New Opportunities for Students

www.webdesignerdepot.com/2009/03/50-twitter-comic-strips

Properties of twitter Network Communications among Teenagers

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Introduction

Overview on Online Social Networks (OSNs)

- Over the past decade, online social networking sites (Facebook, Twitter, MySpace, Google+) gained widespread usage.
- This led to scientific study of OSNs as a revolutionary topic within computer science.

http://www.facebook.com

http://www.twitter.com

http://www.google.com/+

Introduction

Overview on Online Social Networks (OSNs)

Before OSNs

-Theoretical studies of behavior of hypothetical networks

[Easley &Kleinberg 2010]

Now

-Actual communications studied on various scales

[Jiang et al. 2010]

- Multidisciplinary applications in economics, business, advertising, psychology, and sociology

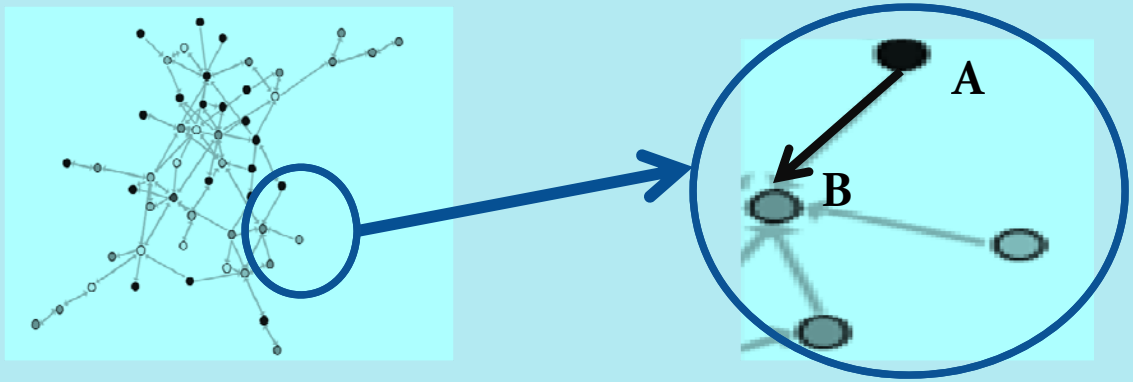
Introduction-Twitter

- Twitter is an online microblogging communication system.
- Offers users the ability to interact with various members in their community.
  - A Twitter community can be defined in many ways;
  - The entire Twitter community, 500 million users, is the Twittersphere [Dungan 2012]
- Key terms of Twitter:
  - "Tweets": short messages of 140 characters or less
  - "Retweet": forwarding a tweet
  - "Followings": the accounts a user follows (any accounts in Twittersphere)
  - "Followers": the accounts that follow a certain user (any in Twittersphere)

Introduction-Twitter

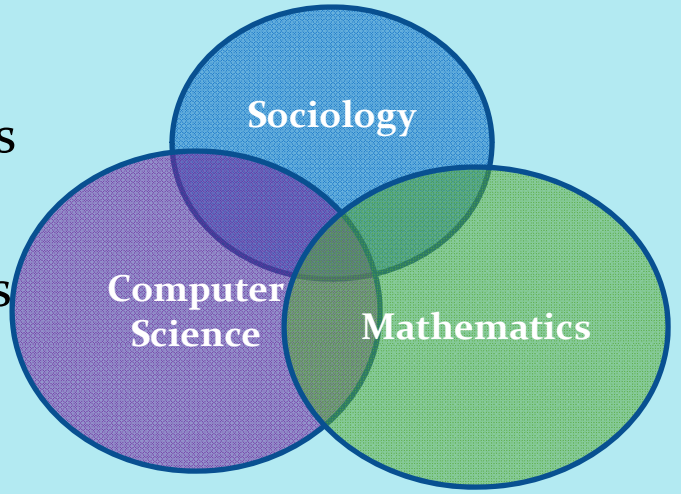
- Unlike other OSNs (Facebook, MySpace), Twitter offers a directed relationship; if user A follows B,

  B does not have to follow A.
- Twitter is an open public data site; information can be mined and found by anyone [Kwak et al. 2010, Ye & Wu 2010].
- Twitter has become a popular OSN among teenagers.



Research Purpose

- Links between computer science, mathematics and sociology
- I study statistical properties of Twitter communications among a subset of closely-related teenager communities
  - Two groups each from distinct school districts of ~200 members each
- I analyze:
  - Characteristics of teenager communities
  - Comparisons with Twittersphere results
  - Tendencies of teenagers to interact with others who are like them
- I find applications in:
  - Identifying personalities of certain members
  - Characteristics of gender
  - Twitter; a news media oriented for teenagers
  - Advertising among teenagers



Methods and Analysis Techniques

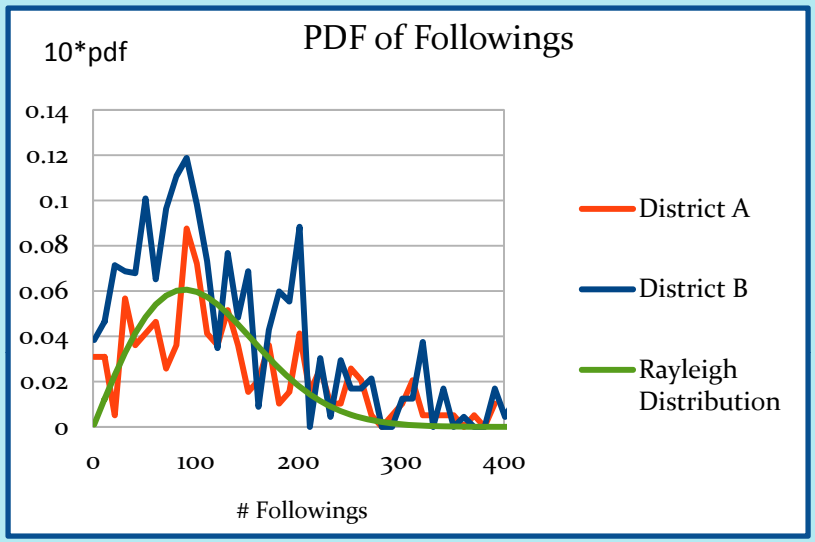
- Data collection methods
  - Codes accessing the data
- Data analysis techniques

  From probability theory
  - **Probability density function** (pdf)
    - *Probability that random member X has a property with value V*
  - **Complementary cumulative distribution function** (ccdf)
    - *Probability that random member X has a property with value greater than V*

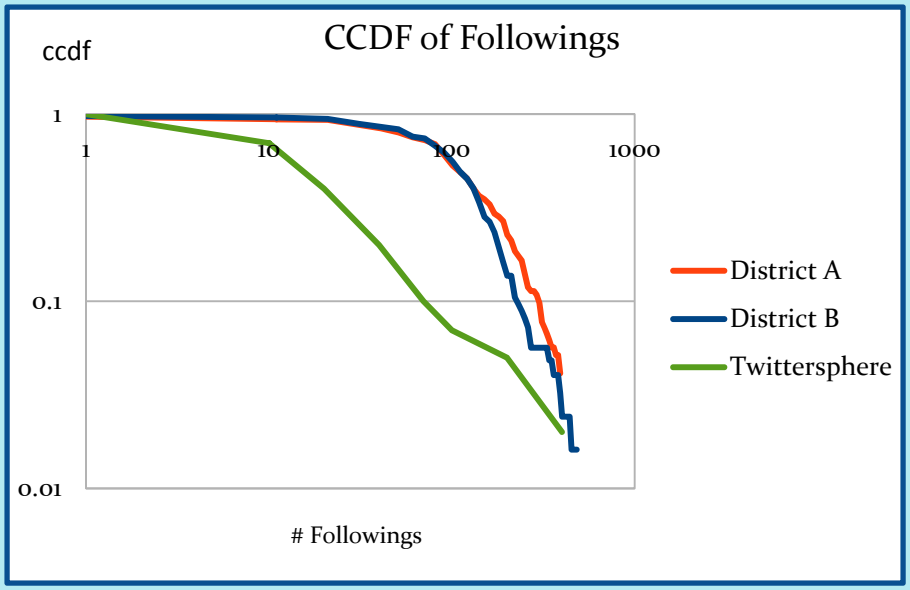
  From graph-network theory
  - Density
  - Breadth First Search (BFS) method[Easley & Kleinberg 2010]
  - Centrality

Results

Distribution of Followings



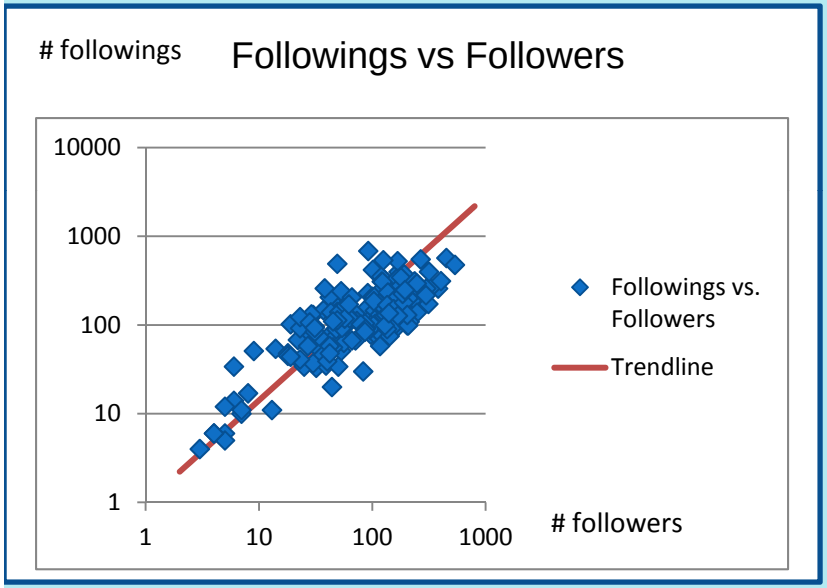
- Similar trends
- Followings pdf- fluctuations from classical Rayleigh curve
- Peaks at: 25, 45, 95, 135, 205 followings
- Dips at: 70, 125, 185, 220 followings
- Reflects groups of followings at certain sizes.



- Similar ccdf that differs from Twittersphere results [Kwak et al. 2010]
- A random teenager follows more users than a general population user.
- Results in a higher density of teenager networks and lower degrees of separation

Results

Correlation of Followers and Followings

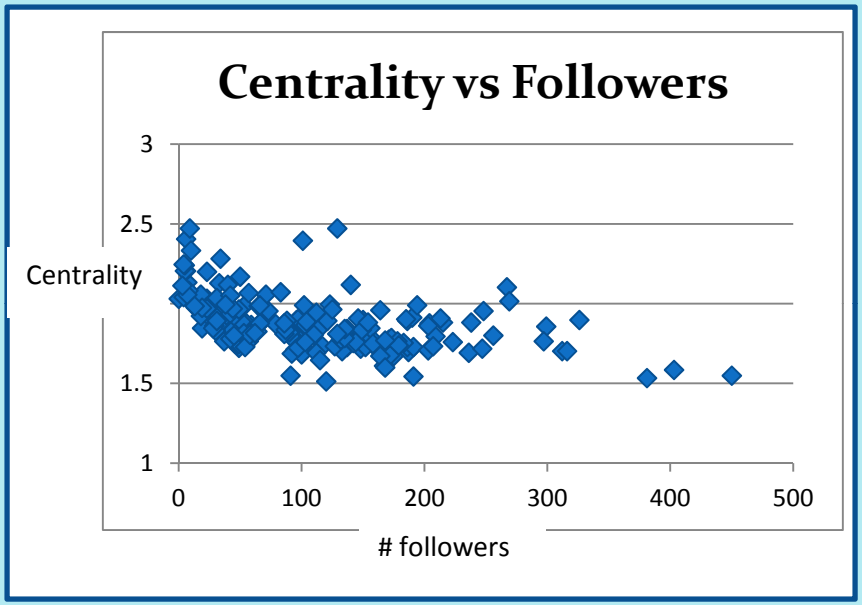


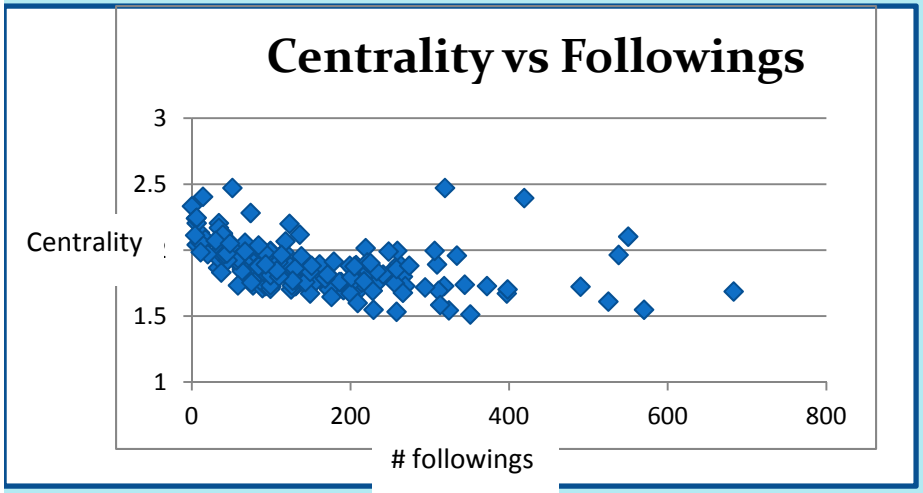
- # followers (*fr*) correlates with # followings (*fg*)
- Trend line: $fg \sim fr^{1.15}$ (power law)

- Favorites = .32(Tweets)$^{.95}$
- Active users tweet more often and also favorite more tweets

Results

Centrality and Personality



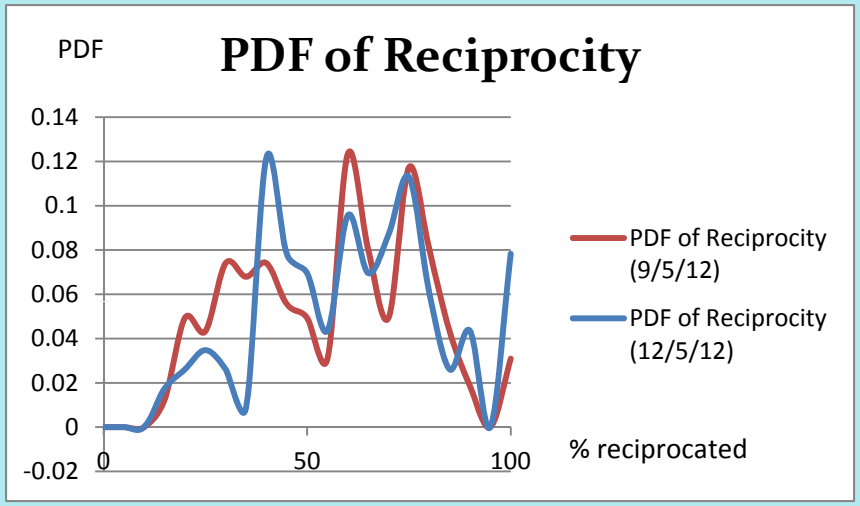


- In general communities: centrality ranges 1 - large #'s
- Theoretical centrality for this group: ranges 1 - 193.
- Actual centrality: ranges 1.5 - 2.5

- Centrality is directly related with # followers and # followings.
- A large number of both followers and followings hints at an extrovert personality [Adali et al. 2012].

Results

Temporal Reciprocity

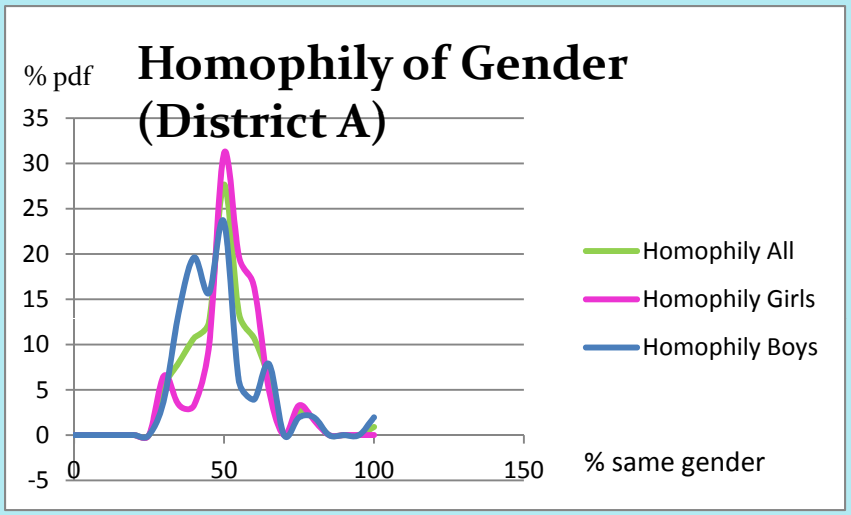


- Reciprocity occurs when user A follows B **and** B follows A back.
- Earlier date: before school started; later date: middle of school year
- Later date reflects shift towards higher end of pdf
- Represents higher % reciprocity
- Expected temporal quality

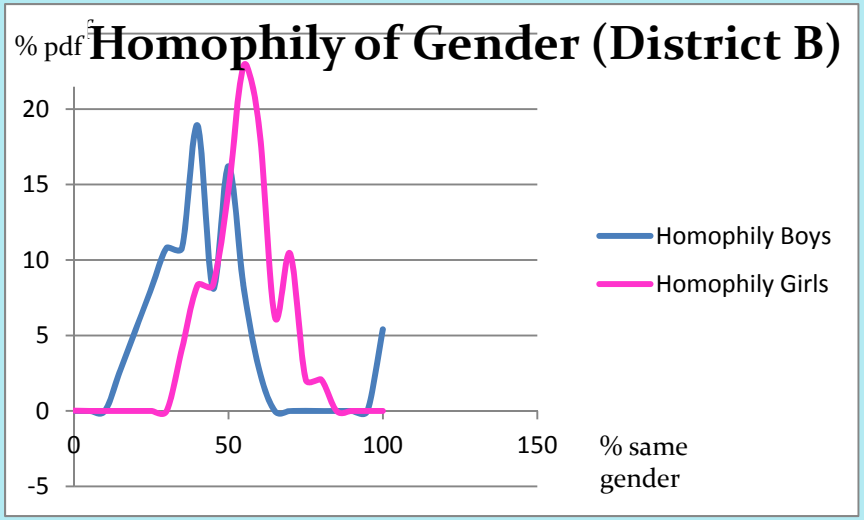
- Large amounts of reciprocated friendships hints at actual friendships
- ~67% of general Twittersphere have no reciprocated friendships, [Kwak et al. 2010]

Results

Homophily of Gender



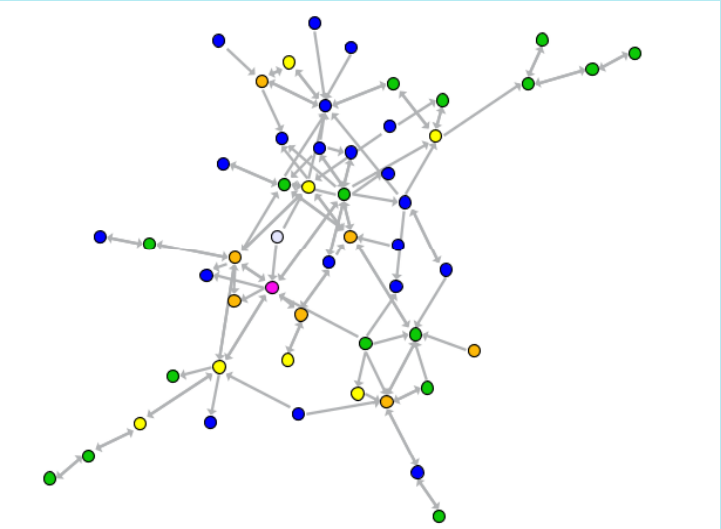
- Homophily: people who are alike will become friends
- Equal number of girls and boys studied
- Girls follow slightly more % other girls than boys follow % other boys.
- Shown by shift of pink towards higher end and blue spread more evenly.

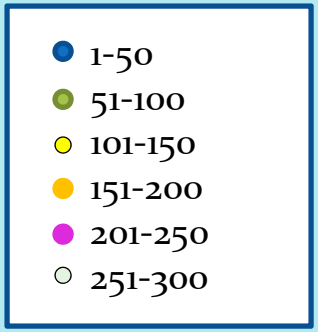


- Homophily of gender in followers is ~52%.
- Links to sociology which shows that girls are more cliquey than boys at teenager level [Ennett & Bauman 2000]
- No such general results exist.

Results

Homophily in # followers





•Close friendship: a directed friendship where user A "mentions" B
•Density of close friendship graph: ~1%; density of all followers: ~17%.
•Results from people talking to some of their followers only.

•This NWB graph shows close friendships of a small random sample.
•Graph is color-coded based on # followers.
•People with similar # followers communicate.

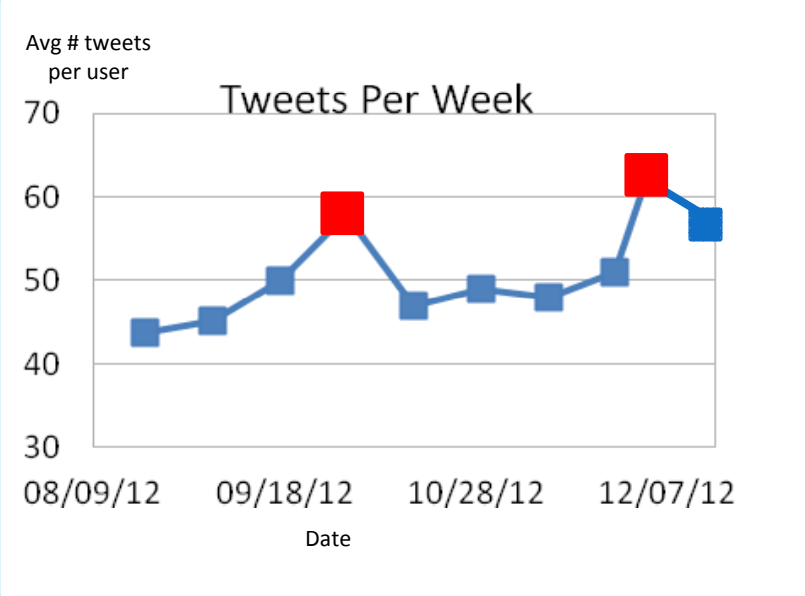
•Triadic closure: if user A is friends with B and C, then B and C are also friends.

Results

Additional Observed Trends

- Degree of separation (dos):
  - # of steps that separates members in the network
  - Within these dense, closely-related communities, dos ~2
  - Within a tweet and retweet most of community receives a message
  - General dos in Twittersphere ~4 [Kwak et al 2010]
- Privacy setting
  - 12% teenagers studied use privacy setting
  - 61% of which were female
  - Only ~6% private accounts in the Twittersphere [Moore 2009]
  - Reflects cautiousness of teenagers, especially among females
- ~50% of a teenager's followers attends school with him

News Media



- Two peaks in number of tweets per week
  - 1) Week of presidential debate and school dance
    - Debate: ~270 tweets
    - Dance: ~600 tweets
  - 2) Tragic event involving local teenagers
    - ~90% of tweets during that day

Conclusions

- Unique teenager properties:
  - Community followings pdf show fluctuations
  - More # followings than # followers
  - Large % reciprocated relationships (real friendships)
  - Central members: many followers and extroverts
  - Females: slightly more friendly with other females
  - Teenager networks: formed based on school district (dense)
  - Teenagers are more cautious than other users

Applications

- Specific **personality traits** and influence on community
  - Done by analyzing centrality in community (extrovert)
  - In terms of school, this also relates to degrees of popularity
- Differences between **cautiousness** of males and females
  - Increase probability of inferring gender
  - Can be used for advertising
  - Future work: try to distinguish more accurately between males and females

Applications

- Determine whether social bullying or harassment is occurring
- Information **flows quickly** through Twitter
  - Especially in teenager setting because of high density (dos ~2)
  - Can be used to spread information/news to community
  - Rumor can be traced back to the member who started it.
- Teenagers use Twitter as **social media**
  - Pertinent [teenagers] news travels quickly
  - I.e. in recent, local tragic events, Twitter was used as a media, to transfer information
  - Teenagers, alone, outreached to famous athletes by trending tweets on Twitter
  - Shows strength, power, and support of teenager community through use of Twitter

Future Work

- Future work includes:
  - Studying properties of more specific actual communications between members of the community (i.e. repeated words, topics of interest)
  - Finding distinguishable characteristics between males and females
  - Tracing retweet trees to further understand mechanisms of information spread
  - Determining subgroups within the tightly connected communities with homophily
  - Conduct comparisons with additional teenager communities to further solidify the trends found.

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Thank you for your attention!