

Finding Symptoms of Misunderstandings in Drawing Software Design

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Introduction

- It is important to have mutual understandings in early stage of software development, but different.
- Reason: Such development takes long term,
Multiple forms of specification,
Different kinds of stakeholders.
- Misunderstandings can be resolved by using design methods and/or specification languages, but ...
- We can also take *another solution* together with such methods, *monitoring the working processes for detecting the misunderstanding.*

Contents

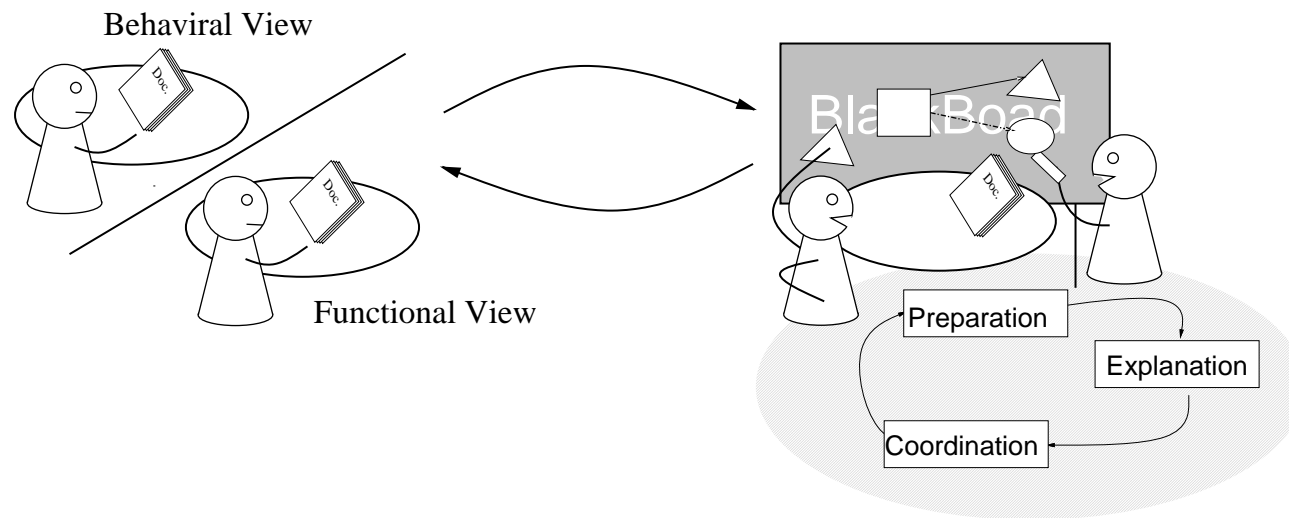
- Clark's contribution theory of discourse.
- The method for finding symptoms of misunderstanding; domain, measures, indices.
- Validating the method; an experiment.
- Conclusion

Contribution theory of discourse

- I assume, *misunderstanding* \equiv *mutual knowledge*.
- Mutual Knowledge is
knowledge that the communicating parties both share and know they share.
- During the communication, mutual knowledge is updated in every moment.
- two phases for updating mutual knowledge;
a) presentation of sender. b) acceptance of receiver.
- Symptoms of mutual knowledge in the acceptance phase.
e.g. acknowledgement of receiver like “uh huh”, relevant next turn, continued attention.

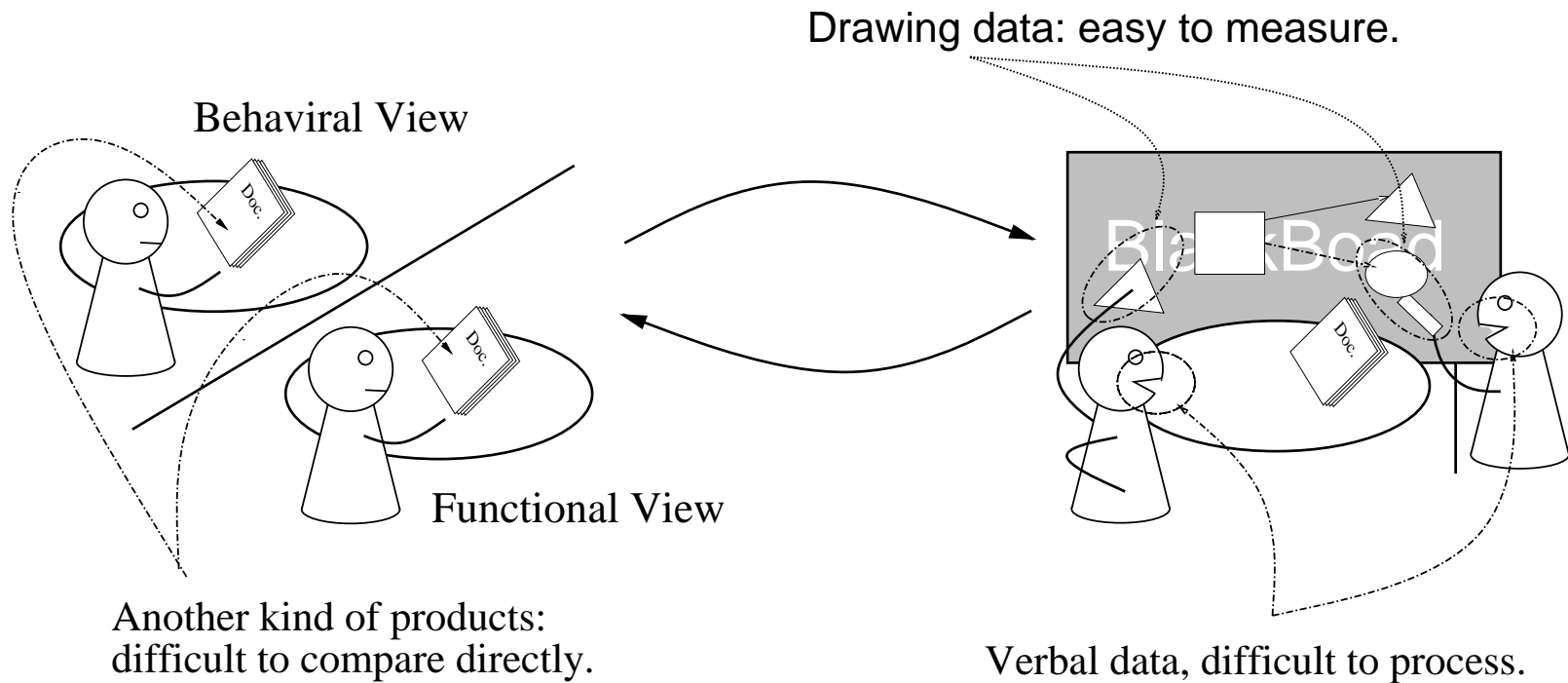
Domain for applying the method

- Specifying a software in multiple views, each view is described by different workers respectively.
- Graphical language; OD, STD, DFD
- Repeating the meeting and the preparation of the meeting.
- Shared workspace like blackboard, in the meeting.
- Phases in meetings; Preparation, Explanation, Coordination.



Measured data for the method

Toward the automated support ~ superficial data.



Indices of the method

Each index reflects whether *a part* in a specification is misunderstood or not.

1. **Number of reference:** Reference is a kind of action e.g. pointing, drawing or deleting *the part* of a diagram.

The more its number is, the smaller misunderstandings are occurred.

2. **Number of conversation:** how many conversations *the part* was discussed.

The more its number is, the smaller misunderstandings are occurred.

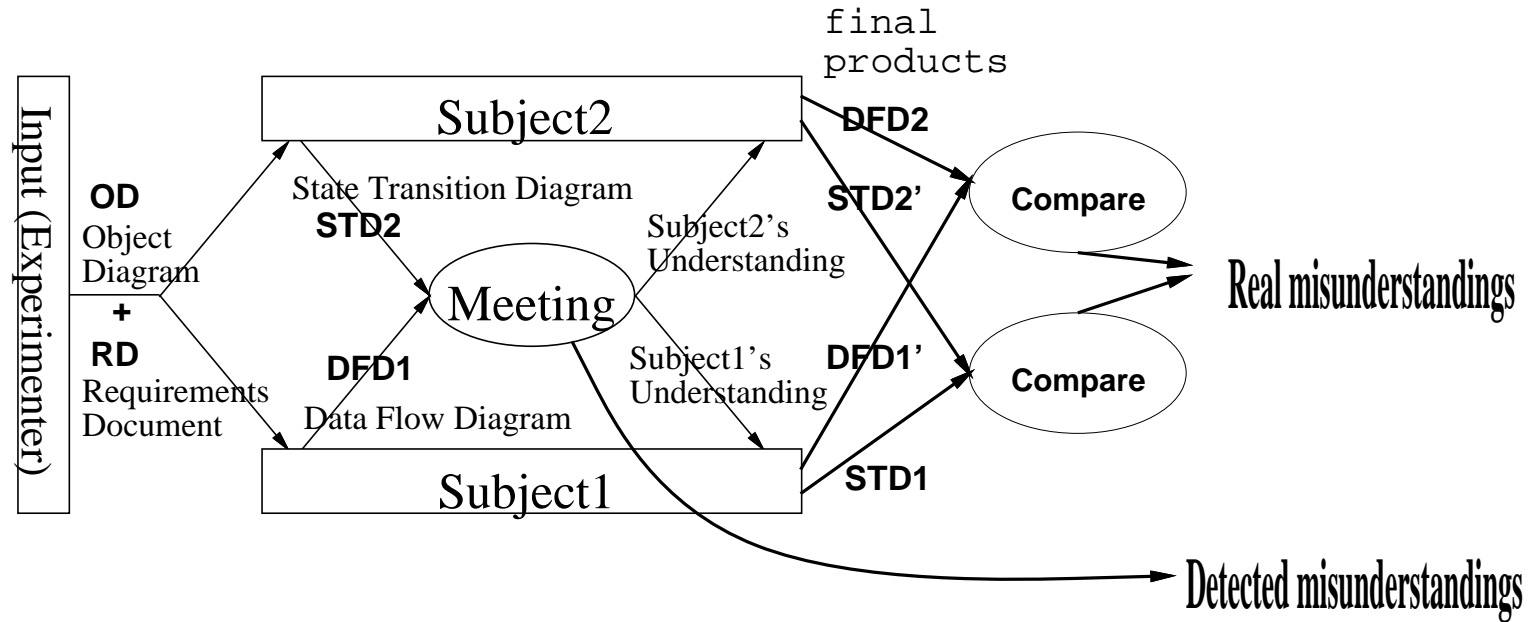
3. **Rate of cooperation:** How many participants except its proposer do contribute to communication about *the part*. The part is suspected to misunderstood part if the rate is near zero.
4. **Occurrences over the phases:** If a part is discussed both coordination phase and other phases, the part is regarded as mutually understood part.

By these four indices, one can detect a part, whether misunderstood part or not.

Validating the method ~ The Policy

- By these indices, we believe one can distinguish misunderstood part from the others.
- Comparing the index's value of *real* misunderstood part with the value of others.
- If the values are significantly different, the index would be valid.

Validating the method ~ An experiment



In subject1's diagrams	○	—	○	—	*
In subject2's diagrams	○	○	—	—	*
In the meeting	○	○	○	○	—
	mutual understood		misunderstood		—

An overview of the result

- Problem: “Modeling the task in wholesale store”
- 4 pairs of subjects, half of them are acquainted.
- About 20 ~ 30 nodes and arcs of final products.
- About 1 ~ 2 hours of meeting.
- Several *real* misunderstood parts existed.

Validating the number of reference & conversation

Comparing the average.

Pair Number	#1	#2	#3	#4
Reference: Real mutual understood part	4.5	7.6	8.3	5.3
Real misunderstood part	2.5	5.6	3.0	2.6
Significance	Yes	No	Yes	No

Pair Number	#1	#2	#3	#4
Conversation: Real mutual understood part	2.6	3.8	4.4	3.8
Real misunderstood part	1.5	2.7	2.3	2.2
Significance	Yes	No	Yes	No

These indices seem to be valid, but the data of two pairs is not significant.

Validating the rate of cooperation

In this experiment, the number of participants is two, so the rate of cooperation takes *one* or *zero*, one for mutually understood part and zero for misunderstood part. So,

$$\text{Compare } \frac{\text{Num. of parts rated one}}{\text{Num. of all parts}} \times 100 (\%)$$

Pair Number	#1	#2	#3	#4
Real understood part (%)	30.8	46.0	41.3	40.0
		^		
Real misunderstood part (%)	25.0	60.0	37.0	0.0
Significant	No	No	No	Yes

No significance, against intuition(pair2).

Reason: cooperation is accomplished not only the actions of drawing but also others, e.g. utterances, gazing.

Validating the occurrences over phases

$$\text{Compare } \frac{\text{Num. of parts occurring over phases}}{\text{Num. of all parts}} \times 100.$$

Pair Number	#1	#2	#3	#4
Real understood part (%)	53.9	56.8	50.8	52.0
Real misunderstood part (%)	6.3	40.0	29.6	16.7
Significance	Yes	No	Yes	Yes

Only pair#2 is not significant, but others are, where this index seems to be valid.

Discussing a part again in coordinating phase, seems to be a good indicator of mutual understanding. Because it reflects the strong interest of addressee.

Conclusion

- Presenting a method for finding the misunderstanding among the cooperative workers.
- Using superficial data towards the automated support.
- Validating the method by an experiment.
- Some indices in the method is not enough.
- But some indices reflects the misunderstandings among the workers although the measured data is superficial one.
- We can also use an existence of utterance for refining this method, which is also automatically collected.