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- Friends?... Fair enough.

An analytical model of utility based on social networks and fairness[1]

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Abstract:

Social network analysis is one of the fields in the social sciences which went through a huge development in the last two decades. With the availability of newer tools and methods, in-depth analysis of huge networks became possible resulting in important results at various fields. Despite this advancement, the strength of a tie – a foundation of this theory – is still a hot topic in SNA. This paper aims to provide another approach to tie strength, which is based on one of the internal properties of agents manifesting in human interactions – fairness. An analytical model of tie strength is introduced focusing on fairness concerns of people towards each other. The model is analyzed and an experimental method is shown to test the model. Also pilot results are introduced.

Keywords: fairness, social network analysis, tie strength

1. A short introduction – Social network analysis

A social network consists of a finite set or sets of actors and the relation or relations defined on them [1]. Actors can be people, institutions, or groups of people or institutions. Network theory emphasizes that while standard sociological research focuses on an individual element of the society, a fundamental element of being a society is the connection, or relationship between the elements forming the society [1]. Being in a social network has many advantages. It produces various kind of capital, for example social capital or sometimes economic capital. Other very important roles of social networks are giving

1 This work was partially funded by TÁMOP (TÁMOP-4.2.1/B-09/1/KMR-2010-0005); the experiments were funded by the Doctoral School of Sociology, Corvinus University Budapest

way to spreading of information, new ideas, promoting and producing collective action etc.

Since there are many approaches to functions of networks, the number of possible parameters defined as ties is also huge. Generally the ties are defined according to the processes they explain – or the conducted research.

The use of more complex indices to as tie strength is practical in the research of personal relationship and social support. Also social relations – unable to be described by only a simple parameter – are crucial in economic actions as well [2]. There were many attempts to capture the complex nature of social relations using multiple-item indices. For example [3] uses scales for love, commitment and investments in close personal relationships.

Determining network tie strength is a problematic task for network sampling, as people often refer to different notions, different concepts. In [4] the authors found that the best measure for tie strength was the closeness or intensity in a research of best friend ties. Also duration was more important in this regard than kinship and frequency was only weakly associated with duration or closeness. In a study of searching for jobs Wegener determined some aspects of tie strength; intimacy, formality and leisure [5]. Closeness, duration and frequency were strongly related to intimacy, what should be the most consequential property of social ties.

Some of these properties can be measured explicitly – frequency, duration –, while some others – closeness, leisure, intimacy etc. – can only be determined subjectively. Objective measures are relatively easy to obtain and they can be compared to the nodes and ties. On the other hand subjective measures are sometimes hard to interpret, but are more influential in certain processes. They're collected using surveys, which have their limitations ([6] gives a summary on these problems) and thus give subjective opinion, or 'subjective strength'.

One of the most productive approaches using a subjective measure was Granovetter's 'strength of the weak ties' hypothesis [7], [8]. Granovetter suggested a simpler classification of ties (strong and weak) and associated several phenomena with these types. I classified this measure as subjective as it's composed of multiple factors including subjective measures as well.

Relationship between people can also be described by the fairness of their behaviour towards each other. People generally have certain internalized fairness norms, but the application of fairness norms with various people is different. We are willing to give, but not to everybody. We're also willing to punish people, but do not care to punish everyone – especially when punishment is not 'free'.

Objective measure	Subjective measure
Existence	Love
Duration	Commitment
Kinship	Closeness
Frequency	Intensity
Reciprocity	Intimacy
	Formality
	Leisure
Fairness concerns, fair behaviour	

Table I.: Objective and subjective measures of network strength

Each of these measures is clearly assigned either as objective, or subjective measure. Fairness however is only partially objective. People may be asked how fairly they would behave, they'd also even provide answers, but the correct test of fairness is a real situation. Before discussing these methods in detail, a short review of fairness models is given and the integrated fairness network (IFN) model is introduced.

2. A short introduction – fairness models

The selfishness principle is a general assumption in economics. It means, that the only goal of the atomistic actor is to maximize its own well-being, thus has no concern for the other actors' well-being (nor for the effect of their actions on others). In impersonal exchanges – markets – this assumption may be valid, but behaviour in interpersonal exchanges can't be explained by selfishness. Many economists have pointed out that people do care for others' well-being in some situations [9-12] (for further references see [13], [14]).

The existence of other norms and behavioral patterns was proven in numerous experiments [15-17]. People often not only care for others' well-being, but also are prone to punish those who treat them badly [18-22]. Also the effect of certain types of relationship was shown [23], [24].

Based on experimental methods and results several analytical models of fairness, altruism and reciprocity were developed [25-28]. A more thorough review on these models may be read in [29], [30].

The most important feature of these models – from the point of view of this paper – is the model of *inequality aversion* [26]. The main assumption of this model is that people are hurt by perceived inequality in every aspect. Thus in real situations people are hurt if they get either better, or worse off than others. Fehr and Schmidt define this assumption in a utility model describing the utility depending on the payoffs of the individual, and the other individuals – they tested the model using game theory, so the notion of payoff is used commonly in this paper as well irrespective of its non-material meaning in some situations. This model structure emphasizes that the individual always compares payoffs to its own payoff. Fehr and Schmidt also point out that for example in firms, the effect of comparative wages on job satisfaction is very strong. Also they refer other literature showing a strong relationship between an individual's job satisfaction and the difference between the earned wage and the expected wage for a given job.

The structure of the model is the following [26]:

$$U_i = \pi_i - \frac{\alpha_i}{n-1}\sum \max\{\pi_j - \pi_i;0\} - \frac{\beta_i}{n-1}\sum \max\{\pi_i - \pi_j;0\}$$

(1)

In this model π denotes the payoff of the individuals and the parameters α and β denote the individual's fairness preferences. According to this model, fairness dictates equal sharing, so when this is violated, the fairness concerns 'kick in' to decrease utility. The two terms following the payoff denote the fairness concerns, as they are bigger than 0 only if an unequal share is given.

Generally this model says, that an individual's fairness preferences shall be interpreted as the 'strength' of these two terms – as such, they're described by α and β. Also note that this model assumes quantifiable payoffs. The comparison of payoff is made with every other person in the given situation. So if the parameters (α, β) have a relatively big value, inequality has a huge negative impact on the individual's utility, the individual has strong fairness preferences.

Fehr and Schmidt give numerous experimental results which are well explained by this model. The model is applied to ultimatum games (see [15] on the ultimatum game), public good games and even the prisoner's dilemma giving good explanation for each game.

Since this model contains differentiation between different individuals, the assumption of inequality aversion may be extended by raising the question of inequality of people in the inequality aversion. We are more 'sensitive' to inequality versus one person than versus another. It was also shown in experiments that in public good games, the contribution – a way of promoting equality – is substantially larger when the group consists of friends [31].

Taking into account the difference between the relationships between people – the ties in their network – and inequality aversion, a model can be created incorporating both of these factors influencing human behaviour.

3. The integrated fairness network (IFN) model and its field of application

As described in the previous section concerns for equality, fairness and the relationships all influence behaviour. The IFN model has the following analytical form for dyadic interactions:

$$U_i = \pi_i - \alpha_i c_j \max\{0, \pi_j - c_j \pi_i\} - \beta_i c_j \max\{0, c_j \pi_i - \pi_j\}$$

(2)

This model extends the model proposed by Fehr and Schmidt by including an additional parameter c_{ij} into the expression. This parameter describes the tie strength between the actors, a number without dimension, between 0 and 1.

If the strength of the tie is 0 ($c_{ij}=0$), then the individual does not have any fairness concerns towards the other actor. In this case (2) is simplified to $U_i=\pi_i$, meaning that an individual cares only for its own material well-being. If the strength of the tie is 1 ($c_{ij}=1$), then the individual's fairness norms dictate that equity is fair. In this case (2) is equivalent to (1) for dyadic interactions, the model proposed by Fehr and Schmidt.

The role of c_{ij} is dual in this model. It is a multiplier of the effect of the fairness concerns (the negative terms). It means that when a person is interacting with someone important to him (somebody with a strong tie), the effects of fairness concerns are proportional to tie strength. The more important the parties in the interaction are to each other, the stronger the fairness concerns' effects are. In other words, people are nicer with their friends.

Fairness concerns also depend on the strength of a tie. If somebody is interacting with a friend (c_{ij} is close to 1), then equality is percieved as fair behavior. In other cases an unequal outcome is preferred – this goes against the assumption inequality aversion. This means that fair behavior is percieved to be different when interacting friends and when interacting strangers.

In analytical terms, the IFN model's maximum (the maximum of the individual's expected utility) is strongly influenced by c_{ij} (unlike in the model of inequality aversion, where it always corresponds to equal outcomes). Just like according to the phrase 'all people are equal, but some are more equal than others' [32], this model says, that we perceive different levels of equality as 'fair' depending on what relationship we are in with the other person.

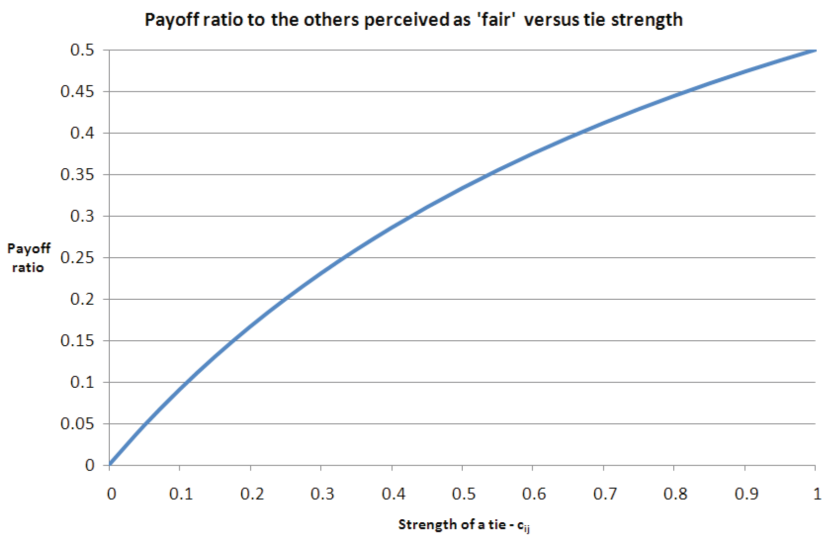


Figure I.: payoff ratio perceived as 'fair'

Figure I. shows how 'fairness' is perceived in different ties. In this figure – and in the following explanation of the model – I assumed a simple situation, a dictator game. It is a simple voluntary sharing of goods. A person – or player i – receives a certain amount of good and is given the opportunity to share with another person.

This figure only shows where the fairness concerns does not decrease the utility when playing a dictator game with another person. In other words, giving this much does not 'hurt'. Nor does the person feel guilt because of not giving enough to the other person, nor does he feel envy that the other got too much. So if the tie is strong, the preferred payoff – speaking about fairness only – is the equal splitting. If the tie is not very strong (but >0), then the preferred payoff ratio is somewhat unequal. If there's no tie at all, selfish behavior is predicted by the model.

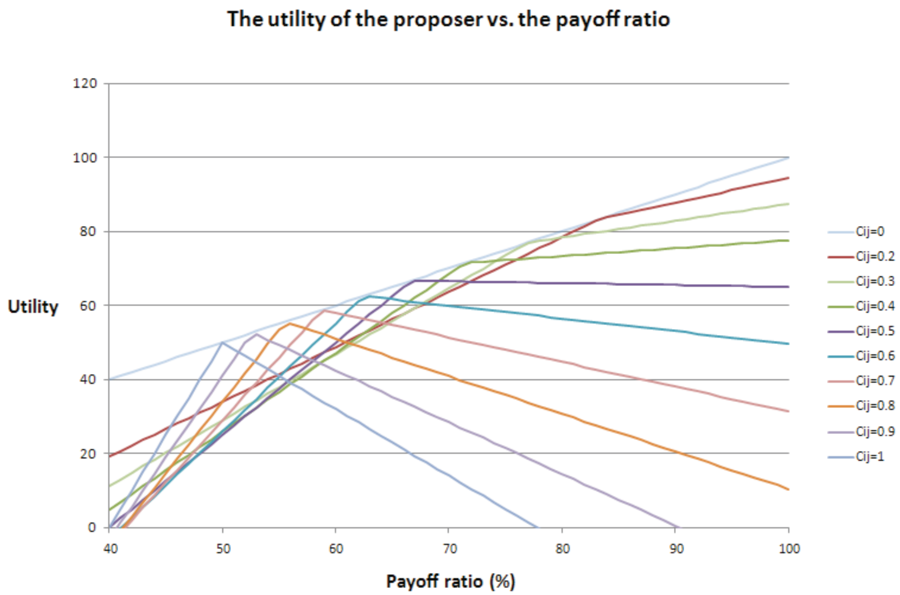


Figure II.: the utility given by the IFN model (α=2 and β=1.4)

The functions in Figure II show the model at given tie strengths. Note that as the stronger the tie gets the more equal split of goods results in the maximal utility. But under a certain strength the maximal utility corresponds to the completely unequal splits, giving nothing to the other person (with the current values given for Fig II. it's between 0.4-0.5 and below).

In the literature describing experimental economics, the notion of 'Perfect Stranger' (PS) is often used. It refers to a person, with whom the subject of the experiment is not related in any ways [33]. Intuition would suggest that in the IFN model it would mean that the tie strength versus a PS is 0. However this is not the actual case. Several experimental studies of DG show that people are indeed willing to share goods with PSs voluntarily [17] especially if their decisions are heavily guided by norms [34].

This suggests, that being in the same group with the other party to share with – it may be no less in this case than just being a human being! – in itself presents a connection, thus yield some preexisting fairness concerns. But computer experiments also show for example that if people know they're playing UG with a computer, their acceptance threshold changes [35].

The IFN model also presents a different approach to fairness norms.. If we assume that people always try to behave as fairly as their norms dictate – since we accept utility maximizing behaviour as a dominant behaviour and assuming the IFN model we do so –, then we can also conclude that the tie strengths may be examind by forcing people to make choices where their fairness norms should play key roles.

So given such choices an individual's ties can be mapped. Mapping ties is commonly used in sociometry, but also uncovering informal networks is very important at organizations or certain groups. Since the IFN model describes ties as an analytical quantity – measurable and comparable -, the network ties may be described by c_{ij} values, thus a network can be mapped. Using these games along with survey methods the networks can be explored in a different way, asymmetries and relations can be explored

In practice the games are useful for exploring informal networks before forming a formal network. This can be put into good use in firms before creating research groups or workgroups. Sometimes it is useful to have existing informal networks among employees [36] in workgroups, and also the fairness norms in the group may be important – especially when the group will face situations requiring cooperation. The IFN model and the games introduced in the next section help in examining these norms, and exploring the networks.

4. **Experimental methods and results**

The experimental setup

Of course mapping these ties means that the individual is put into such situations with everybody who is important in the individual's network; or a group of people is forced into such situations with each other. This can't be realised with ordinary means, but the tools of experimental economics and game theory may be used.

The two basic types of games used in fairness research are the ultimatum game (UG) and the dictator game (DG) [15]. Both games implement sharing of certain goods. While DG is a voluntary sharing of a given quantity of goods, UG is more similar to bargaining. In the UG there's a 'Proposer' and a 'Responder'. The quantity of goods to share is given and the Proposer offers an amount of that good to the Responder.

The Responder then decides if he accepts the offer. If he does, then the quantity of goods is given to both parties, while if he refuses, neither of them get anything. In all of the games, the quantity of goods to share is known to the players, but their identity is kept hidden from each other. So by using ordinary UG or DG the tie strength can't be investigated.

However when these rules are changed and the Proposer gets to know the Responder's identity, both UG and DG results change. In researching the application of the IFN model, such modified forms of UGs and DGs were used.

An experimental group consists of 6 people, 2 perfect strangers, and 4 non-strangers (preferrably friends). The first step of this experiment is a survey, where the tie is mapped using sociometrical methods (selecting tie strength on a scale of 0; 1-5). The experimental games discussed in this paper involve two person DGs, but also note that 3 person DGs along with 2 and 3 person UGs were also conducted. There were a different number of games (50-60 per person) for the test groups and the number of the games was not known for the group at the beginning of the experiment to avoid trend effects to some degree. Also according to the basic rules of experimental economics, the players were given money depending on the outcome of the experimental games.

The experimental results and model parameters

Based on the DG-s and UGs the strength of the tie between two players can be determined. If a player is a Proposer in a two person DG, then the offer given by the player depends on strength of the tie to the Responder. If the strength is below a given level, then the Proposer will propose 100-0 as a division. (In the analysis I assumed that $\alpha=2$ and $\beta=1.4$.) If the tie is strong, then an equal split (50-50) is proposed in the DG.

As Fig. II. shows the strength of a tie (from the Proposer to the Responder) can be determined based on the offer of the Proposer until a given level. However if a 0 offer is given, then the strength of the tie can only be determined to be within a given interval (0-0,4). For example if the offer was a 65-35 split then the tie strength is approximately 0.55.

This situation is more complex in UGs. In these games the Proposer has to approximate the expectations of the Responder. Namely the Proposer has to approximate how strong the Responder's fairness concerns are. (Note that the Proposer's identity is unknown for the Responder, so the decision of acceptance or refusal of the offer does not depend on their relationship, but on the Responder's own fairness concerns.) If the Responder accepts the offer, then it was in the interval defined by the Responder's fairness concerns, while if the Responder refuses the offer, then it was not. Hence if multiple UGs are played, the basic fairness concerns of the players can be mapped. The offers from the Proposer on the other hand reflect his basic fairness concerns.

As noted before, the experimental sessions also included 3 person DGs and UGs. In these games the Proposer had to make an offer for two responders (who knew each others' identity). In UGs one of the responders had the opportunity to react, the other was just a 'passive' player. The explanation of this game is not in the scope of this paper (nor are results described). The 3 person DG is a good way to make a Proposer differentiate between two other players (his identity is still unknown). So if Responder 1 is a friend of the Proposer and Responder 2 is a PS, then it's expected from the Proposer to give an offer reflecting this difference, for example 50-50-0. A very interesting situation occurs when the proposer plays with two friends. In this case the offer clearly shows if the Proposer feels differently towards the Responders – the most interesting phenomena occur if the

Proposer reports the two Responders as equally important in the survey. In this case even the slightest difference between the offers has a meaning.

4.1. Case study – a common grudge

There were 11 experiments conducted so far. One is shown (group #7) in this paper in details as a case study to show an interesting observation and general data from another one (group #9) is shown as a short comparison with previous experimental data.

Group #7 consisted of a usual setup of 4 friends and 2 perfect strangers. The group of friends had an interesting composition as it included a brother and a sister which presents a huge bias. There was also a member who barely knew two of the others – so this group was far from the ideal group. Note that it's hard to gather adequate groups, as the subjects interpret 'friend' differently. (For some subjects 'friends' were indeed close friends, for others they were simple classmates). This mixed pattern of relationship is shown in the socioletric survey as well, seen in this table below. (The colours correspond to the experimental results' conclusions, it's discussed later.)

Reported rel.	F1	F2 (PS)	M1	F3	F4 (PS)	F5
F1		0	5	4	0	0
F2 (PS)	0		0	0	0	0
M1	5	0		3	0	0
F3	5	0	2		0	4
F4 (PS)	0	0	0	0		0
F5	0	0	0	3	0	

Table II.: The reported relationships (survey results)

So the reported relationships also show that the experimental group was not perfect (0 – unknown; 1-5 subjective friendship level). The two real PSs (F2 and F4), but to some extent F5 can also be classified as a PS, as she only know one other person in the group, F3 (F – female; M – male). Also their tie as they report it is not very strong.

The strength of the ties was calculated using DG results only in this case, with the method introduced in the previous section. The following table shows the tie strengths based on the two person DG median offers. There were 1-3 games played for the players – some players weren't DG Proposers at all, since the computer assigns pairs randomly. The colour codes represent the following: green – consistent behaviour (with self and/or survey); red – the common grudge (presented in details); brown – sister and brother (presented in details); blue – not clearly consistent/inconsistent.

Calc. Rel.	F1	F2 (PS)	M1	F3	F4 (PS)	F5
F1			1	0.15	0.35	
F2 (PS)	0.78		1	0.78	0.44	0.78
M1	1000	1		0.19	0.54	0.22
F3	1		0		0.33	1
F4 (PS)	0.61	0.26				
F5	0.19	0.15		0.62	0.35	

Table III.: tie strength (c_{ij}) calculated with the IFN model

Missing numbers correspond to that some people weren't assigned as proposers with others. As the numbers in green show the behaviour and the reported relationships are mostly consistent. It's important here to point out the results of F2. Despite being a PS she consistently exhibited strong fairness concerns towards the group members, and less strong towards the other PS. So she consistently did not behave as a PS, which has to do with her general attitude towards other humans.

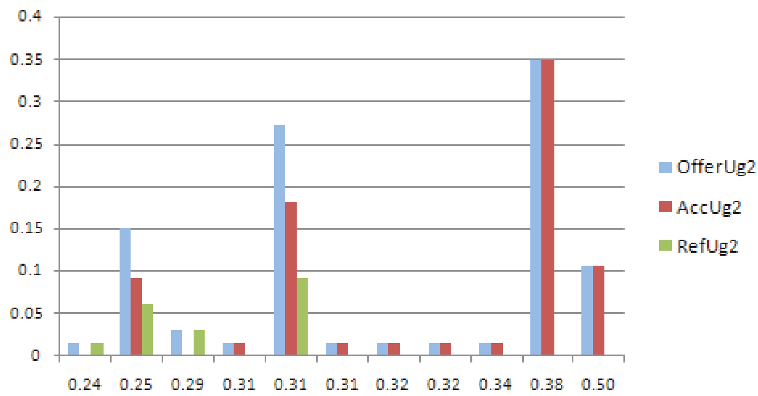
The most important behaviour was shown by F1, M1 (sister-brother) and F3. The survey has shown, that the brother and sister had a good relationship, and a less strong one with F3. In the experiment though, it seemed that they had a common grudge against F3 – denoted with red. They consistently (twice) gave unequal share in the DG to F3. Also F3 did give a low amount to M1 – still we have to emphasize that Proposer anonymity was assured during the experiment.

The behaviour of the brother and sister was also very interesting (brown). In the survey, they reported a strong relationship, but DGs proved that it's biased in favour of the sister. She gave an equal split in the DG, but the brother gave all of the goods to the sister (that's the reason for the 1000 value of c_{ij} in this case). Clearly, this couldn't have been shown using the survey.

As this table shows the survey results and the experimental results were consistent in most of the cases. The contradicting data showed an interesting pattern – the brother and sister showing a common grudge against a third person – which again was not presented in the survey.

4.2. A general result compared with previous experiments

The results of the experiment conducted with another group gave a better general picture of fairness concerns. The group consisted of university group members, so the original experimental setup of 4 friends and 2 PSs was overridden this time. The players in these two experimental groups knew each other. Their relationship was mixed (from simple classmates to good friends), they were all girls. However the results were surprising.



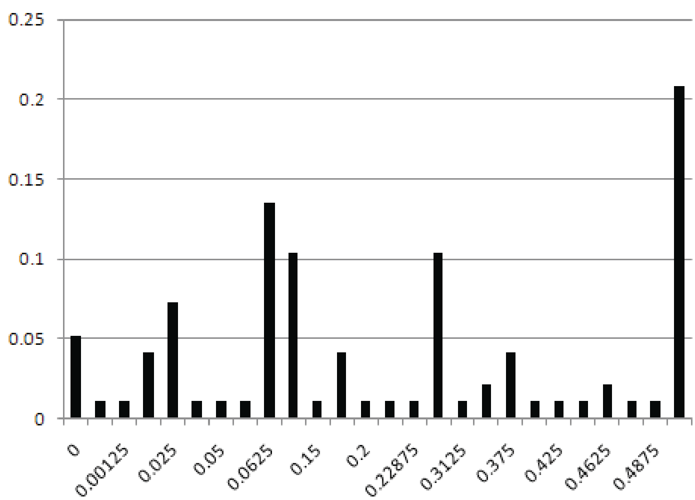


Figure III.: results of DG (right) and UG (left)

The right figure shows the offers in DGs in the group, while UG behaviour is shown in the figure to the right (Blue – offers; red – accepted offers; green – rejected offers). According to the earlier results [17] the DG shows that people do not care for the other. Note, that in that case, anonymous people play the game. Violating the rule of anonymity did in fact show, that people do care for others, if there's a connection between them as 20% of the propositions was an equal split in the DG. Also note the peaks in the propositions at third and tenth of the total amount of goods.

The figure at the left on the other hand is in line with earlier results at low propositions. A key difference in case is that we see a peak at 0.38 meaning that when somebody received 38% of the goods as an offer, he or she accepted it! This happened in 35% of the UGs, which is a substantial result. In these UGs the total amount of goods was 8000HUF and this proposition corresponds to offering 3000HUF to the Responder and keeping 5000HUF – so in this case round numbers also played a role in the decision. The total amount of goods and the fact that everybody knows that they were only related loosely with each other explain this frequent offer and the high acceptance rate.

4.3. **Future steps in the experiments and general remarks**

Realizing experiments with such complex underlying assumptions has many difficulties. Due to some technical barriers I wasn't able to completely separate the PSs from the friends group. This introduces sympathy to the experiment which presents a bias in the results. Also since to adequately map a network a relatively large number of experimental rounds is required, the experiment takes a long time (~30-40 minutes). Thus some trend effects and also fatigue effects bias the experimental results. Since in some cases the games are not very easy to understand (especially three player games), and the UGs and DGs change randomly, errors are also committed (a few subject indicated that they made a mistake when making an offer in a DG or UG).

Also the explanation of the behaviour is given based on data only. Another post survey asking questions about specific behavior patterns (like the common grudge here) shall be introduced if interesting phenomena are seen in the results.

Even though randomity is assured in the experiments, it may result in the same pairs playing the same roles in two consequtive turns, which is not practical – it gives an immediate opportunity for reconsidering the Proposer's decisions. It'd also be practical to assign 'interesting' pairs during the experiment to further investigate their behavior. It also involves real-time analysis – a difficult, yet not impossible task to realize.

The future develpoment of these experiments (besides the mentioned technical upgrades) means generally focus on a given game type as the current experiments take a quite long time (with the pre and post surveys). The frequent change of games causes mistakes, which may distort experimental results. A shorter experiment with less game types yields more accurate results (less mistakes, and weaker trend effects), but yields more costs (to preserve real-life behaviour the rewards shouldn't be decreased).

5. **Conclusions**

In this paper a new approach to the strength of a tie was introduced and some experimental results were shown. The IFN model shown in this paper assumes that the tie strength between people is mainly reflected in their behaviour towards each other. Thus this model mainly describes the situations where the payoffs of players is known so that players can judge if they're better or worse off than others due to their behaviour – thus the fairness concerns can come into play.

Analysis has also shown that the model explains interesting phenomena which were observed in earlier experiments and the results introduced point out other interesting behaviour patterns. The future development is mainly aimed at experimental fields. Currently it's difficult to give clear values to the tie strengths, because the basic fairness norm strength (α; β in the model) is relatively hard to determine. Also another limitation of the experimental use of this model is the network size. With a network size of 6, 15 pairs can be created randomly, thus it requires at least 5 turns (3 pairs per turn) to have everybody play one game turn with everybody else, not even considering the different roles in the games. Of course only one game turn is not enough to draw conclusions.

The IFN model is an important change to previous fairness models, since it connects two distant fields in sociology: social network analysis and fairness theories. As such it will hopefully present a more measurable quantity for describing tie strength contributing to both fields.

References

[1] S. Wasserman and K. Faust, *Social network analysis: Methods and applications*. Cambridge University Press, 1994.

[2] M. Granovetter, "Economic Action and Social Structure: The Problem of Embeddedness," *The American Journal of Sociology*, vol. 91, sz. 3, o. 481-510, Nov. 1985.

[3] M. Lund, "The development of investment and commitment scales for predicting continuity of personal relationships," *Journal of Social and Personal Relationships*, vol. 2, sz. 1, o. 3, 1985.

[4] P. V. Marsden and K. E. Campbell, "Measuring Tie Strength," *Social Forces*, vol. 63, sz. 2, o. 482-501, Dec. 1984.

[5] B. Wegener, "Mobility and the Structure and Sex Composition of Social Ties," *Pres. Int. Sociol. Assoc. Res. Common 28*, 1989.

[6] P. V. Marsden, "Network data and measurement," *Annual review of sociology*, vol. 16, sz. 1, o. 435-463, 1990.

[7] M. S. Granovetter, "The Strength of Weak Ties," *The American Journal of Sociology*, vol. 78, sz. 6, o. 1360-1380, Máj. 1973.

[8] M. Granovetter, "The Strength of Weak Ties: A Network Theory Revisited," *Sociological Theory*, vol. 1, o. 201-233, 1983.

[9] A. Smith, *The Theory of Moral Sentiments*. 1761.

[10] G. S. Becker, "Altruism, Egoism, and Genetic Fitness: Economics and Sociobiology," *Journal of Economic Literature*, vol. 14, sz. 3, o. 817-826, Szept. 1976.

[11] P. A. Samuelson, "Altruism as a problem involving group versus individual selection in economics and biology," *The American Economic Review*, o. 143-148, 1993.

[12] A. Sen, *Moral codes and economic success*. Suntory-Toyota International Centre for Economics and Related Disciplines (STICERD), 1993.

[13] B. Janky, "Szolidaritás and jóléti preferenciák," 2005.

[14] D. M. Hausman and M. S. McPherson, "Taking Ethics Seriously: Economics and Contemporary Moral Philosophy," *Journal of Economic Literature*, vol. 31, sz. 2, o. 671-731, Jún. 1993.

[15] W. Güth, R. Schmittberger, and B. Schwarze, "An experimental analysis of ultimatum bargaining," *Journal of Economic Behavior and Organization*, vol. 3, sz. 4, o. 367–388, 1982.

[16] A. E. Roth, V. Prasnikar, M. Okuno-Fujiwara, and S. Zamir, "Bargaining and market behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: An experimental study," *The American Economic Review*, o. 1068-1095, 1991.

[17] R. Forsythe, J. L. Horowitz, N. E. Savin, and M. Sefton, “Fairness in simple bargaining experiments,” *Games and Economic Behavior*, vol. 6, sz. 3, o. 347-369, 1994.

[18] E. Fehr and S. Gächter, “Fairness and Retaliation: The Economics of Reciprocity,” *The Journal of Economic Perspectives*, vol. 14, sz. 3, o. 159-181, Summer. 2000.

[19] E. Fehr and S. Gächter, “Cooperation and Punishment in Public Goods Experiments,” *The American Economic Review*, vol. 90, sz. 4, o. 980-994, Szept. 2000.

[20] E. Fehr and S. Gächter, “Altruistic punishment in humans,” *Nature*, vol. 415, o. 137-140, 2002.

[21] S. Bowles and H. Gintis, “The Evolution of Strong Reciprocity: Cooperation in Heterogeneous Populations,” *SSRN eLibrary*, Szept. 2003.

[22] H. Gintis, “Strong reciprocity and human sociality,” *Journal of Theoretical Biology*, vol. 206, sz. 2, o. 169-179, 2000.

[23] G. E. Bolton and R. Zwick, “Anonymity versus Punishment in Ultimatum Bargaining,” *Games and Economic Behavior*, vol. 10, sz. 1, o. 95-121, Júl. 1995.

[24] B. Vollan, *Kinship and friendship in a trust game with third party punishment*. Philipps-Universität Marburg, Faculty of Business Administration and Economics, Department of Economics (Volkswirtschaftliche Abteilung), 2008.

[25] G. E. Bolton and A. Ockenfels, “ERC: A Theory of Equity, Reciprocity, and Competition,” *The American Economic Review*, vol. 90, sz. 1, o. 166-193, Márc. 2000.

[26] E. Fehr and K. M. Schmidt, “A Theory of Fairness, Competition, and Cooperation,” *The Quarterly Journal of Economics*, vol. 114, sz. 3, o. 817-868, Aug. 1999.

[27] D. K. Levine, “Modeling altruism and spitefulness in experiments,” *Review of economic dynamics*, vol. 1, sz. 3, o. 593-622, 1998.

[28] M. Rabin, “Incorporating Fairness into Game Theory and Economics,” *The American Economic Review*, vol. 83, sz. 5, o. 1281-1302, Dec. 1993.

[29] A. Gulyás, “A méltányosságelmélet alapjai,” *Közgazdasági Szemle*, vol. 52, sz. 2, o. 167-183, Febr. 2007.

[30] D. Engelmann and M. Strobel, *An experimental comparison of the fairness models by Bolton and Ockenfels and by Fehr and Schmidt*. Sonderforschungsbereich 373, 2000.

[31] M. A. Haan, P. Kooreman, and T. Riemersma, “Friendship in a Public Good Experiment,” *SSRN eLibrary*, Ápr. 2006.

[32] G. Orwell, *Animal Farm - a fairy story*. United Kingdom: secker and Warburg, 1945.

[33] C. F. Camerer, *Behavioral Game Theory: Experiments in Strategic Interaction*. Princeton University Press, 2003.

[34] J. P. Henrich, R. Boyd, and E. Fehr, *Foundations of human sociality*. 2004.

[35] S. Blount, “When Social Outcomes Aren’t Fair: The Effect of Causal Attributions on Preferences,” *Organizational Behavior and Human Decision Processes*, vol. 63, sz. 2, o. 131-144, Aug. 1995.

[36] D. Krackhardt and J. R. Hanson, “Informal networks: The company behind the charts.,” *Harvard Business Review*, vol. 71, sz. 4, o. 104-111, Júl. 1993.