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Transcribing Group interaction to identify lies

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Overview of Transcription Work

- What can we learn from doing transcriptions?
 - Services charge thousands, we wanted to try products that could perform better (or as well) without using human transcriptionists.
 - Timestamping at a precise level—to coordinate with audio and video analyses
 - Transcripts allow analysis of spoken words—linguistic analyses
 - Coding of what was said—not everything spoken by spies is a lie
 - Strategy analysis—how do different spies perpetrate deception
 - Biases and beliefs analysis—how do biases and beliefs about human behavior influence deceptive interactions



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Overview of Deception

Linguistic/Verbal

- Pronoun use
- Bigrams/Unigrams
- Nouns/Verbs
- Lexical diversity
- Types of lies

Nonverbal/Behavioral

- Gaze direction
- Facial action units
- Gestures
- Facial rigidity
- Head movements

Vocalic/Acoustic

- Pitch
- Pitch variety
- Loudness
- Harmonics
- Voice quality
- Hesitations



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Detecting Deception from Patterns or Clusters of Cues



Cluster 1: Tension

- Higher Pitch
- Pupil dilation
- Vocal tension
- Lip pressing
- Less smiling



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Cluster 2: Uncertainty

- Less dominant
- More ambivalent
- Less plausible
- Less involved and immediate
- Less embracement
- More negative statements



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Cluster 3: Cognitive Load

- Pause longer
- Wait longer to answer
- Fewer illustrators
- Fewer hand/finger movements
- Fewer leg/foot movements
- More repetitions
- Shorter answers



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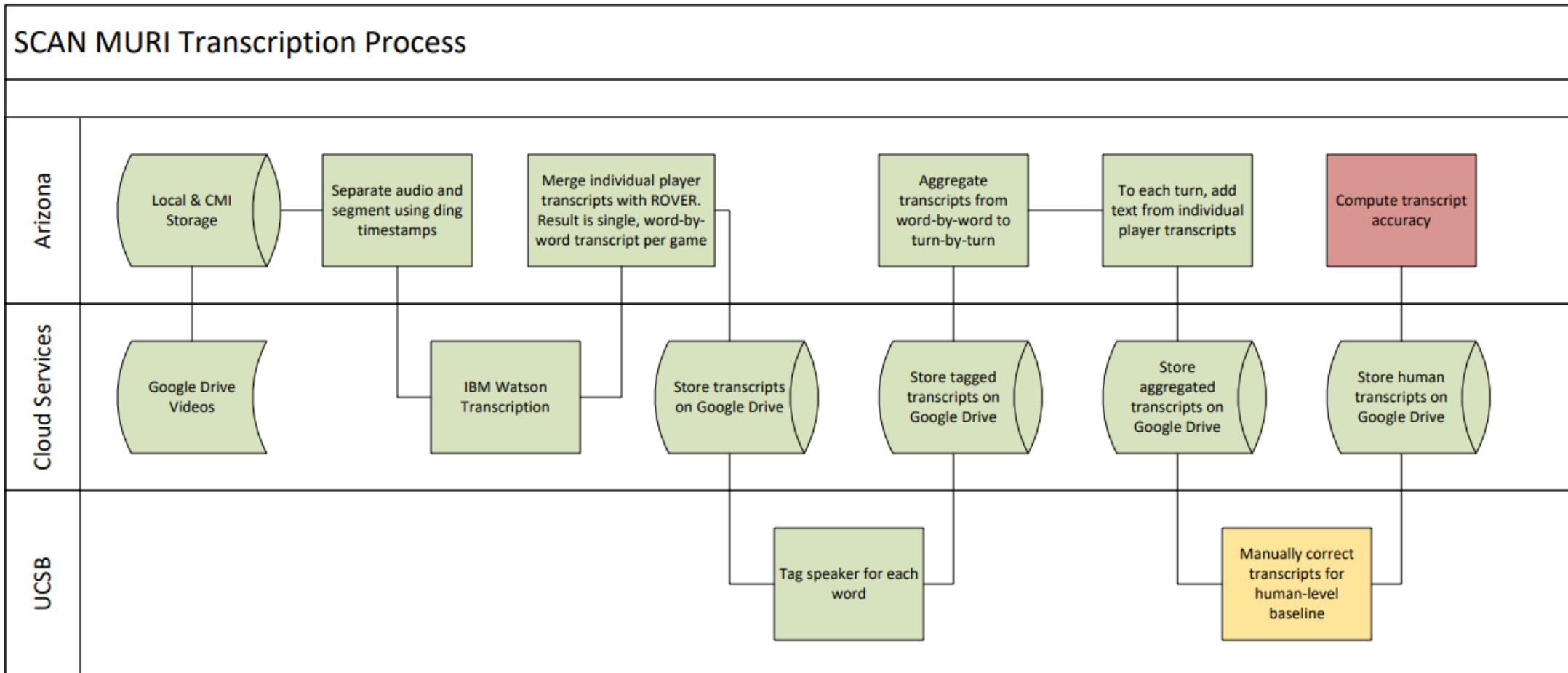
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SCAN MURI Transcription Process



Process is well-established.
Software, RA documents are completed

Process is being developed.
Software, RA documents are in testing

Process development in planning phase

Data Storage

Process



Start with a JSON File from Watson

```
{
  "warnings": [
    "Custom model 23e994aa-5ba7-4443-a5e9-af90afea5499 is temporarily unavailable. Using the base model instead.",
    "Unknown arguments: continuous."
  ],
  "results": [
    {
      "alternatives": [
        {
          "transcript": "so",
          "confidence": 0.745,
          "word_confidence": [
            [
              "so",
              0.745
            ]
          ],
          "timestamps": [
            [
              "so",
              1.8,
              2.06
            ]
          ]
        }
      ],
      "final": true
    },
    {
      "alternatives": [
        {
          "transcript": "a",
          "confidence": 0.894,
          "word_confidence": [
            [
              "a",
              0.894
            ]
          ],
          "timestamps": [
            [
              "a",
              2.66,
              3.02
            ]
          ]
        }
      ]
    }
  ]
}
```



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Convert to CSV

A	B	C	D	E	F	G	H	I	J
	startRow	endRow	roundname	timeStart	timeEnd	speaker	newphrase		
0	0	9	Intro	2.5	4.84	0	So before we begin the game we would like to go around the room and ask each of you to		
1	10	12	Intro	13.1	6.284	0	Introduce yourself we will		
2	13	20	Intro	8.293	8.86	0	ask you to say your first name so first name only, not your last name		
3	21	21	Intro	10.117	10.414	0	Something about yourself		
4	22	27	Intro	16.3	11.78	0	and something interesting that will help		
5	28	30	Intro	13.46	14.205	0	the other players remember you		



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Convert to Word, listen with video and tag speakers, correct words (2 steps)

	startRow	endRow	roundname	timeStart	timeEnd	speaker	newphrase
0	0	9	Intro	2.5	4.84	0	they so like to go around and happy to be
1	10	12	Intro	13.1	6.284	0	person yourself will
2	13	20	Intro	8.293	8.86	0	ask your first name so over the name
3	21	21	Intro	10.117	10.414	0	some
4	22	27	Intro	16.3	11.78	0	to and interesting about will and
5	28	30	Intro	13.46	14.205	0	the other players
6	31	34	Intro	15.265	16.895	0	then ask the person
7	35	57	Intro	18.065	24.155	0	sort of all question to learn more about your interest interesting detail so for you if i'm playing which i not but
8	57	63	Intro	25.8	27.45	0	if i were i would say that

209	3015	3029	Round1	25.53	28.83	0	so number seven why do you think you a you would make a good leader
210	3030	3068	Round1	29.628	39.956	7	%hesitation on- I like like to like i like to really listen to people like their opinions like really like matter to me so i don't want to make my own decisions are rather just take everyone's like- this-decisions that into accounts
211	3069	3079	Round1	40.54	46.165	0	ok and and number two why did you nominate number seven to be
212	3080	3087	Round1	47.053	49.09	2	Because he looks like a trustworthy answer the guy so
213	3088	3092	Round1	50.21	51.305	2	so is-I said it was a good idea



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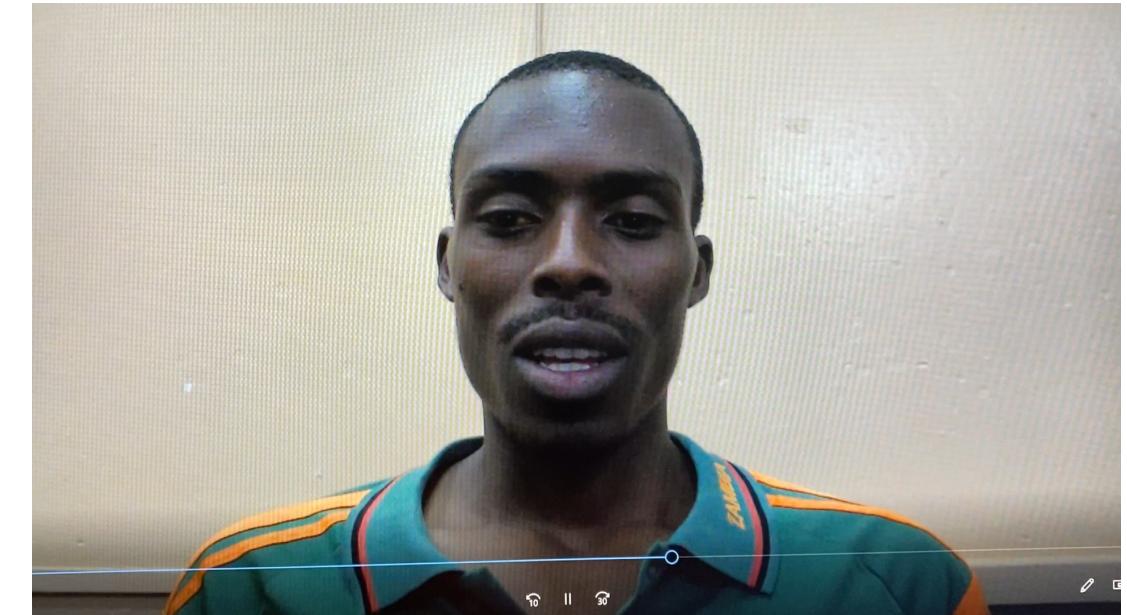
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Example 006ZAM: Player 2, Round 2

How this was transcribed by Watson

those
those four what team
those four what team for participants number three
for to buy a show
a respectable %HESITATION addition with the other
party spines
so we
so we have a vote I needs in the
so we have a vote I needs in the
so we have a vote I needs in the
in the majority of





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Example 006ZAM: Player 2, Round 2

What the transcript said

those
those four what team
those four what team for participants number three
for to buy a show
a respectable %HESITATION addition with the other
party spines
so we
so we have a vote I needs in the
so we have a vote I needs in the
so we have a vote I needs in the
in the majority of

What he actually said

- Those for voting for participant number three, let's vote by a show of hands in respective of our ordination with other participants.
- So we have a vote and its in the majority of participant number three.



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Listen with video again, Code for Lies

6 3 4	406 5	408 6	Roun d1	438. 92	444. 53	3	Yeah I don't know it just seemed to like she knew exactly what to do he was like talking to her she was like		45:15 Raises suspicion of a conspiracy between Players 6 and 7
6 3 5	408 7	408 9	Roun d1	447. 5	445. 45	3	I don't know it just didn't seem		
6 3 6	409 0	409 4	Roun d1	447. 133	447. 67	3	It seems		

Lie: Says something that is demonstrably false (I'm a Villager, Player 6 is a spy)

Misdirection: Does something that might throw Villagers off but might not be factually incorrect.



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Merge split speaking turns together

6 3 4	406 5	408 6	Roun d1	438. 92	444. 53	3	Yeah I don't know it just seemed to like she knew exactly what to do he was like talking to her she was like I don't know it just didn't seem It seems		45:15 Raises suspicion of a conspiracy between Players 6 and 7
-------------	----------	----------	------------	------------	------------	---	--	--	---



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Conduct Lie Analysis

- Compute # of speaking turns per person
- Compute # of lies and misdirections for each spy
- % of time spies spend deceiving others
- # of speaking turns as a measure of dominance



Results (N = 289)

- 40 transcripts were analyzed with an average number of 7.6 players per game
- Average number of speaking turns per game: 432.725
- Each speaking turn was coded as either:
 1. Truth
 2. Lie
 3. Misdirection
- Average Villager Turns: 53.51
- Average Spy Turns: 44.45
 - Near significantly different $t(39) = -1.821, p = .076$
- % of turns spies are deceptive: 16.49%



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Fight or Flight? An Example Game (008SB)



- Player 1
- Spoke 24 times
- 1 lie
- 2 misdirections
- Deception 13.63%



- Player 5
- Spoke 48 times
- 3 lies
- 7 misdirections
- Deception 21.73%



- Player 8
- Spoke 179 times
- 12 lies
- 37 misdirections
- Deception 27.37%



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Coding for Lies: What We Learned

- Each lie & misdirection by a “spy” was then summed and averaged as a percentage of the total amount of deception that they contributed to the game based on how many total turns they had.
 - E.g., = [(Spy # Lies + Spy # Misdirections) / Total # of Turns for Spy During Game) * 100]
- These scores were then analyzed with the post-survey data from players (both villagers and spies) to determine central themes.



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Three Central Themes Emerged

1. Dominance
2. Player Experience
3. Winning Teams





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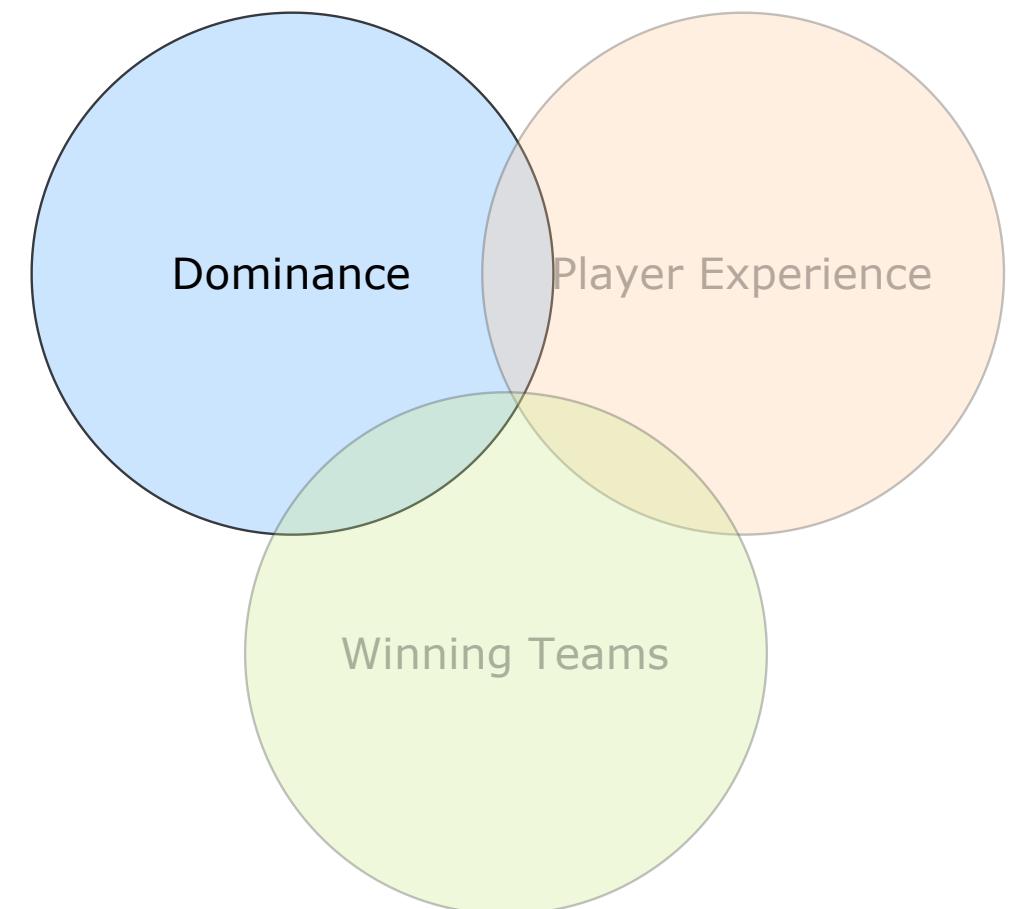


Central Theme: Dominance

Dominance – context and relationship dependent interactional patterns in which one actor's assertion of control is met by acquiescence from another (Dunbar & Burgoon, 2005, p. 208).

Players who were perceived as more dominant throughout the game:

1. Had a higher number of speaking turns ($r = .488$).
2. Lied more than players who were perceived as less dominant ($r = .406$).
3. Misdirected other players at a higher rate than those who were perceived as less dominant ($r = .460$).





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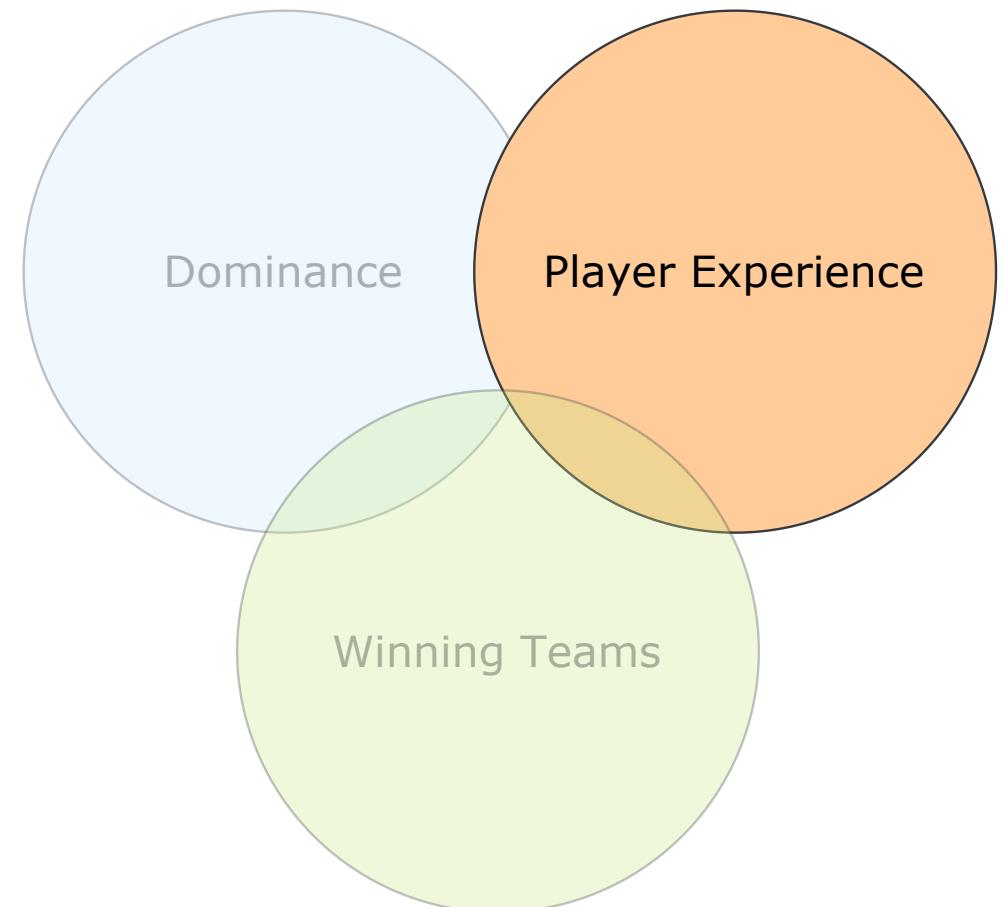


Central Theme: Player Experience

Player Experience – measured as Y/N if the participant had played Mafia prior to the study.

Players who reported having experience with the game:

1. Predicted the number of speaking turns throughout the game.
 - Experienced player had an average of 51.62 turns ($SD = 44.74$), while inexperienced players had an average of 39.81 ($SD = 41.29$).
2. Did not predict how many lies or misdirections the player had throughout the game.





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Central Theme: Winning Teams

Winning Teams – operationalized as a successful team of spies during the game (i.e., spies were successful more rounds than villagers).

Winning team of spies had a higher rate of deception (outright lies and misdirections) than their losing counterparts:

1. Winning teams *spoke* on average 51.73 ($SD = 42.23$), compared to losing teams at 36.64 times ($SD = 40.09$).
2. Winning teams *lied* on average 1.88 times ($SD = 2.33$), compared to losing teams at 1.00 times ($SD = 1.32$).
3. Winning teams *misdirected* their peers on average 5.18 times ($SD = 5.70$), compared to losing teams at 2.39 times ($SD = 2.22$).





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Vocalic Indicators of Deception

Characteristics of Deceivers		Associated Vocalic Cues to Deception
Cognitive Load	Increased Cognitive Load	<ul style="list-style-type: none">• Disturbances in utterances• Delayed responses• Shorter utterances
Emotions	Fear of Getting Caught	<ul style="list-style-type: none">• Decreased loudness• Lower pitch variability• Higher pitch
	Duping Delight	<ul style="list-style-type: none">• Higher pitch• Faster and louder speech
	Emotion of Guilt	<ul style="list-style-type: none">• Lower voice quality due to distancing and vagueness
Strategic Management of Behavior	--	<ul style="list-style-type: none">• Vocalic cues may become less prominent due to asserted control



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Linguistic Indicators of Deception

Characteristics of Deceivers		Associated Indicators of Deception
Cognitive Load	Increased Cognitive Load	<ul style="list-style-type: none">• Fewer words• Less lexical diversity• More disfluencies
Emotions	Fear of Getting Caught	<ul style="list-style-type: none">• Fewer details• Fewer turns at talk• Shorter turns
	Duping Delight	<ul style="list-style-type: none">• Excitement /delight expressed by language
	Emotion of Guilt	<ul style="list-style-type: none">• More hedging and uncertain language• Negative sentiment
Strategic Management of Behavior	Intentional control	<ul style="list-style-type: none">• Linguistic cues may become less prominent due to asserted control



Vocalic / Linguistic *t*-tests with deceivers and truth-tellers

- *Method: T-tests*
- *Details:* Compare truth-tellers' and deceivers' vocalic / linguistic features in the three game phases (T1: Intro, T2: Round 1 & 2, T3: Other game rounds)
- *Results:*
 - Truth-tellers had higher maximum fundamental frequency in T2 than deceivers
 - Deceivers had lower minimum jitter level in T2 than truth-tellers
 - Deceivers have higher dominance ratio in T3 than truth-tellers



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Vocalic / Linguistic Predictors of Deception

- *Method:* Linear Mixed-Effect Model (LME)
- *Details*

Variable Category	Variable Names
Dependent Variable	Vocalic features extracted (pitch/loudness/HNR...) / Linguistic features extracted by SPLICE
Independent Variable	Game role (deceiver/truth-teller)
Control Variables	Game phase, Gender, Game Experience, Whether an English Native, Game status



Combined Behavioral Predictors of Deception

- Analysis of vocal, linguistic, facial, and head behavioral predictors of spies (deceivers) versus villagers (truthtellers)
- Compared to truth tellers, deceivers (spies) display across game rounds:
 - less change in pitch
 - lower vocal quality (shimmer)
 - briefer utterances
 - fewer 1st & 3rd person pronouns, more 2nd person pronouns
 - more lexical diversity than truthtellers as game progressed

	FF-mean	FF-Std	Loudnes s-mean	Loudnes s-Std	HNR-mean	HNR-Std	TaT Duration	Jitter-mean	Jitter-Std	Shimmer -mean	Shimmer -Std
T2	5.472	5.724***	0.034***	0.031***	1.947	0.731	-3.047***	0.003*	0.005*	0.003	0.002
	(3.430)	(1.579)	(0.013)	(0.010)	(3.997)	(1.296)	(0.829)	(0.002)	(0.003)	(0.002)	(0.002)
T3	9.124***	8.492***	0.050***	0.045***	-0.022	1.408	-3.943***	0.004**	0.004	0.004**	0.001
	(3.310)	(1.525)	(0.013)	(0.010)	(3.865)	(1.253)	(0.801)	(0.002)	(0.003)	(0.002)	(0.002)
Role	-0.850	-1.248	0.005	-0.003	6.981	-0.551	1.727*	-0.001	-0.001	0.003	0.004
	(3.647)	(1.679)	(0.014)	(0.011)	(4.250)	(1.378)	(0.881)	(0.002)	(0.003)	(0.002)	(0.002)
Gender	-	-16.802***	0.005	0.016**	-8.262***	-1.570*	1.014*	0.003**	0.003*	0.011***	0.021***
		57.016**	(1.064)	(0.009)	(0.007)	(2.720)	(0.882)	(0.559)	(0.001)	(0.002)	(0.001)
		*	(2.286)								
Experience	-3.796	-1.784	0.0002	0.002	-6.654*	-4.459***	-1.327**	-0.001	-0.003	0.001	-0.001
	(2.613)	(1.277)	(0.011)	(0.009)	(3.408)	(1.109)	(0.672)	(0.001)	(0.002)	(0.002)	(0.002)
English	8.072***	0.651	0.024*	0.025***	-2.779	0.004	0.522	0.001	0.001	0.003	0.002
	(2.756)	(1.384)	(0.012)	(0.009)	(3.809)	(1.243)	(0.729)	(0.002)	(0.002)	(0.002)	(0.002)
Status	-0.556	-0.451	0.0003	0.001	-0.547	0.251	0.536**	-0.001	-0.001	0.0004	0.001
	(1.004)	(0.486)	(0.004)	(0.003)	(1.277)	(0.415)	(0.255)	(0.001)	(0.003)	(0.001)	(0.001)
T2*Role	-2.873	1.052	0.002	-0.005	-0.381	0.176	-2.624**	0.003	0.004	-0.002	-0.003
	(5.352)	(2.462)	(0.020)	(0.016)	(6.228)	(2.019)	(1.292)	(0.003)	(0.004)	(0.003)	(0.004)
T3*Role	-2.166	-0.976	0.002	-0.006	-0.189	0.021	-3.055**	0.004	0.004	-0.0004	-0.002
	(5.211)	(2.397)	(0.020)	(0.016)	(6.066)	(1.966)	(1.258)	(0.003)	(0.004)	(0.003)	(0.004)
Observations	388	388	388	388	388	388	388	388	388	388	388

Note: *p<0.1; **p<0.05; ***p<0.01

Deceivers had shorter turn-at-talk duration in middle and end of game

	Dominance Ratio	Number of Words	Number of Sentences	Sentiment Score	Hedge Ratio	Disfluency	
T2	-0.0002 (0.015)	0.283** (0.142)	0.350*** (0.133)	-0.048*** (0.014)	0.019*** (0.005)	-0.007 (0.006)	
T3	0.004 (0.014)	0.825*** (0.135)	1.027*** (0.126)	-0.067*** (0.014)	0.014*** (0.005)	-0.020*** (0.006)	
Role	0.019 (0.016)	0.090 (0.151)	0.076 (0.141)	0.001 (0.015)	-0.002 (0.006)	-0.002 (0.007)	T2 & T3 differ from baseline
Gender	-0.004 (0.010)	0.451*** (0.092)	0.432*** (0.086)	-0.008 (0.009)	-0.001 (0.003)	-0.004 (0.004)	
Experience	0.011 (0.010)	0.134 (0.103)	0.136 (0.100)	0.008 (0.011)	0.003 (0.004)	0.002 (0.005)	Truth tellers and deceivers do not differ significantly in dominance
English	0.011 (0.010)	0.290*** (0.111)	0.317*** (0.110)	-0.018 (0.013)	0.003 (0.004)	0.006 (0.005)	ratio, number of words, number of sentences, sentiment score, hedge ratio or disfluency
Status	-0.003 (0.004)	0.006 (0.038)	-0.022 (0.036)	-0.006 (0.004)	0.001 (0.001)	0.001 (0.002)	
T2*Role	-0.014 (0.023)	-0.163 (0.216)	-0.088 (0.202)	0.015 (0.022)	0.008 (0.008)	-0.001 (0.010)	
T3*Role	0.006 (0.023)	-0.248 (0.212)	-0.292 (0.198)	-0.002 (0.022)	0.002 (0.008)	0.001 (0.010)	
Intercept	0.054*** (0.013)	-0.772*** (0.138)	-0.878*** (0.138)	0.178*** (0.017)	0.027*** (0.005)	0.049*** (0.011)	
Observations	414	414	414	414	414	414	

Note: *p<0.1; **p<0.05; ***p<0.01



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Accuracy in Predicting Deception from Behavioral Indicators

- Accuracy from statistical analysis: After controlling for all the variables that were covariates, prediction that deceivers won or lost is 75%, specificity is 78%, sensitivity is 78%. Variability due to culture:

Round 4 Deceiver Classification Metrics by Site with Villager Win Information							
	Zambia	Israel	Fiji	US	Hong Kong, China	Singapore	Overall
N Games	15	9	14	30	15	12	95
Win Rate	20%	33%	36%	50%	80%	83%	51%
Accuracy	65%	70%	71%	72%	66%	75%	70%
Sensitivity	52%	61%	62%	65%	57%	68%	61%
Specificity	74%	75%	77%	76%	71%	79%	75%

- Villagers in Asian countries have the highest accuracy of detecting spies despite lack of game experience.
- Vertical individualism is positively correlated with the chance of winning games/detecting liars.



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Summary and Discussion of the Deception Analysis

- Turn-at-talk duration is significantly different between truth-tellers and deceivers
- Many deception cues are theorized to be due to high arousal to “leak” out inadvertently.
- In group interaction, these indicators may be muted or subdued. A deceiver may not be under the same level of scrutiny compared to dyadic or smaller group communication, so they were able to act more naturally
- A large group setting may also provide a deceiver more unobstructed time to consider manipulation strategies. Deceivers need not talk as often as others.

Discussion

- *The importance of more granular, temporal measurement.*
 - impressions at different stages of the group process add information to the ability to predict veracity
- *Relational communication becomes the leading edge in assessing the truthfulness or deceptiveness of others.*



Up next: Qualitative deep dive into single game

Why qualitative analysis?

- Allows for a delicate understanding of deceptive interactions
- Allows for the examination of premises of experimental studies
- Helps to have a better understanding of strengths and weaknesses of quantitative research
- Fosters the emergence of new experimental research questions
- Enables a wide range of other possibilities for data use (e.g., showing how different spies perpetrate the lie, how biases and beliefs about human behavior influence deceptive interactions)



Qualitative deep dive into single game

Showing how different spies perpetrate the lie

- To address the truthfulness or deceptiveness of an utterance, a question has to be asked: what was the previous utterance, and what is the goal of the player, i.e., deceive on the single utterance vs. deceive as to their status (villager or spy)?
- This changes how deception can be performed



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Examples

Examples of Lies

- 008SB
 - Vill4: [nominates self as leader] Because I was on a team that has success.
 - Spy8: So therefore you think you will be successful?
 - Vill4: Well, I think that its like one vote that you don't have to worry about.
 - Spy8: You could have just totally pressed success and are a spy.

Examples of Misrepresentations

- 008SB
 - [Spy5 talking about Spy8 leader nomination]
 - I feel like she's really trustworthy (referring to Vill4) **but so are you** (Spy8) **because you've been the one of the ones speaking about what you think and stuff.**



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Context changes the lie

Player X (a spy)

“Yeah, just say the truth”

The single utterance

Not true, not false

The status of the player

Player X invite others to say the truth, and therefore implies that he or she is telling the truth

“Go villagers!”

Not true, not false

Player X encourages villagers, and therefore implies he or she is a villager.

“Yes”

False (but false because of the question : “You’re claiming not to be a spy?”)

Player X explicitly positions himself or herself as a villager.



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Watching biases play out

Player X (a villager)

"I think I have a lot of leadership experience from past mentorships and I think I'm very strategic and know how to read people well so I think that comes to our advantages" (to the question: "Why would you make a good leader?"

Utterances

Overconfidence

"Little suspicious on defending right there" (Referring to Player A)

Suspicion

"I feel like it's a really... it's a strange defense mechanism to... to reiterate I'm a villager" (Referring to Player A)

Suspicion

"Yeah... He's been on my radar since the very beginning" (Referring to Player A)

Confirm initial assessment

"I'm pretty sure it's [...]" (Referring to Player A)

Final assessment similar to initial assessment



Questions?

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