"By the way, do you like Spider Man?"

Towards A Social Planning Model for Rapport

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Example

Example

TUTOR: It should be k equals something. [1]
TUTEE: yeah that's right, I forgot about the k. [2]
TUTOR: yeah, so it wouldn't be that it'd be this. [3]
TUTOR: so the reason why I'm so tired today is that I was up until like twelve thirty working on this script all right... [4]
TUTEE: oh... [5]
: (...5mins of off-task talk)
TUTOR: all right so let's get back on topic to see what you're doing here [6]
TUTEE: yeah. [7]

Outline

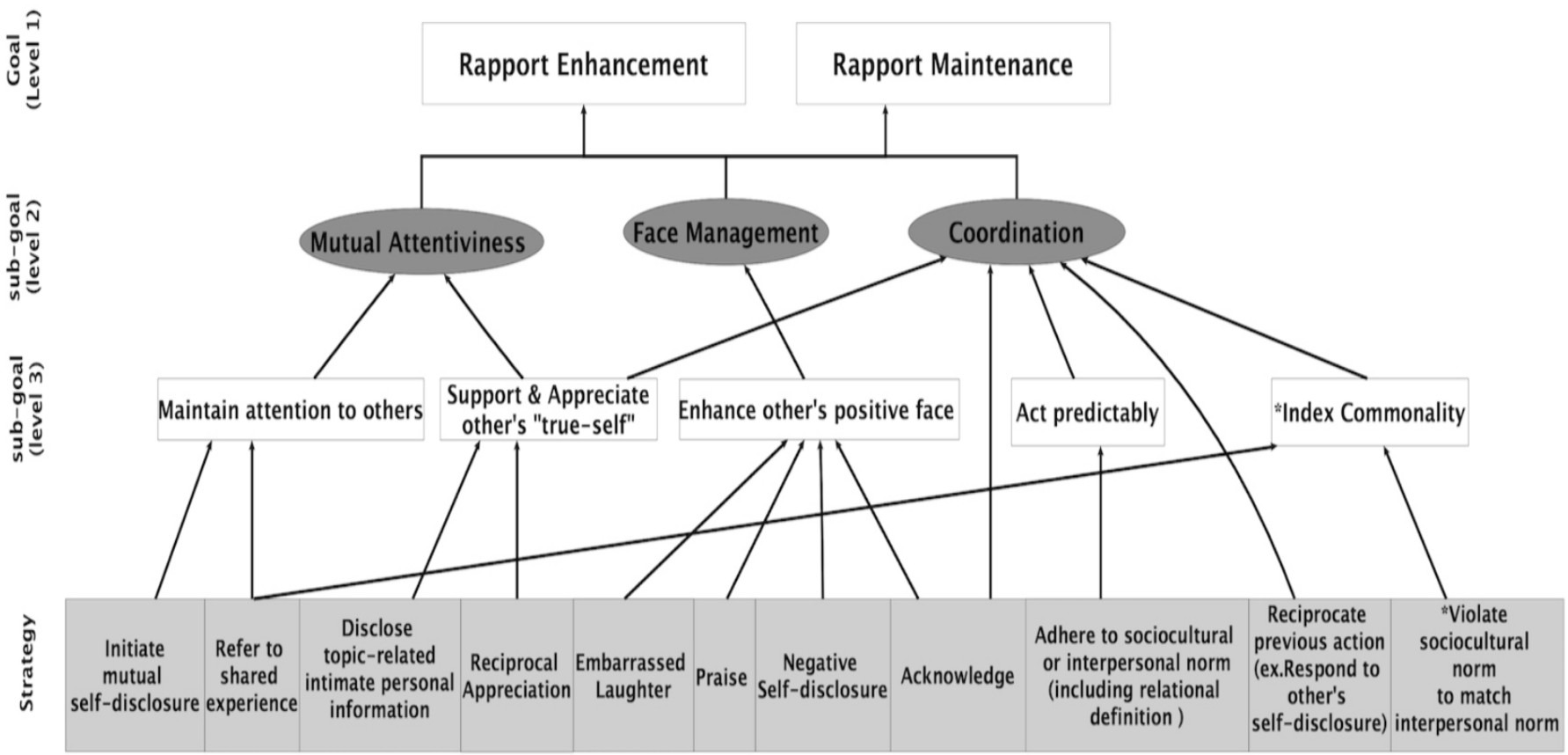
Introduction

- It has been shown that the interlude where the tutor engages in self-disclosure (Derlega et al., 1993) may help the two interlocutors to establish a closer social relationship, which in turn may help the tutor achieve his task goals (Sinha and Cassell, 2015).
- Interleaving of on-task and off-task moves is common and placement is not random (Coupland, 2014) $\rightarrow$ Pursuing multiple goals (Tracy and Coupland, 1990).
- In the peer tutoring data[1], we found a certain amount of interleaving of Off-task talk (OTT) and task talk.
- This activity may therefore help to enhance and maintain *rapport* (Spencer-Oatey, 2005; Tickle-Degnen and Rosenthal, 1990; Zhao et al., 2014), an important way of building closeness.

[1] Algebra peer tutoring by Skype among teenagers

Introduction

Rapport



2

[2] From (Zhao et al., 2014)

Questions

- Does Off-Task Talk follow low rapport?
- Rapport can help both to achieve task goal and social goal (Sinha et al., 2015). Is Off Task Talk one of the rapport building strategies that contributes to increased task performance?

Data Analysis

Data

- Video recordings of reciprocal peer tutoring interaction taken from 14 dyads of teenagers (those dyads in the corpus whose rapport varied significantly over the course of the interaction), who met twice over 2 weeks.
- Before and after each session all participants were tested in order to measure their learning gains.
- A total of 24 interaction transcripts, This yielded a total of 22709 clauses.
- Their interactions were split into 30 second slices and rapport was estimated by Amazon Mechanical Turk annotators, based on thin slice annotation. (Ambady and Rosenthal, 1993)
- 2 annotators coded for 4 kinds of talk 1) on-task talk, 2) off-task talk—side sequences involving topics that are distinct from the task, 3) clauses that reject or ignore off-task talk. 4) meta-task talk—clarification sequences concerning the task itself.
- All disagreements were discussed and resolved by the 2 annotators.

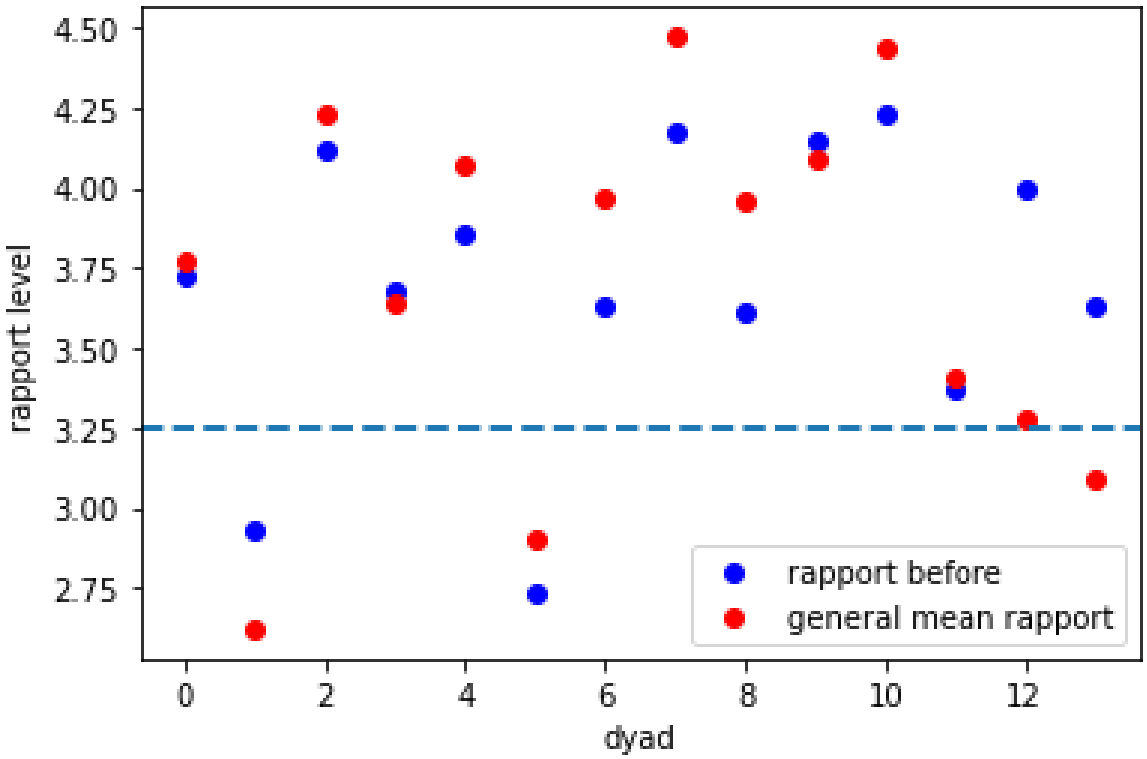
Data Analysis

Result

- The Pearson Correlation between the time spent per session off-task talk and the dyad average learning gain is 0.3558, ($p = 0.08 > 0.05$) $\rightarrow$ not significant $\rightarrow$ cannot be sure about the contribution of OTT.
- The 10 slices that do not appear to be OTT before the OTT slices were used as reference objects. Means were calculated for each dyad and these were compared with the general rapport mean to perform a paired t-test $\rightarrow$ $t = -1.4587, p = 0.1470 > 0.05$ $\rightarrow$ not significant $\rightarrow$ So we examined the data for each dyad, and clustered it as shown in the figure that follows.

Data Analysis

Result



- We observe that 9 out of 14 dyads satisfy our hypothesis → OTT occurs after low rapport.

Data Analysis

Result

Utopy

- Utopy intuitively captures whether we are more likely to see an **improvement** or a **deterioration** in rapport dynamics over the course of an interaction. (Sinha, 2016)
- From -1 to 1, 1 represents that this time series is most likely to end with high rapport. -1 represents the opposite.
- We calculate the *utopy* for the interaction (10 30-sec slices) before every OTT and categorize them into 3 types: high, maintenance and low.

high	maintenance	low
33%	21%	45%

χ^2 test: 11.56 p $<$.005. OTT happens more often after falling rapport.

Tutoring: the interplay between task goals and social goals

Example

AGENT: No, that's not it. [1]

TEENAGER: I don't know. [2]

AGENT: So why did you do it that way? Sometimes I have a tough time explaining my thinking. [3] (neg self-disclosure)

TEENAGER: I wasn't right, so like. . . I don't know how to do it. [4]

AGENT: You want to get the x term by itself. I hope I'm explaining this okay. [5]

TEENAGER: I. . . still don't know. [6]

How to operationalize this: social repair

- Communicative repair (Ginzburg, 2012; Jefferson et al., 1977; Purver, 2004) enables one interlocutor to fully understand another's interlocutor's initially incompletely comprehended utterance and associated intentions.
- *Social repair* concerns the need to restore social relations such as rapport, power, trust, to "appropriate" levels called (*rapport repair* in the paper).
- Some of Zhao et al. (2014)'s conversational strategies can be delivered within a single clause (e.g., praise, adherence to social norms, etc.) But here we focus more on strategies that may involve more than one clause (e.g., referring to shared experience at length, extended self-disclosure).
- We also assume the existence of a *repair set* $REP = \{ep_1^r, \ldots, ep_n^r\}$ which is composed of several *repair actions*, which include actions construed as OTT.

Rapport Accumulation

- Returning to the example above, we observe that the child repeats that he doesn't know what to do next, and this statement also appears after the assistant gives him a hint how to solve the problem ([5]).
- Following Madaio et al. (2017)'s rapport estimator, we operationalize the rapport level as a time series function where the value range is from 1 to 7 (1 for the lowest rapport level and 7 for the highest). We claim that the rapport persists and accumulates in one's *Cognitive State*, as an effect of short-term memory. So we introduce an accumulation of rapport over time with a retrospective monitoring time window of 10-second slices.

Definition

$$r_a(t) = rp(t_0) + \gamma * rp(t_1) \ldots + \gamma^{(\Delta t - 1)} * rp(t_0 - \Delta t)) = \sum_{t=t_0-\Delta t}^{t=t_0} \gamma^{t-t_0} * rp(t) \quad (1)$$

Δt is the time window in the past taken into account by an individual Δt time to now.

Social Planning

a. Total Cognitive State $=_{def}$

$$\begin{bmatrix} \text{dialoguegameboard} : \text{DGBtype} \\ \text{private} : \text{Private} \end{bmatrix}$$

b. DGBType $=_{def}$

$$\begin{bmatrix} \text{spkr} : \text{Ind} & \text{turn} \\ \text{addr} : \text{Ind} & \text{owner-} \\ \text{utt-time} : \text{Time} & \text{ship} \\ \text{c-utt} : \text{addressing(spkr,addr,utt-time)} & \\ \text{Facts} : \text{Set(Proposition)} & \text{shared assumptions} \\ \text{VisSit} : \begin{bmatrix} \text{InAttention} : \text{Ind} \end{bmatrix} & \text{visual field} \\ \text{Pending} : \text{list(locutionary Proposition)} & \text{ungrounded utts} \\ \text{Moves} : \text{list(illocutionaryProposition)} & \text{grounded utts} \\ \text{QUD} : \text{poset(Question)} & \text{qs under disc} \\ \text{Mood} : \text{Appraisal} & \text{face} \end{bmatrix}$$

Rapport estimation

Relies on publicized information (i.e., DGB) perceived during the interaction (verbal (Zhao et al., 2014) and non-verbal (Tickle-Degnen and Rosenthal, 1990) actions). Madaio et al. (2017) use such information to implement a rapport estimator with temporal association rules.

Social Planning

Planning

- As the plan becomes more complex, it can be divided into different sub-tasks or *episodes* with sub initial states and sub end states in accordance with *social repair* episodes.
- Then a plan $\rightarrow p = stack(\{ep_1, ..., ep_n\}) = stack(EP)$.
- We hypothesize that low rapport accumulation is the trigger of the task plan change.
- We introduce Ω as a set of weights relating to the goals: $\Omega = \{\omega_1, \ldots, \omega_k\}$.
- For current purposes, we restrict attention to: $G = \{g_t, g_s\}$ (i.e., task goal and social goal) and $\Omega = \{\omega_t, \omega_s\}$.
- We define r_{th} as one's accumulated rapport threshold. From this, we obtain $\omega_s * r_{th}$ as the weighted rapport accumulation threshold.

Social Planning

Extended Private Part

$$
\text{PRIVATE} = \begin{bmatrix}
\text{Agenda:OpenQueue(Action)} \\
\text{Plan: OpenStack(PlanConstruct)} \\
\text{BEL:} \begin{bmatrix} \text{Rapport} = \begin{bmatrix} \text{Cur} = rp(t) \\ \text{Accu} = r_a(t) \\ \text{Trd} = r_{th} \end{bmatrix} \end{bmatrix} \\
\text{Goals:} \begin{bmatrix} \text{GoalsSet: List(Prop)} \\ \text{GoalsIpt} = \Omega\text{: List(Float)} \end{bmatrix} \\
\text{RepairSet: Set(Plan)}
\end{bmatrix}
$$

- Rapport is given by a function over time: $rp(t)$.
- r_{th} as one's accumulated rapport threshold that triggers the task plan changes if $r_i^j < \omega_s * r_{th}$.
- r_{th} implies the agent's social sensibility during the interaction.

Social Planning

Update rule

If the threshold condition is reached, we infer that the next episode in the plan ep_{j+1} can be *deferred*. If one episode is *deferred*, an element of the repair set ep_i^r can be *inserted* before ep_{j+1}.

$$\begin{array}{c} \textbf{Off} \qquad \textbf{Topic} \qquad \textbf{Triggering} \\ \left[\begin{array}{l} \text{Pre:}\left[\text{BEL.Rapport.Accu} < \text{BEL.Rapport.trd}\right] \\ \text{Eff:}\left[insert(ep_i^r, Plan.cur)\right] \end{array}\right] \end{array}$$

Exemplifying the account: first example I

Example

AGENT: No that's not it. [1]

TEENAGER: I don't know. [2]

AGENT: So why did you do it that way? Sometimes I have a tough time explaining my thinking. [3] (neg self-disclosure)

TEENAGER: I wasn't right, so like. . . I don't know how to do it. [4]

AGENT: You want to get the x term by itself. I hope I'm explaining this okay. [5]

TEENAGER: I. . . still don't know. [6]

Exemplifying the account: first example II

We assume:

- The decay rate is 0.8.
- This conversation takes place in the j th episode.
- The rapport accumulation threshold is $r_{th} = 5$.
- We assume that at the completion of utterance [2], the rapport score (in ascending order from 1 to 7) is 4, and after [6], it is 2.
- The assistant's $\Omega = (\omega_t, \omega_s) = (0.5, 0.5)$. This means that equal importance is assigned to the task and social goals.
- $\Delta t = 1$. This means the turn span is one. We calculate the accumulation from [2] to [6].

- From (1), r[2]: $r_2^j = \sum_{t=1}^{t=2} \gamma^{2-t} rp(t) > \omega_s * r_{th}^j$ and r[6]: $r_6^j = \sum_{t=5}^{t=6} \gamma^{6-t} rp(t) < \omega_s * r_{th}^j$
- When [6] triggers the accumulation threshold condition, the assistant defers the current episode (i.e. the agent could say:" Let's take a break.");
- The assistant needs to select an episode that maximizes the rapport raising among the social repair set EP^r, inserting an off task topic (i.e., agent might say: "By the way, do you like Spider-Man?").

Exemplifying the account: second example I

Example

PARENT: You should do this (points) . . . [1]

TEENAGER: I don't know. [2]

PARENT: What do you mean? You should understand, you should do exactly like this . . . [3]

TEENAGER: Yes, but I still don't know how to do it. [4]

PARENT: You should do this and this (points)! [5]

TEENAGER: OK. . . [6]

Exemplifying the account: second example II

We assume:

- The decay rate is 0.8.
- This conversation takes place in the j th episode.
- The accumulation threshold is $r_{th} = 5$.
- We assume that at the completion of [2], the rapport score (in ascending order from 1 to 7) is 3, and after [3], it is 1.
- The parent's $\Omega = (\omega_t, \omega_s) = (0.8, 0.2)$. This means that the parent's focus is more on task than on the social needs.
- $\Delta t = 1$. This means the turn span is one.

- From (1), r[2]: $r_2^j = \sum_{t=1}^{t=2} \gamma^{2-t} rp(t) > \omega_s * r_{th}^j$ and r[5]: $r_5^j = \sum_{t=4}^{t=5} \gamma^{5-t} rp(t) > \omega_s * r_{th}^j$
- After [3], since the rapport accumulation is not lower than the parent's threshold, the social repair mechanism is less likely to be triggered than in the first example. Hence, the parent pushes the child to continue the task with [5].

Future Work

- Certain conversational strategies in the rapport model proposed by Zhao et al. (2014) can improve rapport when social repair is required. How this, and more generally how rapport estimation can be integrated into a formal model of dialogue such as KoS, remains to be worked out.
- We plan to investigate how the off-task mode differs in functionality across different types of conversation.
- In reality, the individual's rapport accumulation threshold r_{th} changes dynamically in accordance with the dialogue context and type of conversation. We would like to integrate the type of conversation (Wong and Ginzburg, 2018) into the assessment of rapport accumulation threshold.
- Is the distribution of OTT with respect to rapport level different than that of other conversational strategies that last less than one clause?

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