

# Social Signal Processing

## Understanding Nonverbal Behaviour in Social Interactions

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University  
of Glasgow

# Outline



- Social Signal Processing
- The Conflict Example
- Conclusions

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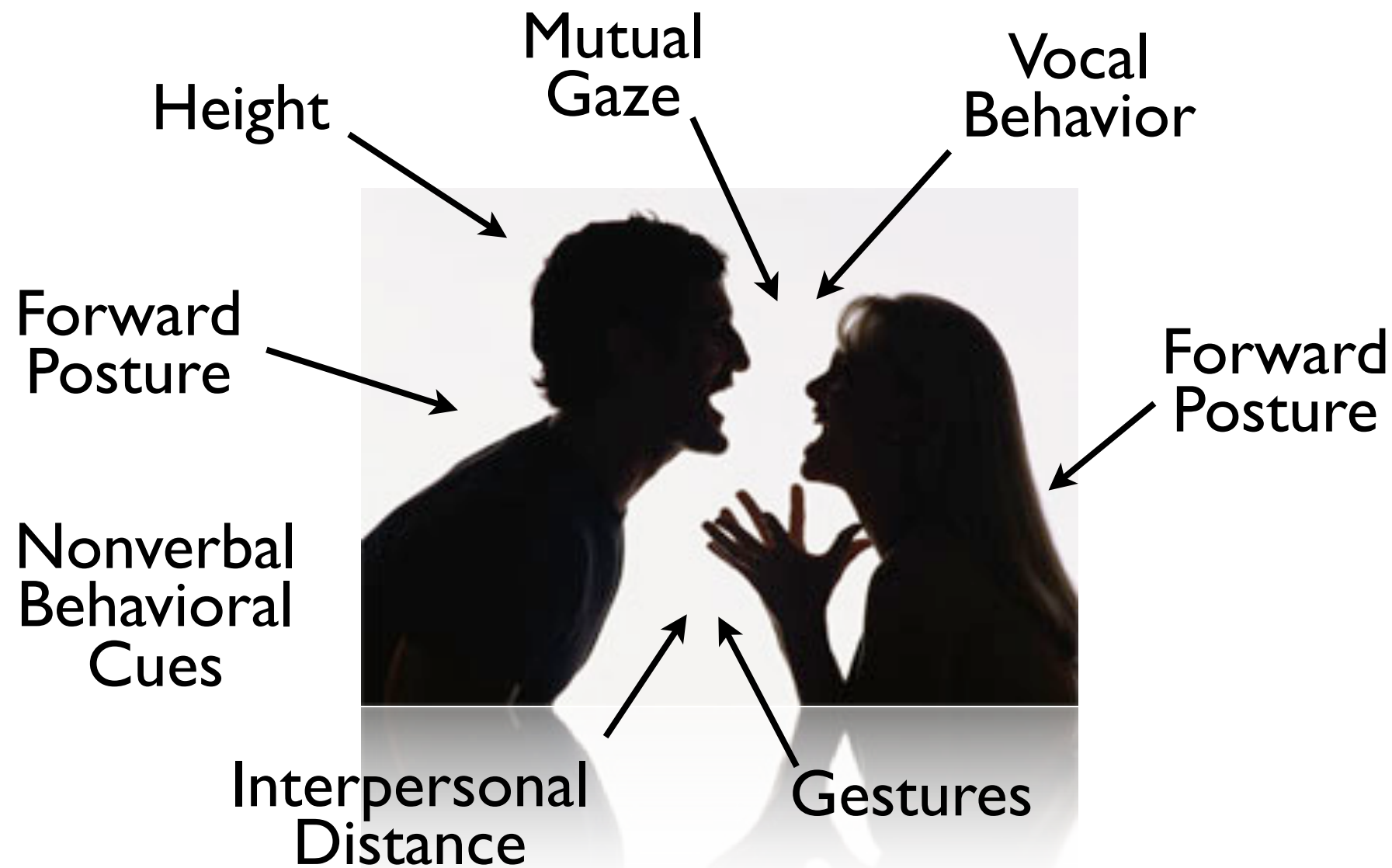
# Nonverbal Communication (I)

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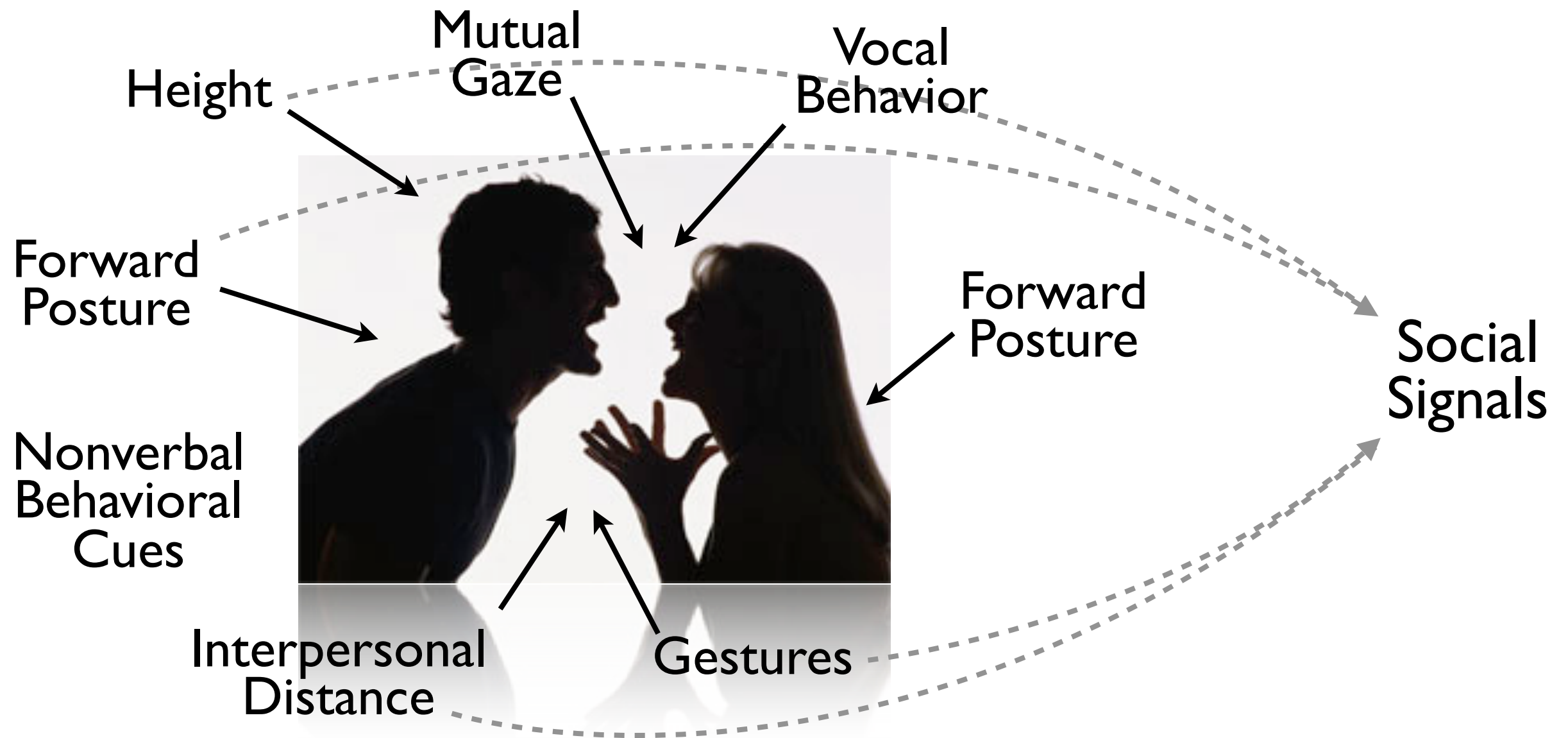
Vinciarelli, Pantic and Bourlard, “*Social Signal Processing: Survey of an Emerging Domain*”, *Journal of Image and Vision Computing*, 27(12):1743-1759, 2009

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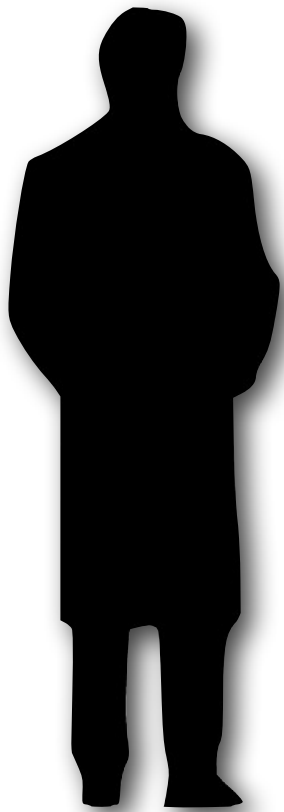
# Nonverbal Communication (I)



Vinciarelli, Pantic and Bourlard, “*Social Signal Processing: Survey of an Emerging Domain*”, Journal of Image and Vision Computing, 27(12):1743-1759, 2009

# Nonverbal Communication (II)

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Richmond and McCroskey, “*Nonverbal Behaviors in Interpersonal Relations*”,  
Allyn and Bacon, 1995

# Nonverbal Communication (II)

## Cues

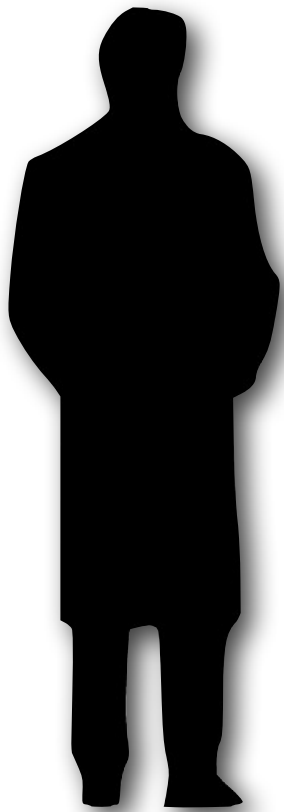
Attractiveness  
Clothes, etc.

Expressions  
Gaze, etc.

Vocalisations,  
Prosody, etc.

Self-touching,  
Orientation

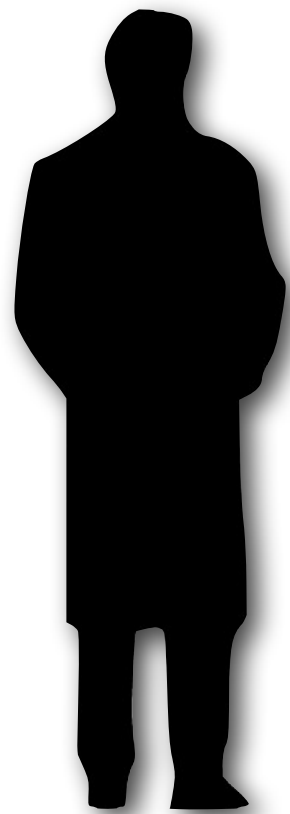
Distances,  
Seating, etc.



Richmond and McCroskey, “*Nonverbal Behaviors in Interpersonal Relations*”,  
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# Nonverbal Communication (II)



## Cues

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Clothes, etc.

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Distances,  
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## Codes

Physical  
Appearance

Face  
Behavior

Voice  
Behavior

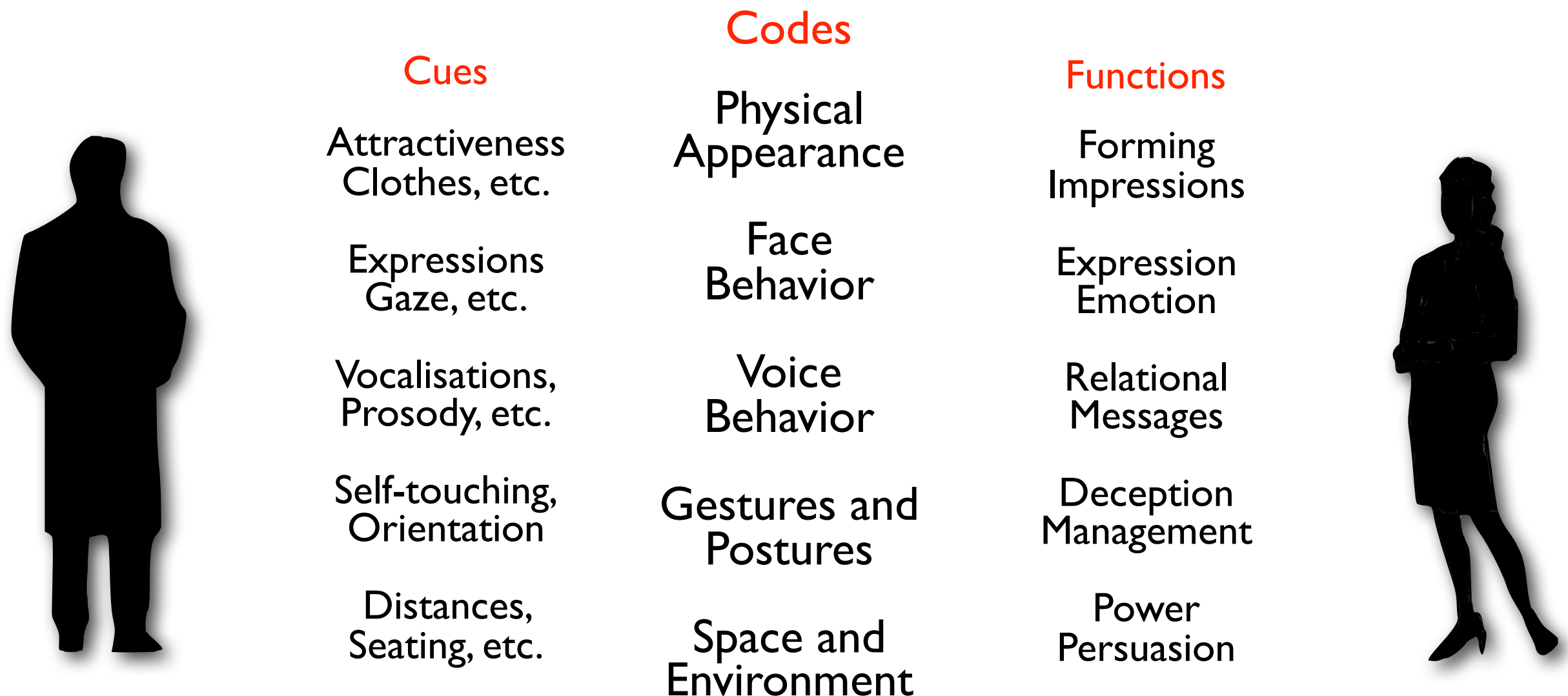
Gestures and  
Postures

Space and  
Environment



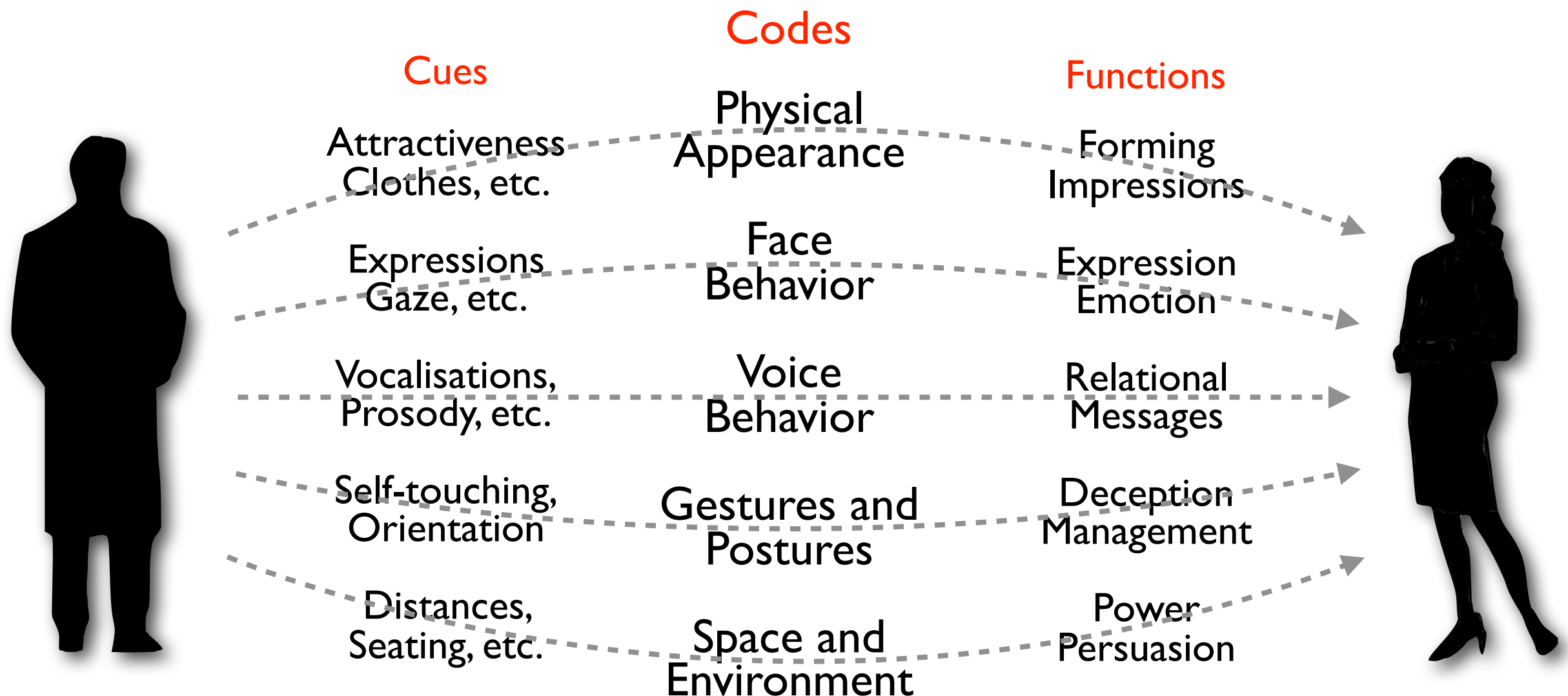
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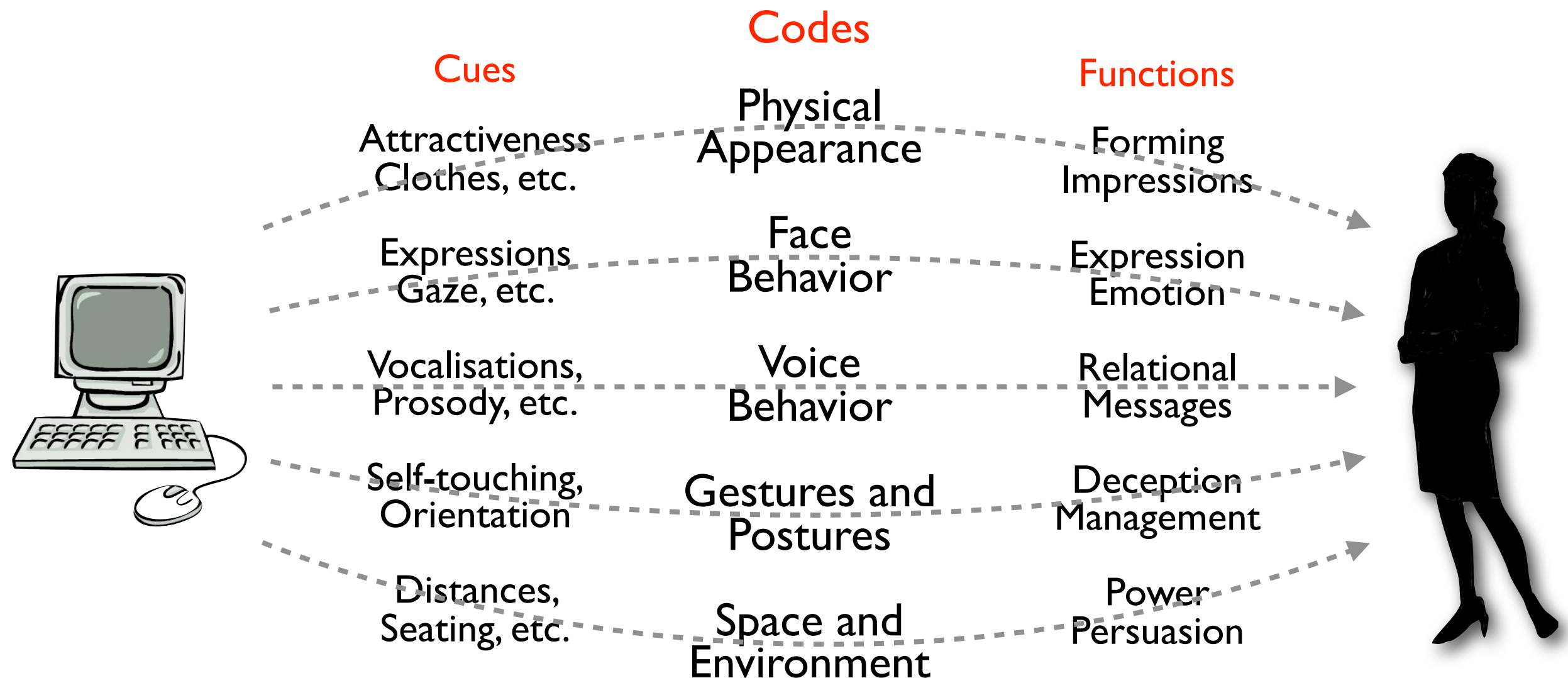
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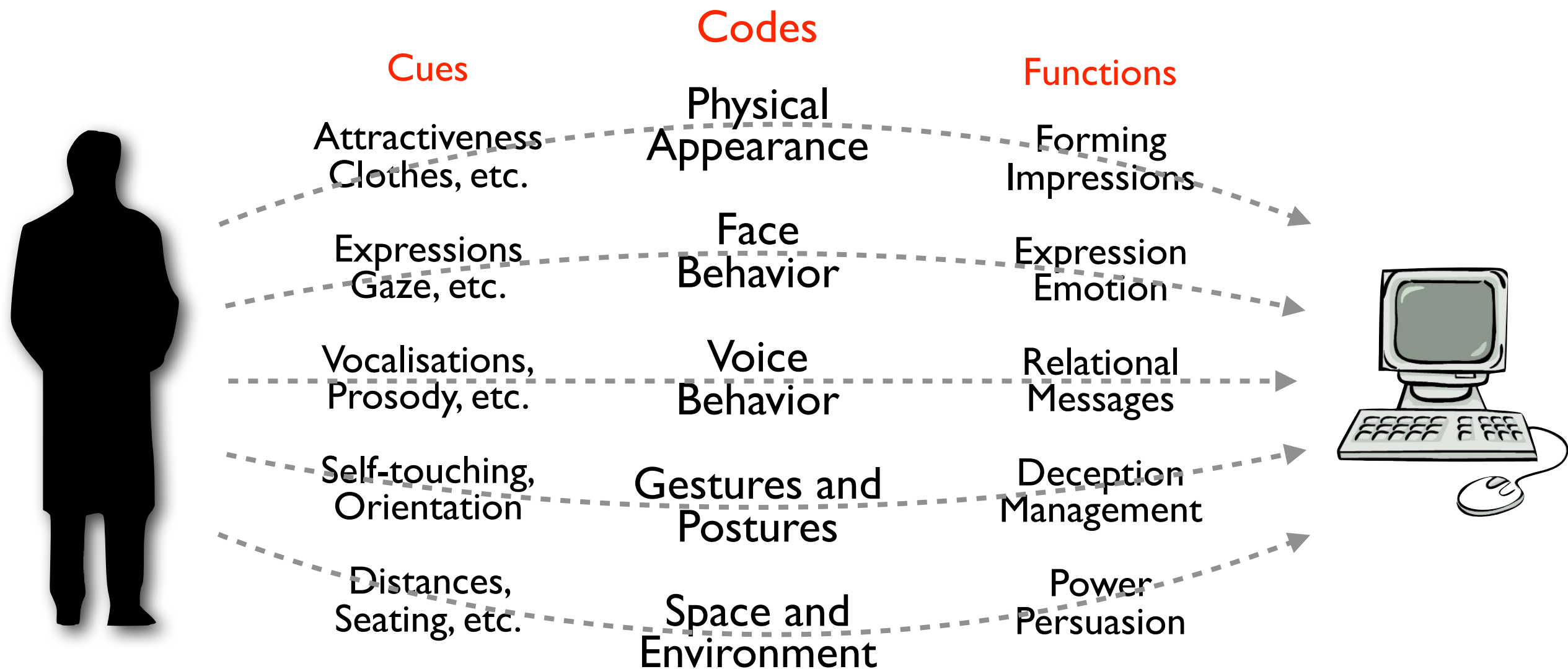
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# SSP: Synthesis



Vinciarelli, Pantic, Heylen, Pelachaud, Poggi, D'Errico, Schroeder, "Bridging the Gap Between Social Animal and Unsocial Machine: A Survey of SSP", IEEE Transactions on Affective Computing, 3(1):69-87, 2012

# SSP: Analysis



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# Conflict



*“[Conflict is a] mode of interaction [where] the attainment of the goal by one party precludes its attainment by the others.”*

Judd, “Cognitive Effects of Attitude Conflict Resolution”, Journal of Conflict Resolution, 22(3):483-498, 1978.

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# Political Debates



Vinciarelli, Dielmann, Favre, Salamin, “*Canal9: a database of political debates for analysis of social interactions*”, Proc. of Social Signal Processing Workshop, 2009

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Vinciarelli, Dielmann, Favre, Salamin, “*Canal9: a database of political debates for analysis of social interactions*”, Proc. of Social Signal Processing Workshop, 2009



# SSPNet Conflict Corpus



Source	Canal9
Number of Clips	1430
Clip Length	30 sec.
Total Length	11 h 55 m
Subjects	135
Subjects per Clip	At least 2
Assessors	10/clip (MTurk)
Questionnaire Items	15
Total Items	214,500

Vinciarelli et al., “*Collecting Data for Socially Intelligent Surveillance and Monitoring Approaches: The Case of Conflict in Competitive Conversations*”, Proc. of IEEE Intl. Symposium on Communications, Control and Signal Processing, pp. 1-4, 2012.

# Measuring Conflict Perception



The atmosphere is relaxed  
People wait for their turn before speaking  
One or more people talk fast  
One or more people fidget  
People argue  
One or more people raise their voice  
One or more people shake their heads and nod  
People show mutual respect  
People interrupt one another  
One or more people gesture with their hands  
One or more people are aggressive  
The ambience is tense  
One or more people compete to talk  
People are actively engaged  
One or more people frown

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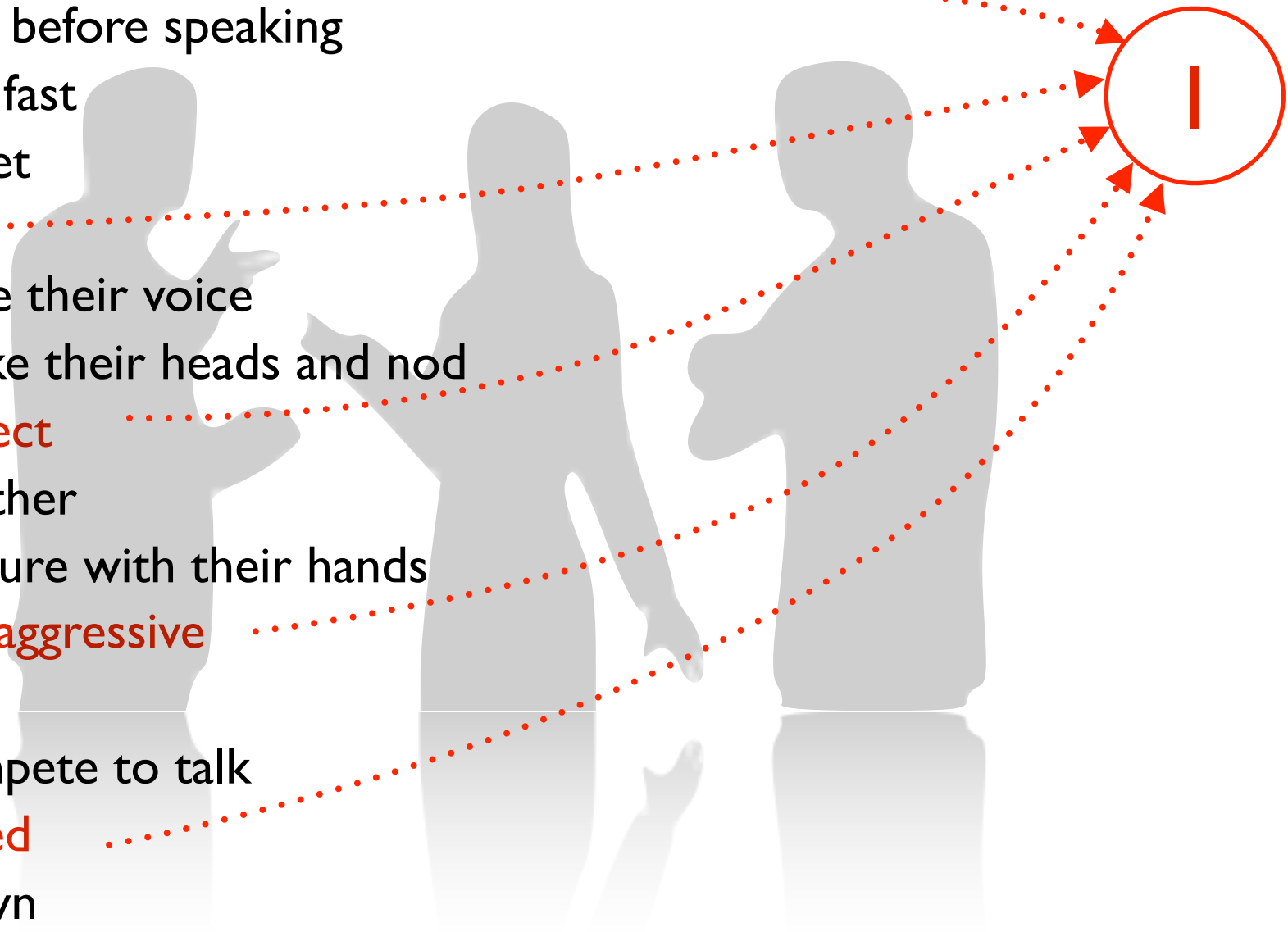
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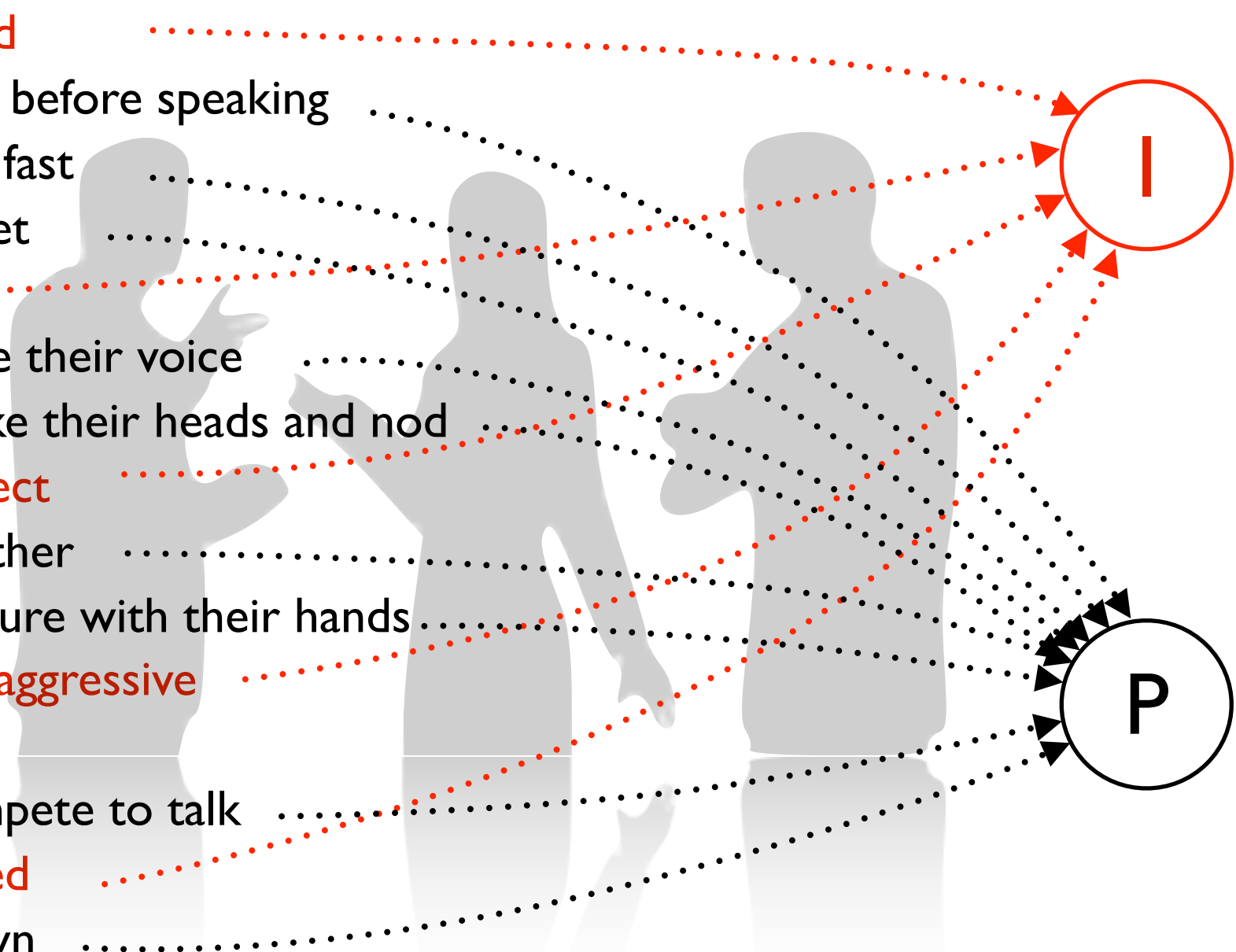
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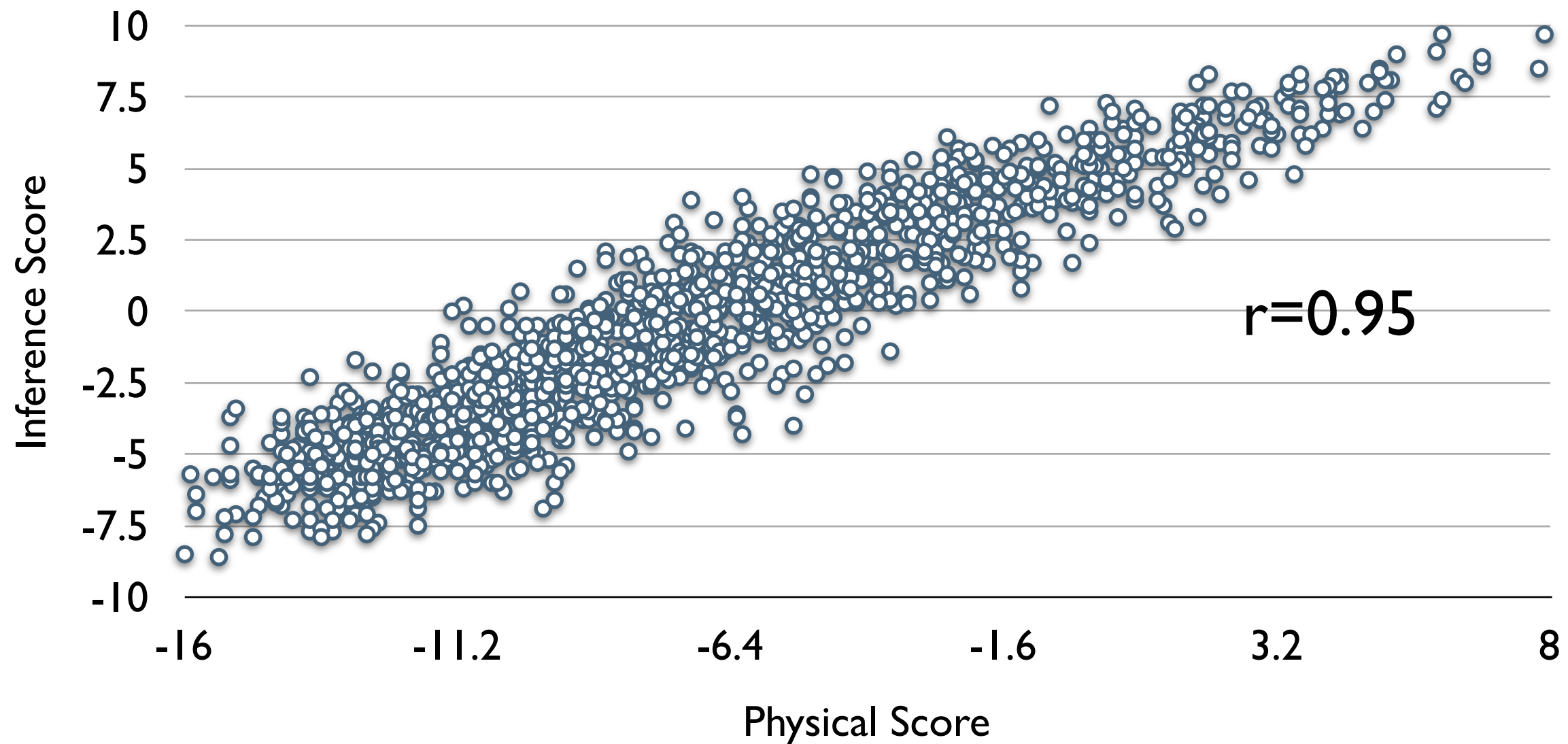
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# Inference vs Physical



Vinciarelli et al., “*Collecting Data for Socially Intelligent Surveillance and Monitoring Approaches: The Case of Conflict in Competitive Conversations*”, Proc. of IEEE Intl. Symposium on Communications, Control and Signal Processing, pp. 1-4, 2012.

# Examples (Low)




Vinciarelli et al., “*Collecting Data for Socially Intelligent Surveillance and Monitoring Approaches: The Case of Conflict in Competitive Conversations*”, Proc. of IEEE Intl. Symposium on Communications, Control and Signal Processing, pp. 1-4, 2012.

# Examples (Low)



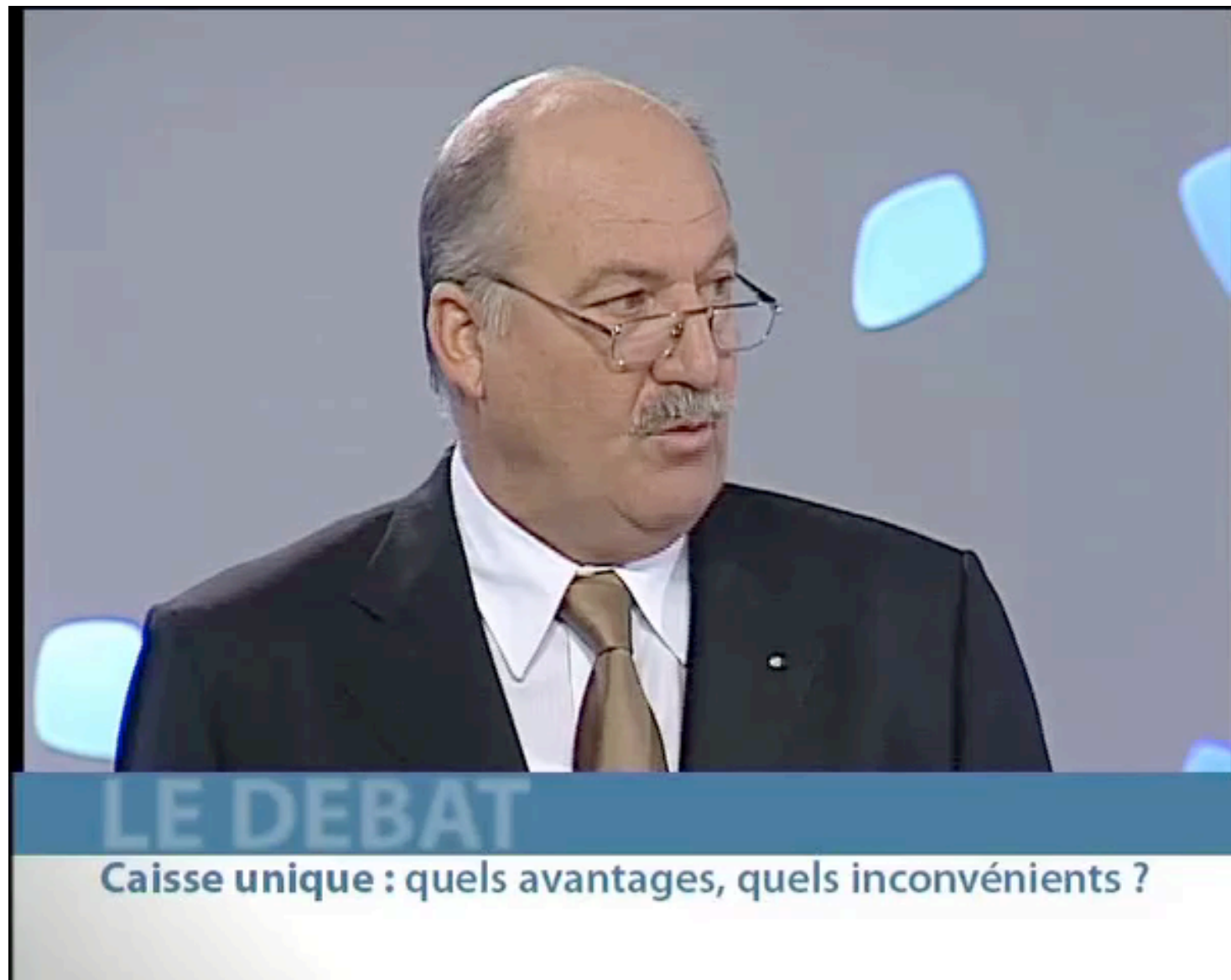
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# Examples (Medium)




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# Examples (High)



Vinciarelli et al., “*Collecting Data for Socially Intelligent Surveillance and Monitoring Approaches: The Case of Conflict in Competitive Conversations*”, Proc. of IEEE Intl. Symposium on Communications, Control and Signal Processing, pp. 1-4, 2012.

# Examples (High)



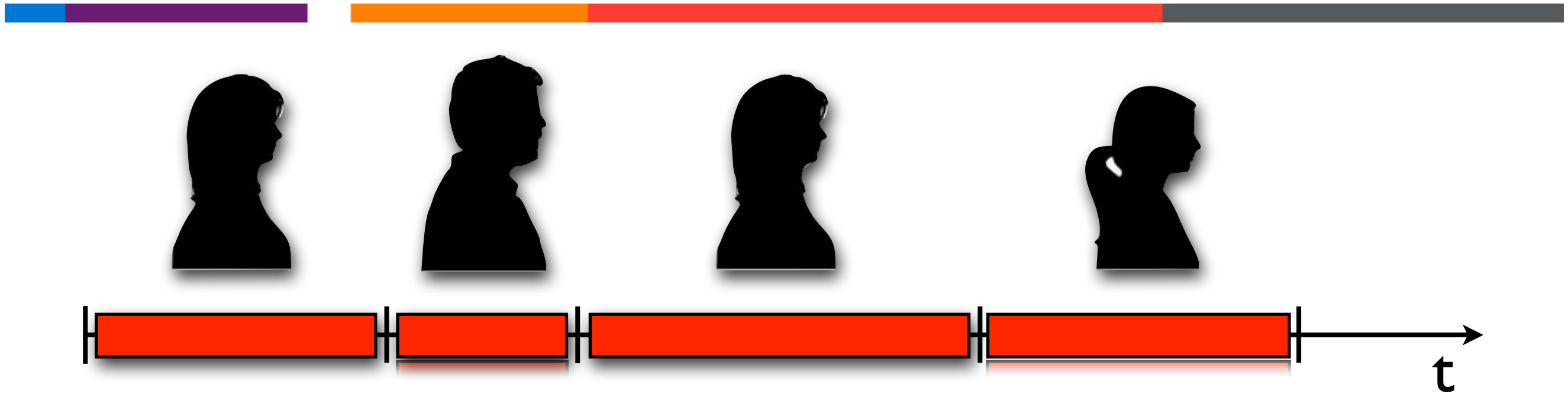
Vinciarelli et al., “*Collecting Data for Socially Intelligent Surveillance and Monitoring Approaches: The Case of Conflict in Competitive Conversations*”, Proc. of IEEE Intl. Symposium on Communications, Control and Signal Processing, pp. 1-4, 2012.

# Speech Features

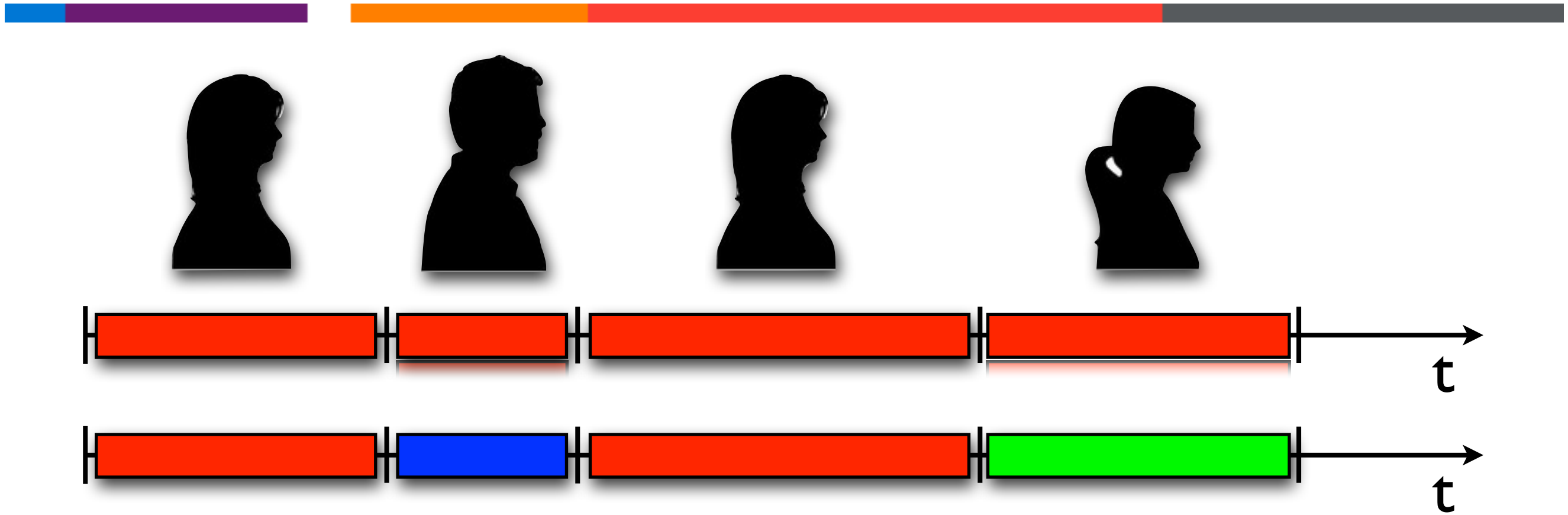




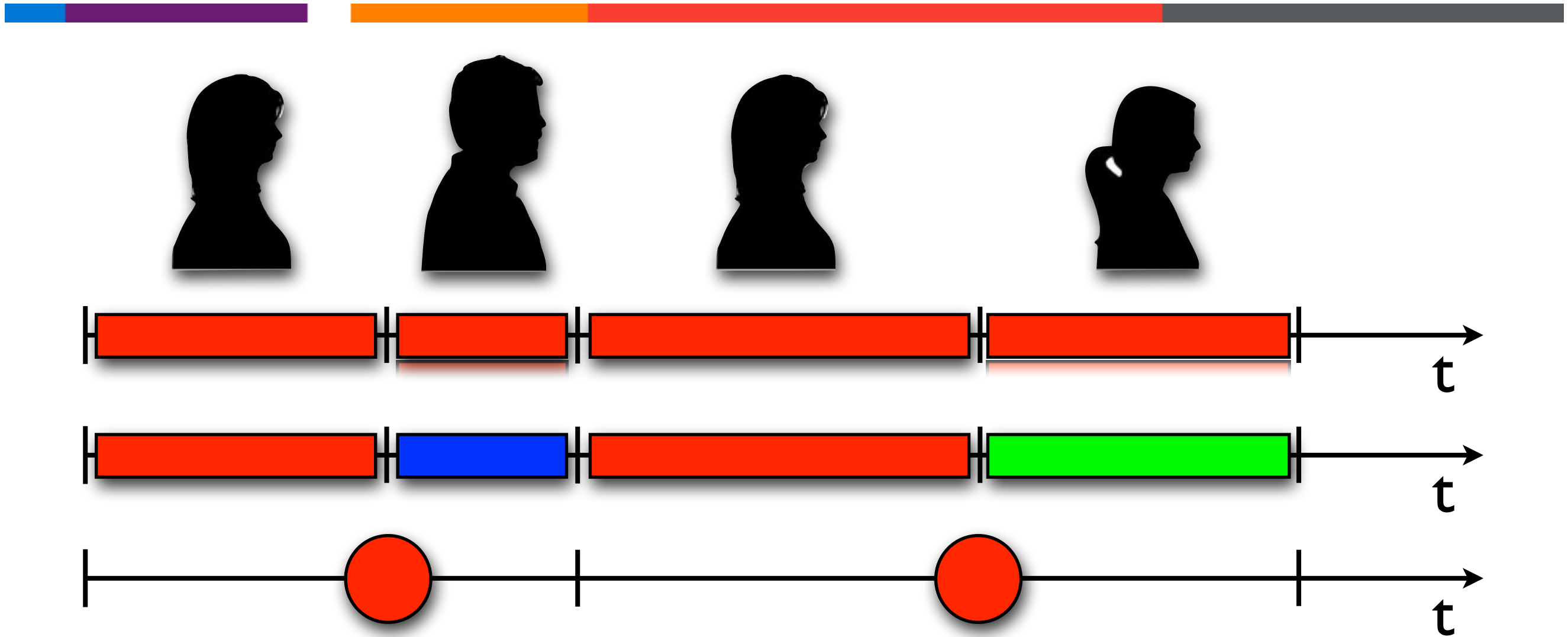
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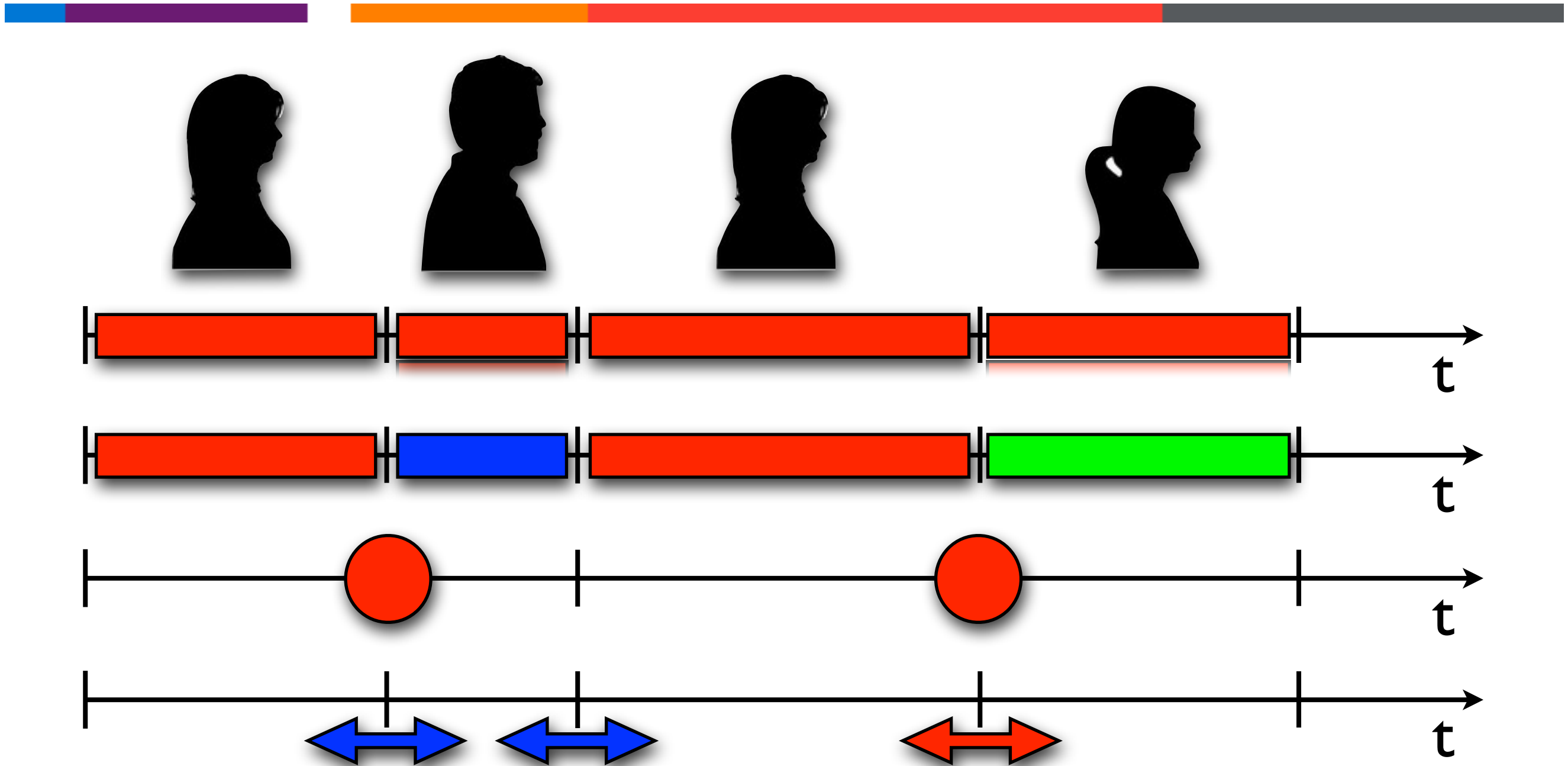
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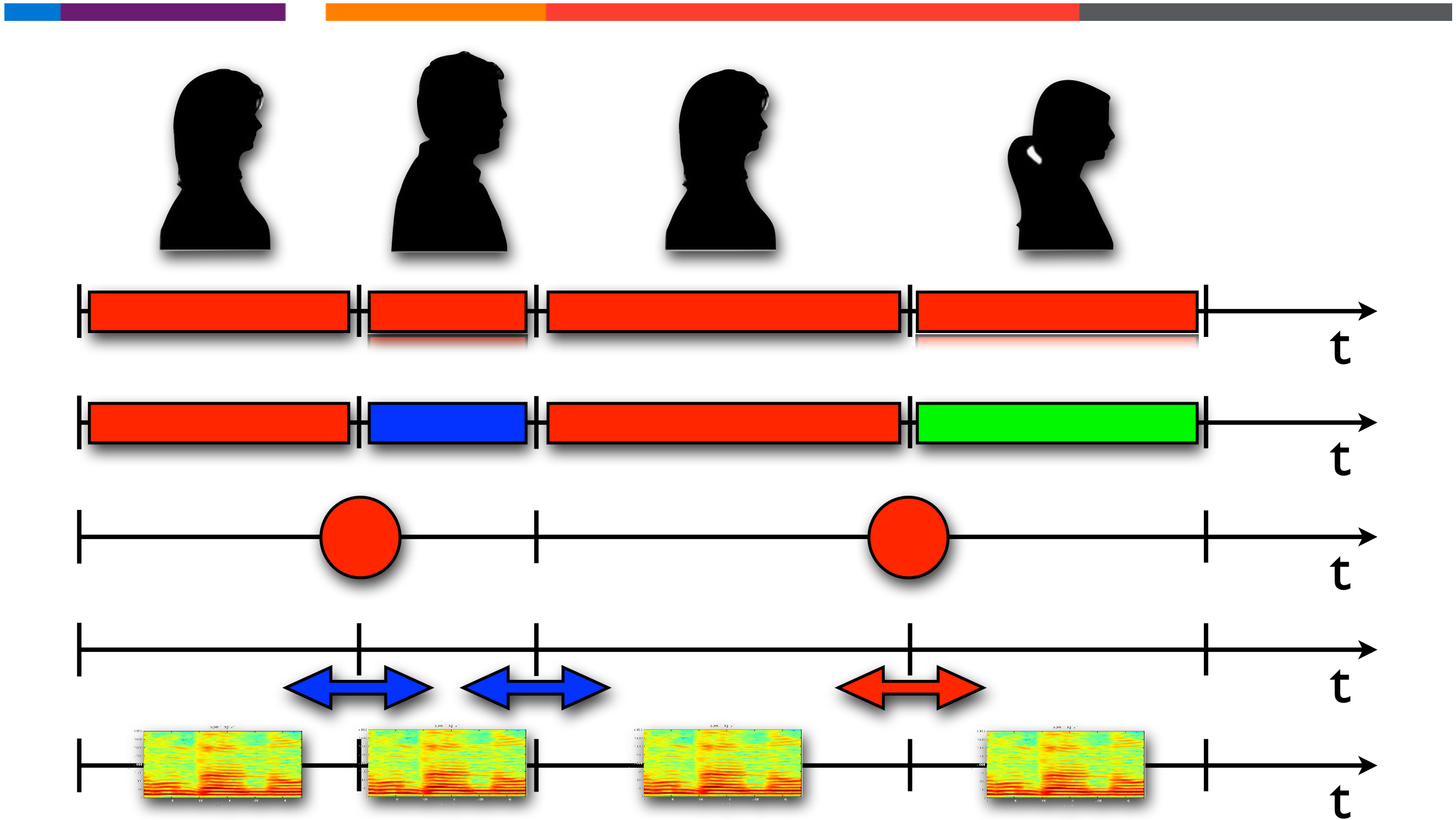
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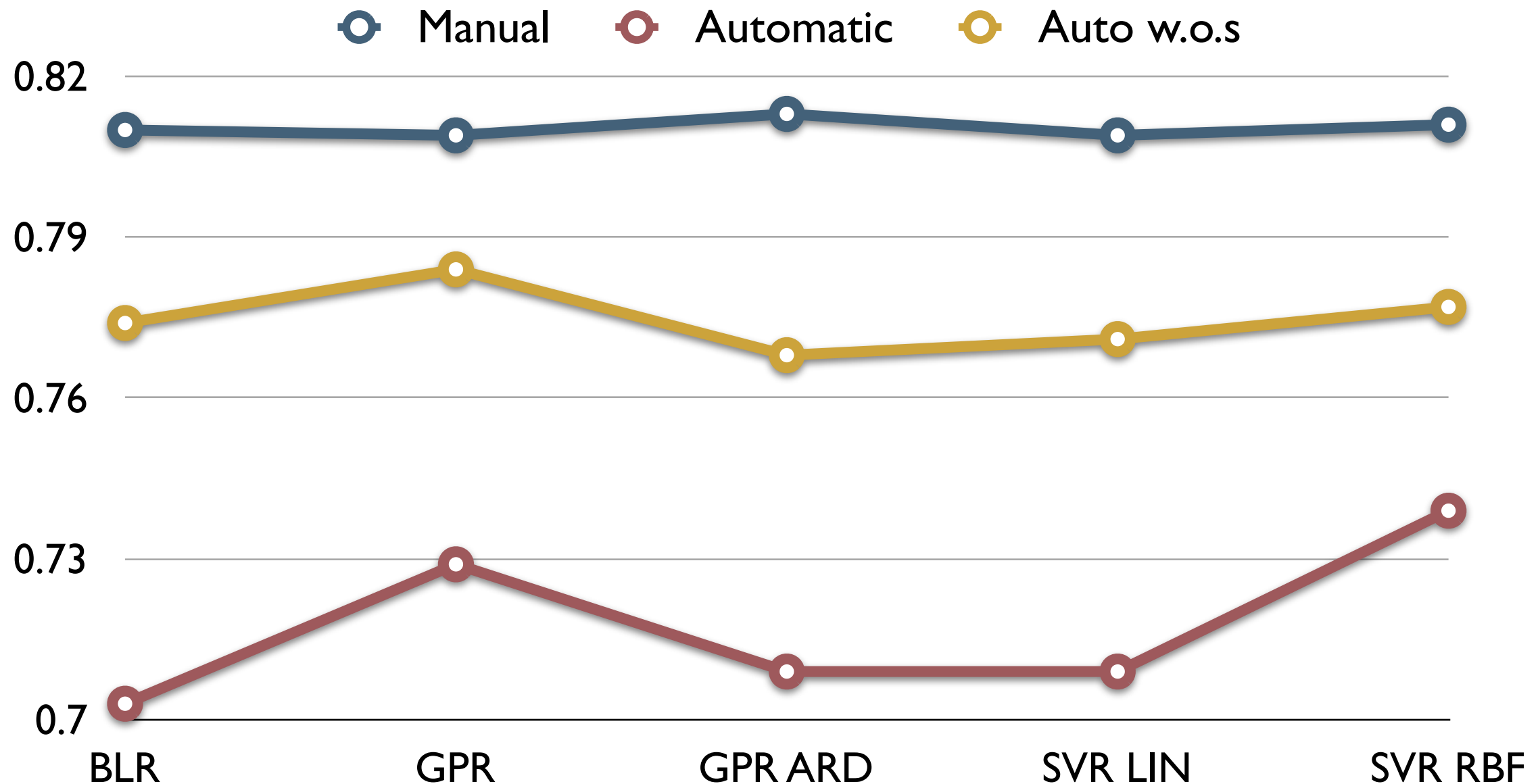
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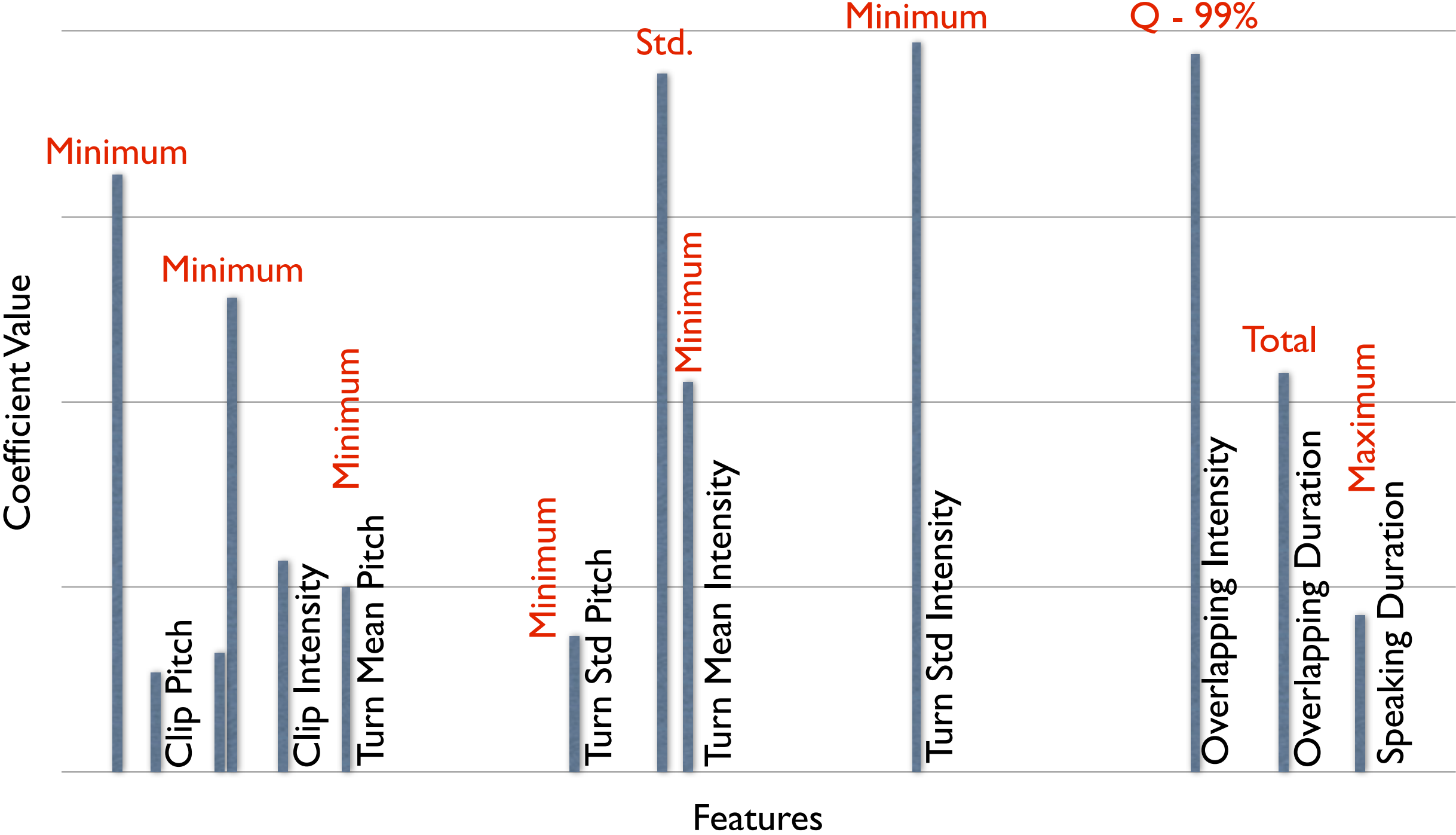


# Results



Kim, Filippone, Valente, Vinciarelli, “*Predicting the Conflict Level in Television Political Debates: an Approach Based on Crowdsourcing, Nonverbal Communication and Gaussian Processes*”, Proc. of ACM Intl. Conf. on Multimedia, 793-796, 2012.

# ARD Results (Automatic w.o.s.)



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# The SSPNet Portal



More information available at:

<http://www.sspnet.eu>

- Around 250 hours of annotated material
- More than 150 Presentation Recordings
- More than 20 software packages

A.Vinciarelli, M.Pantic, “A Web Portal for Social Signal Processing”, IEEE Signal Processing Magazine, 27(4):142-144, 2010

# Conclusions



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- Nonverbal communication is a physical, machine detectable evidence of social and psychological phenomena

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- Nonverbal communication is a physical, machine detectable evidence of social and psychological phenomena
- Interdisciplinary approaches including both human and computing sciences can perform better
- Real world applications are the next frontier in terms of data, problems and methodological issues

# Thank you!



Many thanks to:

- Gelareh Mohammadi (Idiap Research Institute / EPFL)
- Maurizio Filippone (University of Glasgow)
- Antonio Origlia (University of Napoli Federico II)
- Fabio Valente (idiap Research Institute)
- Samuel Kim (Yonsei University)
- Bjoern Schuller (TU Munich)