toplanmasıyla oluşturulmuştur. Böylece, 1914-2018 yılları arasında üretilen 9,441 tekil film ve bu filmlerde rol alan aktör/aktris bilgisine ulaşılmıştır.

Tek boyutlu Aktör-Aktör çizgesi 21,113 düğümden (aktör) ve bu düğümler arasındaki 314,862 bağlantıdan (film) oluşmaktadır. Çizge içinde yer alan aktörler/aktrisler ortalama 29 filmde rol almışlardır. En kısa yol ve yakınlık merkeziliği değerlerine göre Sühely Eğriboz, Nubar Terziyan ve Renan Fosforoğlu Türk Sineması çizgesi içinde olası merkezi düğüm için öne çıkan aktörler olmuştur. Bu aktörler arasında, her bir ayrılık derecesine göre çizge içinde ulaşabileceği aktör/aktris sayısına göre yapılan sınıflandırma sonucunda Sühely Eğriboz'un merkez düğüm olduğu sonucuna ulaşılmıştır. Sühely Eğriboz'un, çizge içindeki herhangi bir diğer aktör/aktrise ortalama 3.142 adımda ulaşabildiği görülmüştür.

Anahtar Kelimeler: Sinema, Ağ, Derece, Ayrım, Çizge, Sinema.