Let us Date!: A model of dating

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Abstract. In this project, we have investigated a simple model of the social activities of dating using agent based modelling. In our model, we have a bipartite set of agents/persons (Romeos and Juliets) moving randomly in the model space, who pair up and break up according to a simple set of rules. In brief, each person has a radius of influence. At each time step, each person randomly and independently chooses a person of the opposite sex in this radius. If two persons choose each other, they pair up and move together through the model space. At a later time step, they break up if either of them chooses a person other than their partner, who also happens to choose them. This process is repeated through the life span of the simulation. We did different studies by varying parameters of the system. In particular, we studied what our model predicts about relationships in (idealized) Eastern and Western cultures. We assumed that, in general, there is greater interaction towards dating in Western cultures and thus, there should be more but shorter relationships in western culture and fewer but longer relationships in Eastern culture. However, our model shows there should not be any significant difference based on just this reason. Thus, it seems that there will be other social factors strongly influencing the interactions in real life. Among other interesting results, there seems to be a possibility of a power-law distribution for the life span of couples. We believe this simple model can be extended to many different areas e.g. chemical reactions and molecular interactions.

1 Introduction

The social behaviour of dating has attracted intrigue and scientific research. Many well known scientists have tried to make sense of this complex phenomena in the past. Strogatz [1] discusses about love affairs in his book and an earlier short seminal article on dating . He showed that even just for two individuals, Romeo and Juliet, under the simplest conditions, the love and hate dynamics are nonlinear. Rinaldi and Gragnani [2], and Sprott [3] extended his work and got similar results. The basic ideas in these papers are very simple - They assume there are four potential love feeling conditions for a person, which Strogatz [1] calls Eager beaver, Narcissistic nerd, Cautious lover, and Hermit. For Eager beaver, Romeo is positive towards his own feeling as well as Juliet's;

for Narcissistic nerd, Romeo is positive towards his own feelings but negative towards Juliet's; for Cautious lover, Romeo is negative towards his own feelings but positive towards Juliet's; For Hermit, Romeo is negative to his own feelings as well as Juliet's. The realistic situation is much more complex than these simple conditions, which means there is no comprehensible way to describe love feelings between two given persons. In our paper, we go a step above. We study individuals as a collection - the society, which includes a lot of these nonlinear dynamic love feeling processes. In fact, we believe, given this complexity, we can reasonably model love between individuals as a random interaction. As far as we know, there have been no models describing dating at the level of the society itself.

In this study, we build a simple model of the social behaviour of dating. Dating can be viewed as an interaction between a bipartite set of agents who come together and go apart according to some rules. We constructed a simple model which is explained further. Using Netlogo [4], we ran agent based simulations and tried to discover various interesting patterns. The few parameters that our model has can be tuned to correspond to cultural differences and different societies. Making a few assumptions, we setup a simple study of difference in dating in Eastern and Western cultures. Eastern cultures, generally being more conservative, we can assume that there are less interactions geared towards dating (in our model, this means smaller radius of influence and lower density in emotional space) compared to Western cultures. We investigated the effect of various parameters such as radius of influence, ratio of the sexes, population density on measures such as maximum and average life span of couples, number of couples, breakup rates etc.

2 The Model

In our model, the actors (Juliets and Romeos) are moving around in a fixed space. The number of actors gives us the *density*. Each actor has a *radius of influence*, which is the radius in which they influence other actors. Thus, if they have to attract a mate, they would do so in this radius.

At each time step:

- Romeos and Juliets move in space, by default a single step in a random direction.
- Each person randomly and independently chooses a person of the opposite sex in the radius.
- If two persons choose each other, they *Hook up* and move together.
- *Break up*: If either partner (of a pair) chooses somebody else who also chooses him/her, the couple breaks up. Note that either partner can break up a relationship.

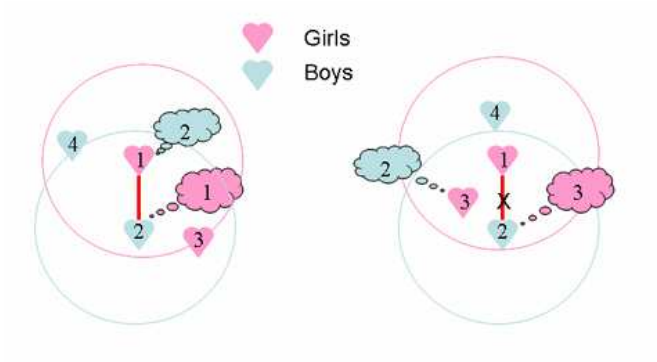

FIGURE 0: The Hookup-Breakup Model

3 Simulation Setup

We used agent based modelling, simulating our model in *NetLogo*. *NetLogo* is a convenient and powerful environment for agent based modelling. The basic landscape we used was a 20 X 20 toroidal grid. If we have 100 Romeos and 100 Juliets, this would give us 200 actors over a space of 400 units or 1 actor for 2 unit space. *NetLogo* is also convenient for gathering statistics and getting plots. *Behaviorspace* in *NetLogo* allows you to gather statistics over multiple runs (experiments). We ran multiple experiments to gather average statistics and collated data in a spreadsheet to construct our final results.

NetLogo

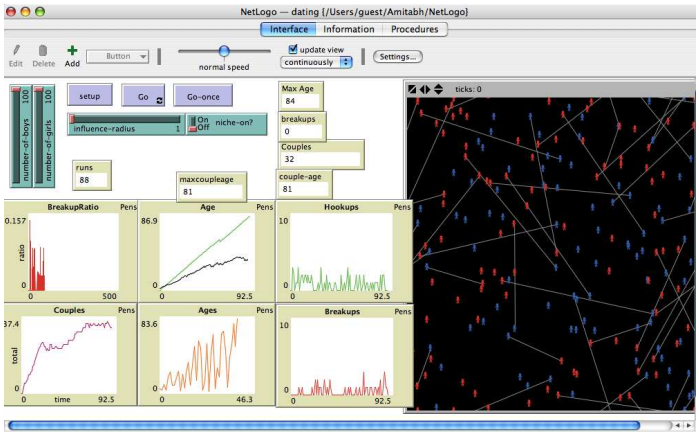

FIGURE 1: Dating in the NetLogo world

4 Results

The Netlogo simulation was done for 100 Romeos and 100 Juliets over a toroidal grid of 20 X 20 in NetLogo. Figures 4, 4, 4 show the effect of the *radius of influence* on the number of couples, the mean duration and maximum durations of the relationships. As can be seen, the graph has an extrema near the radii of 4. We think that this particular radii is due to the amount of grid space we have chosen in our model i.e. at some particular ratio there is an extrema. This does however show the nonlinear relationship between the radius and the other quantities.

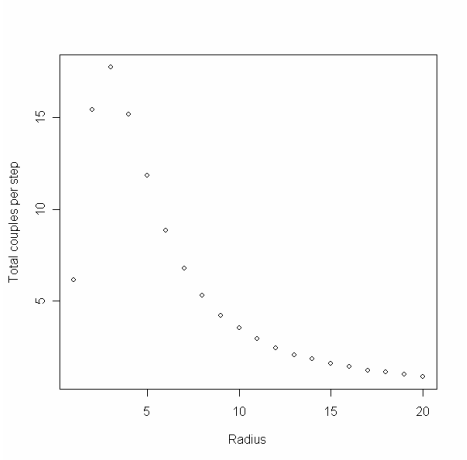

FIGURE 2: Radius vs. Couples

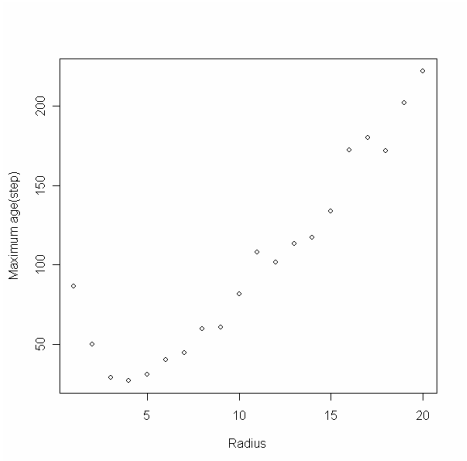

FIGURE 3: Radius vs. Age

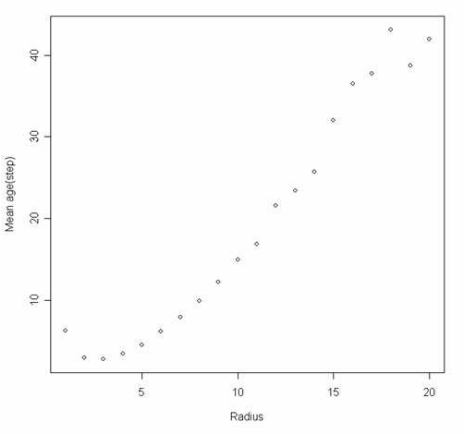

FIGURE 4: Mean age and Radius

Figure 4 has a *radius of influence* equal to 3 and we vary the density for the agents. This figure shows that the maximum mean age happens around the ratio of 1:1 regardless of the actual density in the system.

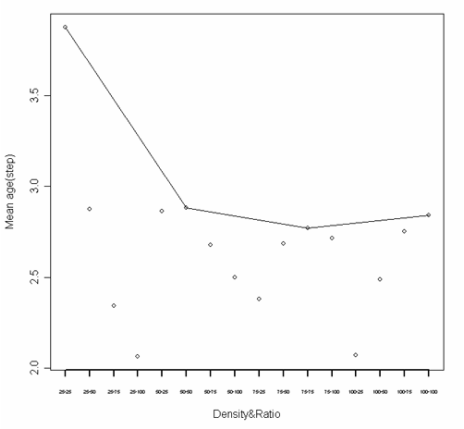

FIGURE 5: Mean age vs. Density

Figure 4 is similiar to 4. This also shows that the maximum of the maximum lifespan of couples is achieved near a ratio of 1:1. The different color of the lines correspond to different numbers of the agents. This also shows an optimum number at the 1:1 ratio.

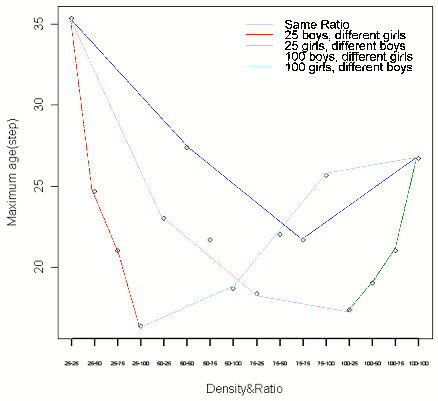

FIGURE 6: Density and Ratio vs. Age

5 A cultural Model

To put our model into context, we did a simple comparison of Eastern and Western cultures with respect to dating. The space here is *emotional space* - the virtual space of feelings.

We made the following assumptions:

- Eastern cultures: Generally more conservative, lower dating frequency, thus, lower *density* and *radius of influence* in feeling space.
- Western cultures: More open, higher dating frequency, thus, larger *density* and *radius of influence* in feeling space.

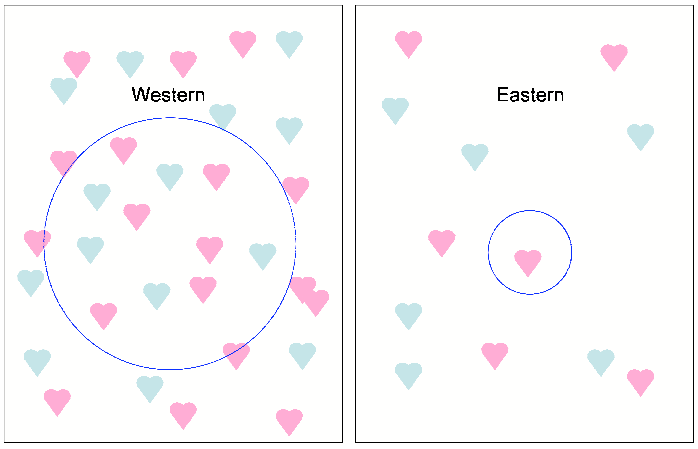

FIGURE 7: Difference of cultures with regard to feelings

	Avg Couples	Avg Couple age	Unstable couples	Max couple age	Unstability ratio
Western	2.22	15.19	71	103	0.06
Eastern	0.90	3.52	50	156	0.11

Our model predicts that there will be more couples but with shorter longevity spans in western culture and less couples in eastern couples but in general the relationships are longer lasting!! We welcome experts in these areas to suggest more realistic parameters to use in our model, and to conduct different experiments using our model.

6 Discussion

Our results show that *radius of influence* and *density* both effect the stability of relationships. Thus, there is not a linear effect on stability by either of the parameters, in fact, there is a nonlinear dependence. Thus, we can achieve the same effects with different combinations of the parameters e.g. low radius and low density can give similiar results to high radius and high density. In the cultural model we created, we discovered that overall the results were not significantly different. From this, we hypothise that if there was free interaction in society just based on the personality type (we can assume the culture has influenced personality) there should not be a major difference in the interactions. The differences in real life in relationship patterns in societies thus may have even more to do with moral norms imposed by different societies rather than the conditioning of the individuals.

7 Future Work

There are a number of directions to explore:

- Finding applications of the model(s) in different areas.
- Studying influence of various parameters.
- Including repulsive forces instead of only attractive.
- Increasing parameters in the model such as bond strengths etc.

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4.