Game of Hearts

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Introduction and Abstract

Online dating has drastically transformed the way people find romantic partners. In 2017, approximately 39 percent of heterosexual couples reported meeting their partner online, compared to 22 percent in 2009. While online dating provides a convenient and efficient way to meet potential partners, it also comes with potential risks and dangers. The highly competitive nature of online dating gives rise to social pressures to be the "perfect" candidate. Many individuals feel the need to present themselves in the best possible light with the perfect features thus leading to a rise in the popularity of Catfishing. **With romance deception increasing exponentially along with the overall usage of dating apps such as Tinder, Bumble, Hinge and much more, we aim to model and analyze how user interaction in a dating environment evolves over time.**

Methods and Definitions

Use a 2x2 matrix with 4 different types of players:

1. A Trustworthy Initiator (**TI**) presents their dating profile honestly.
2. An Untrustworthy Initiator (**UI**) exaggerates their profile to make themselves seem more attractive, hoping to attract higher quality dates.
3. A Trusting Recipient (**TR**) agrees to go on a date.
4. An Untrusting Recipient (**UR**) refuses to go on a date.

Table 1: Payoff matrix

		Recipient: TR	Recipient: UR
Initiator	TI	*R, R*	*-N-S, -N*
	UI	*R+B, -L*	*-N, -N*

Evolutionary fitness for the different players:

$$f_{TI}(y) = Ry - (N + S)(1 - y)$$
$$f_{UI}(y) = (R + B)y - N(1 - y)$$
$$f_{TR}(x) = Rx - L(1 - x)$$
$$f_{UR}(x) =- N$$

Average fitness:

- $\bar{f}_I = xf_{TI}(y) + (1 - x)f_{UI}(y)$
- $\bar{f}_R = yf_{TR}(x) + (1 - y)f_{UR}(x)$

References

https://www.statista.com/chart/24165/online-dating-penetration-rate-revenue-selected-countries/
https://www.statista.com/topics/2158/online-dating/#topicOverview
https://www.garbo.io/blog/what-is-catfishing
https://blog.gitnux.com/catfishing-statistics/
https://www.ftc.gov/news-events/data-visualizations/data-spotlight/2022/02/reports-romance-scams-hit-record-highs-2021
https://www.cl.cam.ac.uk/~rja14/shb09/hancock2.pdf

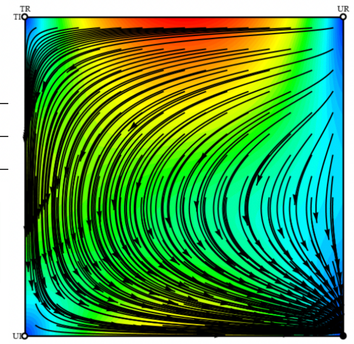
Results

1. Base Case Scenerio

Table 2: Base case matrix

		Recipient: TR	Recipient: UR
Initiator	TI	5, 5	-2, -1
	UI	8, -5	-1, -1

Strict Nash equilibrium
There is an evolutionary stable strategy (ESS)



2. Desperation

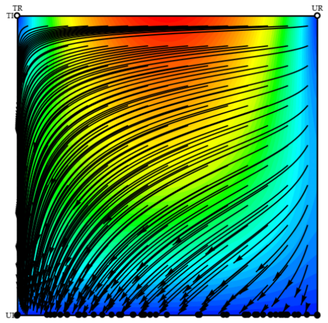


Table 3: Desperation payoff matrix

		Recipient: TR	Recipient: UR
Initiator	TI	5, 5	-4, -3
	UI	8, -3	-3, -3

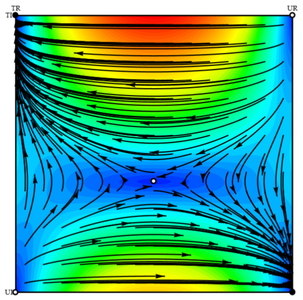
Stable rest points (no longterm rest)
No evolutionary stable strategy (ESS)

3. Punishment Payoff

Table 4: Punishment payoff matrix

		Recipient: TR	Recipient: UR
Initiator	TI	5, 5	-2, -1
	UI	4, -5	-1, -1

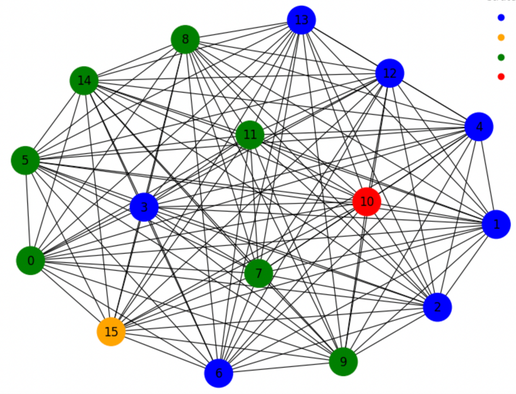
Two Nash equilibrium
There is an evolutionary stable strategy (ESS)

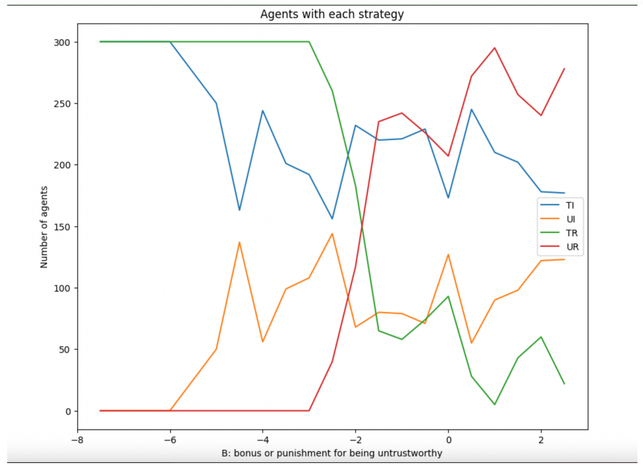


Conclusion

Our research shows that 100% trustworthiness is an unattainable goal for most dating platforms. However, even moderate punishment for false profiles results in an environment where users are receptive to going on dates, and a significant portion of those dates are between two trusting individuals. In sum, dating apps should explore avenues to punish dishonesty—perhaps a system where Recipients report false profiles, which are then penalized by the algorithm - in order to promote trustworthiness and better the experience for users.

Simulations





The simulation's results differed from the replicator dynamic outcomes in that not every single user is going to be untrustworthy in a longterm situation. However, we do see that the majority of agents are untrusting. The simulation results are that every Initiator becomes untrustworthy, though 84/300 Recipients are still trusting. This is due to each agent's probability of updating strategies and is reflective of reality, as some people still believe in the good of humanity and trust the dating platform and that not everyone on these dating platforms is acting untrustworthy. However, the majority of agents still become untrustworthy or untrusting based on our base case payoff matrix

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Figure 1 in Simulations: shows a finite population of 16 and their interactions with one another
Figure 2 in Simulations: the impact of the punishment level on initiator and receptor behavior
Figure in Conclusion: longterm behavior in simulation of player behavior