

Utility, usability and acceptability:
An ergonomic approach to the evaluation
of external representations for learning

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Ergonomic evaluation

- Evaluate to improve devices in situations [*e.g.* external representations for learning]
- What is a good external representation for learning?
 - A representation that allows the learner to reach his/her learning goal?
 - That's no so simple... In particular when evaluation concerns real learning situations

Study 1

(Amiel, Tricot & Mariné, 2004)

- We evaluated an multimedia learning environment, based on external representations: “Formalion”
- “Formalion” is designed to train 70.000 maintenance men in the car industry. It is very expensive
- “Formalion” is quite not used
- We conducted empirical studies
 - to evaluate learning: the results were good
 - to evaluate usability: the results were good

Study 1

(Amiel, Tricot & Mariné, 2004)

- Conclusion: A learning tool can be good and not used
- We conducted a survey: Questions to the 400 trainers, to maintenance men; We also tried to understand how training sessions were organized
- Result: The problem was the organization of time, space and work, which were not compatible with the use of the learning environment
- When learning time (or space) is in competition with production time (or space), production often wins

Study 2

(Tricot, A., Bardin, G., Plégat, F., Frède, V., & Camps, J.F., 2003)

- We evaluated another multimedia learning environment, based on external representations: “UEL” (the French On-Line University)
- The French Ministry of Education asked us to evaluate if UEL was a good distance learning environment
- The design of UEL involved many universities and teachers, for many years

Study 2

(Tricot, A., Bardin, G., Plégat, F., Frède, V., & Camps, J.-F. 2003)

- We conducted empirical studies to evaluate usability (another lab evaluated learning)
 - The results were not very good
- We conducted a survey: Questions to teachers who designed the UEL, to students who used the UEL
- Results: The UEL was not designed nor used (in France) as distance learning environment but as presence learning environment
- Maybe it is a good presence learning environment!

Study 3

(Lemerancier, C., Tricot, A., Chênerie, I., Marty Dessus, D.,
Morancho, F., & Sokoloff, J., 2002)

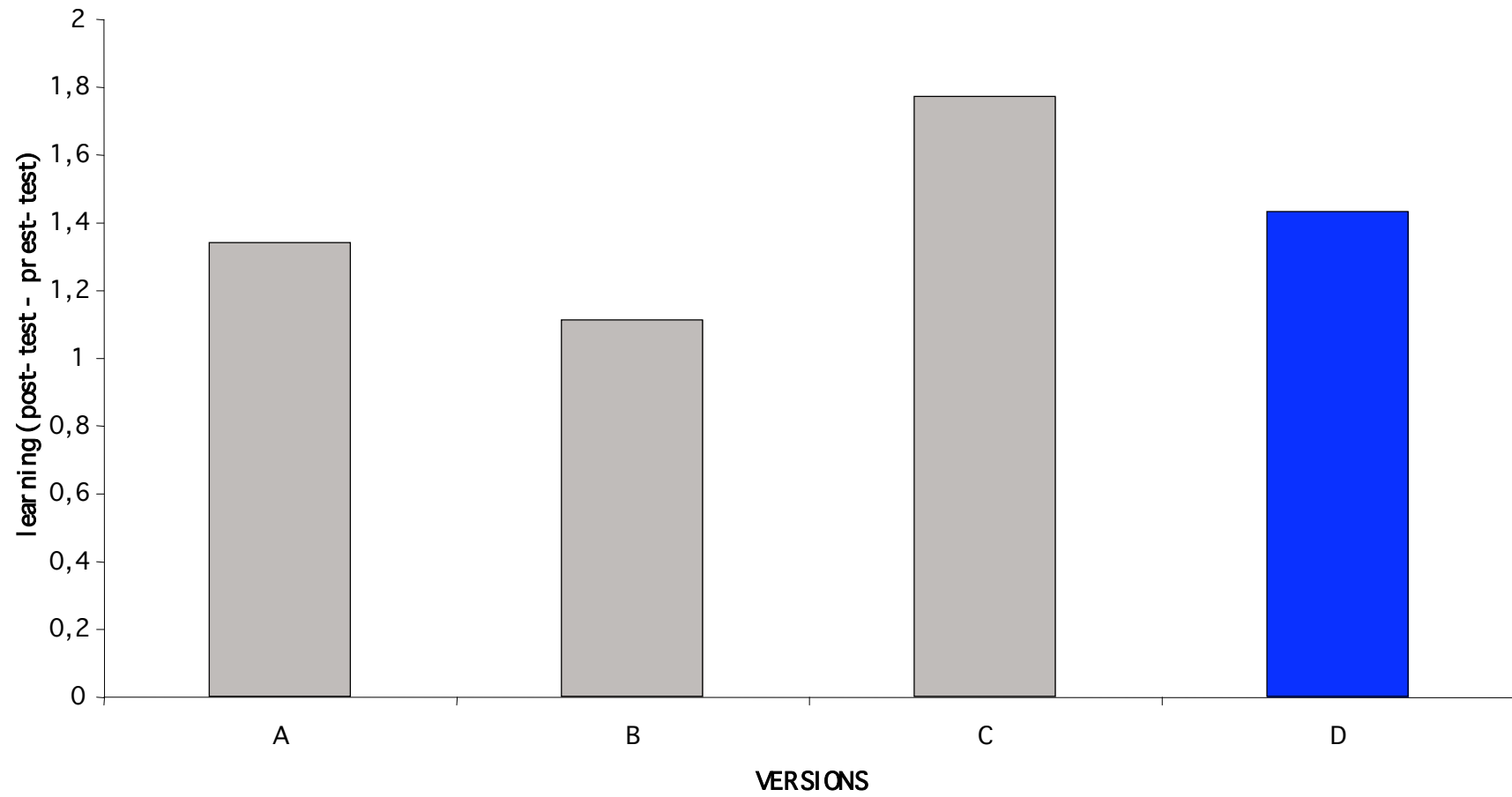
- We conducted empirical evaluation of multimedia document for electricity learning
- We compared 4 formats for 3 series of 10 worked examples
 - A. Paper original format (texts + pictures; 6 problems presented on each page; 10 solutions presented on a different page)
 - B. Paper, printed version of version C (3 problems on each page; 10 solutions presented on a different page)
 - C. Electronic document (1 problem on each page; 10 solutions presented on a different page)
 - D. Electronic document following some “guidelines” from Mayer and Sweller (text and pictures are integrated, solution is integrated in the problem, etc.)

Study 3

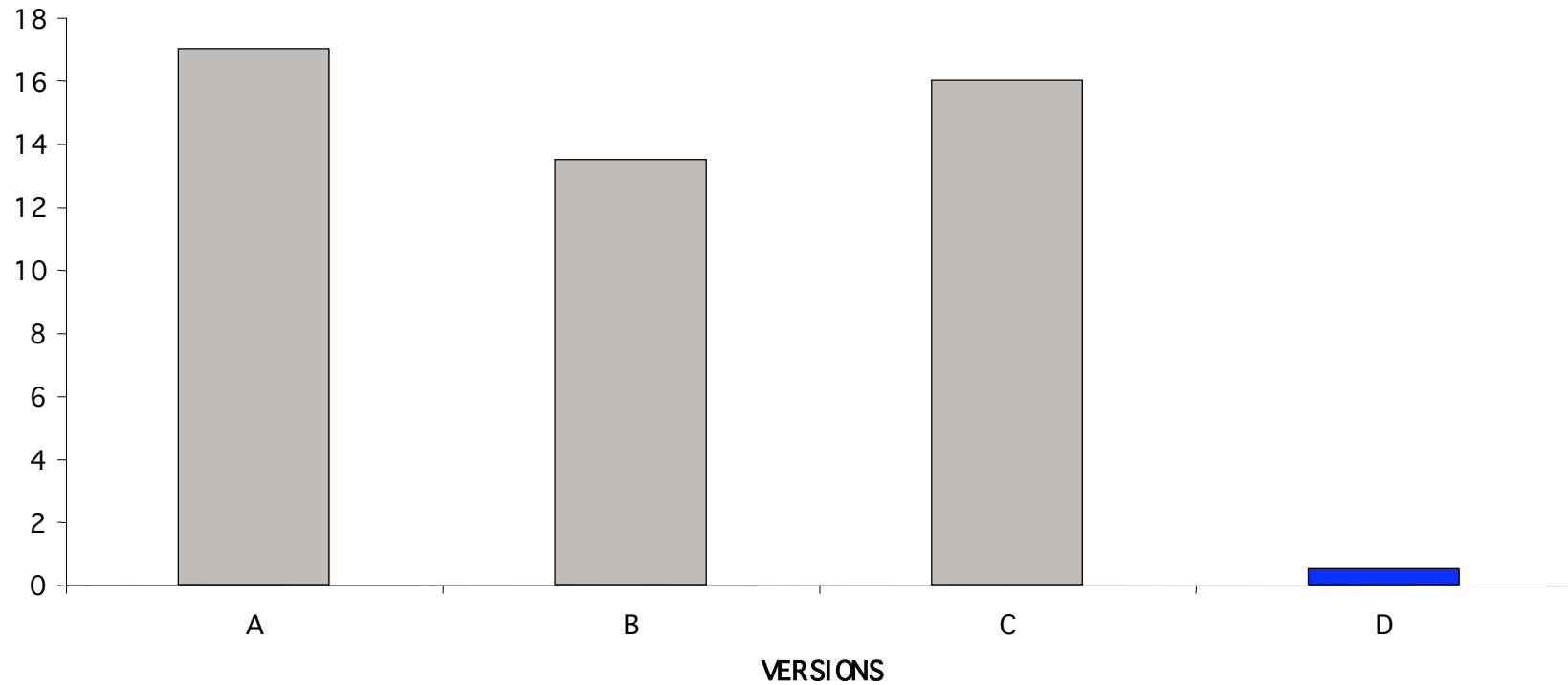
(Lemerancier, C., Tricot, A., Chênerie, I., Marty Dessus, D.,
Morancho, F., & Sokoloff, J., 2002)

- 300 participants randomly assigned in 4 groups
- They are 19 years old, it is their first year at the Technical University of Toulouse
- Protocol
 - Pre-test and post-test (10 questions), performance from 0 to 10 points
 - Between the pre and the post, 100 minutes to study 10 worked examples (each student study 3 series of 10 problems)
 - Their teachers were there to answer questions, to give help
 - 1 teacher for 28 students (and 14 computers)
 - 2 students for 1 document (or one computer)
- Learning performance = post-test – pre-test

Results



Average number of questions answered by teacher in 100 minutes



Conclusion

- Students learn
- Version D (the good one) is not better than version C
- Version D allows them to learn without teachers' help
- Version D allows them to learn autonomously

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- Version D (the good one) is not better than version C
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- The year after, we replicated the study, with 300 participants
- We compared version A and D
- Students had to use the document autonomously (at home)
- The class was to ask questions to the teachers about difficulties
- Result : **a perfect disaster**
 - Students didn't use the document autonomously
 - They prefer the paper version

What is a good external representation for learning?

- It is useful:
 - it allows the learner to reach his/her learning goal
- It is usable:
 - it is easy to learn to use it, efficient, it is easy to memorize how it works, it doesn't cause errors, it is satisfying (Nielsen, 1994)
- It is acceptable:
 - it is compatible with the goals and the constraints of the context (time, space, organization)
 - it is compatible with learner's motivation, affects, culture, values

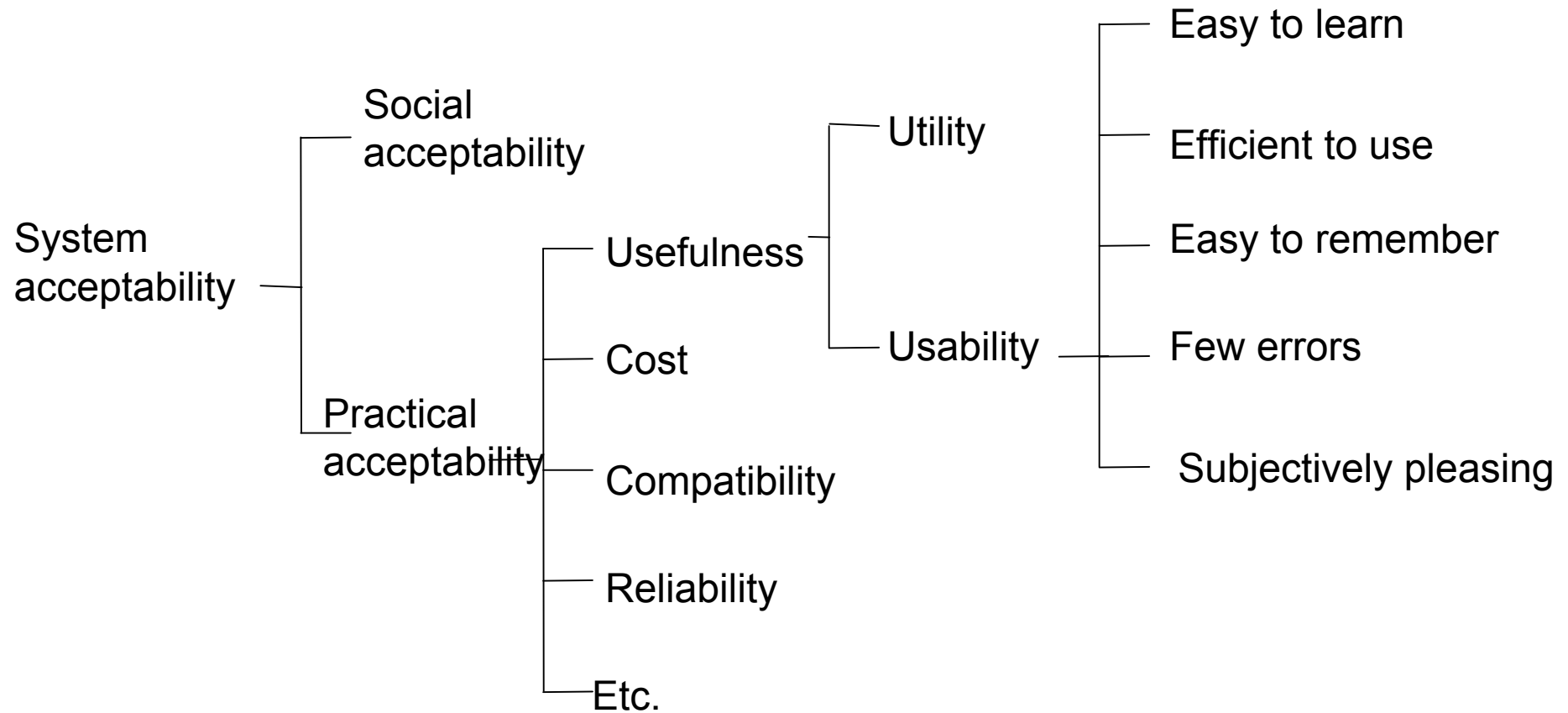
Then the question is:

If I want to improve an external representation for learning, what dimension do I have to improve before?

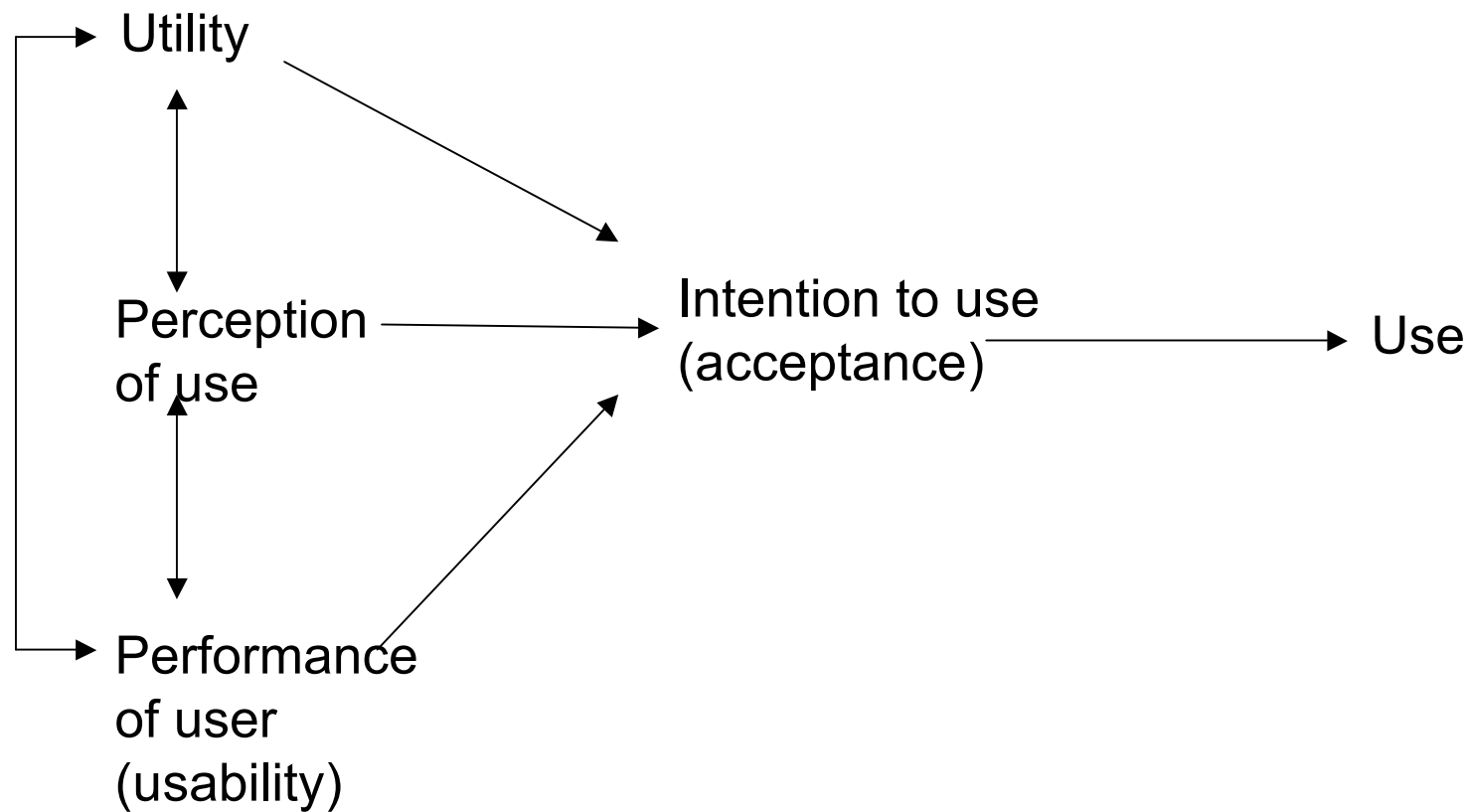
Utility, Usability or Acceptability?

Classical relations between
these three dimensions

Nielsen (1994)



Dillon & Morris (1996, 1998)



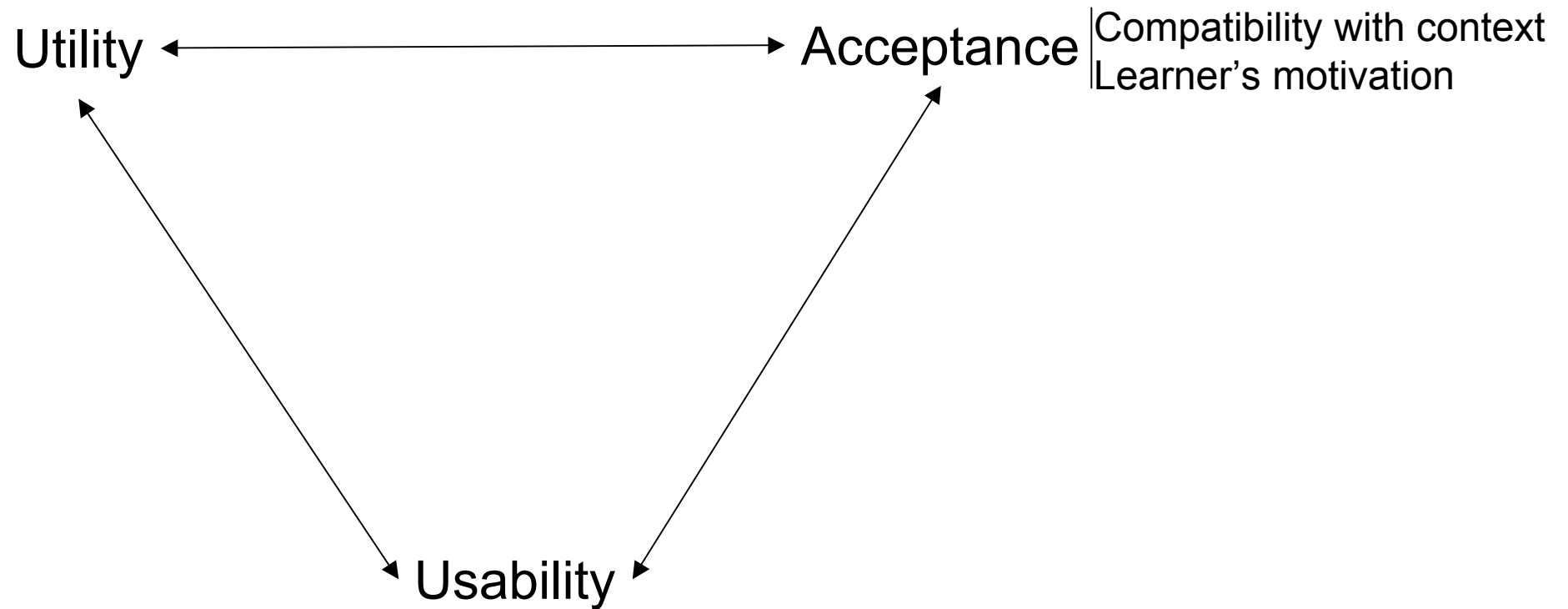
Study 4

(Galy, Camps, Jeunier, Morcillo & Tricot, submitted)

- We analyzed an interactive learning environment (IBM's KidSmart), used in pre-school by 72 teachers
- Results:
 - The teachers do not link usability with environment acceptance.
 - Acceptance was influenced by perceived utility and motivation

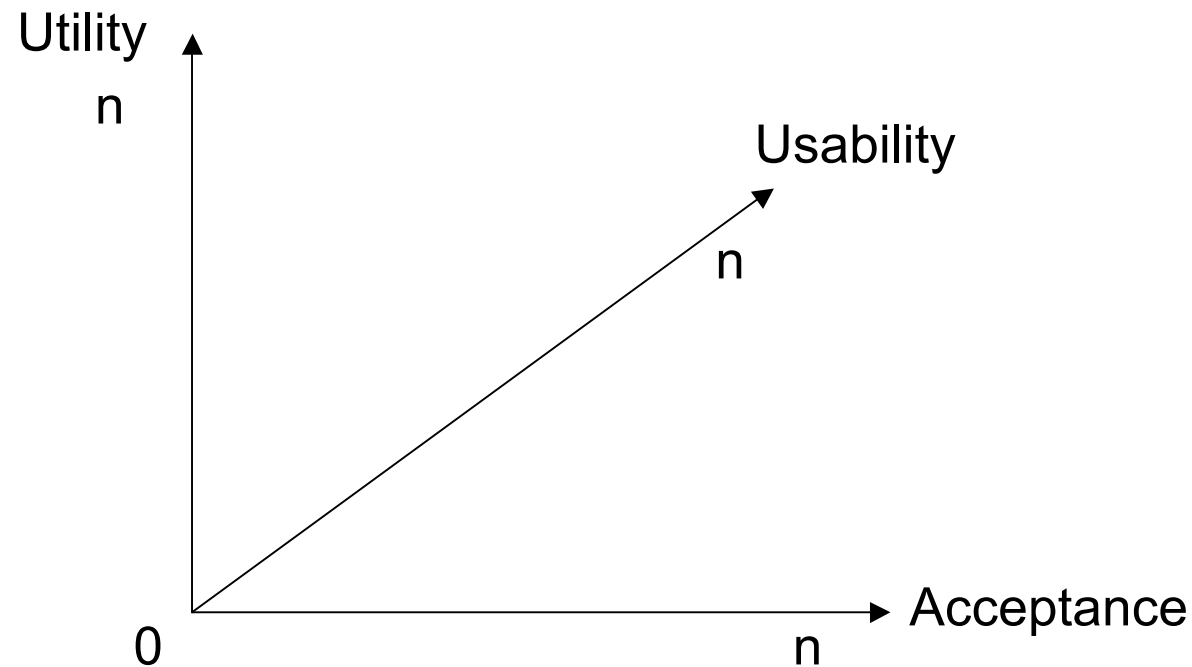
Proposition

- Every kind of relation between the 3 dimensions is possible
- This relation has to be analyzed for every situation



Proposition

- An ergonomic evaluation should measure the 3 dimensions, independently (3 set of tests)
- Then try to infer the relation between the 3 dimensions

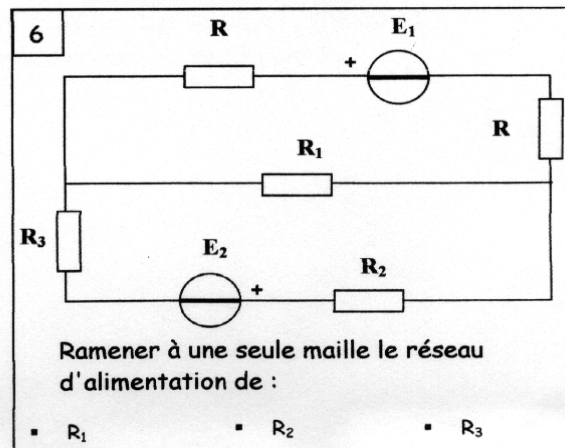
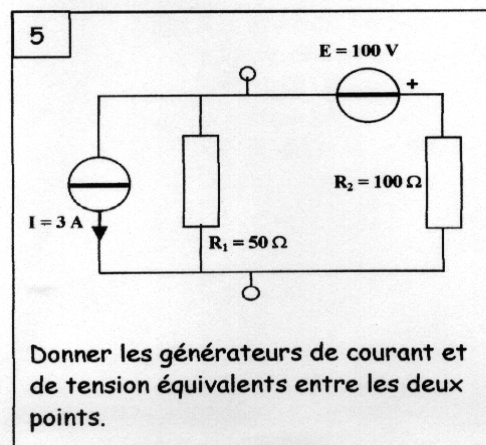
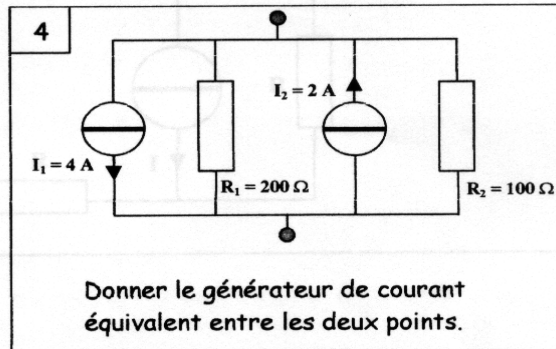
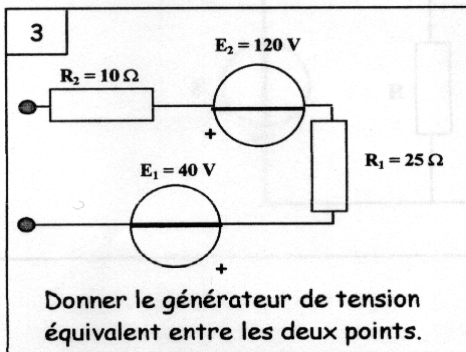
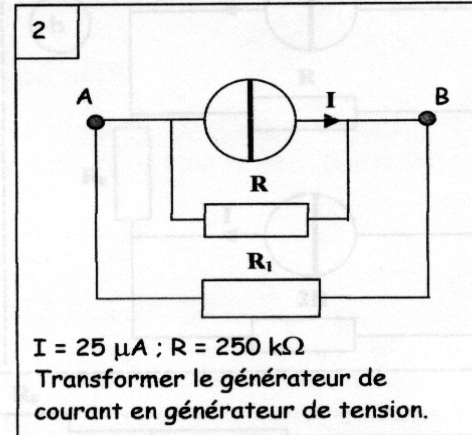
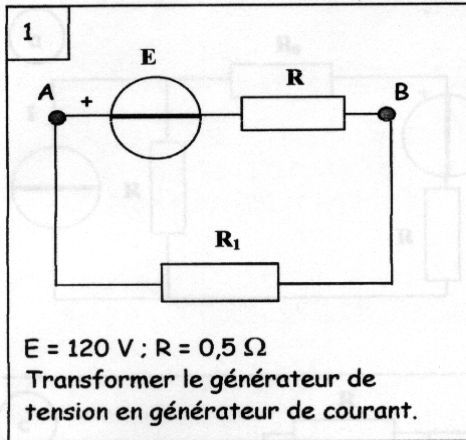


Thank you for your attention

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3 - GENERATEURS EQUIVALENTS :

transformations et associations



VERSION A

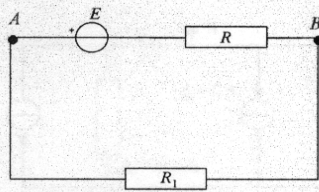
3 - Générateurs équivalents

Sommaire

Exercice 1	*	Exercice 5	**
Exercice 2	*	Exercice 6	**
Exercice 3	*	Exercice 7	**
Exercice 4	*	Exercice 8	***
Exercice 9	*	Exercice 9	***

Cliquer sur l'exercice choisi

Aide



$$E = 120 \text{ V} ; R = 50 \Omega$$

Transformer le générateur de tension en générateur de courant.

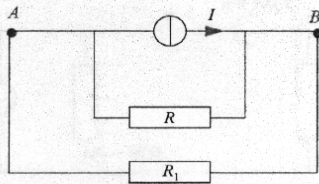
Outils

Conventions

Exercice 1

Sommaire

Aide



$$I = 25 \mu\text{A} ; R = 250 \text{ k}\Omega$$

Transformer le générateur de courant en générateur de tension.

Outils

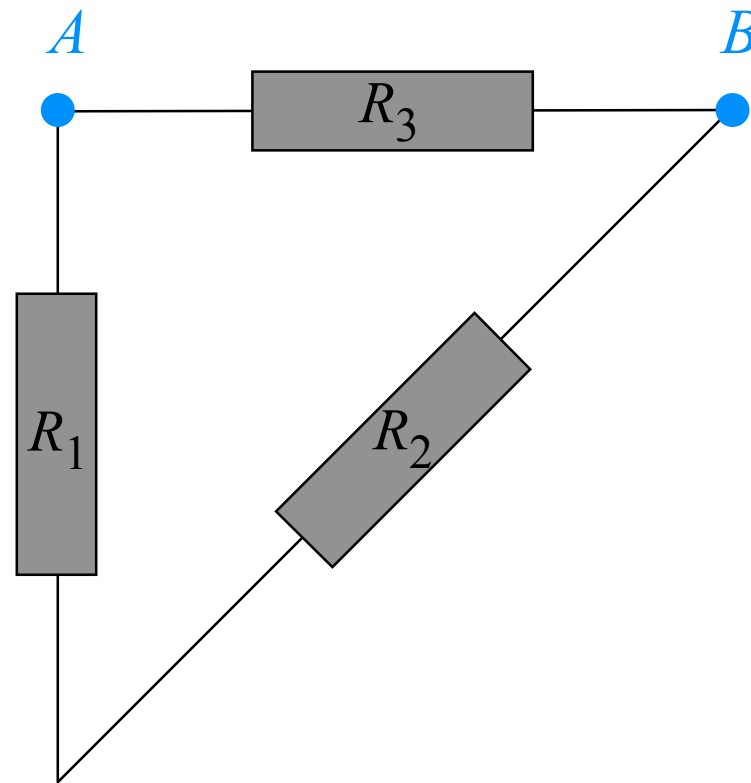
Conventions

Exercice 2

Sommaire

Aide

VERSION B



VERSION C

Calculer la résistance équivalente entre les points A et B .