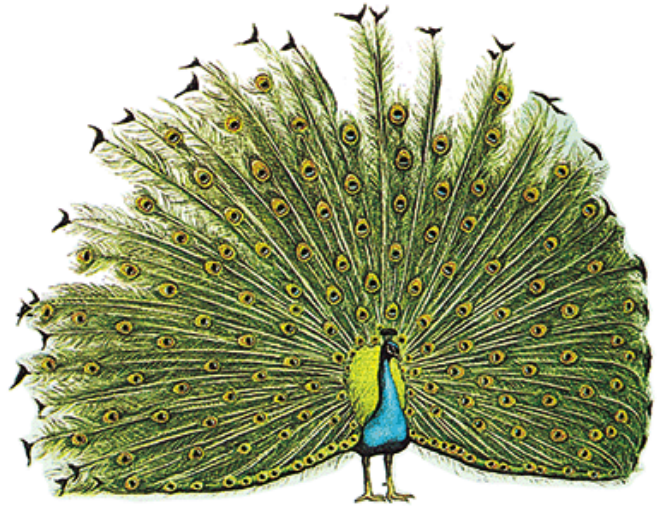


Signaling In Online Dating

Lisa Khanna and Alex Greene

Market Overview

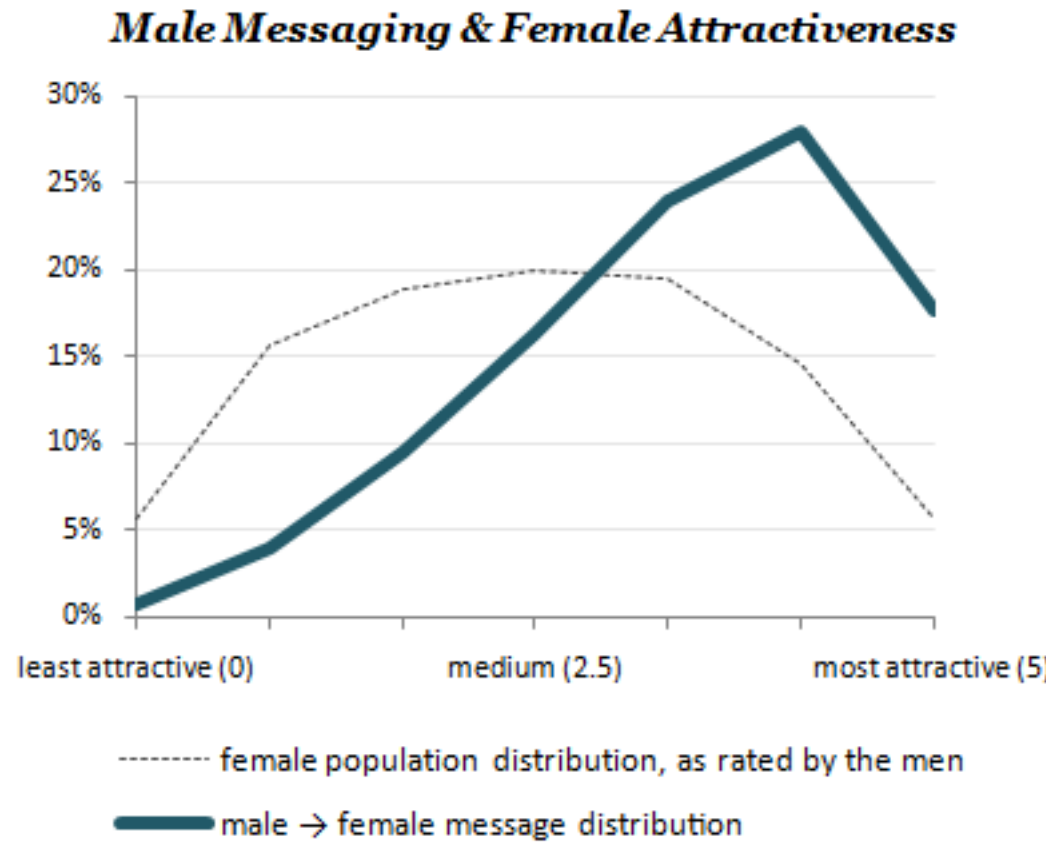
- With over 800 different sites, online dating accounts for 1/6 of all marriages in the U.S.
- In the United States, 37% of all single Internet users looking for a partner have visited a dating Web site*
- The market seems sufficently "thick", but problems with congestion and efficiency persist
- A site can be efficient in terms of numbers of users matched, the quality of those matches, and time spent by users getting their match

http://www.datingsitesreviews.com/staticpages/index.php?page=online-dating-industry-facts-statistics

*Mary Madden and Amanda Lenhart 2006

Problem: Congestion in Online Dating

- There is a problem with congestion, especially for attractive users.
- On OkCupid the top 1/3 of women receive 2/3 of the messages. A woman rated most attractive will receive 25x more messages than one rated least attractive
- One explanation: if there is no cost to sending a message, men send messages to everyone they like, including women out of their league
- The number of messages makes it hard for women to evaluate all matches
- A similar problem also exists for men



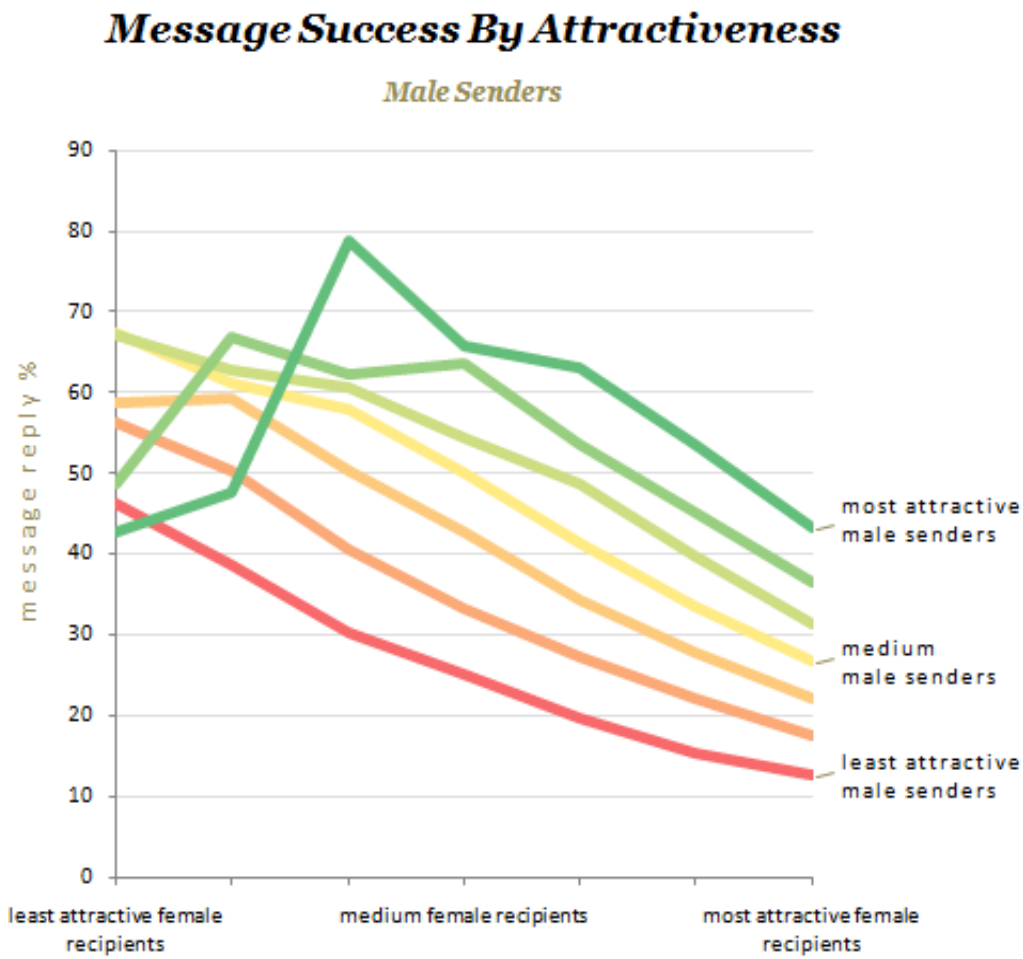
http://blog.okcupid.com/index.php/your-looks-and-online-dating/

Problem: Credibility of Messages

- Another problem in online dating is the credibility of message received

- In this chart from OkCupid we can see that less attractive women are less likely to respond to the most attractive men

- Our theory: Even though they've been sent a message, unattractive women think there is a low probability of a match occurring with an attractive male



http://blog.okcupid.com/index.php/your-looks-and-online-dating/

Why Signal?

- Let a signal be a sign of interest from one person to another

- Signals must be **credible**, that is, costly or in limited supply

- Can help with two major problems in the online dating market: **limited information about preferences** and **congestion**

- Also may help increase trust when the sender is more attractive than the recipient

- Signaling is a simple way to reveal preferences of the other side of m which should facilitate the process of finding a match

- Signaling can also **increase number of matches**

Background Literature

- "Competing by Restricting Choice: The Case of Search Platforms" (Halaburda and Piskorski 2011)
- "Propose With A Rose? Signaling in Internet Dating Markets" (Lee et al)
- "Interviewing in Two-Sided Matching Markets" (Lee and Schwarz, NBER working paper 2009)
- "Matching and Sorting in Online Dating" (Hitsch et al, American Economic Review 2010)
- “Preference Signaling in Matching Markets” (Coles, Kushnir, Niederle)

"Propose With A Rose?"

- A major online dating site in Korea endowed users with a limited number of virtual roses (2 or 8). The users could send up to 10 dating requests, "proposals" to other users with the option of attaching a rose.

- Categorized users into 3 groups based on attractiveness. Participants were more likely to send proposals to the top group followed by middle group (except women in middle group sent more to men in middle group)

- Proposals with a rose were shown to increase P(acceptance) by 3.4% and the acceptance rate by 20% (13)

- Especially effective for recipients in the middle group, and had little effect for most attractive recipients

Psychological Research: What causes attraction?

- Research in the field of social psychology points a few main factors that lead to interpersonal attraction.
- We will incorporate (1), (2), (4) to model the utility that users get from interactions with others on online dating websites

1. Physical attractiveness
2. Similarity & Compatibility
3. Familiarity & Exposure
4. Reciprocal Liking & Reinforcement

Our Model

- E(Ui | i) is the expected utility person i gets from remaining single.
- Aj is the attractiveness of person j: scale of 1 to 10
- C(i,j) is the Compatibility between person i and j, a number from 0 to 100%.
- S denotes a signal from user j to i

E(Ui | j) = Aj * P(success of match(i,j)) - E(Ui | i)

E(Ui | j) = Aj *(C(i,j) + S) - Ai*(.5)

The Model Explained

- We would like to be matched with someone who is attractive, compatible with us, and who likes us back.
- E(Um1| w1) is correlated with other men's utilities for w1 and E(Uw1| m1)
- We assume attractiveness is objective.*
- We model E(Ui | i) as Ai*(.5). The "standards" of person i should increase if i is more attractive, and a compatibility of 50% is neutral. That is, if *i* meets *j* with C(i,j) = .5 and Ai=Aj, they should be indifferent between a match and being single in the absence of signaling.
- Why we subtract E(Ui | i): If person i gains a higher utility from being alone than from a match with j, any interaction with j actually has a negative effect on i. i has a limited amount of time to find a match and should not like to waste time on j.
- A signal should increase the probability of success of a match between person i and j: sign of reciprocal liking and allows you to trust their message more
- We use the expected utility to rank preferences users have for one another

*Hitsch finds attractiveness ratings are very correlated among users

Model without signals

Compatibilities: C(w1,m1) = 0.5 C(w1,m2) = 0.65 C(w2,m1) = 0.59 C(w2,m2) = 0.7	Attractiveness: A(w1) = 7 A(w2) = 6 A(m1) = 5 A(m2) = 7
Expected Utilities: E(Uw1| m1) = -1 E(Uw1| m2) = 1.05 E(Uw2| m1) = -0.05 E(Uw2| m2) = 1.9 E(Um1 |w1) = 1 E(Um1 |w2) = 1.04 E(Um2| w1) = 1.05 E(Um2 |w2) = 0.7	Preferences: w1: m2 > single > m1 w2: m2 > single > m1 m1: w2 > w1 > single m2: w1> w2 > single outcome: m2, w1 match m1, w2 remain single

Model with signals

Suppose the men send a signal worth 10% to their most preferred woman: M2 sends a signal to W1 and M1 sends one to W2 . We see that the matching outcome changes.

Compatibilities: C(w1,m1) = 0.5 C(w1,m2) = 0.65 C(w2,m1) = 0.59 C(w2,m2) = 0.7	Attractiveness: A(w1) = 7 A(w2) = 6 A(m1) = 5 A(m2) = 7
Expected Utilities: E(Uw1| m1) = -1 E(Uw1| m2) = 1.75 **E(Uw2| m1) = .45** E(Uw2| m2) = 1.9	Preferences w1: m2 > single > m1 w2: m2 > m1 > single outcome: m2, w1 match m1, w2 match

Consistency of the Model

- Propose with A Rose presented results from an empirical study but does not provide a model to explain those results
- Using our model, we can explain these two important results found in that study:

1. Signaling has ability to increase the number of matches
2. Quality of dates improves with signaling

Limitations of Our Model & Possible Improvements

• Assumes people have a good idea of C(i,j) and Aj. Signals ideally be introduced after some initial contact between i,j so preferences are well-informed

• Does not account for differences in the value of signals users, especially as attractiveness varies: in *Propose With A Rose* users that were rated as most attractive who signaled the least attractive saw a much greater increases in proposal acceptance. The value of S, then, should actually depend on the sender and receiver of the signal, Ai and Aj.

An Alternative Solution to Congestion

- eHarmony limits the number of new candidates a member can see to seven. Match.com lets users browse freely.
- However, eHarmony users pay a premium of over 25%
- **The Choice Effect** vs **The Competition Effect**: Limiting the pool of potential matches decreases choice, and the expected utility of a match, but also decreases competition among participants in the same side of the market and therefore probability of *finding* a match
- "Competing with Restricted Choice" predicts that users with a higher utility of being single should prefer more choice and users with a lower utility of being single should prefer less competition
- Unlike signaling, this solution does not reveal preferences.

Further Questions

- How can we explain and model how the value of a signal changes with sender and receiver attractiveness?
- A Better Match? Longitudinally, it would be interesting to see if relationships initially formed by signaling are more likely to succeed or if signals just facilitate dates
- Is there a way to optimally assign signals to users so that we maximize the number and quality of matches?
- Are there any negative effects of introducing signals into the online dating market?
- Can signaling incentive users to be more realistic?