

Large-scale Analysis of Counseling Conversations: An Application of NLP to Mental Health

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* Equal contribution



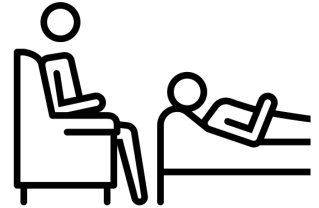
Mental Illness

- Major public health issue
- 43.8 million adults (18.5%) in the U.S. experience mental illness each year
- \$193.2 billion in lost earnings per year



Counseling

- Treatments like **counseling** and psychotherapy can help in crises and with mental illness
 - Existing research on how to counsel effectively
 - But typically small scale & qualitative



- What makes a good counselor?
- How do you help someone feel better?



NLP for Mental Health

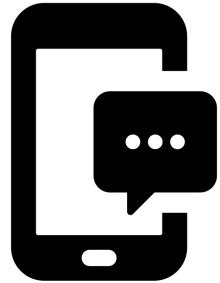
- Counseling works through language & conversation
- What can NLP do to support mental health?

Our Contributions

1. Develop novel computational discourse analysis methods applied to crisis counseling
2. Computationally operationalize fuzzy concepts
3. Quantify conversation dynamics in the largest quantitative study of counseling to date
4. Discover successful conversation strategies
 - Findings have already impacted counselor training

The Data

- Collaboration with nonprofit supporting people in crisis through text messaging
- Texters talk to extensively trained volunteer counselors
- Data includes conversation outcomes: “success”
 - Follow-up survey (19.2% response rate)
 - Positive / negative conversations
 - Potential selection bias but big advantage since it allows using supervised techniques
- 80,855 conversations, 3.2 million messages
- 408 counselors (130 with 15+ conv. incl. outcomes)

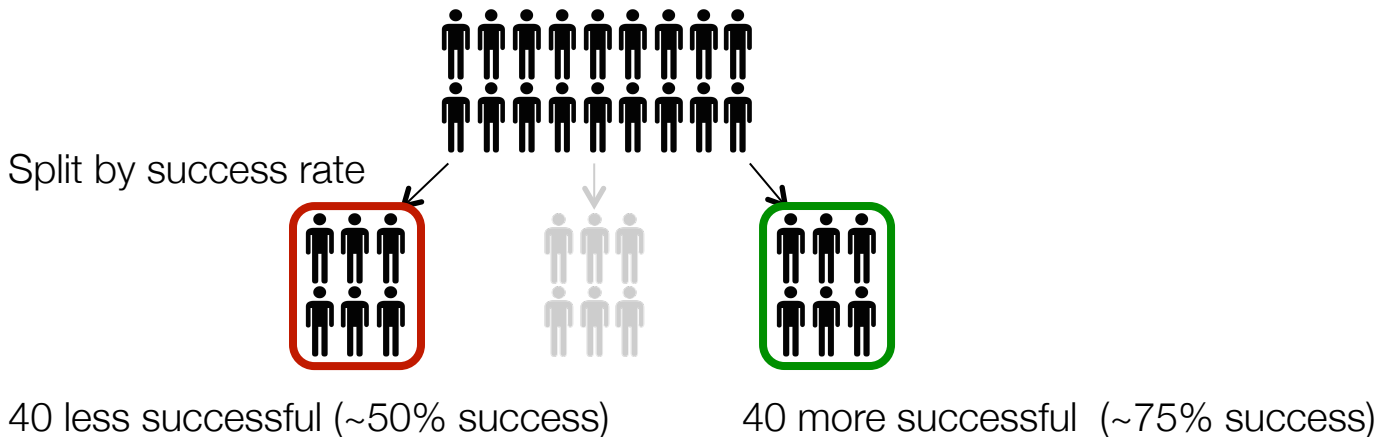


From Conversation to Counselor Quality

- **Key idea:** Success of counselors, not conversations
- Outcome of conversation depends on issue
- Conversations are effectively randomly assigned to counselors (in our dataset)
 - Successful counselors don't just take easier conversations

Counselor Quality

- Counselor success rate: Fraction of conversations rated positive by texter



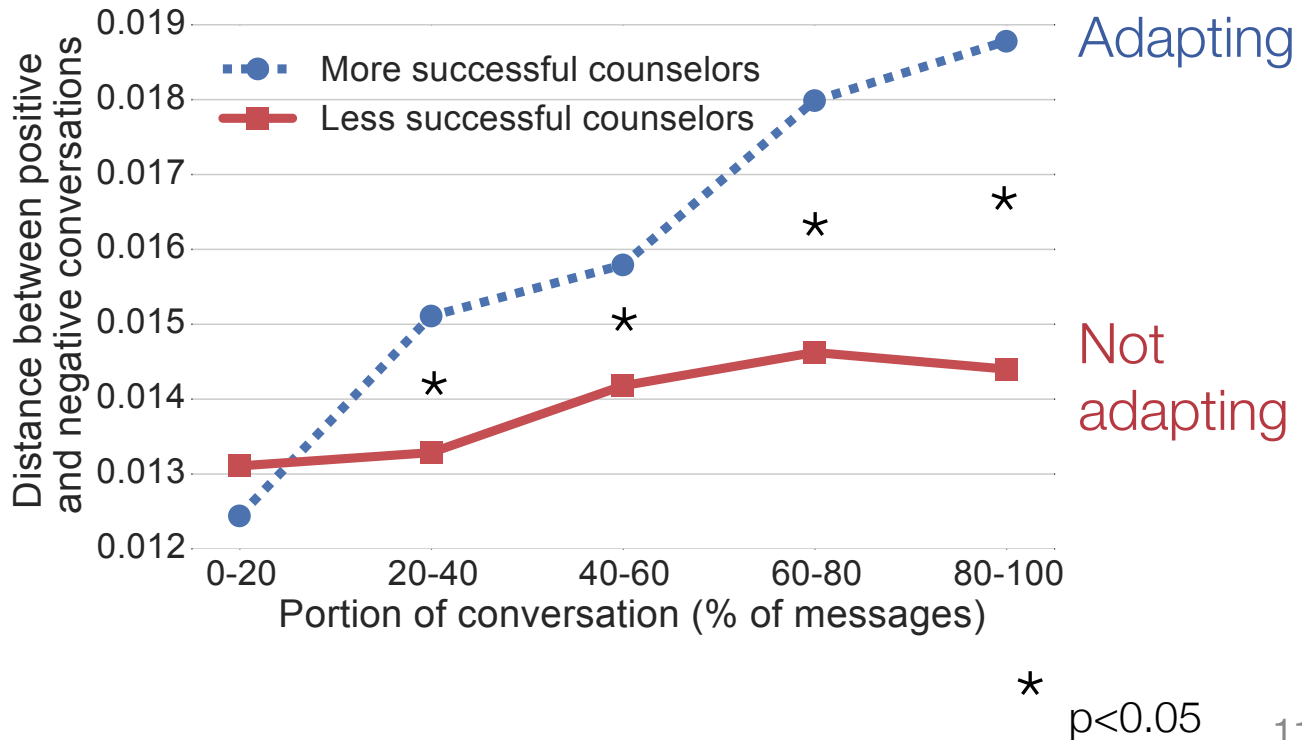
Operationalizing Conversation Strategies

1. Adaptability
2. Creativity
3. Conversation Progress
4. Perspective Change
 - Previously unknown to counselors
 - Replicated through internal focus groups
 - Already impacted counselor training

1. Adaptability: Concept

- Are counselors aware of how conversations are going?
Do they adapt to the conversation?
- Compute distance between counselor language in positive/negative conversations
 - Represent language with TF-IDF vector of word occurrences
 - Cosine similarity for distance
- Observe how distance changes over time

1. Adaptability: Result



1. Adaptability: Adapt How?

- How does the language differ?
- More successful counselors ...
 - address ambiguity by writing more
 - use more check questions
 - “it sounds like...”
 - use more hedges (lessen the impact of an utterance)
 - “maybe”, “fairly”
- Many more examples in the paper
- Next: Creativity

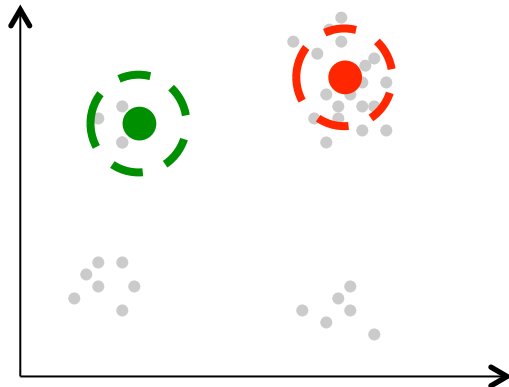
2. Creativity

- Do counselors use generic responses?
 - “How does that make you feel?” vs.
 - “Thanks for sharing that with me. That sounds really challenging. How do you feel about the impact on your family, Tim?”
- Measuring “creativity” by counting the number of very similar responses

2. Creativity: Concept

- Compute the number of close neighbors to each response to almost identical messages by the texter
 - Threshold on cosine distance in TF-IDF space

Space of all counselor responses

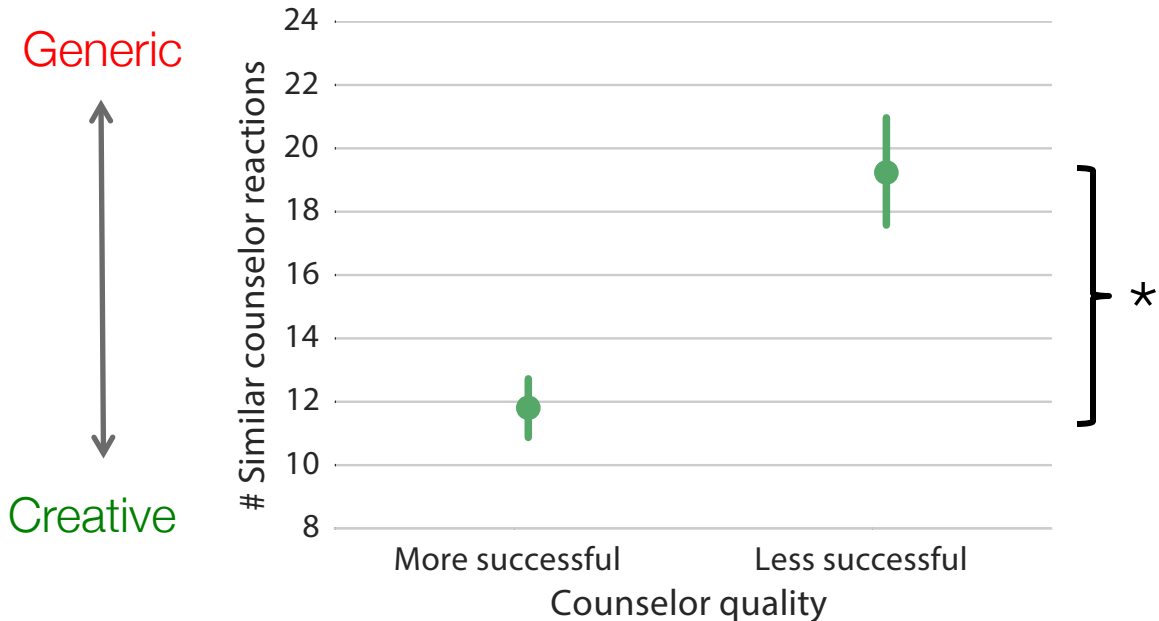


- Message with few similar responses
- Message with many similar responses

Creative

Generic

2. Creativity: Result



Finding: More successful counselors use more **creative** responses than less successful counselors

Error bars: 95% confidence intervals

3. Conversation Progress

- Is there a higher-level structure to counseling conversations?
- How do counselors navigate this structure?
- Use techniques from unsupervised conversation modeling to learn ordered sequence of *conversation stages*

3. Conversation Progress: Model

- Assign each message in each conversation a stage using a Hidden Markov Model with constraints on state transitions
- Extend model from Ritter et al. (2010)
 - Force stages to be in increasing order
 - Treat counselor and texter turns as separate states

Conversation as sequence
of text messages

m_1

m_2

m_3

m_4

m_5



Model assigns a stage to
each message

m_1 stage 1

m_2 stage 2

m_3 stage 2

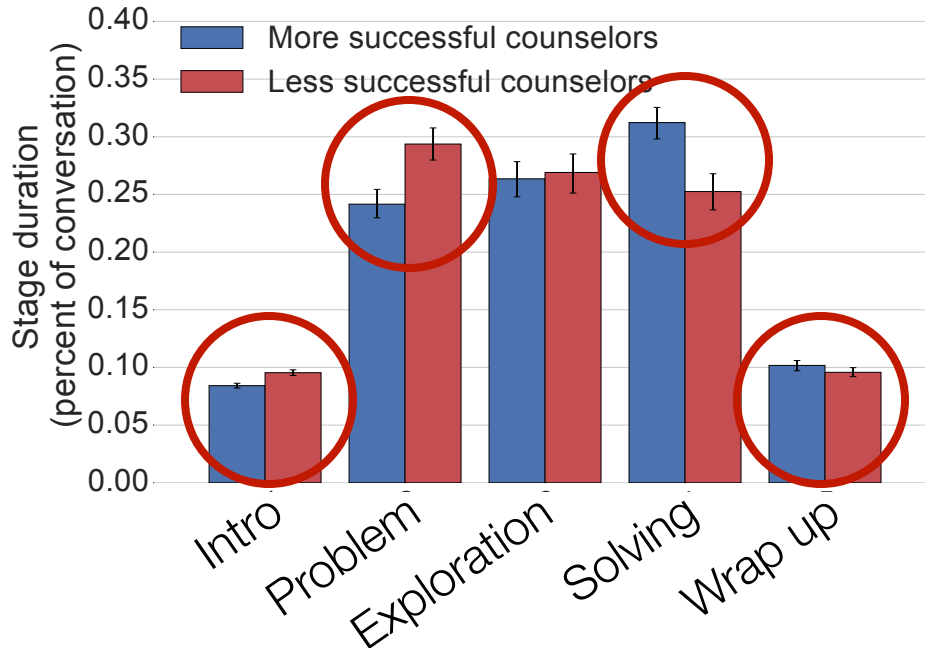
m_4 stage 3

m_5 stage 4

3. Conversation Progress: Stages

| Stage | Interpretation | Texter top words | Counselor top words |
|-------|----------------------|---|---|
| 1 | Introduction | hi, hello, name, listen, hey | hi, name, hello, hey, brings |
| 2 | Problem introduction | dating, moved, date, liked, ended | gosh, terrible, hurtful, painful, ago |
| 3 | Problem exploration | knows, worry, burden, teacher, group | react, cares, considered, supportive, wants |
| 4 | Problem solving | write, writing, music, reading, play | hobbies, writing, activities, distract, music |
| 5 | Wrap up | goodnight, bye, thank, thanks, appreciate | goodnight, 247, anytime |

3. Conversation Progress: Results

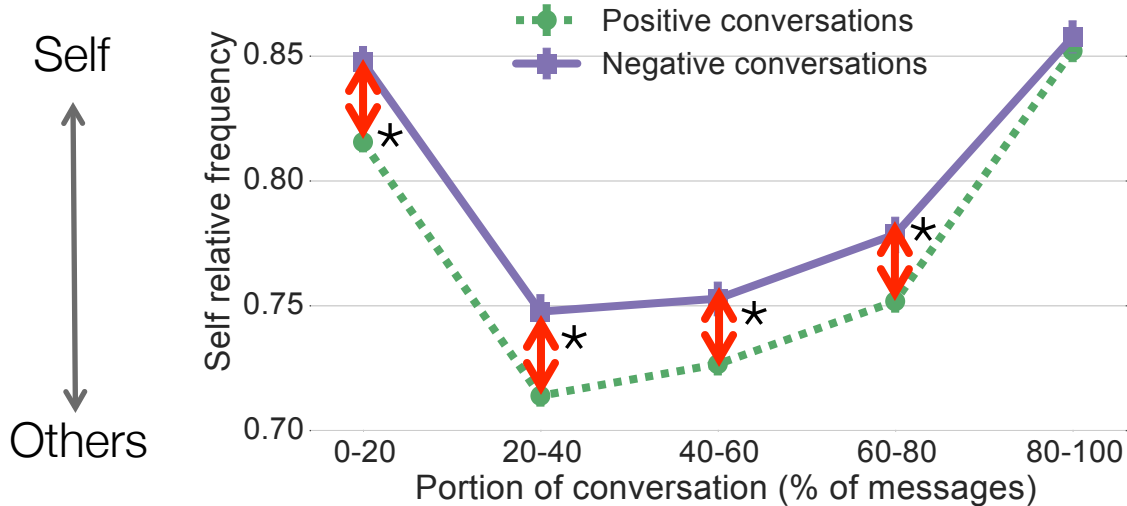


Finding: More successful counselors are quicker to know the problem and spend more time in the problem solving stage ($p < 0.05$)

4. Perspective Change

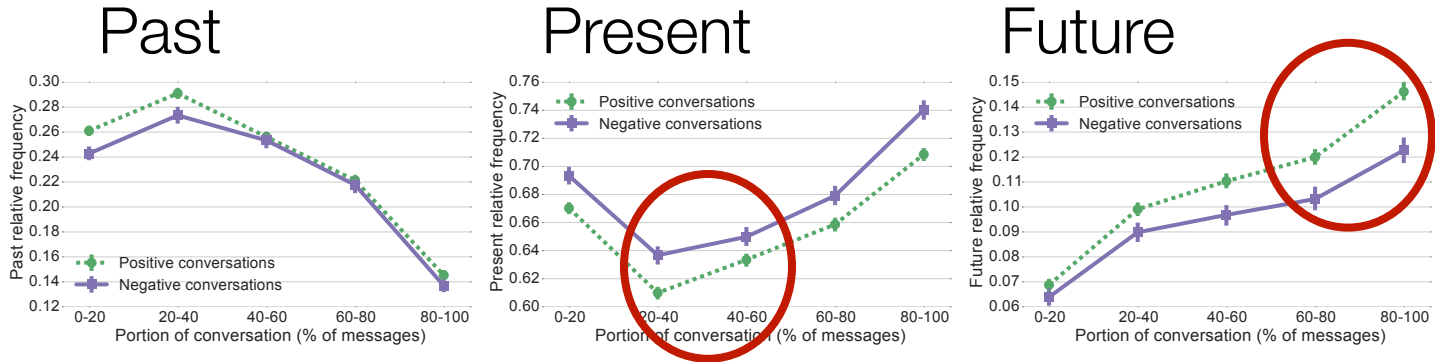
- Prior theory relates depression to
 - a self-focusing style instead of focusing on others (Pyszczynski and Greenberg, 1987)
 - a negative view of the future (Pyszczynski et al., 1987)
- We quantify perspective change by tracking the frequency of LIWC markers (Tausczik and Pennebaker, 2010)
 - “I, me, myself, ...” vs “he, she, they, ...”
 - Past vs Present vs Future

4. Perspective Change: Self-Focus



Finding: Texters who talk less about themselves and more about others tend to have successful conversations

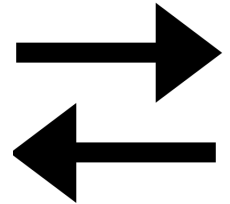
4. Perspective Change: Future



Finding: Texters who talk less about the present and more about the future tend to have successful conversations

4. Perspective Change: Facilitation

- Simple hypothesis: The texter will talk more about something (e.g., the future) if the counselor talks about it first
- Linguistic coordination
 - Use coordination measure from (Danescu-Niculescu-Mizil, 2012)
- We find significant coordination of texter towards counselor for all perspective change markers (e.g. future; $p < 0.01$)
 - Counselor can help *facilitate* perspective change



Conversation Strategies

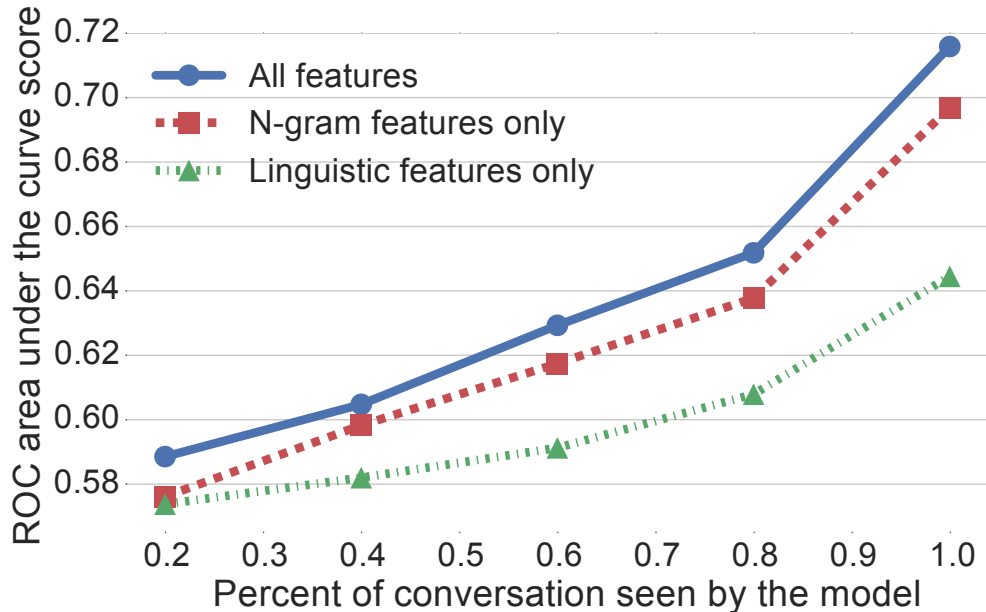
1. Adapt to the conversation
2. Be creative in responses
3. Work towards making progress
4. Facilitate perspective change

Implications for counselor training and counseling support tools.

Predicting Counseling Success

- Are our linguistic features predictive of conversation outcomes?
- Predict conversation outcome (positive/negative)
 - Balanced dataset (~7000 long conv.)
 - Logistic regression classifier
 - ROC AUC measure
 - After seeing 20%, 40%, ... of the conv.

Prediction Throughout Conversation



- Language in conversations signals conversation outcome
- Counselor support tools

More details in the paper!

- How to react to ambiguity
- Conversation modeling
- Perspective change & coordination
- Predicting conversation outcomes

Summary

- Computationally operationalize anecdotal knowledge through novel discourse analysis methods
- Empirical validation on large-scale real-world interactions
- Findings have already impacted counselor training
- Applications beyond counseling: coaching, customer support, ...

NLP for Mental Health

- Great opportunity and challenge for our community!

- Dataset available!

<http://snap.stanford.edu/counseling>

Ask me anything!

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