ON THE IMPACT OF SEMANTIC TRANSPARENCY ON UNDERSTANDING AND REVIEWING SOCIAL GOAL MODELS

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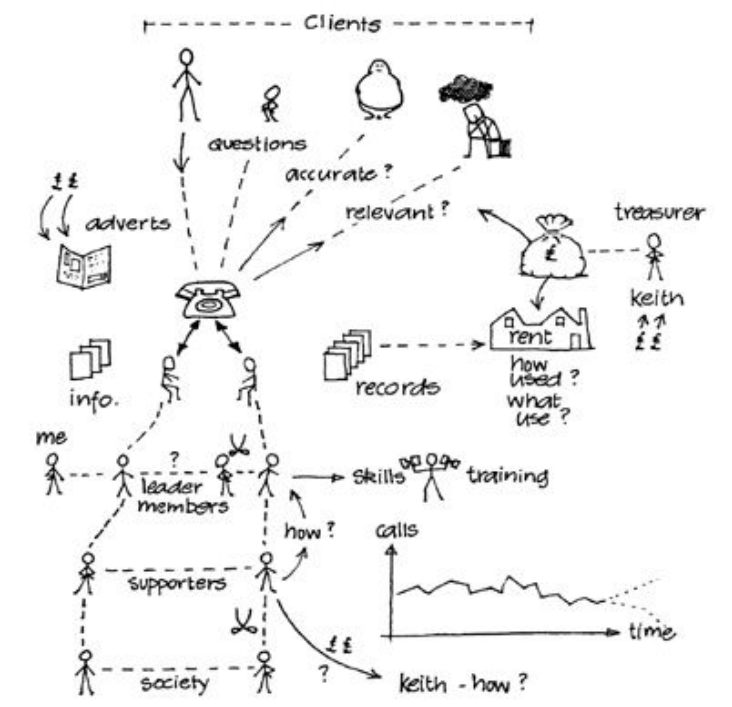
FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

NOVALINCS
LABORATORY FOR COMPUTER SCIENCE AND INFORMATICS

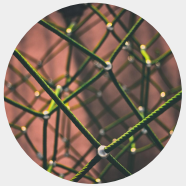
RE SUCCESS DEPENDS ON THE QUALITY OF THE COMMUNICATION AMONG STAKEHOLDERS

VISUAL NOTATIONS ARE PERCEIVED AS MORE EFFECTIVE FOR CONVEYING INFORMATION TO NON-TECHNICAL STAKEHOLDERS THAN TEXT

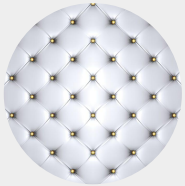


Name	Save item for purchase.
ID	UC_001
Description	While browsing items in the eStore, a user finds an item he is not ready to purchase yet, but he wants to save it to a list so that he can later find the item that he was previously interested in.
Actors	eStore customer.
Organizational Benefits	Increase sales by helping the customer remember products he was previously interested in.
Frequency of Use	20% of users save an item to be bought later each time they visit the site. 50% of saved items are purchased within one year of the saved date.
Triggers	The user selects an option to save an item.
Preconditions	User is viewing an item in the catalog.
Postconditions	The item selected to be saved is visible to the user when he views his saved items. The item selected to be saved is reflected as a saved item when the user views his eStore search and browse results.
Main Course	1. System prompts user to confirm saving selected item instead of purchasing it right away. 2. User confirms to save now (see EX1). 3. System determines user is not logged in and redirects user to log on (see AC1). 4. User logs on (see AC2, AC3). 5. System stores the saved item (see EX2). 6. System redirects the user to their saved items list to view the full list.
Alternate Courses	AC1 System determines user is already logged on. 1. Return to Main Course step 5. AC2 User logs off again. 1. Return user to Main Course step 3. AC3 User does not have an account already. 1. User creates an account. 2. System confirms account creation. 3. Return user to Main Course step 4.
Exceptions	EX1 User decides to purchase the item now. 1. See "Purchase item" Use Case. EX2 System fails on saving item to list. 1. System notifies user that an error has occurred. 2. Return user to Main Course step 1.

PHYSICS OF NOTATIONS: FOR BETTER HUMAN COMMUNICATION AND PROBLEM SOLVING

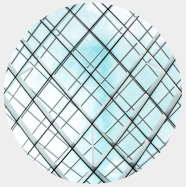


cognitive integration



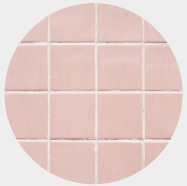
cognitive fit

perceptual discriminability



manageable complexity

semiotic clarity



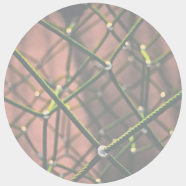
graphic economy

dual coding

visual expressiveness

semantic transparency

THE EXTENT TO WHICH THE MEANING OF A SYMBOL CAN BE INFERRED FROM ITS APPEARANCE



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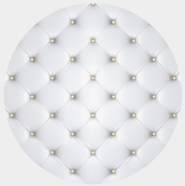

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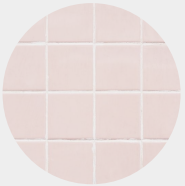

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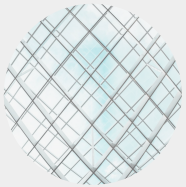

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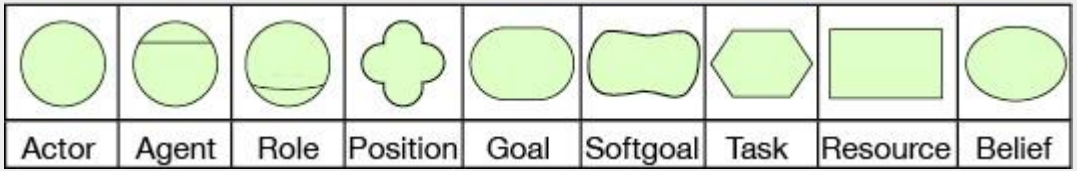
TWO *i** CONCRETE SYNTAXES, WITH DIFFERENT SEMANTIC TRANSPARENCY



Standard *i**
Semantically opaque

New *i**
Symbols with the highest semantic transparency

Caire, Patrice, et al. "Visual notation design 2.0: Towards user comprehensible requirements engineering notations" 21st IEEE International Requirements Engineering Conference (RE 2013)

RESEARCH QUESTIONS

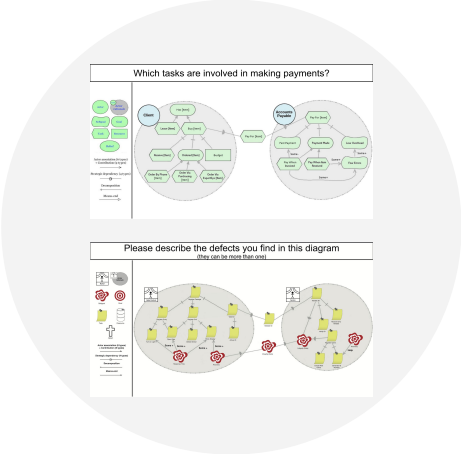
1 Does the adoption of a more semantically transparent concrete syntax improve the **accuracy, speed and ease** when performing **understanding** tasks on *i** SR models?

2 Does the adoption of a more semantically transparent concrete syntax improve the **accuracy, speed and ease** when performing **reviewing** tasks on *i** SR models?

PARTICIPANTS AND EXPERIMENTAL MATERIALS

57 participants

1 eye-tracker

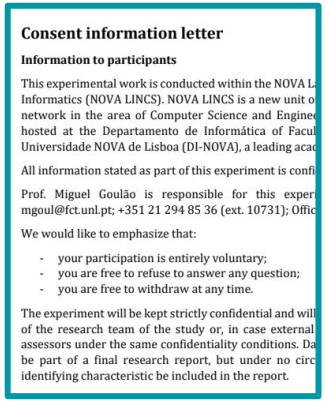


2 domains

QUASI-EXPERIMENT WITH A COMBINATION OF MEASURES

Direct	Indirect	Subjective
Duration Detection time	Fixations Saccades Heatmaps	Performance Effort Frustration Mental demand Physical demand Temporal demand
Precision Recall F-measure		

READ THE CONSENT LETTER



Consent information letter

Information to participants

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All information stated as part of this experiment is confi

Prof. Miguel Goulão is responsible for this exper
mgoul@fct.unl.pt; +351 21 294 85 36 (ext. 10731); Offic

We would like to emphasize that:

- your participation is entirely voluntary;
- you are free to refuse to answer any question;
- you are free to withdraw at any time.

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WATCH A VIDEO TUTORIAL

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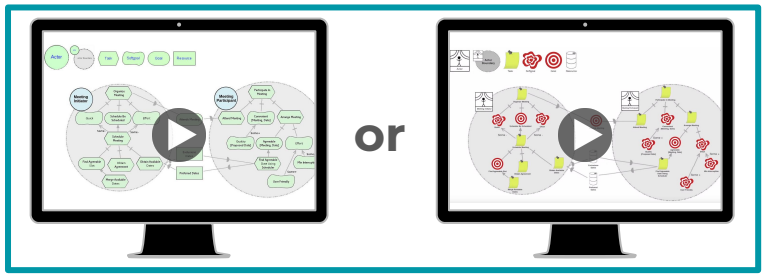

CALIBRATE THE EYE-TRACKER

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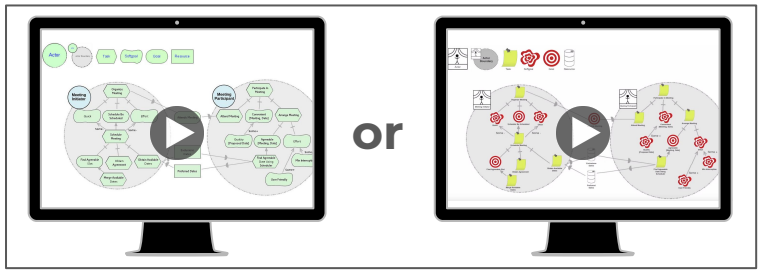

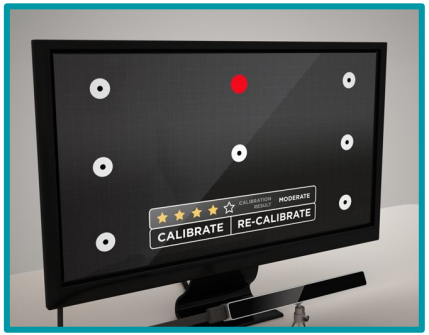

PERFORM A TASK

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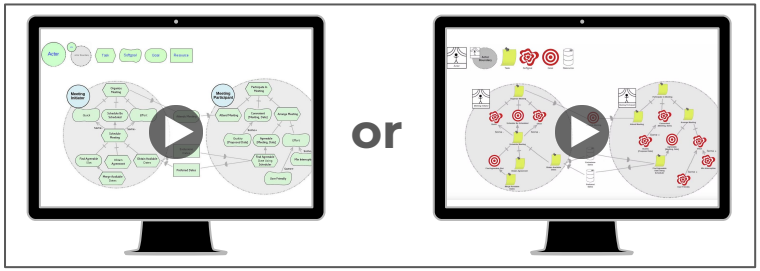

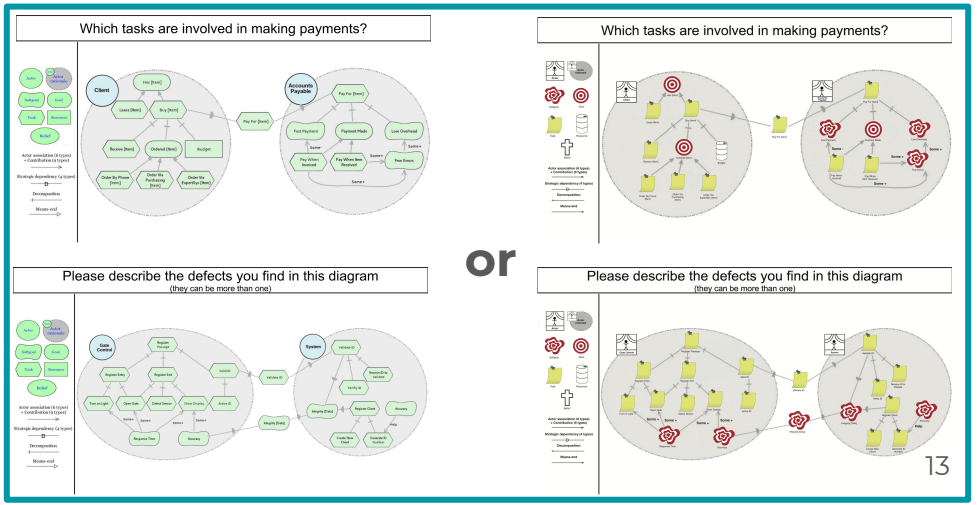

ANSWER A NASA-TLX QUESTIONNAIRE

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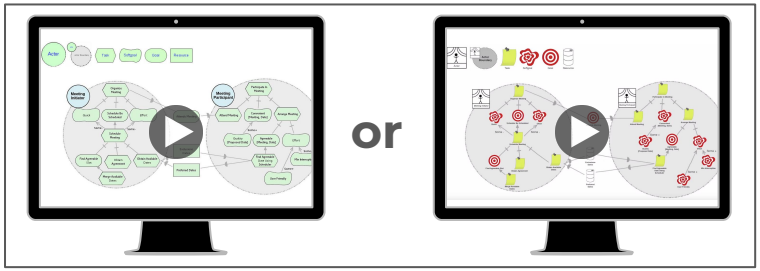

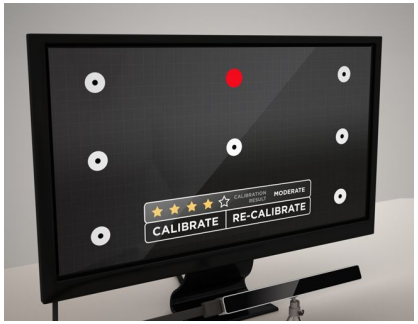

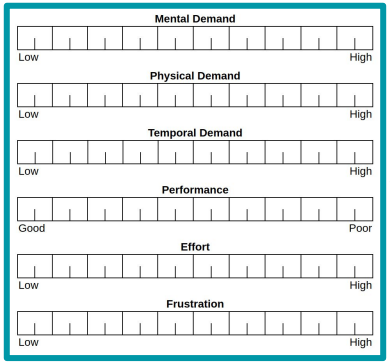

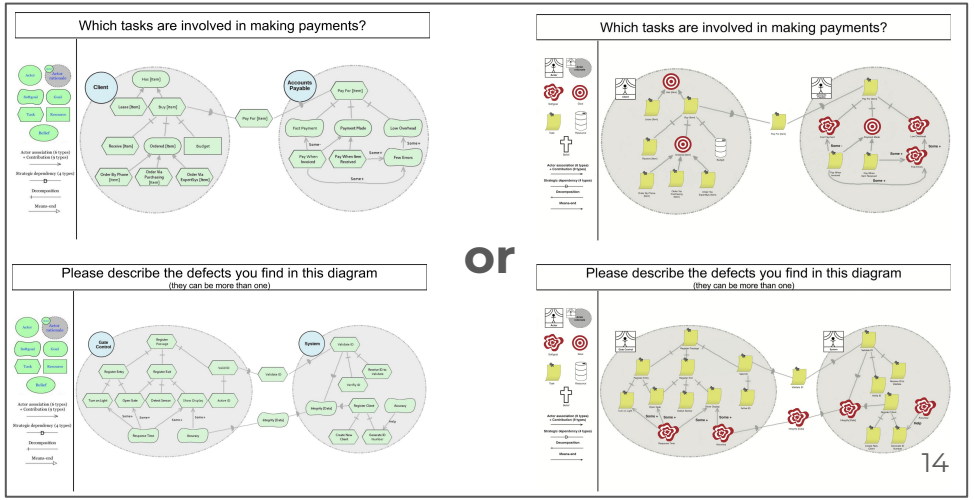

ANSWER TO DEMOGRAPHIC QUESTIONS

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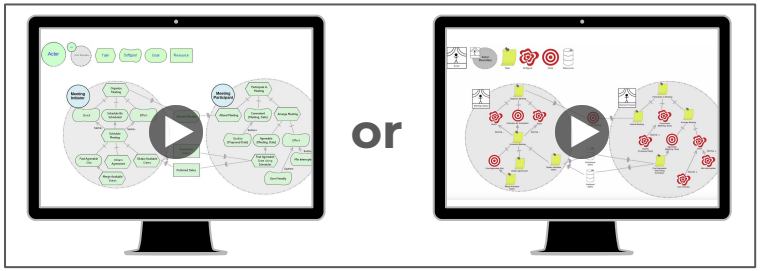
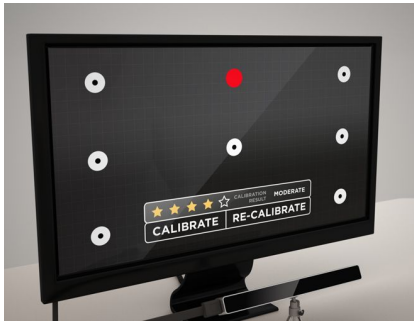




Demographic Data

*Obrigatório

Gender *

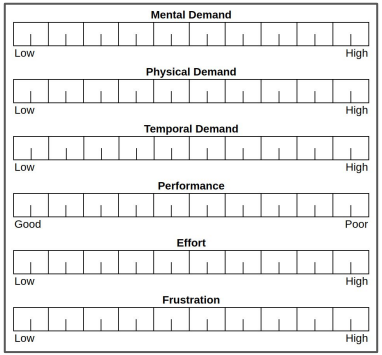
- Male
- Female

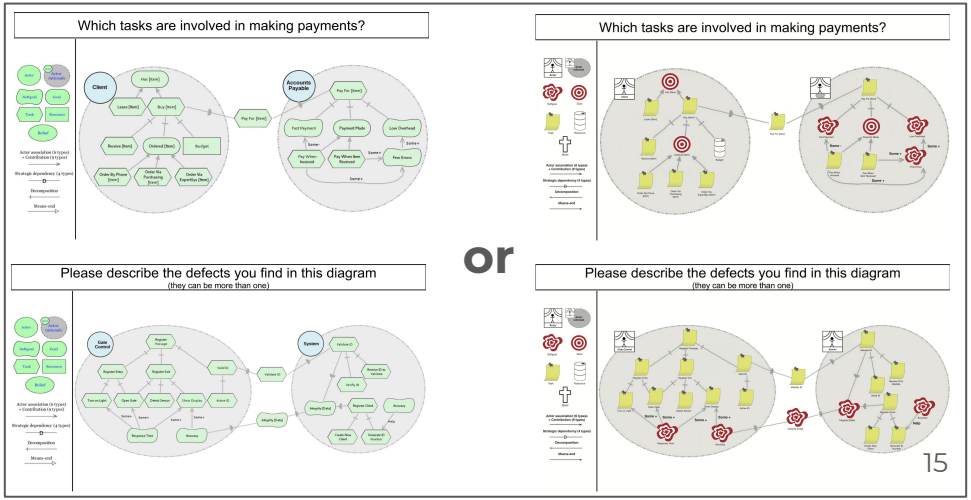
Age *

A sua resposta

Nationality *

A sua resposta





PROTOCOL OF THE EXPERIMENT

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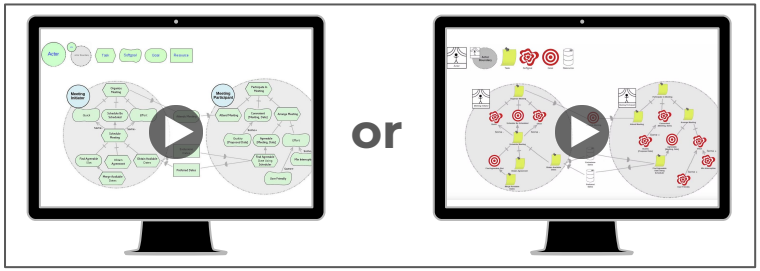

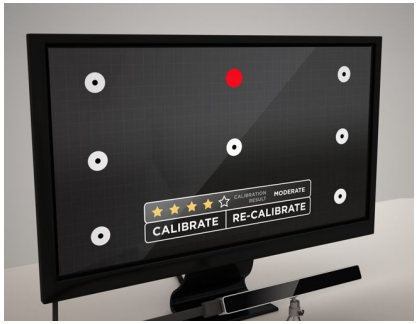

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*Obrigatório

Gender *

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A sua resposta

Nationality *

A sua resposta

Mental Demand
Low — High

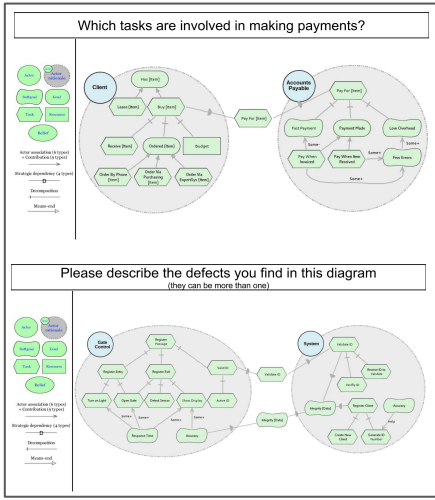
Physical Demand
Low — High

Temporal Demand
Low — High

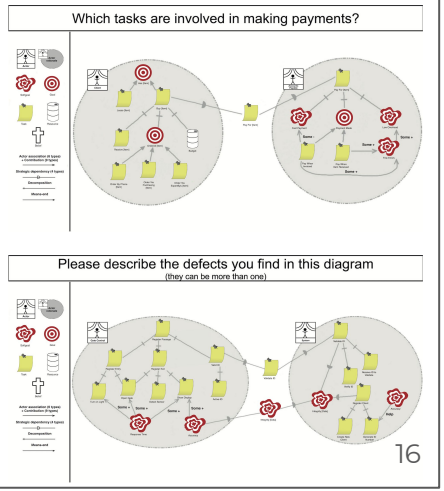
Performance
Good — Poor

Effort
Low — High

Frustration
Low — High

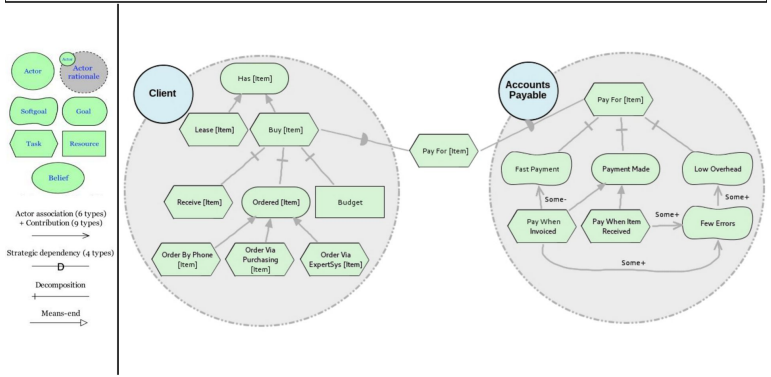


or



TWO UNDERSTANDING AND TWO REVIEW TASKS, BOTH WITH STANDARD *i** AND NEW *i**

Which tasks are involved in making payments?



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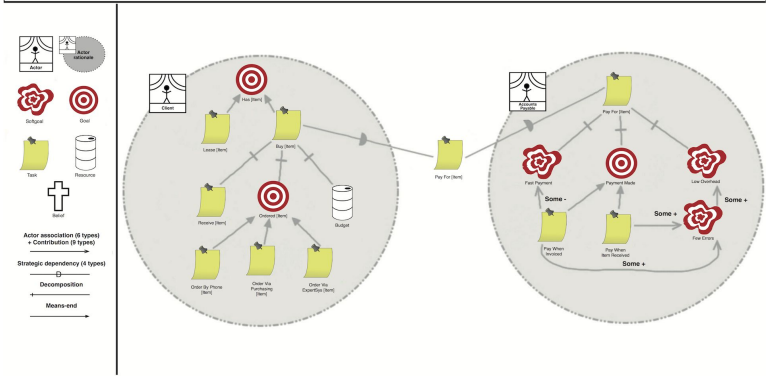
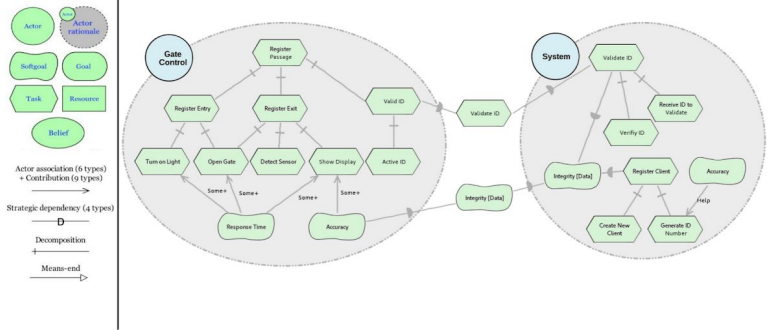


Please describe the defects you find in this diagram
(they can be more than one)



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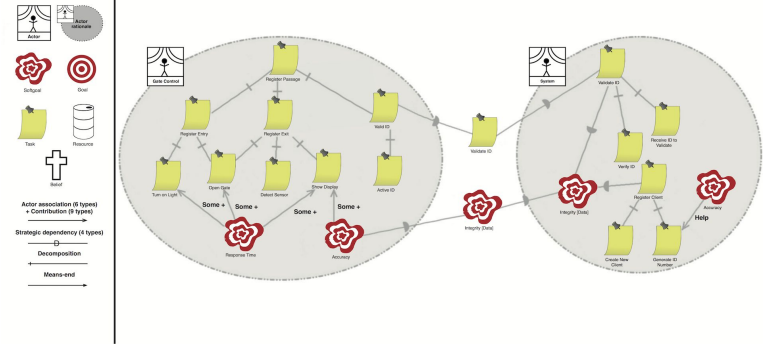

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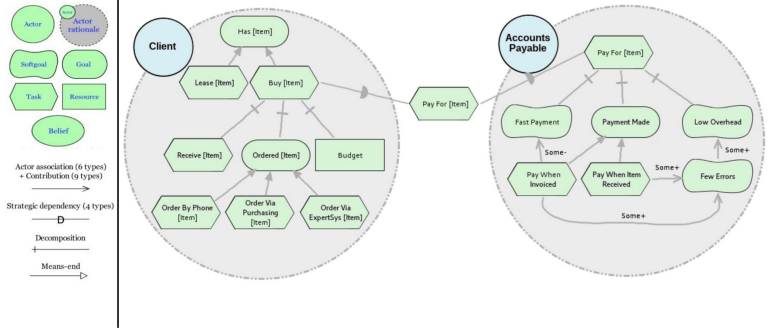
Which tasks are involved in making payments?



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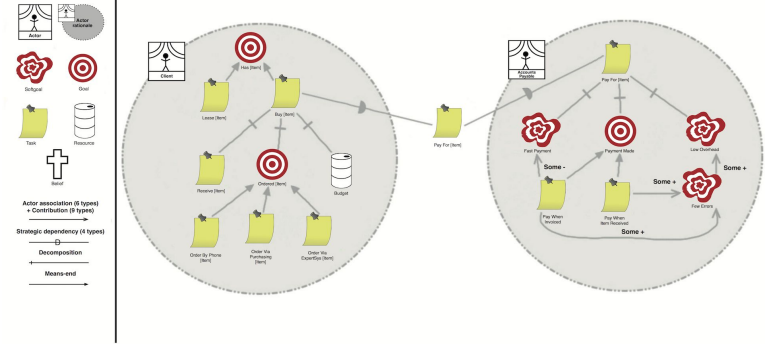

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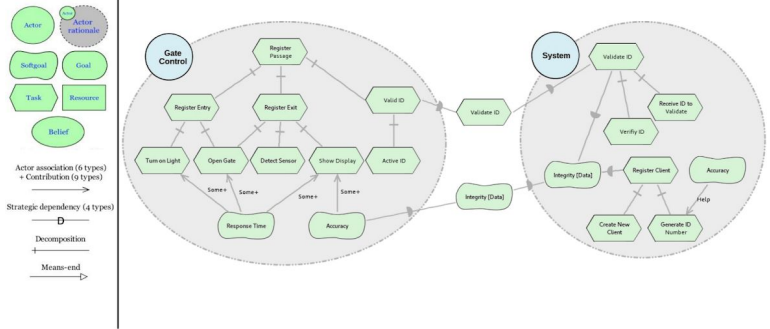

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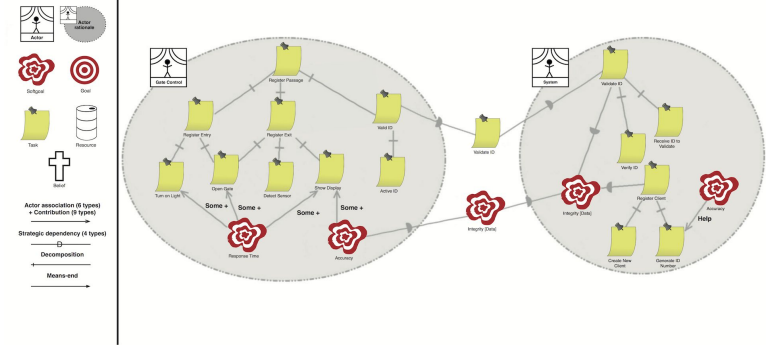
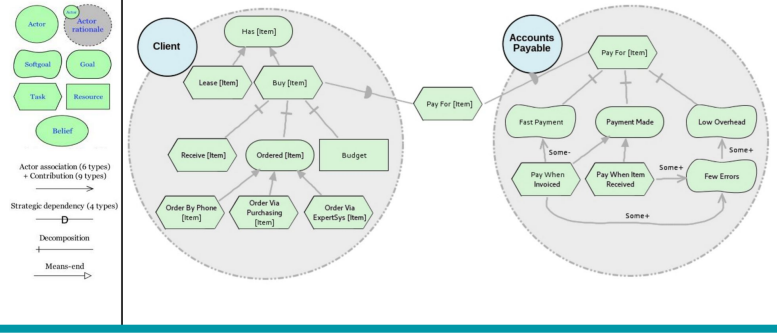
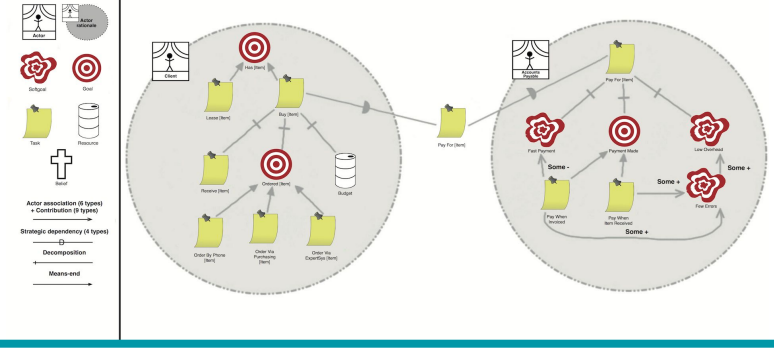


TWO UNDERSTANDING AND **TWO REVIEW** TASKS, BOTH WITH STANDARD *i** AND NEW *i**

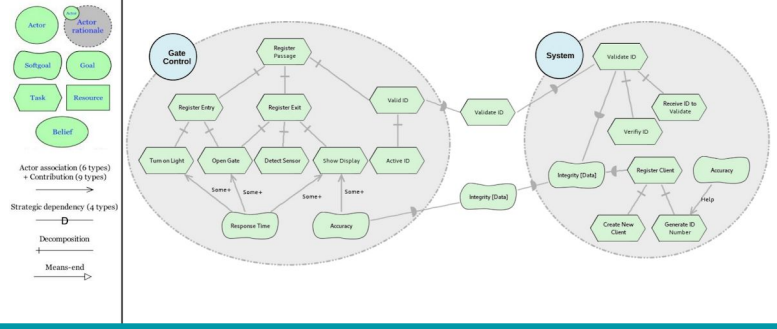
Which tasks are involved in making payments?



Which tasks are involved in making payments?



Please describe the defects you find in this diagram
(they can be more than one)



Please describe the defects you find in this diagram
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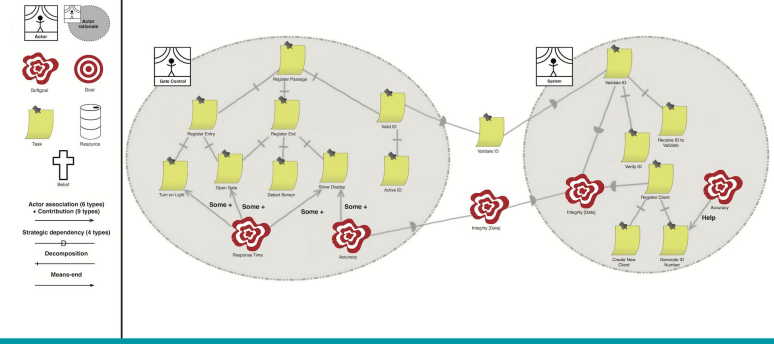

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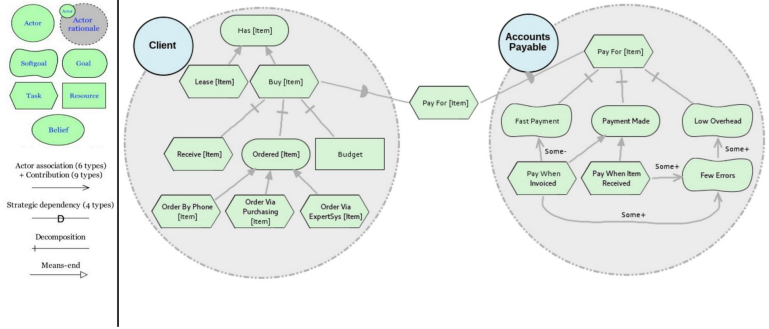

Please describe the defects you find in this diagram
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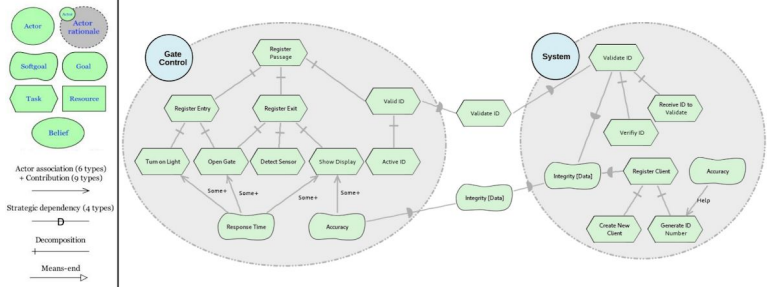
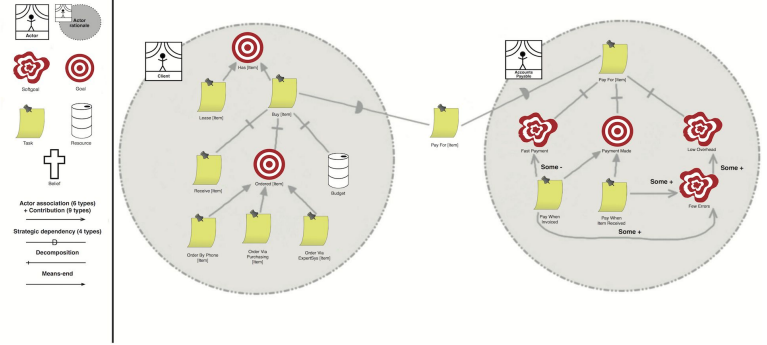
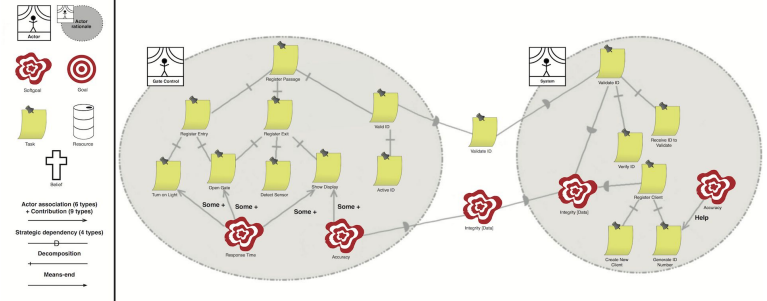


Which tasks are involved in making payments?

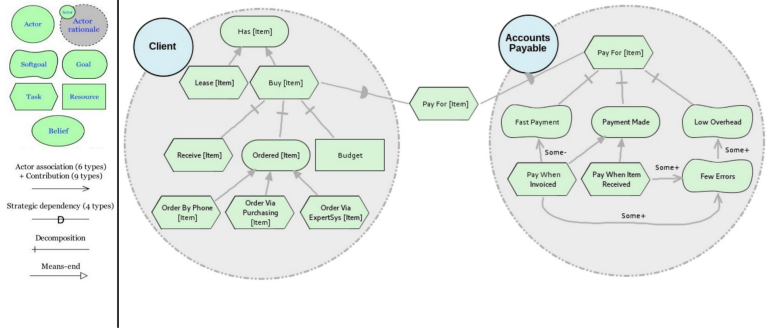


Please describe the defects you find in this diagram
(they can be more than one)

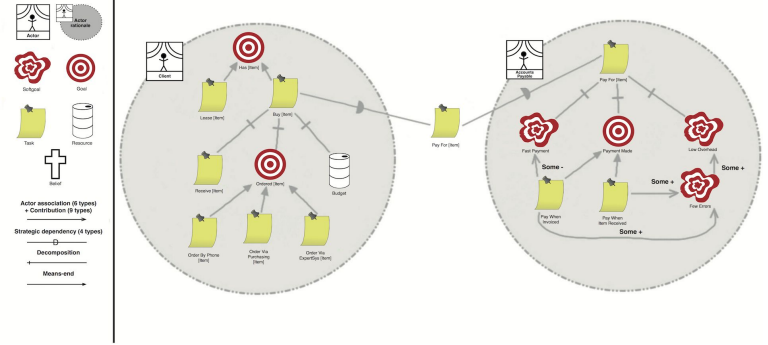


TWO UNDERSTANDING AND TWO REVIEW TASKS, BOTH WITH STANDARD *i** AND **NEW *i****

Which tasks are involved in making payments?



Which tasks are involved in making payments?



Please describe the defects you find in this diagram
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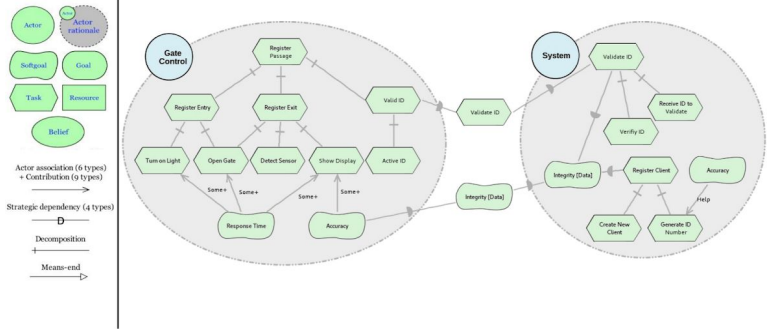

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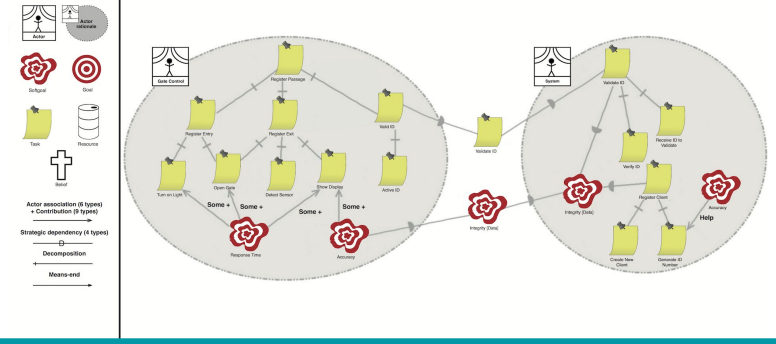
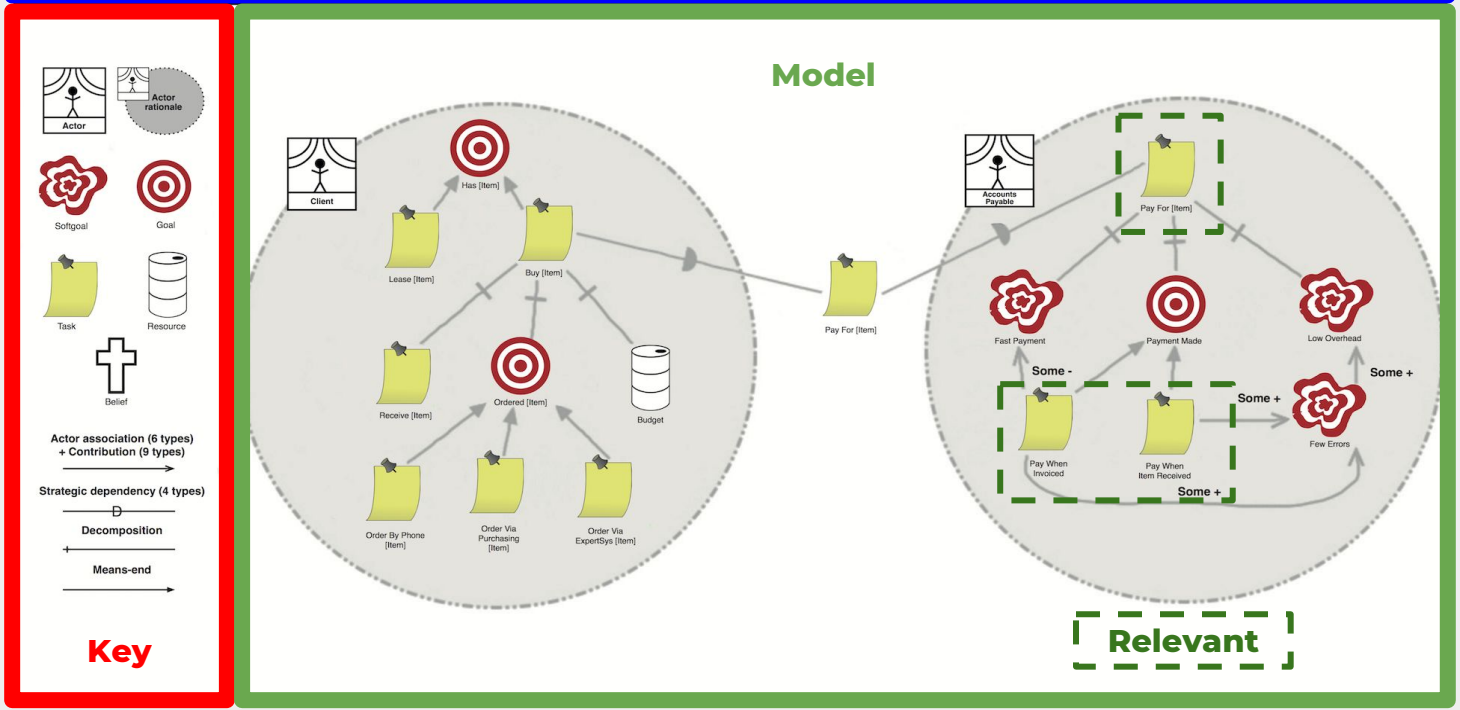
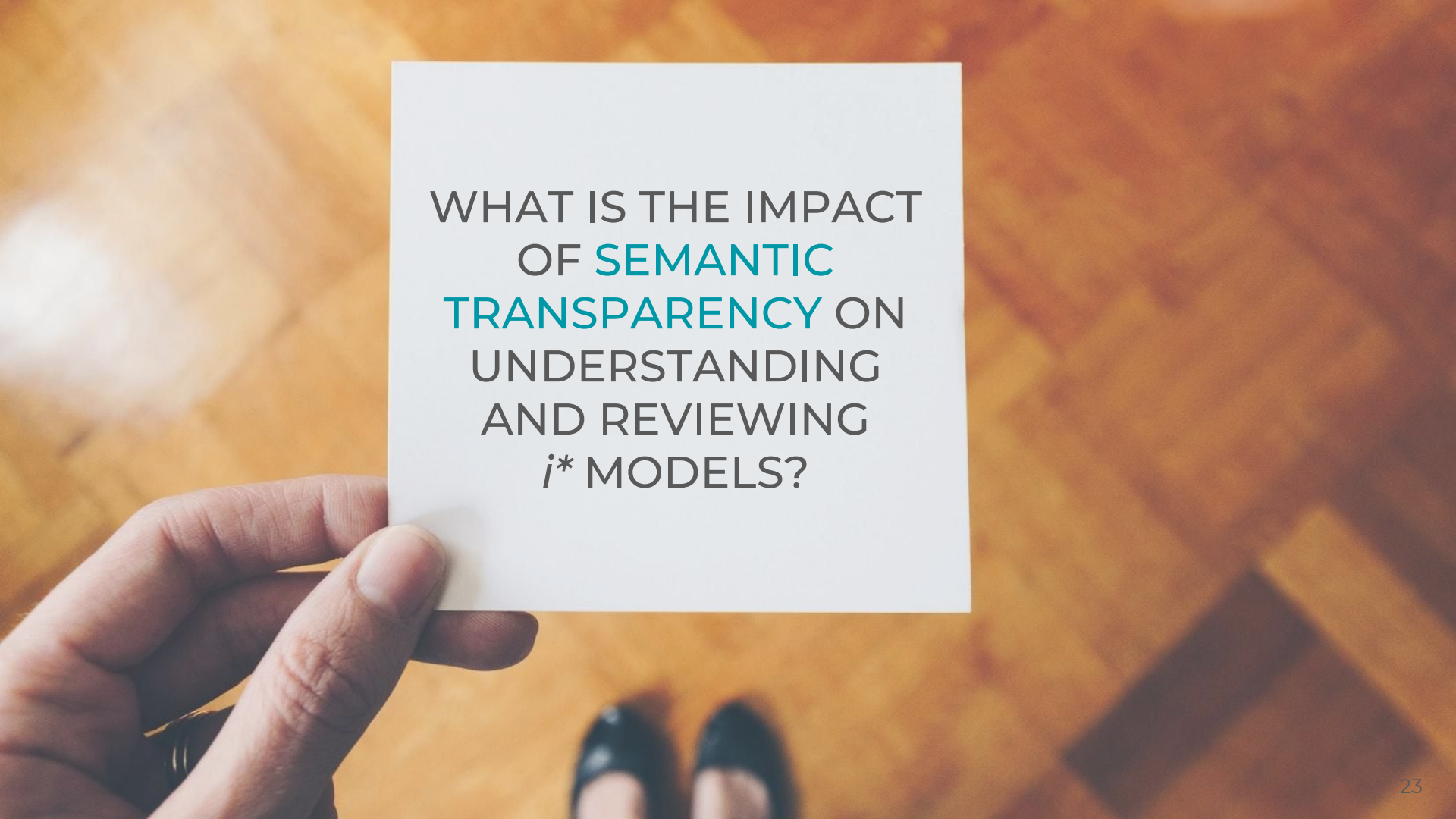
(they can be more than one)



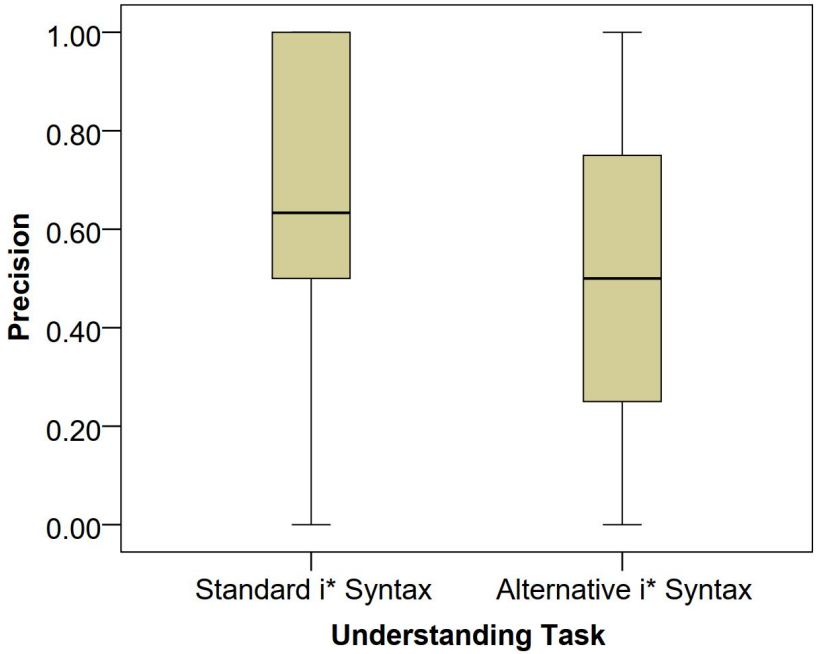
AREAS OF INTEREST

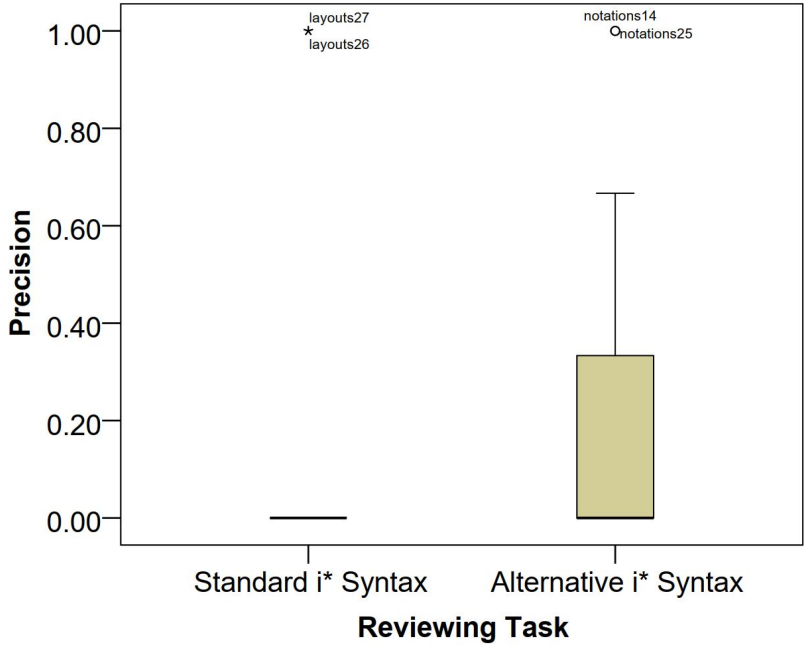
Question Which tasks are involved in making payments?



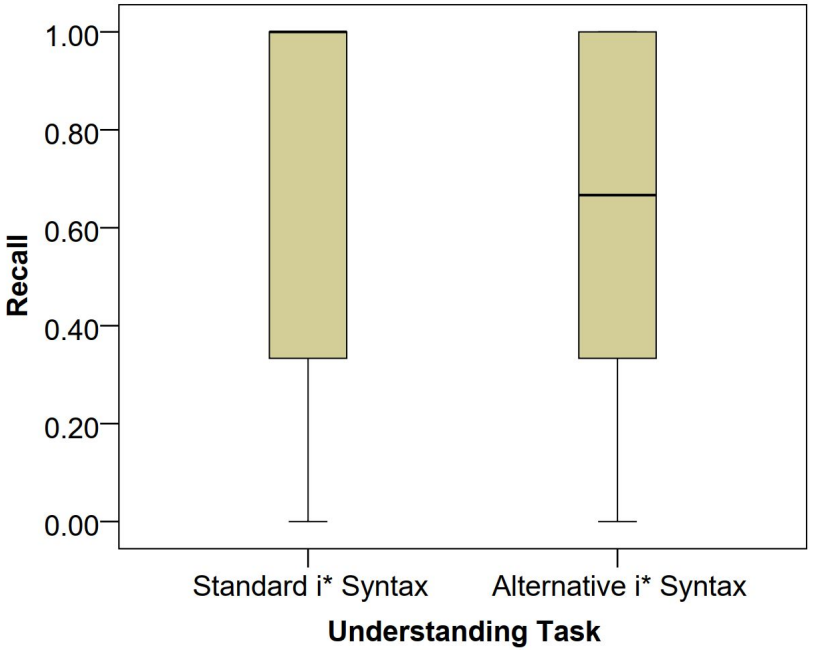

WHAT IS THE IMPACT OF SEMANTIC TRANSPARENCY ON UNDERSTANDING AND REVIEWING *i** MODELS?

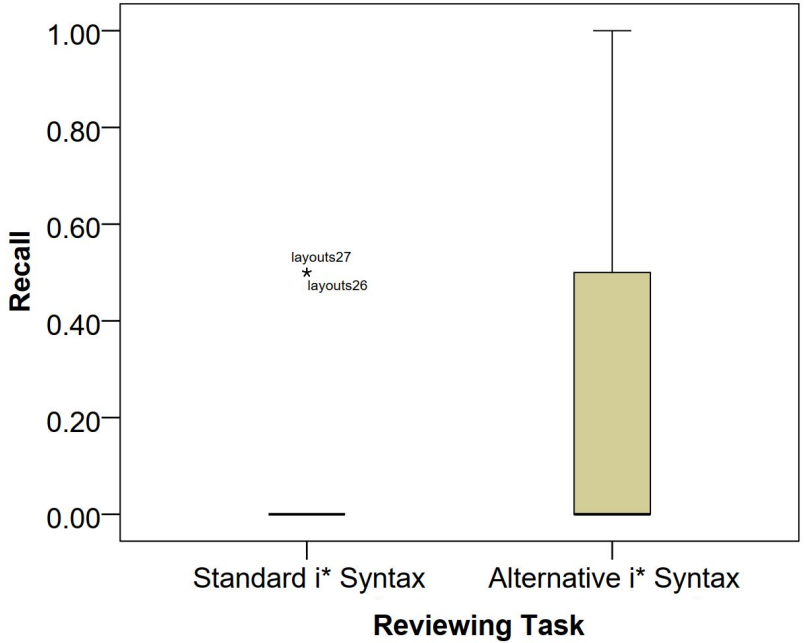
Precision is higher for understanding tasks, but there is no statistically significant difference between concrete syntaxes



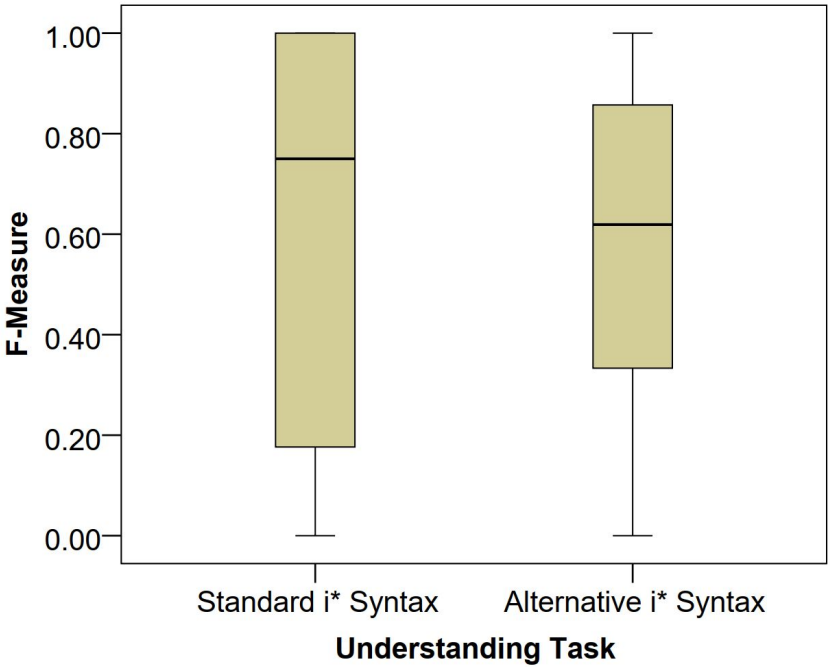


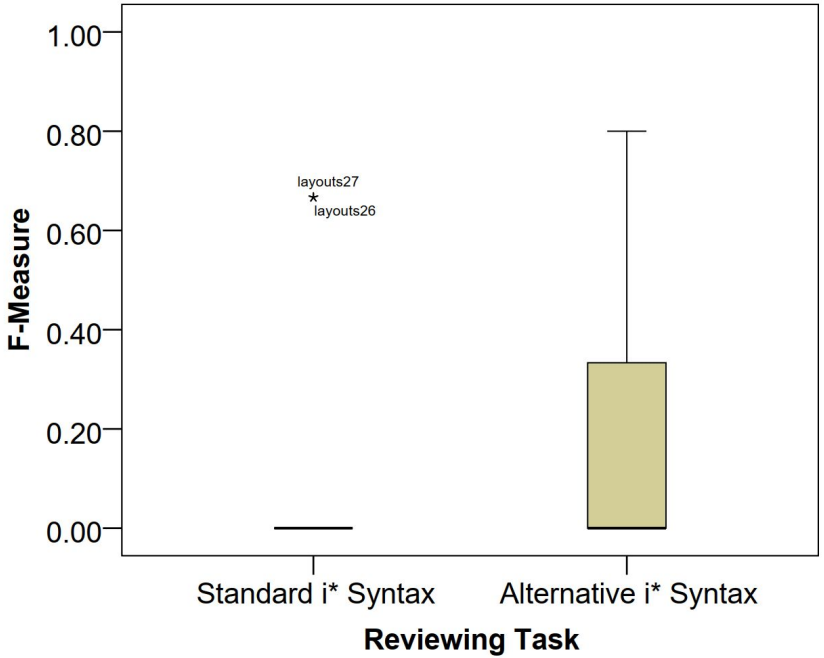
Recall is better for understanding tasks, but there is no statistically significant difference between concrete syntaxes



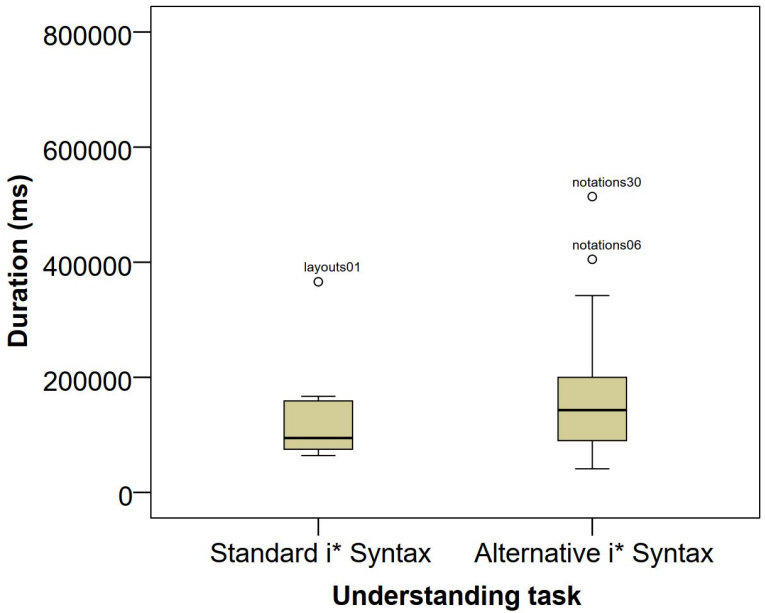


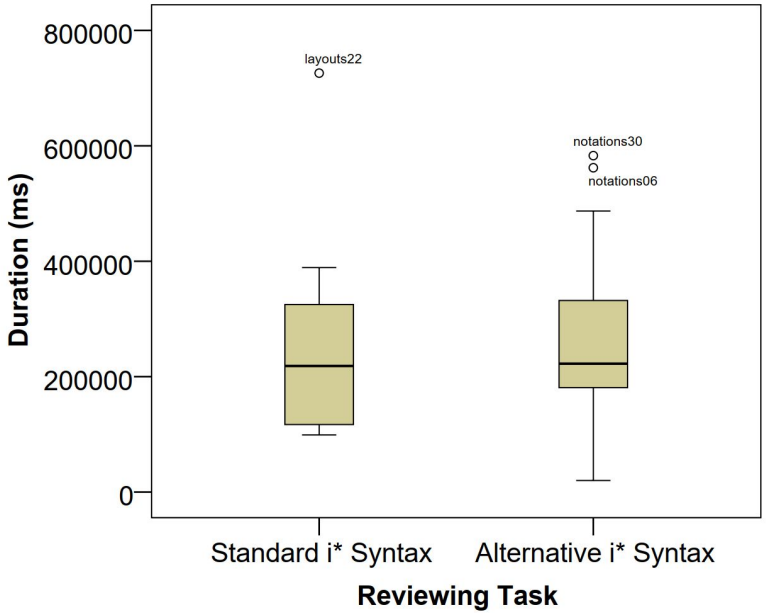
F-Measure is higher for understanding tasks, but there is no statistically significant difference between concrete syntaxes



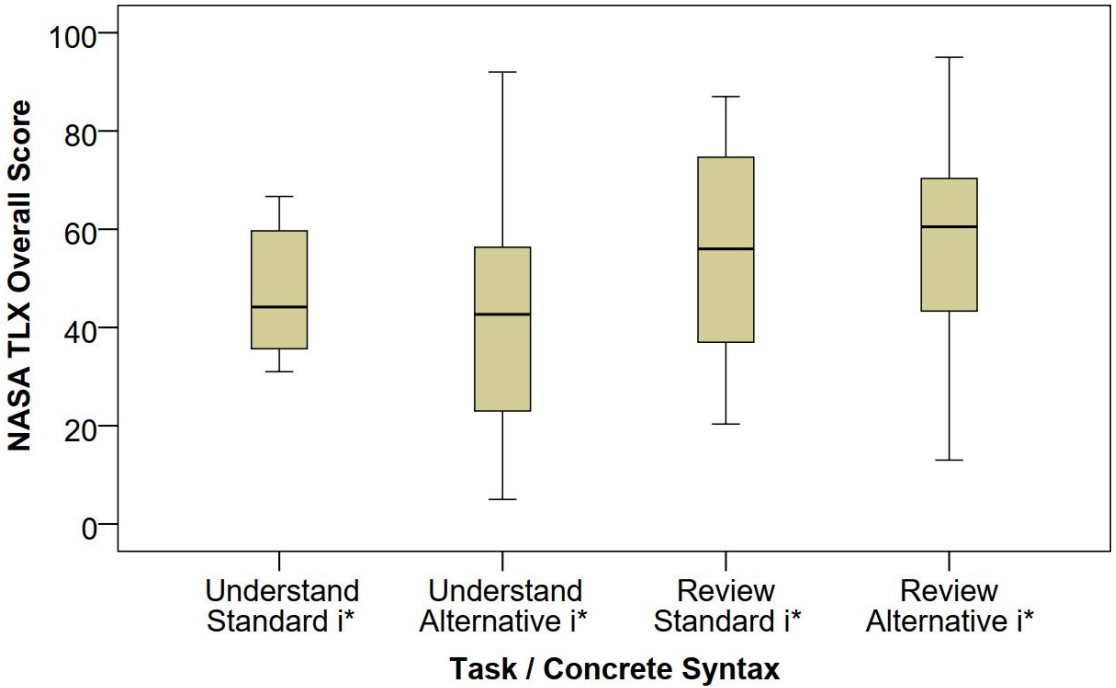


There is no difference in terms of duration, between concrete syntaxes for both tasks



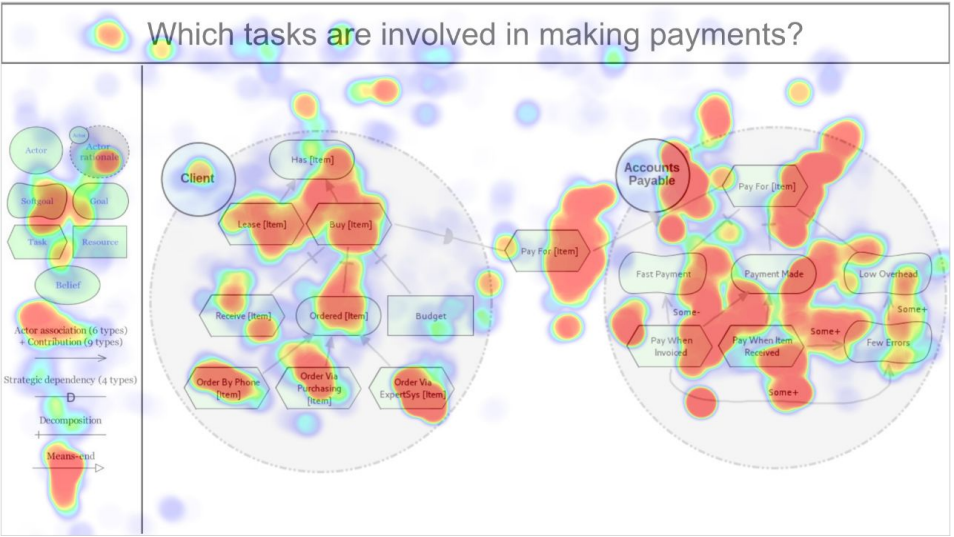


There is no difference in the perception of complexity of the tasks, for both concrete syntaxes

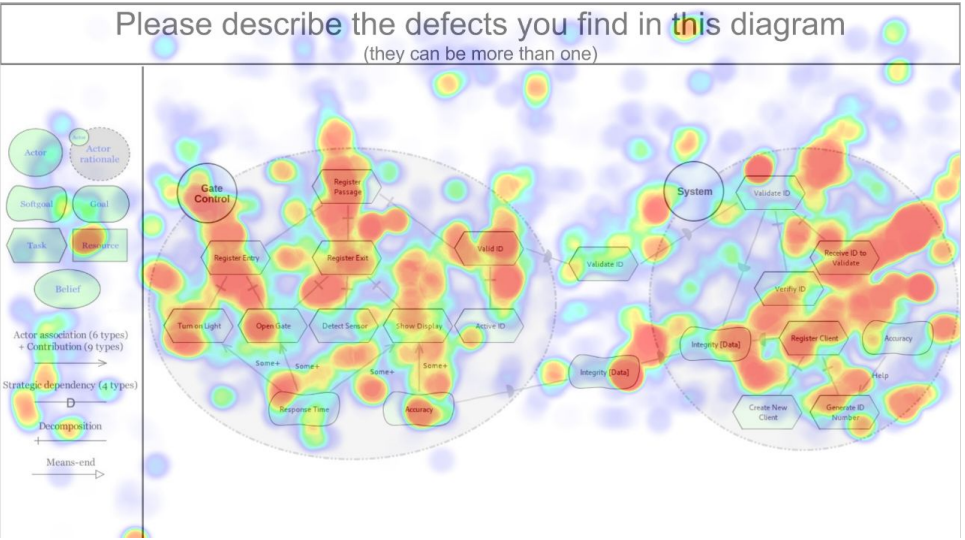


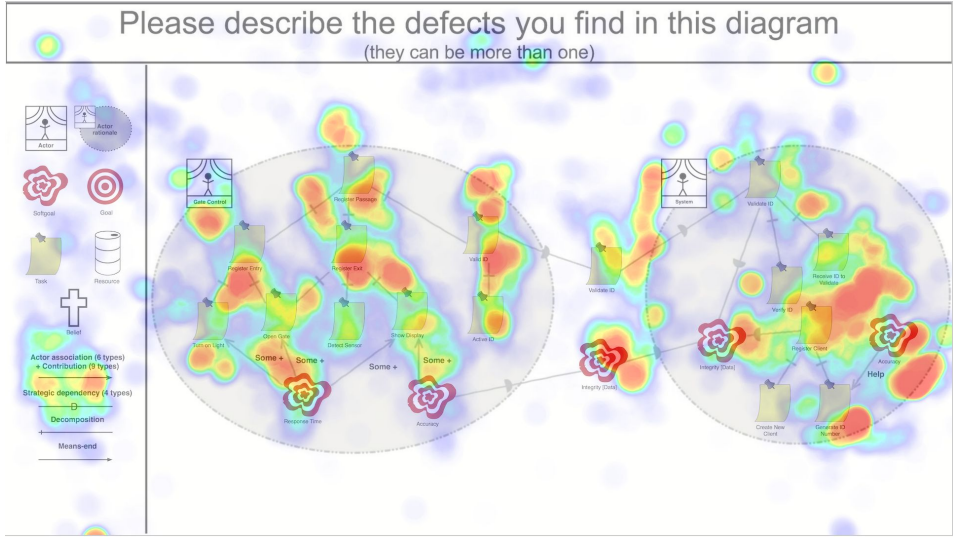
ARE THERE NO STATISTICALLY SIGNIFICANT DIFFERENCES?

Areas that are more frequently gazed during the understand tasks

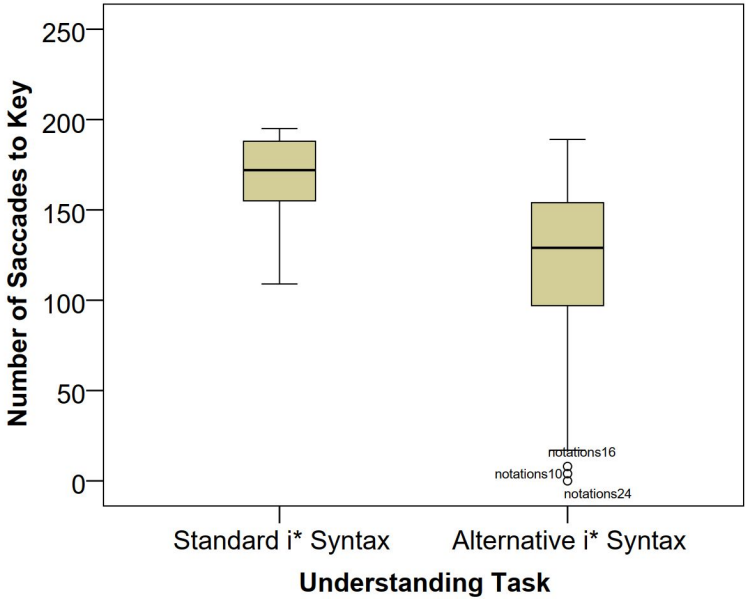


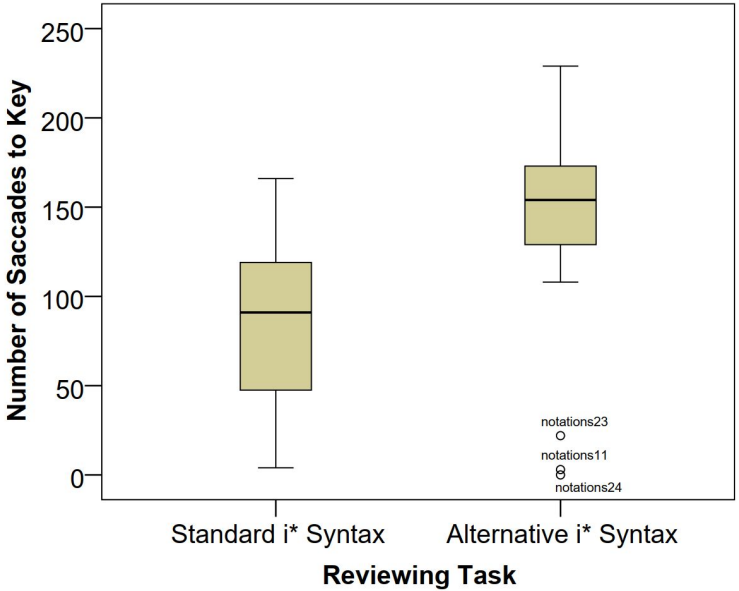
Areas that are more frequently gazed during the review tasks



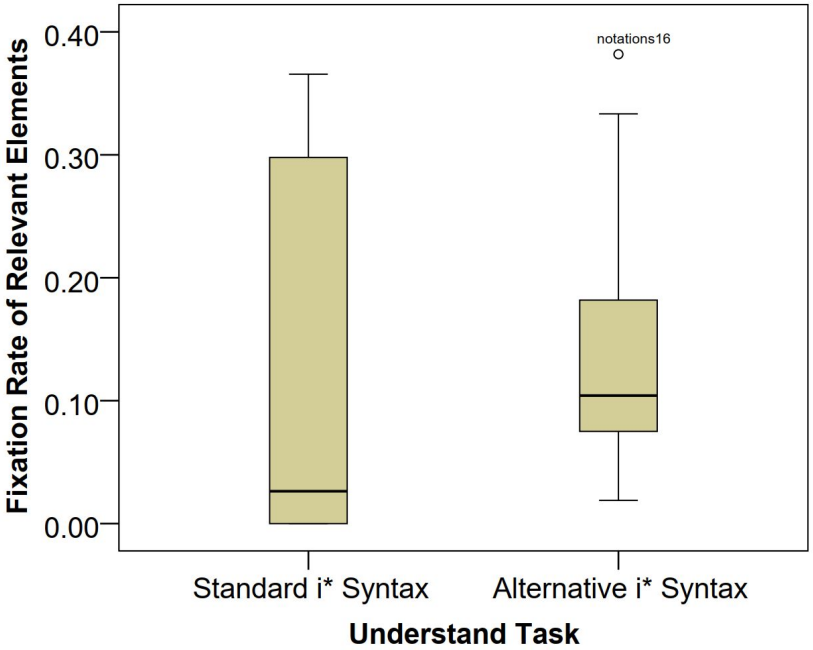


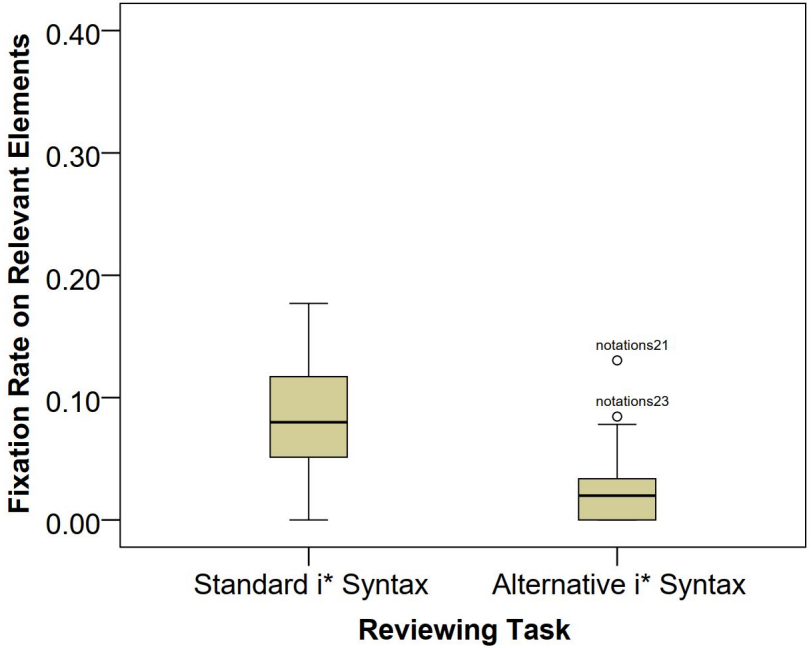
Total number of saccades and saccades to key are higher on understanding tasks for standard *i**, with a statistical significance



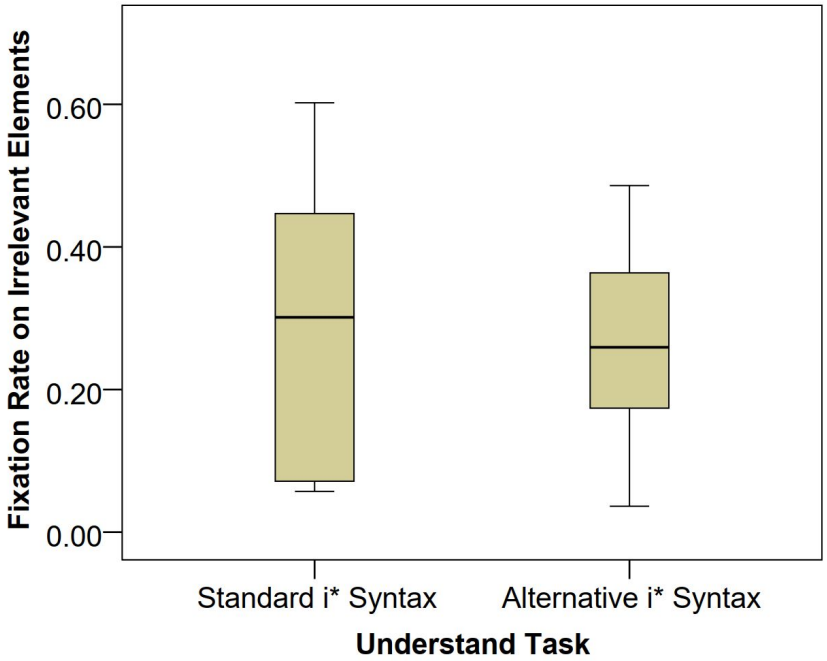


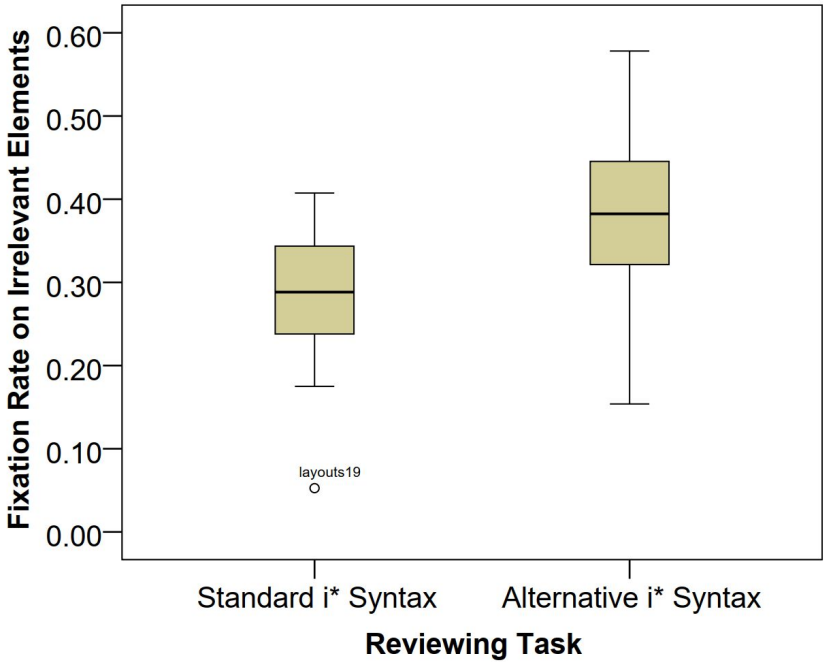
The effort spent looking at the relevant parts of the model decreased with the new *i**...



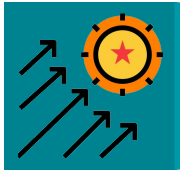
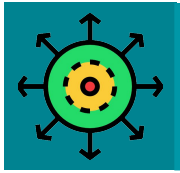
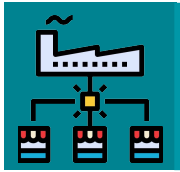


… but the effort on looking at irrelevant parts of the model increased, with the new *i**



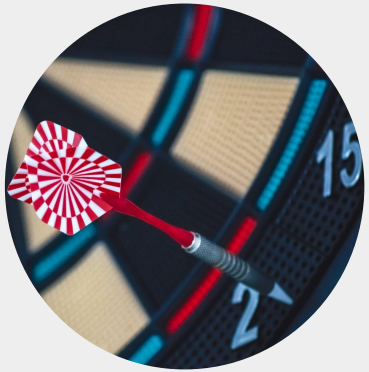


THREATS TO VALIDITY

 conclusion	reasonable number of participants; facilitated independent replicas
 internal	mixed order of the tasks; participants used only one of the concrete syntaxes
 external	size of the models
 construct	participants were not informed about what was being tested

INFERENCES

similar speed
and accuracy



no deep
overall impact
of visual effort

better symbol semantic transparency did
not imply better model understanding

THANK YOU

QUESTIONS?