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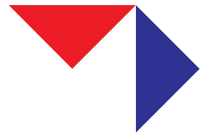
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Engineering students' problem solving using the digital tool Sim2Bil

Introduction

- Mathematics education for engineering students
- Technology brings in new ways of modelling and visualizing mathematics
- Technology-supported collaborative work





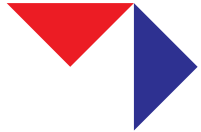
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Explorative study

- Digital visualization tool Sim2Bil
- Mathematical tasks
- Investigate students' problem solving



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Theoretical framework

- The analysis will follow a socio-cultural perspective



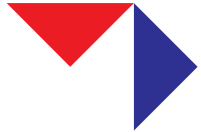
Lev Vygotsky



Luc Trouche



Anna Sfard



Sim2Bil

s = 400
t = 3.36

2:

Determine other mathematical expressions for v_1 and v_2 , so that the cars run with different velocities, and arrive at the finish line at the same time.

Task 1 Task 2 Task 3 Task 4

Motion Info

Car1 Line

Car2 Line

v-t v1-t v2-t

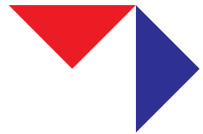
Formula1 Formula2 Grid

t³ t² t¹ t⁰

v1=

v2=

t = 3.36 ⏪ ⏩



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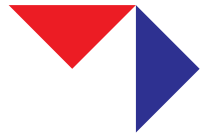
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Research Questions

- How can Sim2Bil engage engineering student while working with mathematics?
 - How do engineering students use visualizations to communicate about representations and applications using Sim2Bil?
 - To what extent can Sim2Bil be used for group work in learning environments, in which students work remotely from each other (synchronously and asynchronously)
 -

Methods

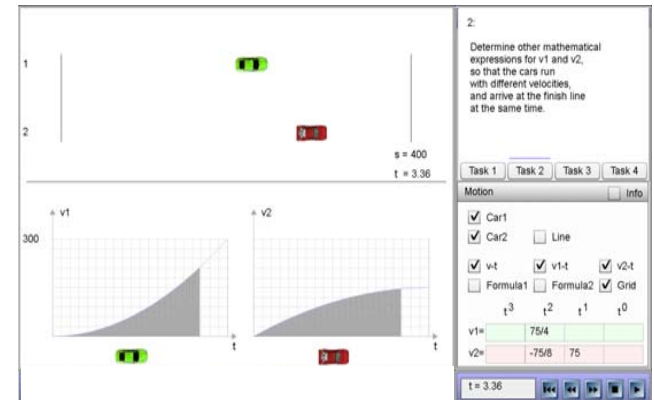
- Small-scaled controlled environment (outside normal lectures)
- **Participants:**
 - Groups of engineering students (1st year)
 - Unfamiliar to Sim2Bil

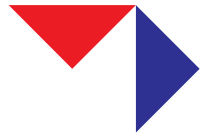


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Tasks

- a) Press “Start” in the program, and explain to each other what happens. What do the shaded areas represent?

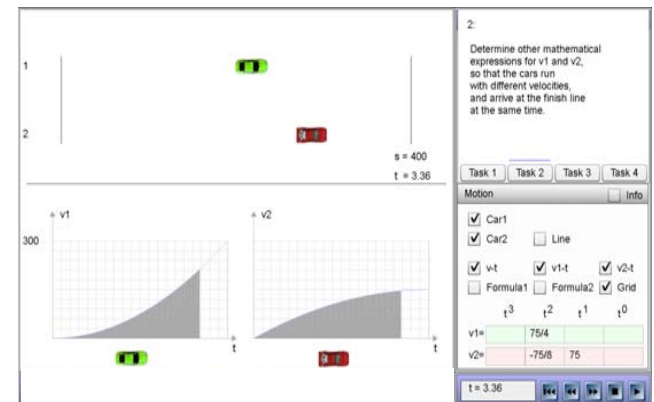


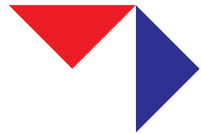


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Task

- Press "Start" in the program, and explain to each other what happens. What do the shaded areas represent?
- Determine other numbers in the table, so that the cars run with different velocities, and arrive at the finish line at the same time.

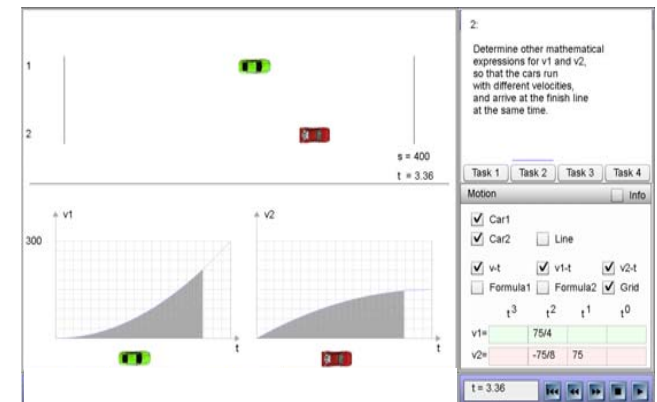


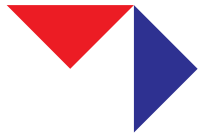


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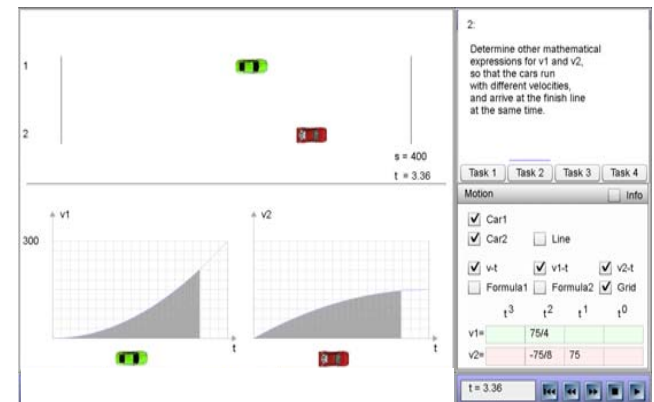
Task

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- Determine other numbers in the table, so that the cars run with different velocities, and arrive at the finish line at the same time.
- What can you do to make the green car be only half way when the red car reaches the finish line?

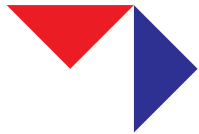




Task

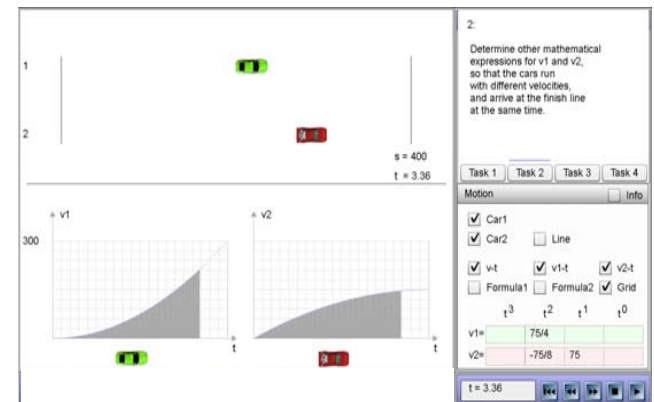


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- Determine other numbers in the table, so that the cars run with different velocities, and arrive at the finish line at the same time.
- What can you do to make the green car be only half way when the red car reaches the finish line?
- Find the velocities of the green and the red car (v_1 and v_2), so that v_2 is half of v_1 when they reach the finish line simultaneously at 4 sec. Can you prove that your answer is correct?

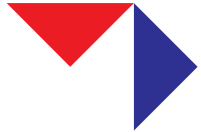


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Task



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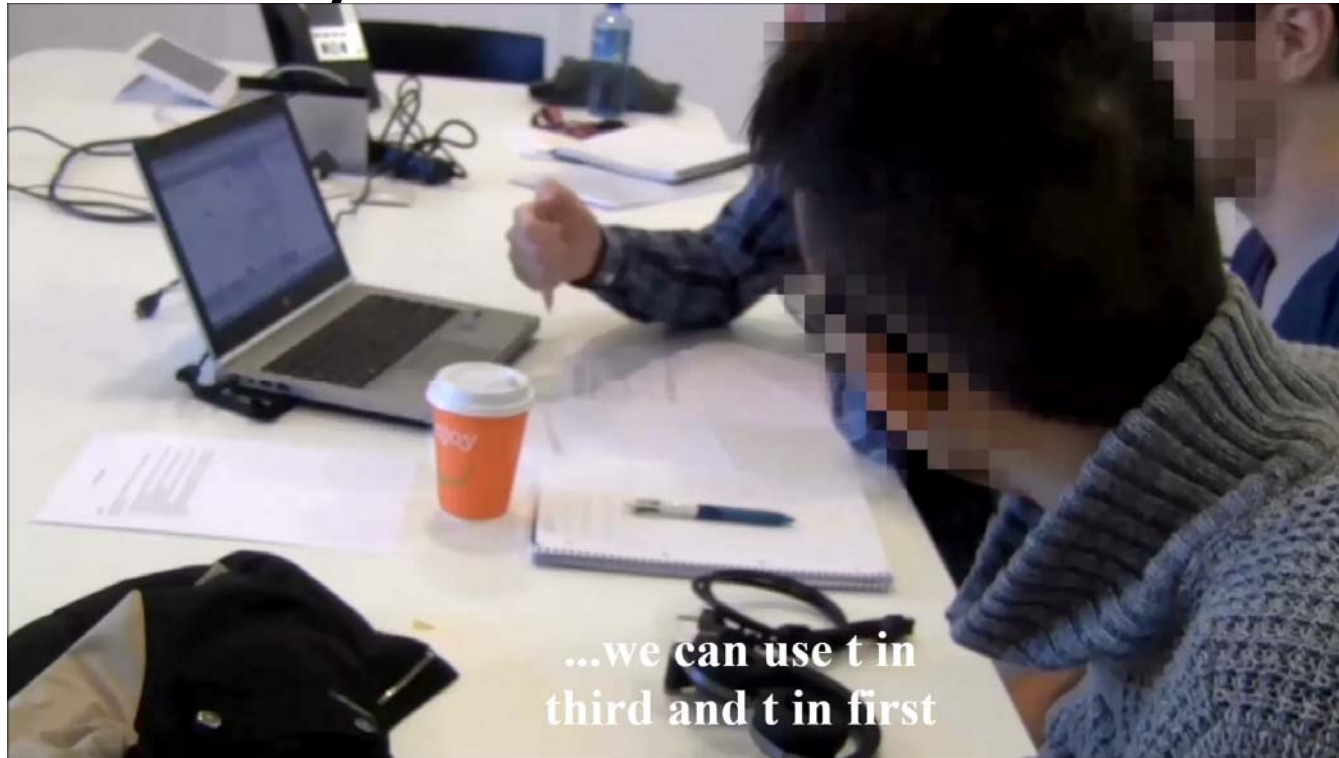


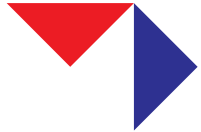
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Video analysis





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A few Findings

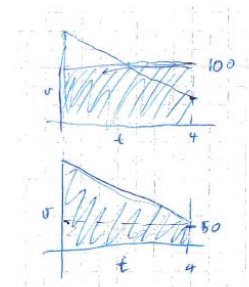
- 1. Gestured to understand the task

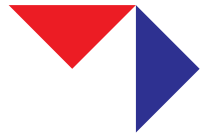


- Mediated how the cars would run

- 2. Visualized areas on paper

- Mediated thoughts to peers





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A few Findings

- Found 5 velocity functions:

– 1b)

$$v_1 = 6,25t^3$$

$$v_2 = 18,75t^2$$

– 1c)

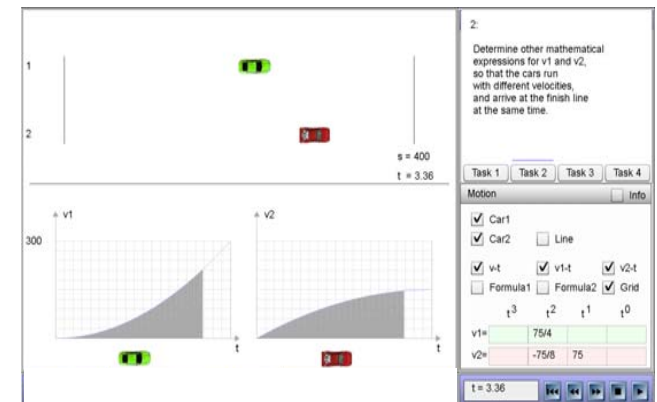
$$v_1 = 3,125t^3$$

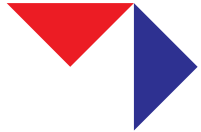
$$v_2 = 18,75t^2$$

– 1d)

$$v_1 = 100$$

$$v_2 = -25t + 150$$





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Final remarks

- ***Visualizations*** are a great support to many learners
- *Visualizations require certain media*
- ***Simulations*** require “experimental space”
- ***Modelling*** may give more meaning to the learning and teaching
- How should we introduce modelling practices to students?
- ***Technology*** brings new ways of teaching and learning mathematics



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Thank you!