Rapport and collective attention: How we predict others will share knowledge

Andrew S. Heim

University of Tennessee, Knoxville, aheim@vols.utk.edu

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To the Graduate Council:

I am submitting herewith a dissertation written by Andrew S. Heim entitled "Rapport and collective attention: How we predict others will share knowledge." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Experimental Psychology.

Garriy Shteynberg, Major Professor

We have read this dissertation and recommend its acceptance:

Lowell Gaertner, Michael Olson, Jon Garthoff

Accepted for the Council:

Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)
RAPPORT AND COLLECTIVE ATTENTION: HOW WE PREDICT OTHERS WILL SHARE KNOWLEDGE

A Dissertation Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Andrew Stephen Heim
May 2024
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ABSTRACT

When we observe people playing cooperative games together, there are several factors such as their rapport, attention, and theory of mind reasoning ability that might influence the information we think they will prioritize. On the one hand, we might expect players to clear up uncertain information. On the other hand, we might expect them to instead share information that is unknown to their partner. Participants observed two players in a cooperative game and predicted how the players would choose to go about prioritizing the sharing of information. We found that participants generally chose to discuss private knowledge. Additionally, it appears that observed psychological rapport is not predicted by the type of rapport building task, but rather by the perception of their synchronicity. Further exploratory analyses demonstrated that observers who had the initial hunch to share information were more likely to want predict others would talk about private knowledge, which was the most rational decision available.
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CHAPTER ONE
INTRODUCTION AND LITERATURE REVIEW

Imagine, for a moment, that you are watching two partners playing a game of bridge. These partners are trying to work together to best determine how to play their respective hands. In this case, one of them has a strong hand and wants to win the opening bid, so they need to work together to convey information before they can play the hand and compete with the opposing team. Each of them knows certain information. They each hold information about the cards in their hand, we might call this information private knowledge in that it is only known to the individual. Other information can be shared, but there will always be a degree of uncertainty involved. In bridge, you are only able to communicate by placing bids on the outcome of the game by using a number and a suit e.g., one spade. These bids can provide clues to your partner regarding the strength and suit of your hand, but they will always fall short of perfect knowledge. You cannot outright tell your partner which cards you have, but you can try to guide them towards this imperfect understanding to better negotiate who should play the hand or even if it would be best to let the opposing team play it. We might call this type of doubtful knowledge shared knowledge, where there is some lack of full or perfect communication. Finally, when the bidding is done, the person who wins the bid will place their partner’s hand face up and play from it as well as their own hand. We might call this state of perfect
knowledge *common knowledge* in that every piece of information is literally out on the table for everyone to see.

If you were observing a game of bridge transpire, what sort of factors might you consider to be beneficial to the partners’ success? One thing that might come to mind is how attentive the partners are to each other when they are communicating through bids. For instance, if one of the partners gets up to go grab a snack in the middle of bidding, forgetting what was communicated previously in the process, you might knock that against their odds. We might also consider how these partners pay attention to what the other players are saying and the game as a whole. We can call this kind of attending *collective attention*. Another consideration might be the length of time the pair has played bridge together, in other words, how much *rapport* do they have. A couple that has been playing together for decades with a strong understanding of the subtleties in each other’s communication style would certainly appear to have an advantage over a partnership of two strangers. As with any game, there will also be an element of innate or trained ability involved. In a game like bridge where people are seeking to understand the knowledge states of others on multiple levels, a person’s *theory of mind reasoning ability* would be the best candidate for consideration.

Taken together, attention, rapport, and theory of mind reasoning might be able to account for what an impartial observer would predict in terms of
outcome and knowledge sharing in a game such as bridge. However, bridge has an interesting limitation in that players are unable to convey the private knowledge of their own hand until the window for communication is closed. This limitation prevents the players from achieving the most logical goal of sharing their entire hand with their partner outright before bidding is completed. But what might happen if this limitation was removed, and players were free to discuss any and all information at their disposal? Would they, under these circumstances, focus only on private knowledge, or might they instead want to clarify uncertain information?

In choosing to focus on the observer, there is some evidence to suggest that observers may not be accurate when they are required to recall information discussed by the people they are observing (Schober and Clark, 1989). However, a recent case has been made that by listening in on a conversation, observers are better able to understand what participants may be thinking about given that they are free to act as a neutral party and do not have to participate in the conversation itself (Castano et al., 2023). That is to say they might not remember everything about the conversation, but they might have a better sense for what the conversational participants might be thinking.

There are two potential hypotheses for how an observer might go about answering those questions. The first is the expectation that the discomfort of shared knowledge will lead an observer to predict that players will discuss
shared knowledge before private knowledge. In other words, the observer will think that people will want to make common what is shared over what is private. Additionally, observing two people collectively attending to new knowledge should evoke a desire to see shared knowledge transformed into common knowledge out of a desire to remove doubt. Given that it is uncertain whether all parties know it or do not know this shared knowledge, observers might assess that participants will share this knowledge to alleviate their psychological discomfort (Hypothesis 1A). The alternative hypothesis is that observing others in a state of collective attention might instead cause us to gloss over shared knowledge so that we may quickly resolve doubts about other people’s mental states. This, in turn, would lead an observer to consider that players would want to talk about private knowledge first. Further, the sharing of private knowledge is the absolute best choice in terms of rationality, so observers should assess that private information will be discussed first (Hypothesis 1B).

In addition to these hypotheses, it would also be interesting to explore several other questions regarding the observer’s ideas about the information that participants will discuss. In addition to the confirmatory analysis, each of the rules will be explored in comparison to the other. Further, the factors of rapport, synchronicity, task type, and theory of mind reasoning ability will be considered as well. To fully address these hypotheses, I will first provide some background
and relevant research on collective attention, psychological rapport, common knowledge, and theory of mind reasoning.

**Psychological Rapport and Collective Attention**

One variable which certainly warrants consideration as an observer of two players in a game is how much rapport they seem to have with each other. Tickele-Degnen & Rosenthal (1990) define rapport as a construct consisting of three essential components, mutual attentiveness, positivity, and coordination. They also argued that there is a shift in the importance placed on each of these aspects of rapport with positivity and attentiveness prioritized at the onset of a relationship between two people. This then shifts towards prioritizing attentiveness and coordination later. Often this construct has been criticized for being quite vague and situational in nature. For instance, the same pause that might diminish rapport in a negotiation, could enhance rapport in a therapy session (Depaulo & Bell, 1990).

Quite similarly to ideas about increasing collective attention, rapport appears to increase when people are communicating synchronously in a face-to-face manner. This way of communication is also the natural preference for people, regardless of the medium being in person or electronic (Johansen, Valee, & Vian, 1979). Others have proposed that conversation and interaction may lead to increased levels of rapport and that these might differ depending on the social situation, e.g. a mother and her child vs. friends playing a game though in each
case it still seems to serve the purpose of enhancing coordination (Argyle, 1990). Further research has indicated that not only the presence of another, but their ability to mirror behavior such as stride when walking can enhance rapport (Miles, Nind, & Macrae, 2009).

Turning briefly to the research on collective attention, we can better demonstrate the rationale behind the competing hypotheses of prioritizing private or shared knowledge. Collective attention is a state in which the perception of attention towards an object takes the form of a first-person plural perspective, i.e., we are attending to something (Shteynberg, 2015). Work in this realm has empirically demonstrated that attending to an object with another person has the potential to increase memory, provide stronger motivation, encourage more extreme judgements, and increase affective intensity (Shteynberg, 2015), and allow for a greater degree of behavioral learning (Shteynberg & Apfelbaum, 2013). Interestingly, Shteynberg (2010) found that words were more quickly and more accurately recalled after co-attending with a similar other. Follow-up research indicated that participants were also better able to remember words that only their partner was responsible for, i.e., they were co-attending to a partner’s word list even when they did not need to do so for the task at hand.

These findings demonstrate that entering into a state of collective agency with another person leads to a focus of cognitive resources onto the object of
attention. Further propositions have pointed to states of collective attention as a potential solution to the problem of common knowledge in that everyone must know that everyone knows something in order to act concerning an object of collective attention (Shteynberg et al., 2020). This is accomplished by means of mitigating any recursive doubt we might feel about another person’s state of mind. By alleviating this doubt, we are then able to turn the power of our cognition towards the object of our collective attention.

Because of rapport and collective attention’s relevance to common knowledge and the cognitive efficiency generated by removing recursive doubt, rapport and collective attention will need to be considered as explanatory factor as we turn our attention towards theory of mind reasoning and the knowledge states themselves.

**Theory of Mind Reasoning Ability**

Finally, it is time to turn towards the innate or learned ability of the players, more specifically in terms of theory of mind. In the realm of human psychology, theory of mind reasoning has been principally observed and discussed in terms of developmental milestones, however there may be more going on than initially met the eyes of researchers.

The initial paradigm for assessing theory of mind in humans was known as a false-belief task in which a child was asked to identify where an observer would predict a marble would be after it had been moved out of their sight.
Children with this ability would be able to correctly identify that the observer would have a false-belief about where the marble was and in doing so select the correct location (Baron-Cohen, Leslie, & Firth, 1985). Birch & Bloom (2007) hypothesized that children in these false-belief paradigms might instead be struggling to overcome a bias that is present due to the curse of knowledge, i.e., the tendency to be biased by one’s own current knowledge state when trying to appreciate a more naïve perspective whether that perspective is our own early perspective, or someone else’s perspective. This conceptualization of the curse of knowledge broadens the earlier idea of hindsight bias (Fischoff, 1977) in that it refers to not only the self, but others as well. In order to test this idea, they utilized a significantly modified version of the Sally-Anne task known as the Violin task. The key differences in this scenario were the use of four different colored boxes, the boxes were rearranged after moving the object, and the adult participant were asked to report the likelihood of the character searching each of the boxes as a percentage. Given that adults should have no conceptual or cognitive issues in false-belief reasoning, it was quite a surprise to find that adults did in fact struggle with this task under conditions in which an alternative search location might be available insofar as they were logically reasonable.

Given that these potential errors in reasoning appear to be present in adults, further work by Hedden & Zhang (2002) indicated that it might be possible to categorize adults into either myopic or predictive in their theory of
mind skill. Those adults who are myopic have difficulty seeing beyond one level of theory of mind. That is, they can make predictions about what someone will do with one recursion. Other adults, classified as predictive, are much more readily able to iterate two or more recursions and thus are more successful at games requiring this ability. In the competitive games in question, participants are posed with a board with four squares labeled A, B, C, and D. Each square has two point values which represent the number of points that each player will receive if the game ends on this square. Starting in square A, participants much decide whether or not they wish to advance from square A to square B, or simply end the game on square A and receive the points indicated. If, however, participants decide to move to square B, their opponent is afforded the same choice, stay on square B and end the game, or advance to square C and pass the turn back to player 1. By varying the point values in the squares, one is able to determine a given participants skill at theory of mind reasoning. Those that are only able to think in one round of recursion tend to not realize that their opponent will simply stop the game if it is advantageous to them. Those with greater ability in this regard are able to think through each step of the game and what their opponent might logically choose (Zhang et al., 2012). Often times the best move for player 1 is simply to end the game outright. Please see Figure 1 for an example of these tasks. In examining theory of mind reasoning ability, it will also be important to consider the knowledge states of those being observed.
Figure 1. Myopic and predictive reasoning task.
Common, Shared, and Private Knowledge

Finally, we can turn to a summary of the knowledge states themselves. When considering the recursive nature of common knowledge, it is practically impossible for two people to be in a state of common knowledge, although they may still have the perception that they are in a state of common knowledge. Halpern (1986) first demonstrated the paradox of common knowledge by proposing a coordinated attack problem in which two generals are attempting to plan an attack. They are only able to communicate via messenger and have no way to confirm their messages have been received. Given this limited communication, they will never be able to fully confirm that a message to advance and attack has been received, and thus there is no way for them to resolve their lack of common by acting together. Rubinstein (1989) proposed that people are uncomfortable with the mathematical induction involved in knowledge that is not held in common and proposed categories of common and almost common knowledge. These categorical propositions lead us to considerations of knowledge as distinct social psychological states. Drawing inspiration from Rousseau’s (1755) classic stag hunt economic game in which hunters can either work independently to guarantee taking home a rabbit or risk working together to bring down a deer, Thomas et al. (2014) established a paradigm to further explore the seemingly categorical nature of these knowledge states. They placed participants in a situation in which they could either work
independently as a butcher or baker and make chicken wings or dinner rolls. In addition to this option, participants could also pool their resources to make hot dogs (See Figure 2). To portray common knowledge, participants in this experiment were told the daily prices for each item over a loudspeaker. There could then be no doubt that each had heard what was said and it was found these participants almost always worked together to make hotdogs. On the other hand, sometimes this information was delivered in an explicitly private fashion, leading participants to work independently to avoid profit loss due to a potentially uncooperative partner even when hotdogs were priced high. Finally, participants were placed in various levels of shared knowledge (e.g., the other participant knows the hotdog price is high, but does not know that you know that) and it was found that they were generally uncooperative. Further, participants did not categorically distinguish between various recursive levels of shared knowledge indicating that anything falling short of common knowledge is considered roughly perceptually equivalent in our minds. Overall, the study demonstrated that while we are prone to make errors distinguishing between different levels of shared knowledge, we make almost no errors distinguishing between private and shared, private, and common, and shared and common.
Figure 2. An example of the payoff matrix in the butcher and baker paradigm.
The Current Study

Taken together, these lines of research suggest that people are extremely good at recognizing the categorical nature of knowledge. There appear to be three distinct psychological states regarding this knowledge, that of private knowledge, shared knowledge, and common knowledge. Further, people seem to be hesitant to take action when they are discomforted by being in the state of shared knowledge in between common and private. The theory of mind literature indicates also that, as in the bridge club, some people might be better at thinking about the knowledge states of others either through innate ability or training. Additionally, the rapport, synchronization, and focus of attention present in states of collective attention may play a role in the potential resolution of this problem of common knowledge. It also appears that utilizing an observer might be the best lens through which to assess a situation like this given that they tend to be unbiased by the situation a hand. This dissertation, therefore, investigates the ways in which an observer might think about how others share or ask about knowledge in cooperative situations.

In order to test these hypotheses, we will begin with an analysis of the effect of synchronicity and task on observed rapport. This is done to determine whether or not different rapport building tasks and the synchronicity of those tasks can increase rapport or not. If there is differentiation based on synchronicity or task type, this will allow for further analysis based on
conditions in which observers felt high or low rapport. There is especially good reason to predict that synchronicity will play a large part in these due to previous work demonstrating that psychological rapport is increased during face-to-face contact which in turn leads to greater cooperation between experimental partners (Drolet & Morris, 1999). These findings would have some implications for the best path to engage in collective attention should some rapport building tasks appear to be superior to others.

Confirmatory analyses will then investigate whether or not increased levels of rapport led observers to predict that participants would give priority to discussing private knowledge or shared knowledge first. This confirmatory analysis will also examine the base rate of choosing to discuss common, shared, and private knowledge in order to provide insight into what most observers choose most of the time regardless of other factors.

Further exploratory investigations examine the impact of an observer’s initial hunch, i.e., if they think that participants will share information first, is it more likely to be private or shared knowledge? Other analyses examine the predictive power of rapport and theory of mind reasoning ability on what information observer’s predict participants will share in a variety of different circumstances.
Participants

Undergraduate students and volunteers ($N = 415$) were recruited either through the University of Tennessee’s SONA system for half an hour of research course credit or as volunteers via a research flyer. Of these participants, $N = 408$ were recruited from the SONA system and $N = 7$ were recruited through social media. The experiment occurred online and generally took between 15 and 30 minutes to complete. In order to investigate the research questions, the experiment principally measured observed rapport and assessed its influence on which rule observers thought participants would discuss. Additionally, a $2$ (asynchronous rapport vs. synchronous rapport) x $2$ (creative rapport vs. conversational rapport) design was utilized to assess the effect of these factors on the observation of rapport between participants. Upon consenting to participate, participants were randomly assigned to one of these four conditions: asynchronous/creative, asynchronous/conversational, synchronous/creative, or synchronous/conversational. In each condition, participants acted as an observer to two people interacting with each other and then playing a password learning game.

A priori power analyses were conducted using G*Power version 3.1.9.7 (Faul et al., 2009) for sample size estimation required to test each study.
hypotheses. Results indicated the required sample size to achieve 80% power for
detecting a medium effect at a significance criterion of \( a = .05 \) with 1 degree of
freedom, was \( N = 128 \). For the logistic regression, sample size was estimated
according to the formula \( N = 100 + 50(i) \) where \( i \) refers to the number of
independent variables in the final model (Bujang et al., 2018). Based on this
estimate, a sample size of 300 should be adequate to test all proposed
hypotheses.

**Instruments**

Measures included a rapport questionnaire, questions about sharing
information, and a task to determine participant’s ability to reason about other
people’s mental states.

**The Creative Rapport Task.** This is a simple task in which participants are
asked to work together with a partner to come up with creative uses for a brick
(Guilford, 1967). The task is used to encourage participants to engage in
collective attention with another person.

**The Conversational Rapport Task.** This two-person task begins with 2
minutes for each of them to introduce themselves. This introduction is followed
by a 5-minute discussion of “positive experiences at the University of
Tennessee.” Each person is instructed to speak for 1 minute about their positive
experiences. After that they are to take turns discussing positive experiences.
They are also provided with sample topics to facilitate conversation (Drolet and Morris, 1999).

**Myopic/Predictive Reasoning Task.** This is a recursive reasoning task in which the observer play a competitive reasoning game against an opponent. The participant is told they are playing a competitive game with another person with the goal of scoring more points than the opponent. The participant is given the option to either move the game piece one quadrant on a board or leave it in place. Point values are assigned for both the participant and the opponent on each quadrant. The opponent also had the same choice. The results of this game can classify the participant as a myopic or predictive reasoner. Myopic reasoners are only able to recursively reason one step ahead, while predictive are able to reason 2 or more steps ahead (Zhang et al., 2012).

**Rapport Questionnaire.** This brief questionnaire contains questions regarding the level of rapport between two people. Questions deal with concepts such as understanding, expression, synch, and harmony (Drolet & Morris, 1999).

**Rule Sharing/Asking Comparisons.** In addition to the above measures, observers were also presented with several questions regarding which rule they would share or ask about. The initial two questions asked about the participant’s initial hunch. The first question asked them if they think Player 1 would ask or share information. Follow up questions made comparisons between different rule options, e.g., would they be more likely to ask about rule 3 or rule 5?
**Procedure**

Participants received a link to a Qualtrics survey via either the UTK SONA System or through online recruitment. They were then prompted to read over a consent form and electronically indicate their consent to participate in the study. Participants were then randomly assigned to one of four conditions based on task type (creative vs. conversational) and visual synchronicity (synchronous vs. asynchronous). They were presented with videos of two players either having a conversation about their positive experiences during their time at the University of Tennessee, or creatively coming up with as many uses for a brick as they could think of. Players were observed either interacting face-to-face with cameras on for the visual synchronicity condition, or with cameras turned off for the asynchronous condition. Once this initial rapport building video was completed, participants then watched the same two players learn the rules for a password identification game from a moderator. Players were told that they would be working together to identify acceptable passwords and that points would be scored collectively. This ensured that there would be every incentive to discuss the information provided and no incentive to keep knowledge to oneself. The main measure of interest is what exactly the participants think the players of the game wanted to discuss first. Participants watched the players learn the rules for valid passwords as either common knowledge, shared knowledge, or private knowledge:
Rule Type 1 – Common Knowledge (We Know the Rule)

Both players heard the rule together. There was no doubt about whether each heard the rule.

Rule 2 and 3 – Common Knowledge Uncertain (It is unclear if we know the rule)

Participant observed Player 1 or Player 2 look away from their camera or pull their earbuds out during the time in which the instructor is teaching the rule.

Rule Type 4 and 5– Private Knowledge (I Know the Rule)

Participant observer each player learn their own unique rule that the other player certainly does not know.

Once the moderator finished providing the last rule, participants turned towards a series of questions regarding the interactions between Player 1 and Player 2.

The initial question concerns what the participants think Player 1 would first (ask or share) and with which rule. Participants were also asked to qualitatively explain their reasoning for why Player 1 would do the option the participant chose. This initial question is followed by a series of comparisons for both sharing and asking in which the participants are asked which of two rules they think Player 1 would be more or less likely to share or ask about to Player 2. After answering these questions, the participant was redirected to fill out a questionnaire asking about the level of rapport they felt the two people they
observed possessed during the experiment. Once this is completed, the participant played a brief recursive reasoning game in order to assess their theory of mind capabilities. For a list of questions, please see Appendix A.

At the conclusion of the experiment, the participant was debriefed regarding the reasoning behind the experiment. They were also provided with materials for further reading. In addition to this, they were encouraged to reach out to the experimental team with any questions they may have.
CHAPTER THREE
RESULTS

Descriptive Statistics

Data collection efforts resulted in an initial sample of $n = 436$ participants. Of this sample, 23 indicated that they did not consent to participate (5) or failed to indicate their consent to participate in the study (18). A further 35 participants were excluded due to failure to complete the experiment. This resulted in a final sample of $n = 378$. These descriptive statistics are summarized in Table 1.

Rapport Scale Principal Cronbach Alpha

The rapport scale that was utilized originally consisted of 5 items ($\alpha = .526$). Each item in the scale was tested by removal in order to determine if it had good reliability in measuring rapport. Results indicated that the removal of items 1, 2, 3, and 4 negatively impacted the reliability of the scale. However, the removal of item five lead to a large increase in Cronbach’s alpha, enhancing reliability (.831). This question was reverse scored, and this is most likely explained by participants not reading the question thoroughly when answering. For further analysis, item 5 was dropped while the other items measuring rapport were retained. The results of this analysis are summarized in Table 2. The rapport scale utilized in this experiment was taken from one developed by Drolet and Morris (1999) and these findings regarding the fifth question of harmony lined up with their rejection of this item as well.
Table 1

Descriptive Statistics for Participants

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<td>11.22</td>
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</tr>
<tr>
<td>Rule 4</td>
<td>26</td>
<td>29.55</td>
<td>27</td>
<td>27.55</td>
<td>28</td>
</tr>
<tr>
<td>Rule 5</td>
<td>36</td>
<td>40.91</td>
<td>41</td>
<td>41.84</td>
<td>36</td>
</tr>
<tr>
<td>Private</td>
<td>62</td>
<td>70.45</td>
<td>68</td>
<td>69.39</td>
<td>64</td>
</tr>
</tbody>
</table>
Table 2
Cronbach’s Alpha for Rapport Scale Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s Alpha if Item Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rapport</td>
<td>.351</td>
</tr>
<tr>
<td>2. Understood1</td>
<td>.226</td>
</tr>
<tr>
<td>3. Understood2</td>
<td>.244</td>
</tr>
<tr>
<td>4. Synch</td>
<td>.312</td>
</tr>
<tr>
<td>5. Effort</td>
<td>.831</td>
</tr>
</tbody>
</table>
Basic Analysis

Results indicated that the majority of observers predicted that the players would discuss private knowledge \((n = 258)\). Observers then thought that that players would want to clarify shared knowledge \((n = 99)\). Very few observers thought that players would want to discuss common knowledge \((n = 21)\). Please see Figures 3 and 4 for a graphical breakdown of these knowledge categories.

Synchronicity and Task Type Analysis of Variance

The results of a 2 x 2 factorial ANOVA comparing the main effects of synchronicity (synchronous, asynchronous) and task type (creative, conversational) on the level of observed rapport between two observed participants indicated that there was a main effect of synchronicity with participants in the synchronous conditions \((n = 186, M=4.29, SD=.88)\) reporting higher levels of observed rapport than those in the asynchronous conditions \((n = 192, M=3.85, SD=.81)\), \(F(1, 374) = 18.018, p < .001, r^2 = .047\). There was no difference found between those observing the creative \((n = 191, M=4.06, SD=.89)\) and conversational \((n = 187, M=4.00, SD=.84)\) task type, \(F(1,374) = .241, p = .624\). There was no interaction between synchronicity and task type, \(F(1,374) = .453, p = .502\). These results are summarized in Table 3, Table 4 and Figure 5.
Figure 3. Share and Ask by Rule Number.
Figure 4. Shared vs. Private Knowledge.
Table 3  
*Means and standard deviations for rapport as a function of a 2 (task type) x 2 (synchronicity) design.*

<table>
<thead>
<tr>
<th>Task Type</th>
<th>Synchronous</th>
<th>Asynchronous</th>
<th>Marginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converational</td>
<td>4.19</td>
<td>1.09</td>
<td>3.75</td>
</tr>
<tr>
<td>Creative</td>
<td>4.31</td>
<td>1.17</td>
<td>3.73</td>
</tr>
<tr>
<td>Marginal</td>
<td>4.26</td>
<td>1.13</td>
<td>3.74</td>
</tr>
</tbody>
</table>
Table 4

*Synchornicity x Task Type on Rapport.*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>SS</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>Partial eta²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6021.80</td>
<td>1</td>
<td>6021.80</td>
<td>4437.25</td>
<td>&lt;.001</td>
<td>.922</td>
</tr>
<tr>
<td>Task Type</td>
<td>.22</td>
<td>1</td>
<td>.22</td>
<td>.16</td>
<td>.688</td>
<td>.000</td>
</tr>
<tr>
<td>Synchronicity</td>
<td>24.81</td>
<td>1</td>
<td>24.81</td>
<td>18.28</td>
<td>&lt;.001*</td>
<td>.047</td>
</tr>
<tr>
<td>Task Type x Synchronicity</td>
<td>.46</td>
<td>1</td>
<td>.46</td>
<td>.34</td>
<td>.561</td>
<td>.001</td>
</tr>
<tr>
<td>Error</td>
<td>507.56</td>
<td>374</td>
<td>1.36</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 5. Synchronicity and average rapport.
**Binary Logistic Regressions for Rules 1 – 5**

Binary logistic regressions indicated that rapport was not a significant predictor of choosing to talk about rule 1 (OR = .821, 95% CI [.57, 1.18], p = .29), rule 2 (OR = 1.061, 95% CI [.85, 1.32], p = .60), rule 3 (OR = .853, 95% CI [.62, 1.17], p = .33), rule 4 (OR = 1.104, 95% CI [.92, 1.33], p = .30), or rule 5 compared to all other rules (OR = .968, 95% CI [.81, 1.15], p = .72). See Table 5 for a summary of the means and standard deviations of rapport for each rule.

**Binary Logistic Regressions for Shared and Private Rules**

Additionally, rapport did not significantly predict difference between the shared knowledge rules 2 and 3 and all other rules (OR = .986, 95% CI [.81, 1.20], p = .90). Neither did higher levels of rapport make a difference for observer’s predictions regarding the sharing of private knowledge rules 4 and 5 compared to all other rules (OR = 1.062, 95% CI [.89, 1.27], p = .52). See Table 6 for a summary of the means and standard deviations of rapport for these analyses.

All further analyses are exploratory. Throughout these analyses, task type is excluded due to its irrelevance to rapport building. Synchronicity is also excluded due to it serving as a significant predictor of rapport. Instead, rapport, theory of mind reasoning ability, and initial hunch that players would ask or share are considered as predictive variables of interest. A correlation matrix is provided for all variables in Table 7.
Table 5

Means and standard deviations for rapport as a function of a rule choice.

<table>
<thead>
<tr>
<th>Rule</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.73</td>
<td>1.02</td>
</tr>
<tr>
<td>2</td>
<td>4.06</td>
<td>1.19</td>
</tr>
<tr>
<td>3</td>
<td>3.78</td>
<td>.67</td>
</tr>
<tr>
<td>4</td>
<td>4.09</td>
<td>1.32</td>
</tr>
<tr>
<td>5</td>
<td>3.97</td>
<td>1.19</td>
</tr>
<tr>
<td>Overall</td>
<td>3.99</td>
<td>1.19</td>
</tr>
</tbody>
</table>
Table 6

*Means and standard deviations for rapport as a function of a rule choice.*

<table>
<thead>
<tr>
<th>Rule</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared</td>
<td>3.98</td>
<td>1.02</td>
</tr>
<tr>
<td>All Except Shared</td>
<td>4.00</td>
<td>1.19</td>
</tr>
<tr>
<td>Private</td>
<td>4.02</td>
<td>.67</td>
</tr>
<tr>
<td>All Except Private</td>
<td>3.94</td>
<td>1.32</td>
</tr>
</tbody>
</table>
Table 7

*Correlation matrix for all independent variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Observed Rapport</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Synchronicity</td>
<td>.22*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Task Type</td>
<td>.08</td>
<td>.01</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Theory of Mind Reasoning</td>
<td>-.03</td>
<td>-.04</td>
<td>.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Initial Hunch</td>
<td>.05</td>
<td>.09</td>
<td>.00</td>
<td>.05</td>
<td>-</td>
</tr>
</tbody>
</table>
Binary Logistic Regression Initial Knowledge Question

A binary logistic regression assessed the likelihood of an observer predicting a player would want to discuss private knowledge over shared knowledge. The predictive variable was whether or not the observer thought the player would ask about or share information. The results indicated that when observers thought that Player 1 would share information instead of ask about it, the odds of discussing private information increased by 92% (OR = 1.92, 95% CI [1.19, 3.09], p < .01). Please see Table 8 and Figure 6 for a summary of these results. The variable of average observed rapport was also considered as a potential main effect and moderator of the initial hunch regarding whether an observer thought the player would ask or share information. In each of these potential models, rapport did not appear to significantly impact the results treated as either a main effect (OR = .1.04, 95% CI [.85, 1.26], p = .70) or a moderator (OR = 1.06, 95% CI [.71, 1.57], p = .79).

Binary Logistic Regressions for Rules Effects and Moderation of Hunch

Further analysis considered the effect of the observer’s initial hunch on whether the player would ask or share information. When this variable was included with rapport as both a main effect and moderator, there were no significant findings for any of the individual rules alone, the shared knowledge rules, or the private rules.
Table 8

*Binary Logistic Regression Predicting Private Knowledge with Share or Ask*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>SE $\beta$</th>
<th>Wald</th>
<th>$p$</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.677</td>
<td>.190</td>
<td>48.749</td>
<td>&lt;.001</td>
<td>1.969</td>
</tr>
<tr>
<td>Share</td>
<td>.650</td>
<td>.244</td>
<td>7.077</td>
<td>.008</td>
<td>1.916</td>
</tr>
</tbody>
</table>
Figure 6. Share and ask information on shared or private knowledge
Binary Logistic Regression Rule v. Rule Breakdowns

In order to understand the predictive power of synchronicity, task type, theory of mind reasoning ability, and average rapport score, binary logistic regressions were conducted on a sampling of the survey questions in which observers reported which of two rules they perceived the players as likely to discuss under the assumption that Player 1 would either be asking about or sharing one of the two rules. While observers were surveyed on many comparisons, the focus of this analysis is on those items which contrast private knowledge and shared knowledge.

**Ask Rule 3 (Uncertain if Player 2 Knows) vs. Rule 5 (Only Player 2 Knows)**

A binary logistic regression assessing the predictive power of theory of mind ability and average perceived rapport on whether observers think that the players will ask about rule 5 (the rule that was told to Player 2 privately) instead of rule 3 (the rule that Player 2 might not know as they appeared distracted). Theory of Mind was not significant. However, there was a significant result for each unit increase in an observer’s perceived rapport, there was a 24% increase in the odds of discussing private knowledge instead of shared knowledge (OR = 1.24, 95% CI [1.02, 1.52], p < .05). The results of this analysis are summarized in Table 9 and Figure 7. This effect held with the inclusion of initial hunch as a main effect.
Table 9

*Binary Logistic Regression Predicting Asking Rule 3 vs. Rule 5*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>SE $\beta$</th>
<th>Wald</th>
<th>$p$</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.22</td>
<td>.42</td>
<td>.59</td>
<td>.44</td>
<td>1.24</td>
</tr>
<tr>
<td>Theory of Mind</td>
<td>-.07</td>
<td>.25</td>
<td>.09</td>
<td>.77</td>
<td>.93</td>
</tr>
<tr>
<td>Average Rapport</td>
<td>.22</td>
<td>.10</td>
<td>4.51</td>
<td>.04*</td>
<td>1.24</td>
</tr>
</tbody>
</table>
Figure 7. Histogram of average rapport for rule 3 and rule 5.
Ask Rule 2 (Uncertain if Player 2 Knows) vs. Rule 5 (Only Player 2 Knows)

An additional binary logistic regression assessing the predictive power of these same variables was conducted on Rule 2 (the Rule that it is unclear if Player 1 heard as they appeared distracted) vs. Rule 5 (the Rule was told to Player 2 privately). In this case, Average Rapport was not significant. In this model, observers who demonstrated higher levels of theory of mind reasoning were 1.58 times more likely to discuss private knowledge instead of shared knowledge (OR = 1.58, 95% CI [1.00, 2.51], p = .05). The results of this analysis are summarized in Table 10.

Further analysis introduced the observer’s initial hunch as a potential main effect and moderator. While initial hunch did not appear to act as a moderator, when included as a main effect, theory of mind reasoning ability (OR = 1.61, 95% CI [1.00, 2.58], p < .05), synchronicity (OR = 1.59, 95% CI [1.00, 2.53], p < .05), and initial hunch (OR = 1.96, 95% CI [1.23, 3.11], p < .01), all significantly predicted the odds of talking about private knowledge. Observers were 61%, 1.58 and 1.89 times more likely to think that the players would discuss private knowledge when they had higher theory of mind reasoning skill and had a hunch to share knowledge respectively. For a summary of these analyses, please see Table 10 and 11 and Figures 8 and 9.
Table 10

*Binary Logistic Regression Predicting Asking Rule 2 vs. Rule 5*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>SE $\beta$</th>
<th>Wald</th>
<th>$p$</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.08</td>
<td>0.39</td>
<td>0.04</td>
<td>0.85</td>
<td>1.08</td>
</tr>
<tr>
<td>Theory of Mind</td>
<td>0.46</td>
<td>0.24</td>
<td>3.75</td>
<td>0.05*</td>
<td>1.58</td>
</tr>
<tr>
<td>Average Rapport</td>
<td>0.14</td>
<td>0.10</td>
<td>2.28</td>
<td>0.13</td>
<td>1.15</td>
</tr>
</tbody>
</table>
Table 11

*Binary Logistic Regression Predicting Asking Rule 2 vs. Rule 5 with Hunch*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>SE $\beta$</th>
<th>Wald</th>
<th>$p$</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.38</td>
<td>.41</td>
<td>.84</td>
<td>.36</td>
<td>1.46</td>
</tr>
<tr>
<td>Theory of Mind</td>
<td>.46</td>
<td>.24</td>
<td>3.71</td>
<td>.05*</td>
<td>1.58</td>
</tr>
<tr>
<td>Average Rapport</td>
<td>.16</td>
<td>.10</td>
<td>2.69</td>
<td>.10</td>
<td>1.17</td>
</tr>
<tr>
<td>Initial Hunch</td>
<td>.64</td>
<td>.23</td>
<td>7.58</td>
<td>.01**</td>
<td>1.89</td>
</tr>
</tbody>
</table>
Figure 8. Myopic vs. predictive reasoners on rule 2 and rule 5.
Figure 9. Initial hunch to share or ask on rule 2 and rule 5.
CHAPTER FOUR
DISCUSSION

Task Type and Synchronicity

In regard to task type and synchronicity, this experiment featured two tasks that were designed to increase feelings of togetherness and psychological closeness. One of these tasks emphasized creative conversation, while the other of these took a more conversational approach. However, it appears that neither of these manipulations was strong enough to influence the two conditions. Based on the results of both the analysis of variance and the binary logistic regressions, it appears as though task type does not matter insofar as it is irrelevant to the cooperative situation at hand. As an example, had these two players been shown preparing to play a cooperative game such as bridge, discussing strategy, tactics, ideas, it is highly likely that task might have played a more significant role in the observer’s judgements. We also may turn to the finding of Dawes et al. (1977) which indicated that irrelevant communication does not appear to influence cooperation on a task. Taken together, it appears as though for collective attention, it is necessary to introduce rapport building tasks that are relevant to the object of collective attention instead of wholly irrelevant in the case of the brick task or the conversational task. While these tasks most likely build some degree of rapport between participants, it would be even better
if this task could be more directly relevant to the goal or object of shared attention. Future research may benefit from tailoring the rapport building task to the objective leading to enhanced feelings of both felt and observed rapport and collective identity.

The Relationship between Rapport and Synchronicity

While the type of task did not play a role in rapport, observers’ observed rapport scores appear to be influenced by synchronicity which is not surprising given the wealth of research that has been conducted on collective attention and synchronicity (Shteynberg & Apfelbaum, 2013; Birch & Baimel, 2018). Future research may consider controlling for factors such as whether the dyad is in-person compared to online and how physical synchronicity beyond mere presence could impact felt rapport. It would also be interesting to investigate the potential interaction between level of synchronicity and a goal specific rapport building task in future work. Other lines of research might wish to examine the interplay between rapport and collective attention over time. As a dyad works together to achieve some object of collective attention over time, does rapport continue to increase and does that in turn affect their propensity to work together? If this were to be a positive feedback loop, what then might the limit be of this enhancement?
Observer’s Initial Hunches and Hypotheses

It appears that overall, people have a strong tendency to expect others to want to talk about private knowledge. This, however, only provides indirect support for hypothesis 1B in that overall, it appears as though perceived rapport does not influence observer’s ideas about what participants will share. However, given the general skew towards sharing private knowledge, it seems that people may not be discomforted enough by shared knowledge to fail in the logical choice to discuss private knowledge. Future research might consider situations in which shared and private knowledge are weighted differently or in which participants are under heightened levels of stress. Perhaps under these conditions, there can be found a tipping point at which shared knowledge might be thought to be more important.

Predicting Shared or Private Knowledge

Across multiple exploratory analyses, it appears as though there are certain factors that may lead an observer to predict that two participants will want to discuss private knowledge over shared or uncertain knowledge. The first of these analyses dealt with the simple first impression or hunch that an observer had. The results indicated that observers felt that when people were going to share information, they may be much more likely to want to share private information as opposed to clarifying potentially unclear information. This is interesting because sharing information is already the most logically consistent
option as indicated by the logic matrix in Figure 10. If someone is already thinking in such a manner, it makes sense that the information they would share would be private knowledge that would, with great certainty, be of use to their partner. Additionally, the scenarios in which a participant might be asking about information are inherently less logical than sharing. Sharing information will lead to a point gain much more readily than asking and waiting for another turn of speech to pass. This is a possible explanation of these results taken as a whole.

These findings may at first appear to clash with the results of the hidden profile task of Stasser and Titus (1985). In their hidden profile paradigm, participants were presented with information that, taken individually, would suggest that an inferior political candidate would be the best. However, when this information is combined with information from fellow group members, the true best candidate is revealed. Overall, their findings suggest that participants did not share unique or private information instead rehashing the information that was already common (Stasser and Titus 2003). While this may seem to contradict the current findings at the surface level, a formula for group discussion was put forward that does seem to take the situation set forth in the current study into account.
<table>
<thead>
<tr>
<th>If Player 1 Shares about Rule</th>
<th>There is a</th>
<th>We Will Gain</th>
<th>Points</th>
<th>Round of Talking</th>
<th>Logical Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Certainty</td>
<td></td>
<td></td>
<td></td>
<td>0 This</td>
<td>3</td>
</tr>
<tr>
<td>3 Possibility</td>
<td></td>
<td></td>
<td></td>
<td>1 This</td>
<td>2</td>
</tr>
<tr>
<td>5 Certainty</td>
<td></td>
<td></td>
<td></td>
<td>1 This</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 10. Logic matrix for password identification game.
This formula:

\[ p(D) = 1 - [1 - p(R)]^n \]

where \( n \) is the number of group members who can recall an item, \( p(R) \) is the probability that a given group member can recall and contribute information, and \( p(D) \) is the probability of discussing an item. By this formula, we can reconcile the results of the current study. The \( p(R) \) for a participant remembering their private rule, should be approaching 100%, as such, we can assume a value of 1. Our value for \( n \) would also be one as only one group member knows each of the private rule. This leaves us with the following formula for both player 1 and player 2:

\[ p(D) = 1 - [1 - 1]^1 \]
\[ p(D) = 1 - [0]^1 \]
\[ p(D) = 1 - 0 \]
\[ p(D) = 1 \]

indicating that there is a near 100% chance of the private knowledge being discussed. The results of the current study would add further support to this formula. Further, it indicates that the probability of discussion formula may have utility for observers of group discussions as well. It would be interesting for future research to consider situations in which more rules were learned and in which there were more players with multiple players knowing certain rules. It might have also been interesting to have observers rate the likelihood that a
player would recall the rules in which there was some sort of disruption to the rule learning process. For instance, if we found that most observers thought it was 22% likely that a given participant did not hear the rule, then we could plug into the formula:

\[ p(D) = 1 - [1 - .22]^{1.22} \]

to arrive at the roughly 26% of people who did want to discuss shared knowledge over private knowledge.

There were no significant findings for any of the asking rule comparisons, while there did appear to be an effect of theory of mind reasoning and hunch between asking about rule 2 vs. rule 5 and an effect of rapport for asking about rule 3 vs. rule 5. It may be that being placed in an inherently illogical situation of asking increases the relevance of theory of mind reasoning ability and observed rapport between two participants.

Regarding the difference in findings between sharing rule 2 or 3 vs. rule 5, interpretation will require further analysis of the inherent logic of these situations. Theory of mind reasoning ability was most likely an important factor in the rule 2 vs. rule 5 question due to the fact that rule two is the least logical of the choices to talk about when compared to both rule 3 and rule 5. A strong theory of mind reasoner would likely be able to import their mental state into these situations and make this determination. On the other hand, when dealing with rule 3 vs. rule 5, theory of mind reasoning may not be as useful given that
both rules have the potential of bringing up new information to Player 1’s partner. This indicates that theory of mind reasoning ability may be more helpful in situations in which there is a clearly superior logical option to take. Turning then to the comparison of rule 3 vs. rule 5, it appears that rapport may potentially be of more interest to the understand what is going on in cases where the logic between two choices is not so clear. In this case as rapport increased, there was a marginally significant increase in wanting to ask about private knowledge instead of clearing up uncertain knowledge. These results taken together demonstrate that theory of mind ability can help us to parse eliminate truly illogical options in favor of logical ones, but when we are presented with two roughly equivalent logical options, rapport may serve to help us reduce uncertainty about what a partner does not know. It appears increased rapport might lead an observer to make the assumption that uncertain knowledge is more common than it actually is. This is in keeping with the idea that collective attention may serve as the solution to the problem of common knowledge. This seems to imply on some level that sharing new information might be more important than clarifying unclear information. However, in the case of this experiment, the curse of knowledge could also have been biasing the observer. Future research should seek to control for this while investigating how rapport and collective attention help us to share private knowledge by investigating the phenomenon from multiple perspectives such as the players themselves,
observers, and coders. Other research has indicated that observer judgments may not always be accurate in judgements of rapport (Bernieri et al., 1996).

An additional exploratory analysis sought to include the initial hunch of the observer that the player would share or ask about information. While it’s inclusion in the rule 3 vs. rule 5 comparison did not appear to make much of a difference as either a moderator or main effect in its own right, it did appear to alter the results of the rule 2 vs. rule 5 comparison. When the initial hunch was included, theory of mind reasoning ability and the hunch were both predictive of discussing rule 5, private knowledge. This does seem to make sense, after all if, as discussed previously, the observer is already better at theory of mind reasoning, it also follows that their initial hunch might be more grounded in logical reasoning about how other people might think. That is to say that those good at theory of mind reasoning should also have a better initial sense for what people should do and talk about first.

The Need for Naturalistic Collective Attention Experiments

The main future direction that this line of research may consider taking is that of more naturalistic, observational studies. Collective attention is a phenomenon that is seen in nearly every situation in which two or more people are coming together to cooperate. These situations ought to be identified and examined as much as possible. This type of work has been done somewhat recently regarding the construct of rapport. Researchers were able to conduct
observational studies about the experiences of rapport in people’s daily lives and have indicated that rapport can be studied quite well and accurately via diary logging throughout a person’s regular day (Baker, Watlington, and Knee, 2020). While this sort of qualitative analysis is more time and resource consuming, there is definitely an opportunity for examining how these factors work outside of a laboratory. Instead, turn towards a local football match, traditional religious services, a workplace team trying to complete a project, a husband and wife planning for their future and even the local bridge club. In each of these arenas, you would have a high likelihood of finding people who want to work together to achieve some common objective. How do they share, how do they ask, does it matter how good they are at reasoning or whether they are even physically together? These questions seem to be answered daily in a variety of settings that are ripe for future exploration.
REFERENCES


APPENDICES
APPENDIX A

Consent Cover Statement
Password Identification Game

You are invited to participate in a research study. The purpose of the study is to investigate play. There is information that the researchers are not sharing at this time that will be disclosed at the end of the experiment.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY
The following is a general description of the study and a reminder of your rights as a potential participant. You will be observing a recording of two people engaging in a rapport building task together. You will then watch a recording of these two people learn the rules of and play a password identification game together. After that, you will answer some questions about their interaction. Finally, you will be provided with instructions for and then play a different, brief, game yourself. This is a psychological research study. The study is being conducted in the Psychology Department associated with the University of Tennessee, as well as through online participation. You have to be 18 years old to participate. The total duration of this study is 20-30 minutes.

RISKS Most research involves some risk to confidentiality, and it is possible that someone could find out you were in this study or see your study information, but the investigators believe this risk is unlikely because of the procedures we will use to protect your information.

BENEFITS Your participation will benefit this research project, contributing answers to the science of psychology.

CONFIDENTIALITY Researchers will take measure to protect your confidentiality. Data will be stored securely and will be made available only to persons conducting the study unless participants specifically give permission in writing to do otherwise.

COMPENSATION If you are a student at the University of Tennessee, signed up through the SONA system, you will receive .5 credits for your participation. If you are not a student at the University of Tennessee, you will not receive compensation. You are eligible for course credit compensation if you choose to withdraw from the study prior to its completion. As an alternative you may write a research paper, each paper is worth 1 credit. The research paper will ask you to summarize and review the major ideas or research processes in a
published psychology research article.

CONTACT INFORMATION If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researchers Andrew Heim aheim@vols.utk.edu or Garriy Shteynberg, at gshteynb@utk.edu. If you have questions about your rights as a participant, you may contact the University of Tennessee IRB Compliance Officer at utkirb@utk.edu or (865) 974-7697.

PARTICIPATION Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be deleted.

CONSENT I have read the above information and I consent to participate.

I CONSENT
I DO NOT CONSENT

Please watch the video below of two people interacting with each other in a task:

Please watch the video below of the same two people, Player 1 and Player 2 learning the rules for a password identification game together:

You will answer a series of questions about the video, so make sure to watch the entire video.

Do you think Player 1 will share information or ask information?
  Share information with Player 2
  Ask Player 2 for Information

Based on your previous answer, which rule will Player 1 share or ask information about first?
  Rule 1
  Rule 2
  Rule 3
  Rule 4
  Rule 5

Why do you think that?
Regardless of your previous answers, you will now be posed with hypothetical situations in which Player 1 chooses to either share or ask about one of two rules. Please select the rule you think they are more likely to share or ask about for each question.

Player 1 is more likely to **share** information about:
- Rule 1
- Rule 2

Player 1 is more likely to **share** information about:
- Rule 1
- Rule 3

Player 1 is more likely to **share** information about:
- Rule 1
- Rule 4

Player 1 is more likely to **share** information about:
- Rule 2
- Rule 3

Player 1 is more likely to **share** information about:
- Rule 2
- Rule 4

Player 1 is more likely to **share** information about:
- Rule 3
- Rule 4

Player 1 is more likely to **ask** information about:
- Rule 1
- Rule 2

Player 1 is more likely to **ask** information about:
- Rule 1
- Rule 3

Player 1 is more likely to **ask** information about:
- Rule 1
- Rule 5
Player 1 is more likely to ask information about:
   Rule 2
   Rule 3

Player 1 is more likely to ask information about:
   Rule 2
   Rule 5

Player 1 is more likely to ask information about:
   Rule 3
   Rule 5

What level of rapport did you feel between Player 1 and Player 2?
   1 Not at All
   2
   3
   4
   5
   6
   7 Quite a Lot

Did you feel that Player 1 understood what Player 2 was trying to express?
   1 Not at All
   2
   3
   4
   5
   6
   7 Quite a Lot

Did you feel that Player 1 and Player 2 were “in synch” or “on the same wavelength with each other?”
   1 Not at All
   2
   3
   4
   5
   6
   7 Quite a Lot
How effortful was it for Player 1 and Player 2 to establish a harmonious feeling in their conversation?

1 Not at All
2
3
4
5
6
7 Quite a Lot

Now you will play a brief competitive game. In this game, there are two players. You will be Player 1. On your turn, you must decide whether to advance the piece to the next square or not. If you choose not to advance the piece, the game is over. Players score points based on the payoff matrix provided in the square in which the game ends. In the example below, if you were to choose to end the game on your first turn, you would score 1 point and your opponent would score 1 point. If you were to advance the piece to square B and then your opponent decided to end the game, you would receive 1 point and they would receive 2 points. The first number in the brackets is always the payoff for Player 1 and the second number is always the payoff for Player 2. In the example game provided here, Player 1 can either decide to stay in A and receive a payoff of 1 while their opponent also receives a payoff of 1. Alternatively, they could choose to move to B. Their opponent Player 2 could then choose to stay at B for a payoff of 2, while Player 1 receives 1, or move to C. Player 1 would then get the chance to decide to take the payoff in C or move to square D where the game will end automatically. Either player can always choose to end the game on the start of their turn.
In the game above, what do you decide to do?

Stay on Square A
Move to Square B

Why did you decide to do that?

Debriefing

Main Conceptual Question/Hypothesis: The study aims to investigate the following questions: 1. What types of situations yield the greatest amount of rapport between two people? 2. Does high rapport inhibit our ability to determine the best way to share knowledge in a cooperative economic game? In order to investigate these questions, the current study will employ a 2 (asynchronous rapport vs. synchronous rapport) x 2 (creative rapport vs. conversational rapport) design.

Measures will include a rapport questionnaire, two questions about sharing information, and a task to determine a participant’s ability to reason about other people’s mental states. Hypotheses H1: Synchronous rapport tasks will receive higher ratings than asynchronous ones. H2: Creative and conversational rapport will be rated differently. H3: High rapport will lead to a preference for sharing knowledge over private information in the cooperative game.

Procedures: To answer these questions, we had you observe a rapport-building task followed by a cooperative game. We were interested in what information you thought the people you were observing would share and in what order. We
had you play a reasoning game at the end to classify your ability to reason about other people’s mental states.

Data Analysis: In order to test H1 and H2, a 2 (synchronicity) x 2 (task type) factorial ANOVA will be conducted with the rapport scale as the dependent variable. To test H3, a binary logistic regression will be conducted to determine the likelihood of selecting which knowledge to share across different pairings of rules. The predictors are synchronicity, task type, observed rapport, and recursive reasoning ability.

Where you can find more: You can learn more about sharing knowledge in this article: https://dash.harvard.edu/bitstream/handle/1/14330738/The%20Psychology%20of%20Common%20Knowledge%20and%20Coordination_Thomas%20DeScioli%20Haque%20%26%20Pinker.pdf?sequence=1&isAllowed=y
You can learn more about theory of mind reasoning in this article: https://www.sciencedirect.com/science/article/abs/pii/S0010027702000549

Contact Information: If you have any questions or comments about this research, please feel free to contact Dr. Garriy Shteynberg gshteynb@utk.edu or Andrew Heim aheim@vols.utk.edu

Task Scripts

Pre – Task
Creative

P1: Ok, do you have any ideas for what a brick could be used for?

P2: Let me think… well, it could be used as a doorstop.

P1: Good one! How about using it as a paperweight?

P2: Haha that works! It can also work as a weight for exercising.

P1: Nice! A brick can be used as a bookend.

P2: Absolutely. And it can be used to make a fire pit.
P1: True. We could also use it to build an outdoor pizza oven.
P2: Yes! And they can be stacked to create a wall.

P1: Good idea! Hmmm you could also build a mailbox with bricks.

P2: Yeah, you could also use them to make a garden path.

P1: Let’s see, what else could we do. Maybe it could be used to build a birdhouse?

P2: Ok great, it looks like we have 10, I think we are done!

Conversational
Player 2: So how did you like your time at UT?

Player 1: Overall, I had a really good experience at UT. The atmosphere was always fun, especially during football season. I had some great professors and I made some really good friends that I still keep in touch with.

Player 2: I had a similar experience. It felt like home, and I got to take a bunch of different courses that allowed me to explore my interests fully. I really got into photography and had the chance to take some classes for it!

Player 1: What was your favorite class at UT, and why?

Player 2: I loved my Geology 101 course. The professor was passionate, and the hands-on field trips made learning about rocks so much fun! How about you? Any favorite classes or professors?

Player 1: Definitely my child development class. The professor was so good telling stories about her own kids. It made me how amazing kids are. Did you join any clubs?

Player 2: Yes, I joined the student government. It taught me a lot of valueable leadership skills and allowed me to get more engaged in campus life. Did you have any memorable campus events?

Player 1: Absolutely, the Homecoming game was unforgettable. I loved watching the band play and singing rocky top! What's your most cherished memory from UT?
Player 2: Graduation day, for sure. My whole family was there watching me walk across the stage, it was so special. How about you?

Player 1: Definitely graduation day for me too. It was a proud moment for me and my family, and it made me realize how far I had come at UT. It was great, I will definitely miss my time at UT.

Player 2: Me too!

**Rule Learning Game:**

Rule 1: Each Password Must Contain an Exclamation Mark ‘!’
Rule 2: Each Password Must Contain at Least 1 Capital Letter
Rule 3: Each Password Cannot Contain Spaces
Rule 4: Each Password Cannot Contain the Letter “N”
Rule 5: Each Password Must Contain the Number “7”
VITA

Andrew Stephen Heim was born on November 28, 1995, to Stephen Heim and Dulcie Butler, in Nashville, Tennessee. In high school, he was awarded the title of Valedictorian. He earned a Bachelor of Science in Pre-Graduate Psychology with a minor in Philosophy from the University of Middle Tennessee, summa cum laude, in 2018. During his undergraduate studies, he also attended the University of Glasgow in Scotland. He received a Master of Arts in Experimental Psychology from the University of Tennessee in 2020 with thesis, titled, "Asch and AI: Conformity to Non-Human Intelligence." His research focuses on collective attention, theory of mind, and suicide prevention. After completing his doctorate, Andrew will continue his work in suicide prevention and teaching.