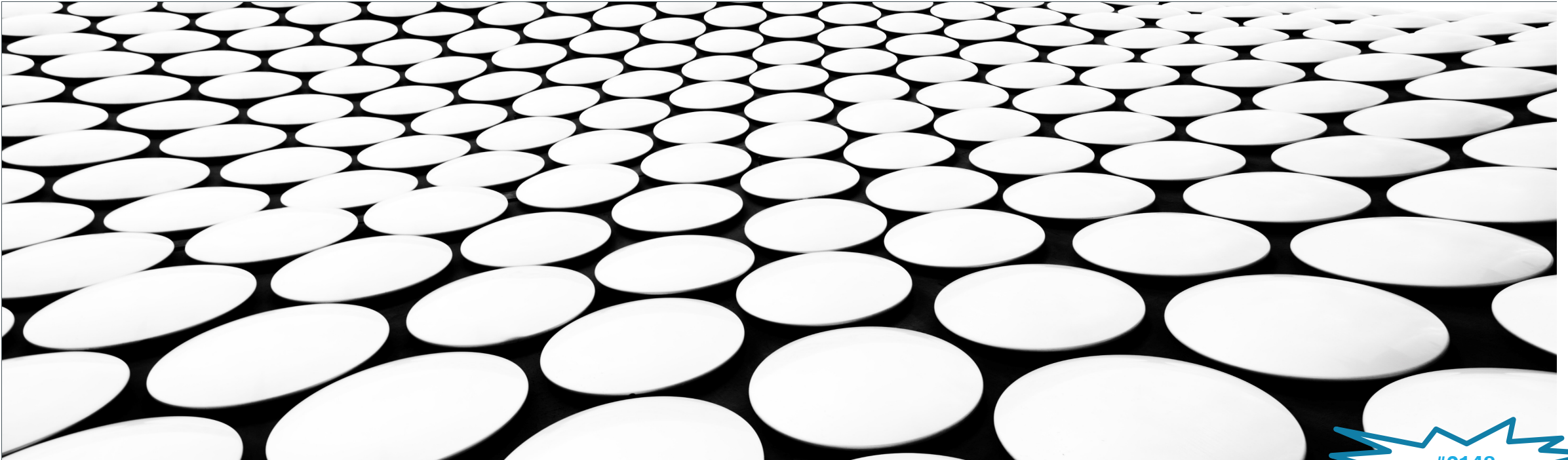

LINGUISTIC ALIGNMENT AND COLLABORATIVE PROBLEM-SOLVING IN ONLINE AND TEAM-BASED INTERACTIONS

AMIE PAIGE¹, CHEN SUN², ANGELA STEWART³, VALERIE SHUTE², SIDNEY D'MELLO³, & NICHOLAS DURAN¹

ARIZONA STATE UNIVERSITY¹, FLORIDA STATE UNIVERSITY², & UNIVERSITY OF COLORADO BOULDER³



BACKGROUND

Constructing shared knowledge

- Shares understanding of problem/solution
- Establishes common ground

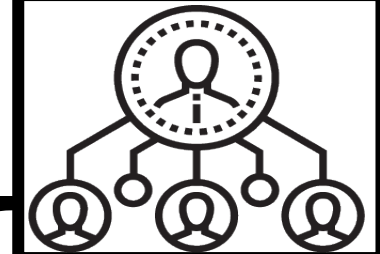
Negotiation/Coordination

- Responds to others' ideas
- Monitors execution of solutions

Maintaining team function

- Fulfills role on team
- Initiative to advance collaboration

Collaborative problem solving



Lexical Alignment

dog

dog

Semantic Alignment

dog

animal that barks

Linguistic alignment

CURRENT STUDY

Do low-level conversational strategies support expressions of core CPS competencies?

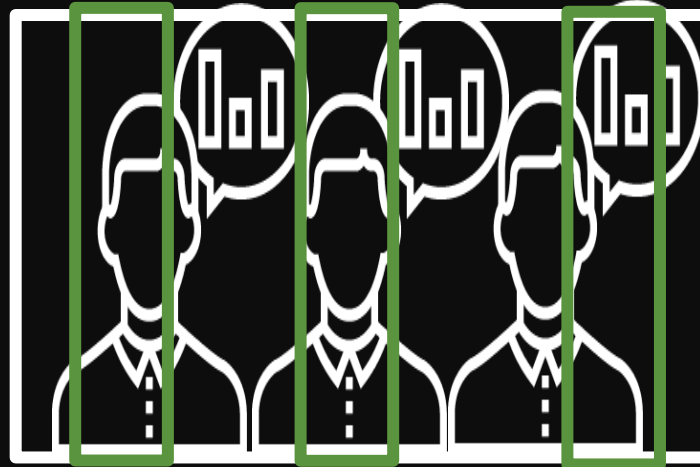
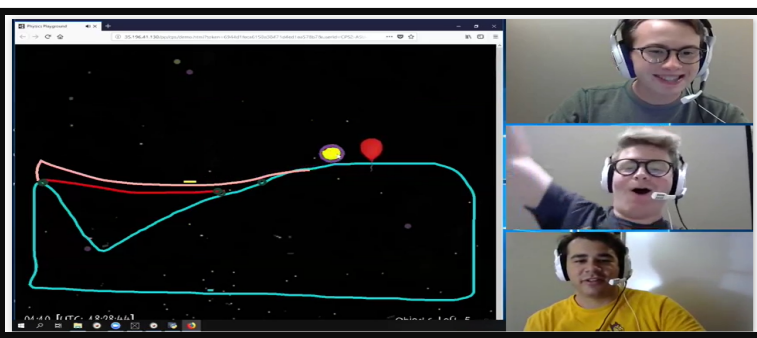
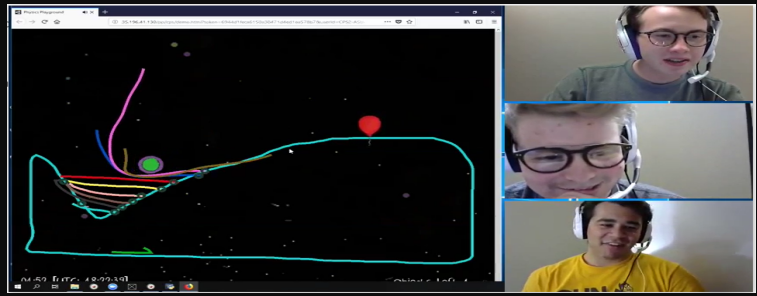
METHOD

96 triads played *Physics Playground*

Warmup

Max levels

Gold trophies



CPS facets coded in thin-slices

Creating CPS scores

COMM

Shares understanding

Establishes common ground

NEGOT

Responds to others' ideas

Monitors execution of solutions

MAINTAIN

Fulfills role on team

Initiative to advance collaboration

Alignment scores

Lexical and Semantic scores created with ALIGN software

Transcripts into lemmas and n-grams

"Where's his dog?"

• [where] [be] [his] [dog]

0 ← → 1
Less similar More similar

23,825
utterances coded

87,943
utterances ALIGNED

#2148

ANALYTICAL APPROACH

Model 1:

COMM ~ Lex + Sem

Model 2:

NEGOT ~ Lex + Sem

Model 3:

MAINTAIN ~ Lex + Sem



Model 4:

Silver ~ Lex + Sem

Model 5:

Gold ~ Lex + Sem

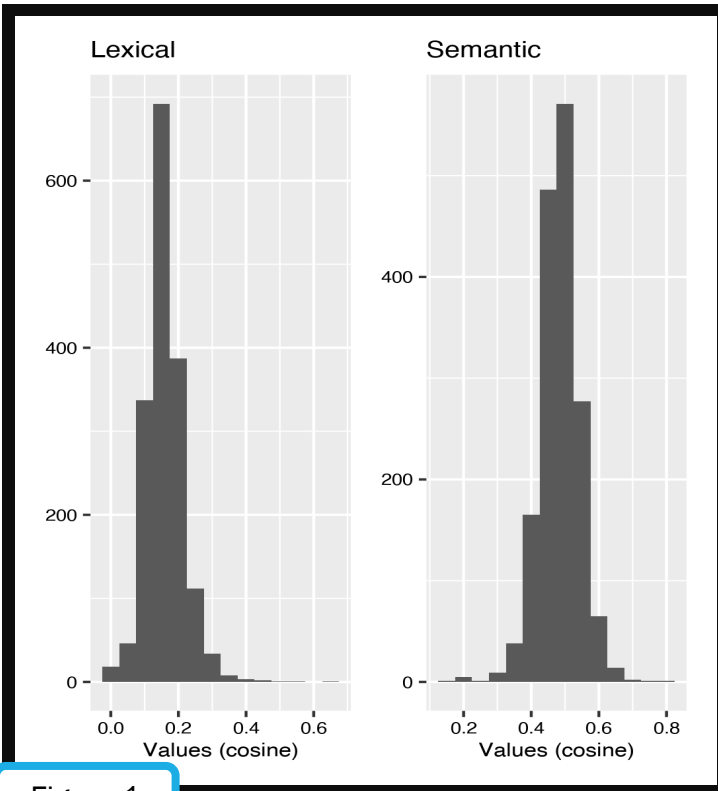


Figure 1

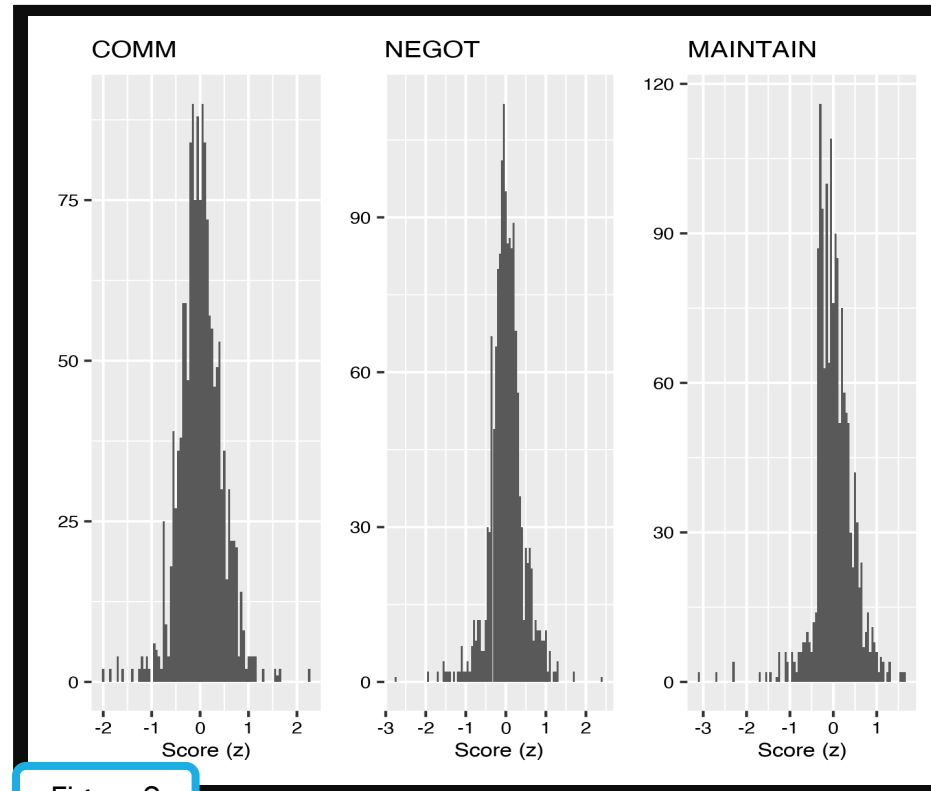


Figure 2

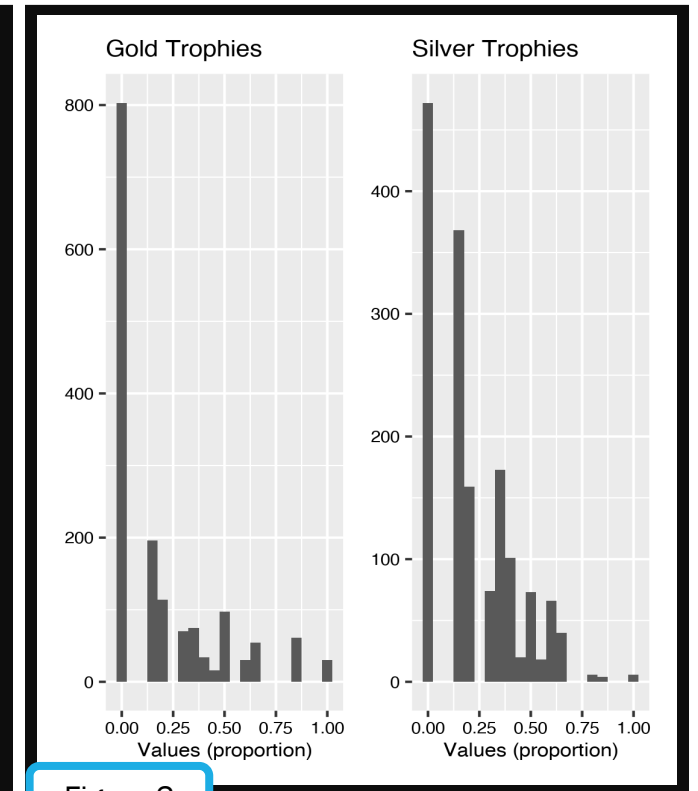
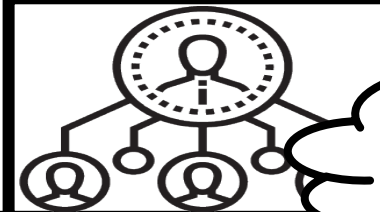
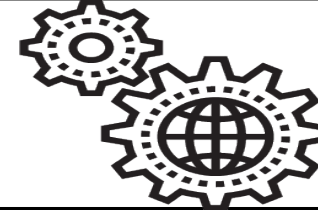


Figure 3

RESULTS - CPS

Predictors	COMM			p	NEGOT			p	MAINTAIN			p
	Estimates	CI			Estimates	CI			Estimates	CI		
(Intercept)	-0.223	-0.419 – -0.027		0.026	-0.130	-0.320 – -0.059		0.178	0.092	-0.107 – 0.290		0.366
Semantic	0.591	0.137 – 1.046		0.011	0.342	-0.098 – 0.783		0.128	-0.133	-0.592 – 0.326		0.571
Lexical	-0.568	-1.043 – -0.092		0.019	0.076	-0.386 – 0.538		0.747	-0.090	-0.570 – 0.389		0.712
Block [block 1]	0.010	-0.041 – 0.061		0.708	0.004	-0.046 – 0.054		0.881	-0.009	-0.060 – 0.043		0.741
Block [block 2]	0.023	-0.028 – 0.074		0.378	0.023	-0.027 – 0.073		0.365	0.000	-0.051 – 0.052		0.992
Aligner Role [controller]	0.058	0.013 – 0.102		0.011	-0.135	-0.179 – -0.092		<0.001	0.005	-0.039 – 0.050		0.817
Utterance Length	0.040	0.017 – 0.062		0.001	0.011	-0.011 – 0.033		0.316	0.049	0.026 – 0.071		<0.001
Random Effects												
σ^2	0.169				0.162				0.171			
τ_{00}	0.023 team_id				0.014 team_id				0.032 team_id			
ICC	0.120				0.078				0.157			
N	93 team_id				93 team_id				93 team_id			
Observations	1549				1549				1549			
Marginal R ² / Conditional R ²	0.018 / 0.136				0.029 / 0.105				0.011 / 0.166			



Model 1: Lexical and Semantic alignment predict COMM scores

- Semantic alignment positively correlated with COMM
- Lexical alignment negatively correlated with COMM

Model 2-3: Lexical and Semantic alignment not related to NEGOT and MAINTAIN

Common ground?

Pickering & Garrod (2004)

Semantic: Predicted Values of COMM

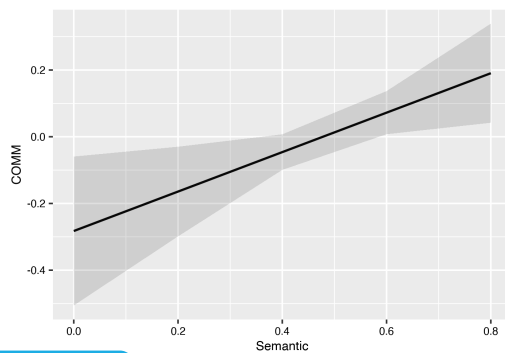


Figure 4

Lexical: Predicted Values of COMM

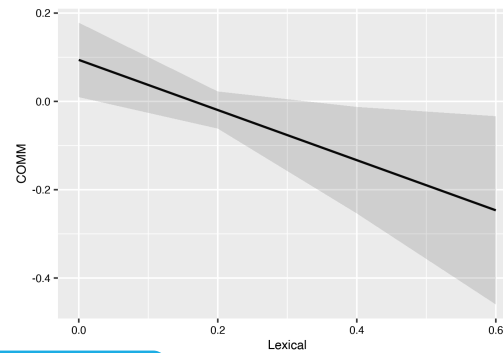


Figure 5

COMM (Constructing Shared Knowledge)

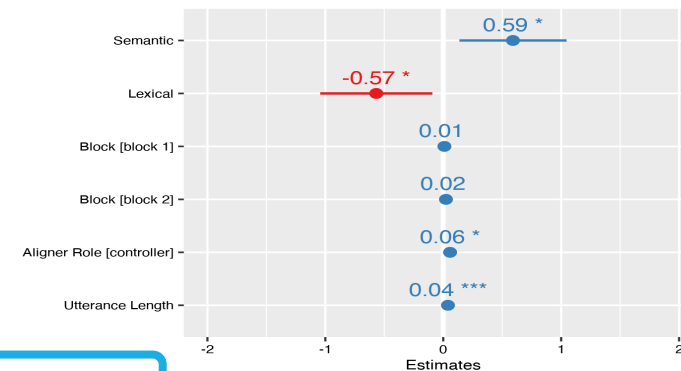


Figure 6

RESULTS - TROPHIES

Gold Trophies			
Predictors	Estimates	CI	p
(Intercept)	-0.042	-0.151 – 0.066	0.444
Semantic	0.302	0.052 – 0.552	0.018
Lexical	-0.012	-0.272 – 0.248	0.927
Block [block 1]	0.094	0.067 – 0.122	<0.001
Block [block 2]	0.165	0.137 – 0.193	<0.001
Utterance Length	-0.012	-0.024 – 0.000	0.054
Number of Utterances	0.013	0.000 – 0.026	0.044
Random Effects			
σ^2	0.051		
τ_{00}	0.011	team_id	
ICC	0.183		
N	94	team_id	
Observations	1577		
Marginal R ² / Conditional R ²	0.076 / 0.245		

Model 4: Lexical and Semantic alignment did not predict silver trophies

Model 5: Semantic alignment predicted gold trophies



Figure 7

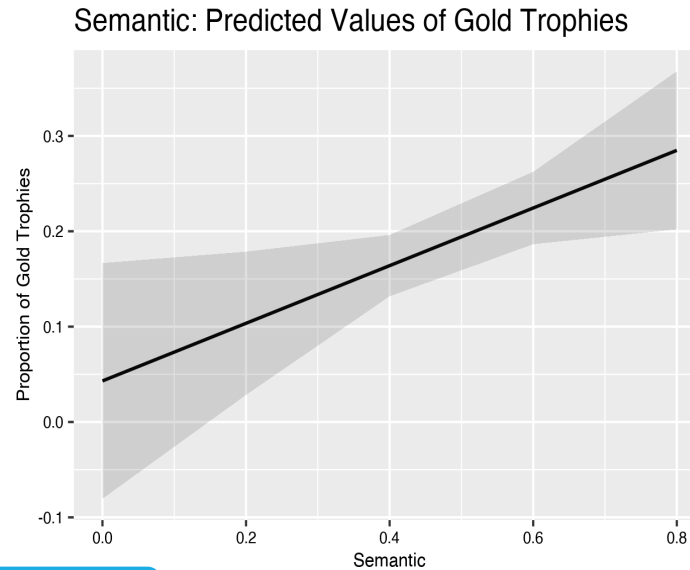
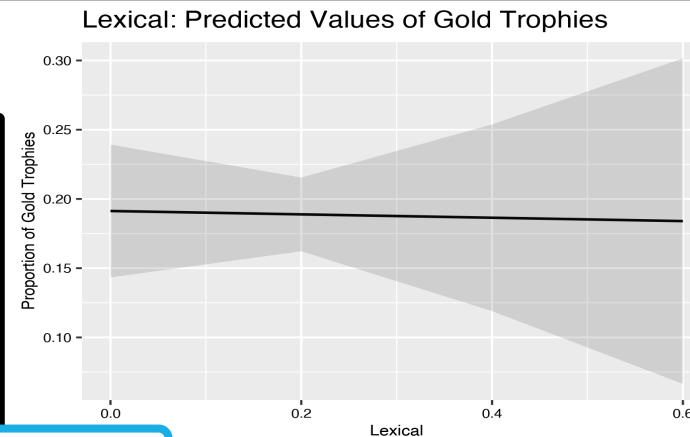


Figure 8



DISCUSSION

- COMM most related to linguistic alignment
- Semantic alignment – better measure for common ground
- Trophy outcomes support this (semantic alignment is golden)

FUTURE DIRECTIONS

Real-time measurement of alignment
Strategies for coaching semantic alignment

[Dynamicog.org/CPS_Psychonomics](https://dynamicog.org/CPS_Psychonomics)