Paper Review #8

[ICWSM 2020] Engagement Patterns of Peer-to-Peer Interactions On Mental Health Platforms

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Contents

1. Method

Dataset Description

TALKLIFE

All interactions are focused on mental health.

Mental Health Subreddits

Only a small part of REDDIT is focused on mental health.

Common ground

Mental health support is provided by volunteer peers **(usually untrained)** and **rarely by professionals.**

Dataset Description (Cont'd)

Data Statistics	TALKLIFE	REDDIT
# of Threads	6.4M	1.6M
# of Posts	24.9M	9.6M
# of Users	339.4K	969.7K
Observation Period	May 2012 to Jan 2019	Jan 2015 to Jan 2019

(All personally identifiable information was removed before analysis.)

Indicators of Thread-Level Engagement

Attention-Based Indicators

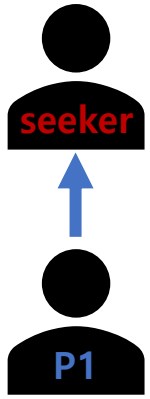
- Quantify the **amount of attention a thread receives.**

A. Thread Length

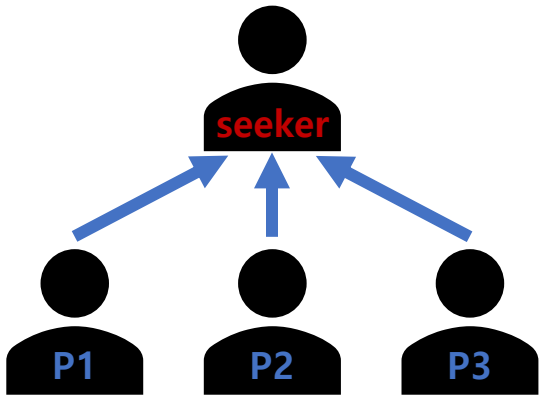
- The **number of posts** in a thread. (***Long / Short Threads***)

B. Peer-Supporters

- The **number of peer-supporters** who post their replies to a thread.



(a) Two-Party Threads



(b) Multi-Party Threads

(c) Isolated Threads

Indicators of Thread-Level Engagement (Cont'd)

Interaction-Based Indicators

- **How** seekers & peer-supporters **interact with each other**.

A. Time between Responses

- The **time difference between consecutive posts** in a thread. (***Quick / Slow Threads***)

B. Degree of Interaction

- To what extent do the seekers and peer-supporters interact in a thread?

(a) Single Interaction (b) Repeated Seeker Interaction (c) Mutual Discourse

(From communication theory (Bretz and Schmidbauer 1983; Williams, Rice, and Rogers 1988).)

Modeling Thread-Level Engagement

$$e \in \underbrace{\{\texttt{Short}, \texttt{Long}\}}_{\text{What is the length?}} \times \underbrace{\{\texttt{Slow}, \texttt{Quick}\}}_{\text{What is the Time between Responses?}} \times \underbrace{\{\texttt{Isolated}, \texttt{Two-Party}, \texttt{Multi-Party}\}}_{\text{How many Peer-Supporters?}} \times \underbrace{\{\texttt{Single Interaction}, \texttt{Repeated Seeker Interaction}, \texttt{Mutual Discourse}\}}_{\text{What is the degree of interaction between seeker and peer-supporter?}} \quad (1)$$

Modeling Thread-Level Engagement (Cont'd)

Modeling Assumptions

A. Tuple Representation for Each Response

$$p_{i,j} = (u_{i,j}, r_{i,j}, \delta_{i,j})$$

$(\boldsymbol{u_{i,j}} = user\ of\ the\ post, \boldsymbol{r_{i,j}} = role\ of\ the\ user, \boldsymbol{\delta_{i,j}} = time\ elapsed\ since\ the\ last\ post)$

B. 4 User Roles

(a) First Peer-Supporter : $j = 1$;

(b) New Peer-Supporter : $\forall k < j : \ u_{i,k} \neq u_{i,j}, \ j \neq 1$;

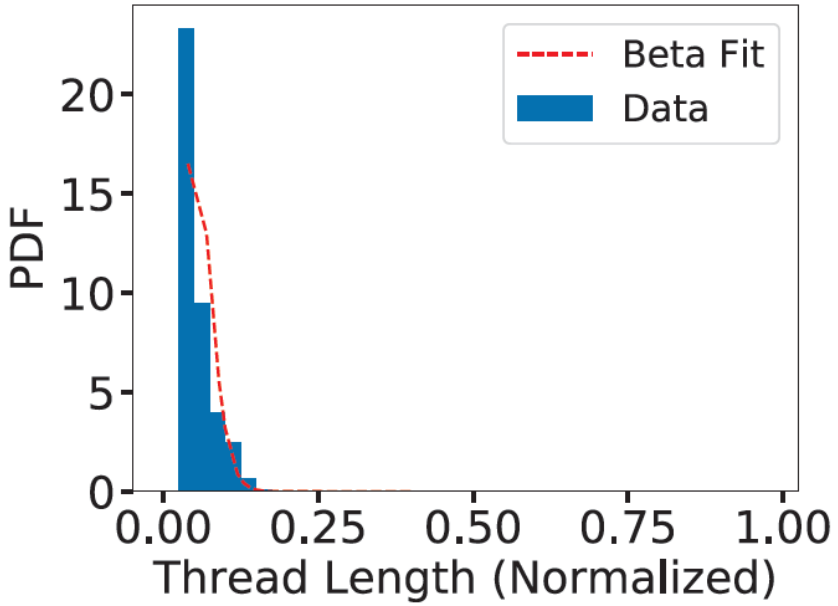
(c) Existing Peer-Supporter : $\exists k < j : \ u_{i,k} = u_{i,j}, \ u_{i,k} \neq u_{i,0}$;

(d) Seeker : $u_{i,j} = u_{i,0}$;

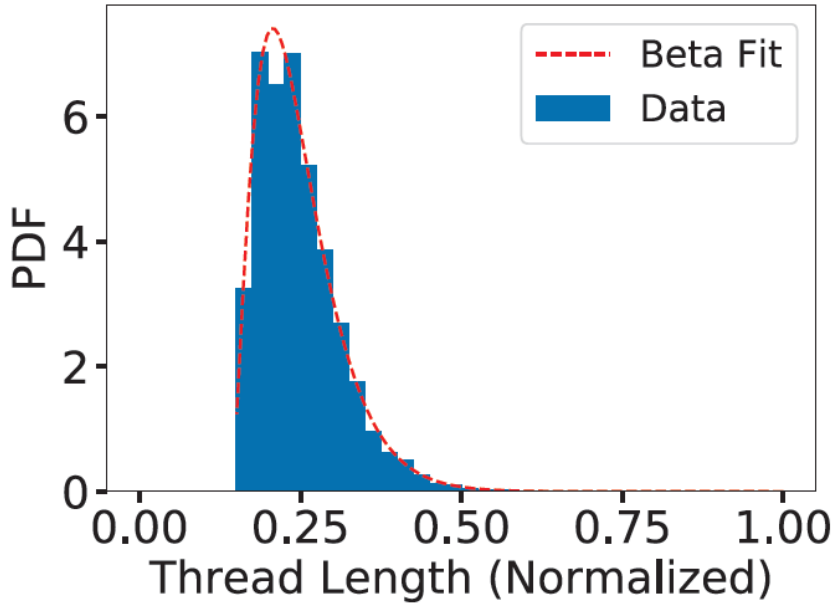
Modeling Thread-Level Engagement (Cont'd)

Modeling Assumptions (Cont'd)

C. Parametric Assumptions



(a) Length distribution of threads with $\delta_{i,j} >= 100$; beta-fit



(b) Length distribution of threads which are Multi-Party Mutual Discourse; beta fit

Modeling Thread-Level Engagement (Cont'd)

Generative Process

Algorithm 1 Generative process of our engagement model

Draw engagement distribution $\theta_{\mathcal{E}} \sim Dir(\alpha_{\mathcal{E}})$
for each engagement cluster $e \in \mathcal{E}$ **do**
    Draw user-role distribution $\phi_e^{\mathcal{R}} \sim Dir(\alpha_{\mathcal{R}})$
end for
for each thread $\mathbf{T}_i \in \mathcal{T}$ **do**
    Draw an engagement cluster $e \sim \theta_{\mathcal{E}}$
    Draw the thread length $k \sim Beta(\alpha_e^{\mathcal{K}}, \beta_e^{\mathcal{K}})$
    for each reply post $p_{ij} \in \mathbf{T}_i$ **do**
        Draw the user role $r_{ij} \sim Multi(\phi_e^{\mathcal{R}})$
        Draw the time to reply $\delta_{ij} \sim Beta(\alpha_e^{\delta}, \beta_e^{\delta})$
    end for
end for

Modeling Thread-Level Engagement (Cont'd)

Generative Process (Cont'd)

$$p(\mathbf{T}_i|e) \propto \frac{n_e + \alpha_{\mathcal{E}}}{|\mathcal{T}| + |\mathcal{E}| * \alpha_{\mathcal{E}}} * \frac{k^{\alpha_e^{\mathcal{K}}-1}(1-k)^{\beta_e^{\mathcal{K}}-1}}{B(\alpha_e^{\mathcal{K}}, \beta_e^{\mathcal{K}})}$$
$$* \prod_{p_{i,0}, p_{i,1}, \cdots, p_{i,k-1}} \left(\phi_e^{\mathcal{R}}(r_{i,j}) * \frac{\delta_{i,j}^{\alpha_e^{\delta}-1}(1-\delta_{i,j})^{\beta_e^{\delta}-1}}{B(\alpha_e^{\delta}, \beta_e^{\delta})} \right) \quad (2)$$

2. Result

Inferred Engagement Patterns

Engagement Patterns of Threads (TALKLIFE & REDDIT)

A. Isolated – $(\mathbf{32.43\%}$ & $\mathbf{27.53\%})$

B. Single Interaction – $(\mathbf{30.57\%}$ & $\mathbf{7.64\%})$

- **Two-Party** $(\mathbf{20.30\%}$ & $\mathbf{0.08\%})$:
  (i) Short Slow Two-Party SI $(\mathbf{20.30\%}$ & $\mathbf{0.08\%})$

- **Multi-Party** $(\mathbf{10.27\%}$ & $\mathbf{7.56\%})$:
  (ii) Short Slow Multi-Party SI $(\mathbf{10.27\%}$ & $\mathbf{7.56\%})$

Inferred Engagement Patterns (Cont'd)

Engagement Patterns of Threads (TALKLIFE & REDDIT) (Cont'd)

C. Repeated Seeker Interaction – $(\mathbf{18.6\%}$ & $\mathbf{21.4\%})$

- **Two-Party** $(\mathbf{4.25\%}$ & $\mathbf{5.58\%})$:
  - (iii) Short Slow Two-Party RSI $(\mathbf{3.39\%}$ & $\mathbf{3.99\%})$
  - (iv) Short Quick Two-Party RSI $(\mathbf{0.86\%}$ & $\mathbf{1.59\%})$

- **Multi-Party** $(\mathbf{14.35\%}$ & $\mathbf{15.82\%})$:
  - (v) Short Slow Multi-Party RSI $(\mathbf{1.10\%}$ & $\mathbf{12.96\%})$
  - (vi) Short Quick Multi-Party RSI $(\mathbf{13.25\%}$ & $\mathbf{2.86\%})$

Inferred Engagement Patterns (Cont'd)

Engagement Patterns of Threads (TALKLIFE & REDDIT) (Cont'd)

D. Mutual Discourse – (**18.4%** & **43.43%**)

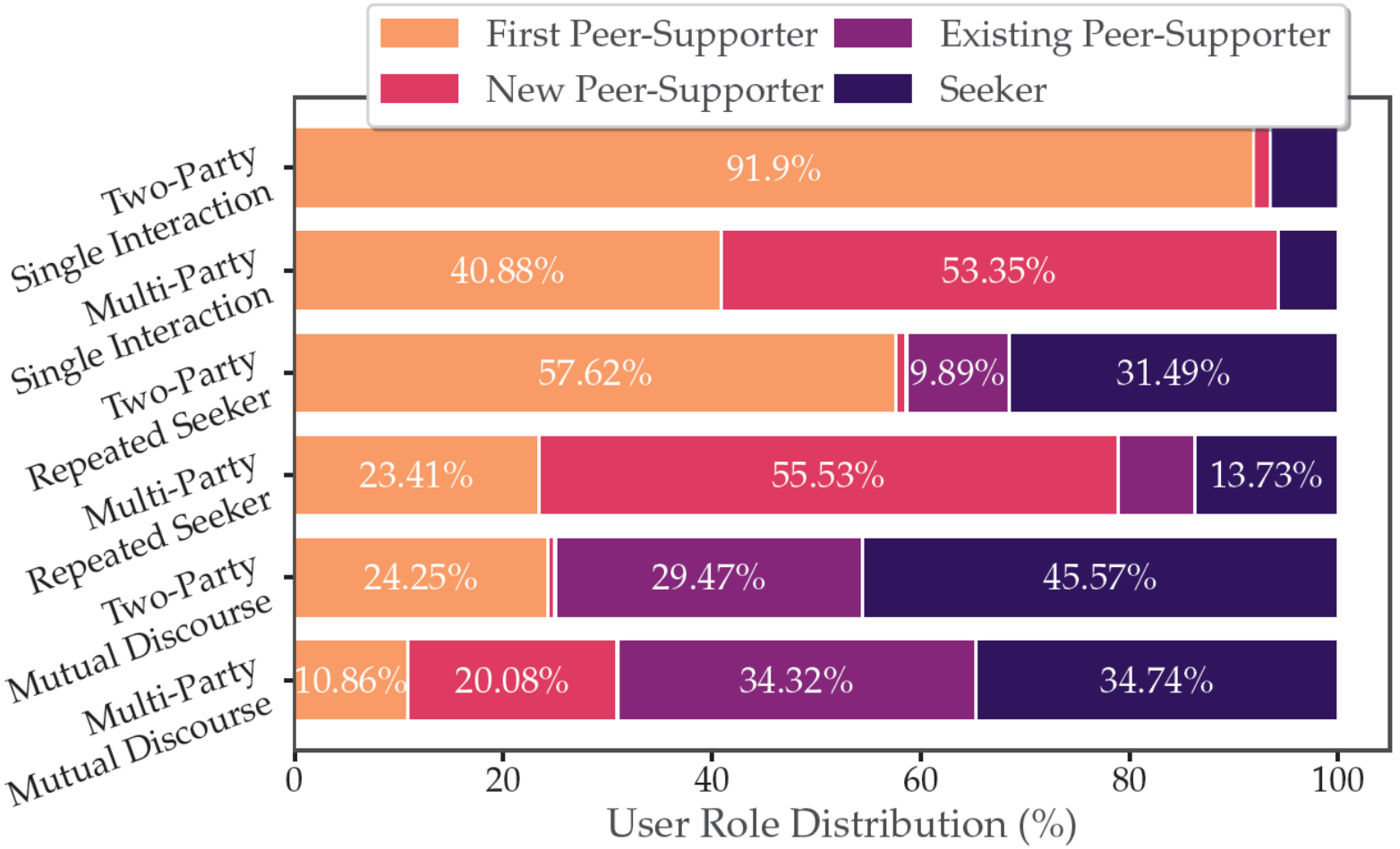
- **Two-Party** (**8.86%** & **22.08%**):
  - (vii) Short Quick Two-Party MD (**8.11%** & **21.99%**)
  - (viii) Long Quick Two-Party MD (**0.75%** & **0.09%**)

- **Multi-Party** (**9.54%** & **21.35%**):
  - (ix) Short Quick Multi-Party MD (**6.17%** & **17.33%**)
  - (x) Long Quick Multi-Party MD (**3.37%** & **4.02%**)

Inferred Engagement Patterns (Cont'd)

Qualitative evaluation of inferred patterns

A. User roles



Inferred Engagement Patterns (Cont'd)

Qualitative evaluation of inferred patterns (Cont'd)

B. Thread Lengths & Time between Responses

TALKLIFE

[Short] (length)
- mean : 3.9, median : 3

[Long] (length)
- mean : 13.5, median : 10

[Slow] (time to reply)
- median : 7 minutes

[Quick] (time to reply)
- median : 1 minutes

Mental Health Subreddits

[Short] (length)
- mean : 3.33, median : 3

[Long] (length)
- mean : 23.95, median : 19

[Slow] (time to reply)
- median : 75 minutes

[Quick] (time to reply)
- median : 16 minutes

Implications of Engagement Patterns

Comparative assessment of TALKLIFE & REDDIT

A. Isolated – $(\mathbf{32.43\%}$ & $\mathbf{27.53\%})$

B. Single Interaction – $(\mathbf{30.57\%}$ & $\mathbf{7.64\%})$

- **Two-Party** ($\mathbf{20.30\%}$ & $\mathbf{0.08\%}$):
  (i) Short Slow Two-Party SI ($\mathbf{20.30\%}$ & $\mathbf{0.08\%}$)
- **Multi-Party** ($\mathbf{10.27\%}$ & $\mathbf{7.56\%}$):
  (ii) Short Slow Multi-Party SI ($\mathbf{10.27\%}$ & $\mathbf{7.56\%}$)

Implications of Engagement Patterns (Cont'd)

Comparative assessment of TALKLIFE & REDDIT (Cont'd)

D. Mutual Discourse – $(\mathbf{18.4\%}$ & $\mathbf{43.43\%})$

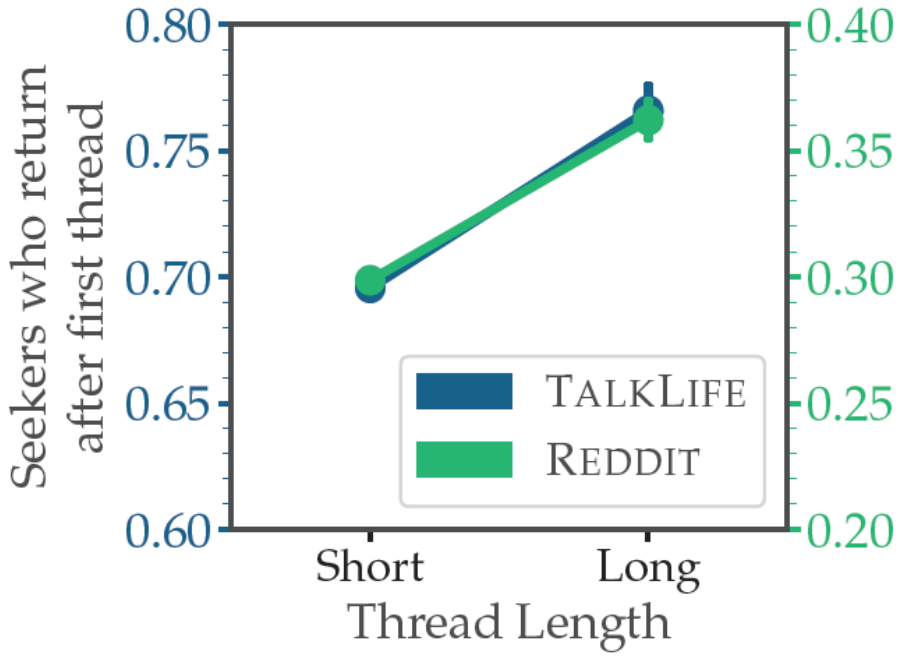
- **Two-Party** $(\mathbf{8.86\%}$ & $\mathbf{22.08\%})$:
  - (vii) Short Quick Two-Party MD $(\mathbf{8.11\%}$ & $\mathbf{21.99\%})$
  - (viii) Long Quick Two-Party MD $(\mathbf{0.75\%}$ & $\mathbf{0.09\%})$

- **Multi-Party** $(\mathbf{9.54\%}$ & $\mathbf{21.35\%})$:
  - (ix) Short Quick Multi-Party MD $(\mathbf{6.17\%}$ & $\mathbf{17.33\%})$
  - (x) Long Quick Multi-Party MD $(\mathbf{3.37\%}$ & $\mathbf{4.02\%})$

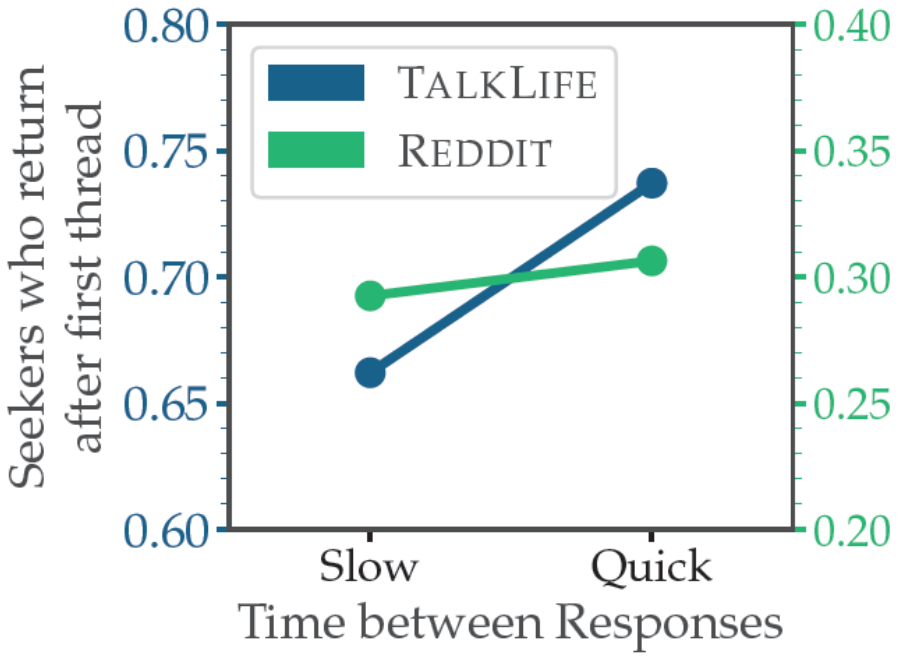
Implications of Engagement Patterns (Cont'd)

Seeker Retention on Support Platforms

A. Seeker retention increases with higher degrees of engagement.



(a) Thread Length

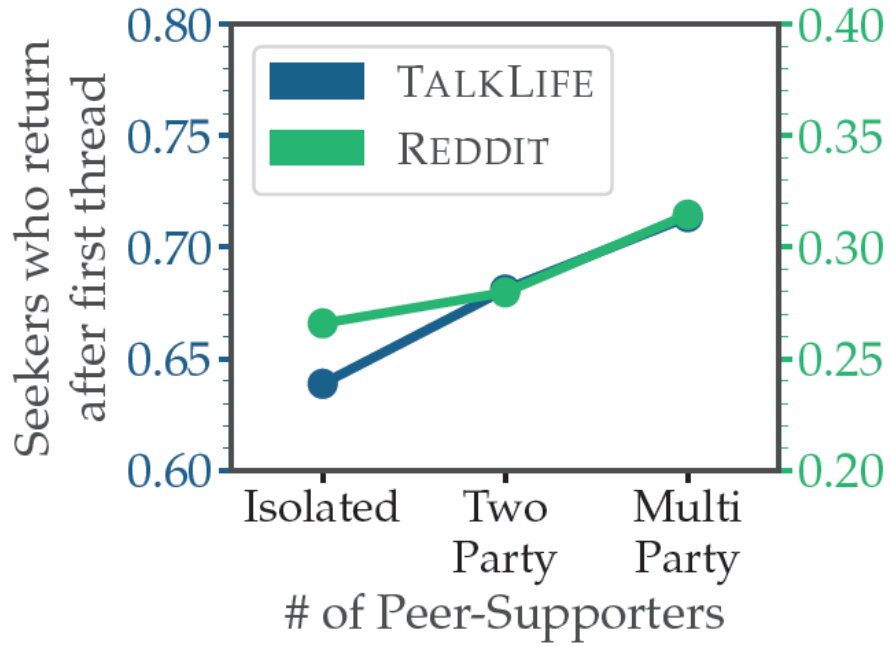


(b) Time between Responses

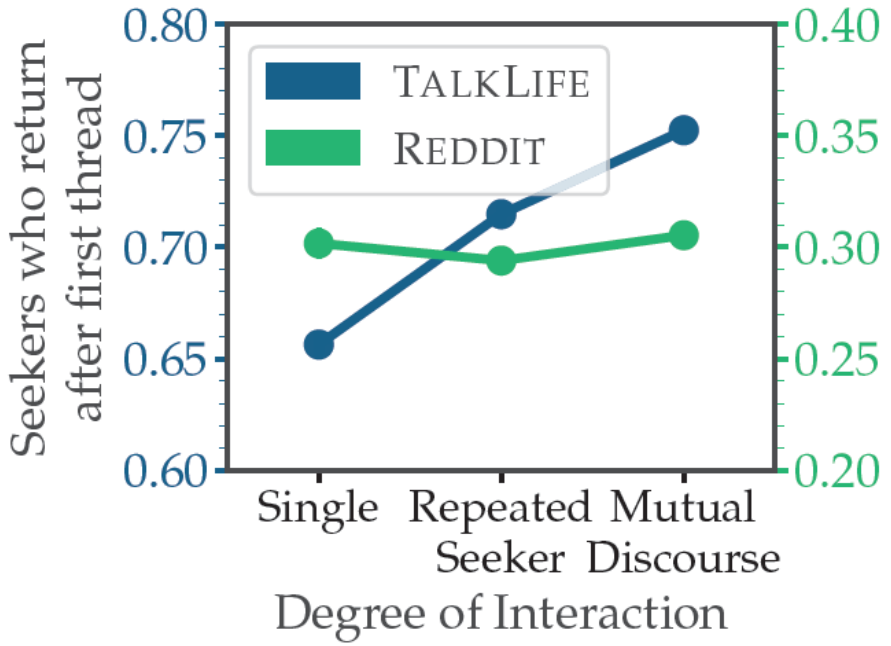
Implications of Engagement Patterns (Cont'd)

Seeker Retention on Support Platforms

A. Seeker retention increases with higher degrees of engagement. (Cont'd)



(c) Number of Peer-Supporters



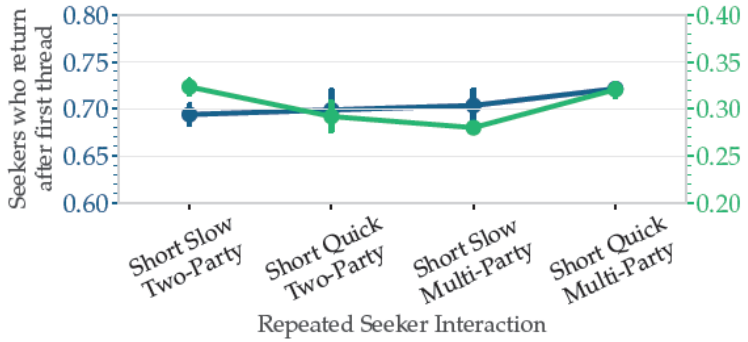
(d) Degree of Interaction

Implications of Engagement Patterns (Cont'd)

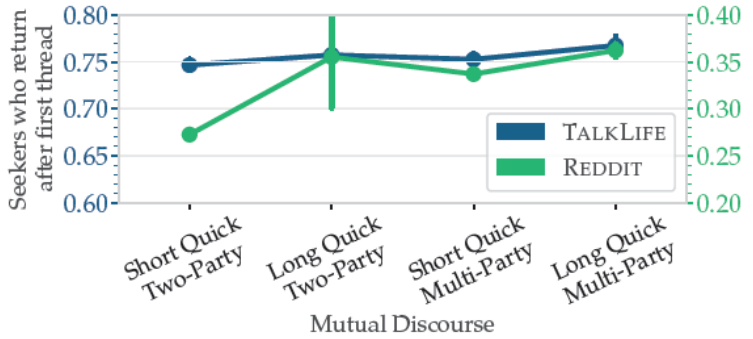
Seeker Retention on Support Platforms (Cont'd)

B. Mutual Discourse is more important for seeker retention independent of other engagement indicators.

(a) Single Interaction Patterns



(b) Repeated Seeker Interaction Patterns

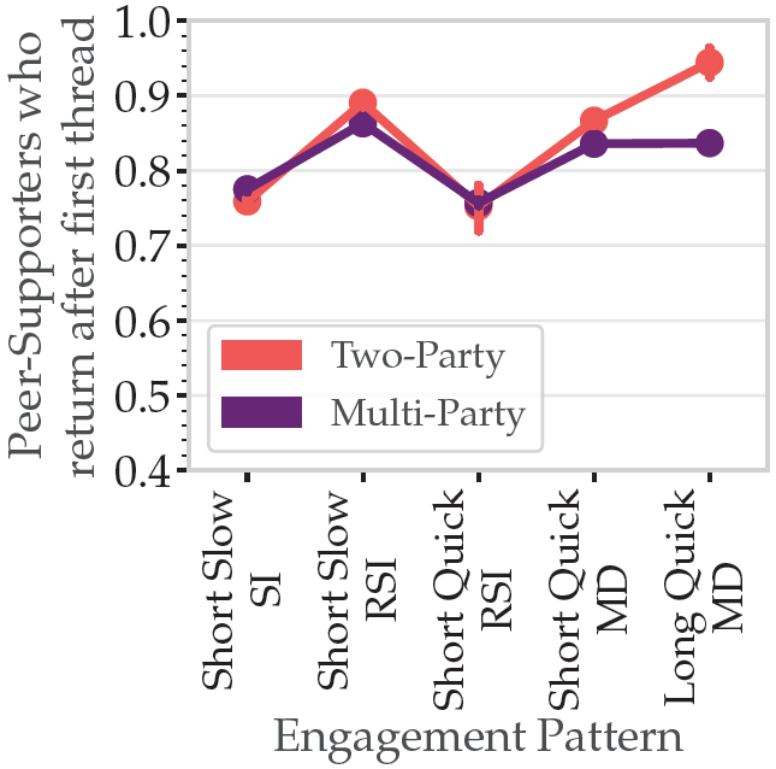


(c) Mutual Discourse Patterns

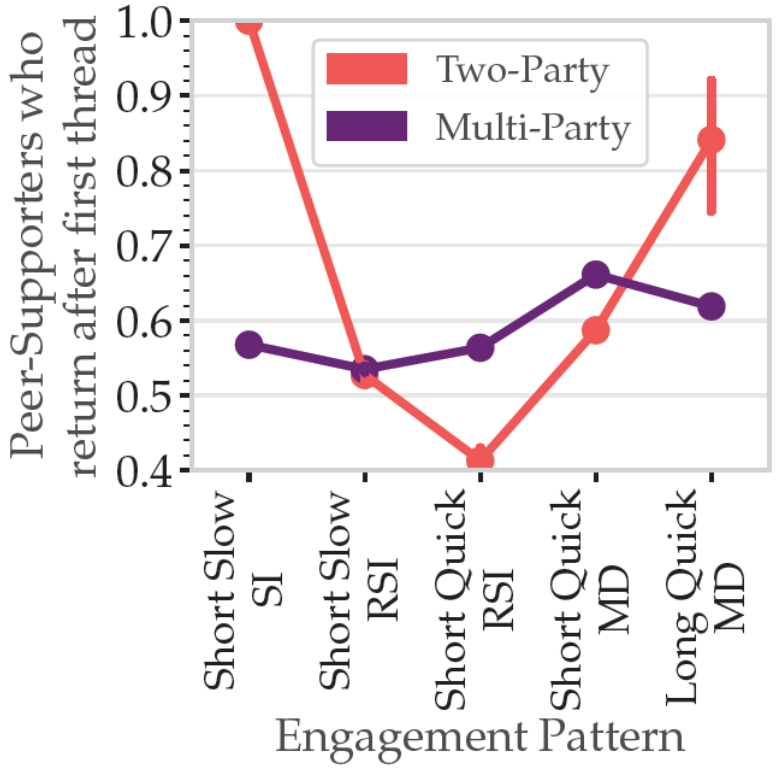
Implications of Engagement Patterns (Cont'd)

Peer-Supporter Retention

A. Peer-Supporters return more often if they were the sole supporters.



(a) TALKLIFE



(b) REDDIT

Implications of Engagement Patterns (Cont'd)

Peer-Supporter Retention

B. Peer-Supporters who are slower-to-act are more likely to return.