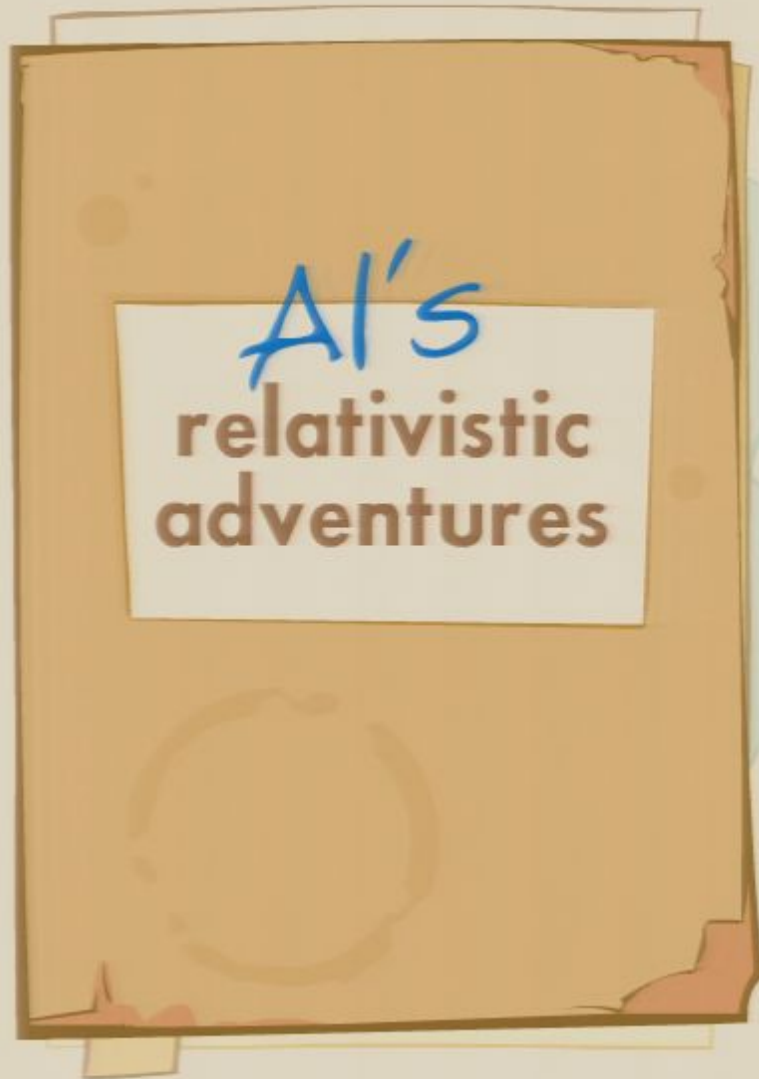


Title: Al's Relativistic Adventures

Date: May 26, 2006 11:10 AM

URL: <http://pirsa.org/06050016>

Abstract: <kw> animation, special relativity, interactive, visual, Al, perspective, motion, on-line, personalized learning, empowering your imagination, thought experiments </kw>



By:
Kiran Sachdev
Jackie English
and Bogdan Luca

Who are we?

Team Canada!

We are the winners of the International
Pirelli Relativity Challenge for best
multimedia explanation of special
relativity to the lay-person.

Go Canada Go!

Who is on the team?

Kiran Sachdev

joint honours in the Math
& Physics program at
McGill University

Jackie English

honours Mechanical Engineering at McGill
University and host/producer of educational
children's programming TVO Kids

Bogdan Luca

Animation and Illustration at Sheridan
College and Visual Art at OCAD

Why are we here?

Our award-winning
interactive animation is
a successful way to
educate the average
person in modern
physics...

CAN YOU SEE IT IN YOUR CLASSROOM?

A New Medium for Learning Modern Physics

- Giving you a personal experience
- Empowering your imagination
- Engaging and entertaining you

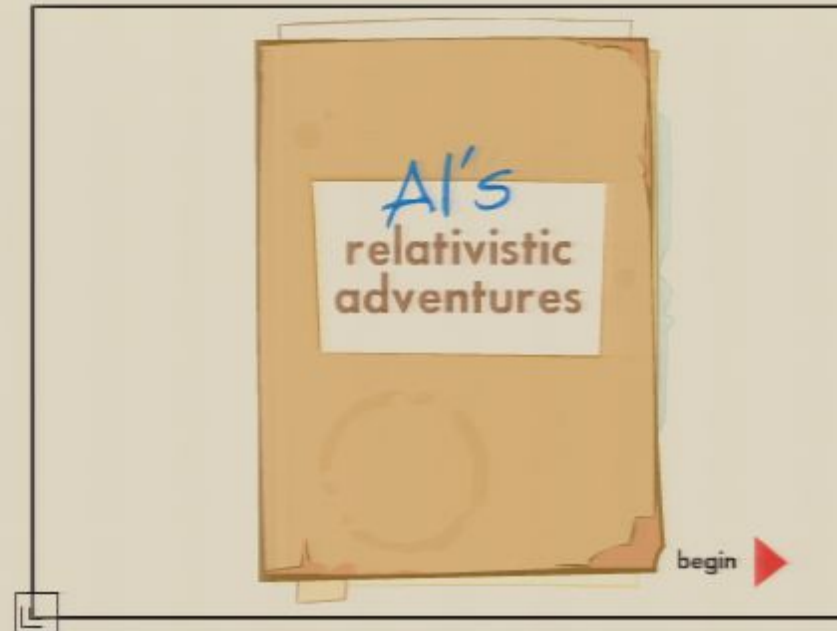
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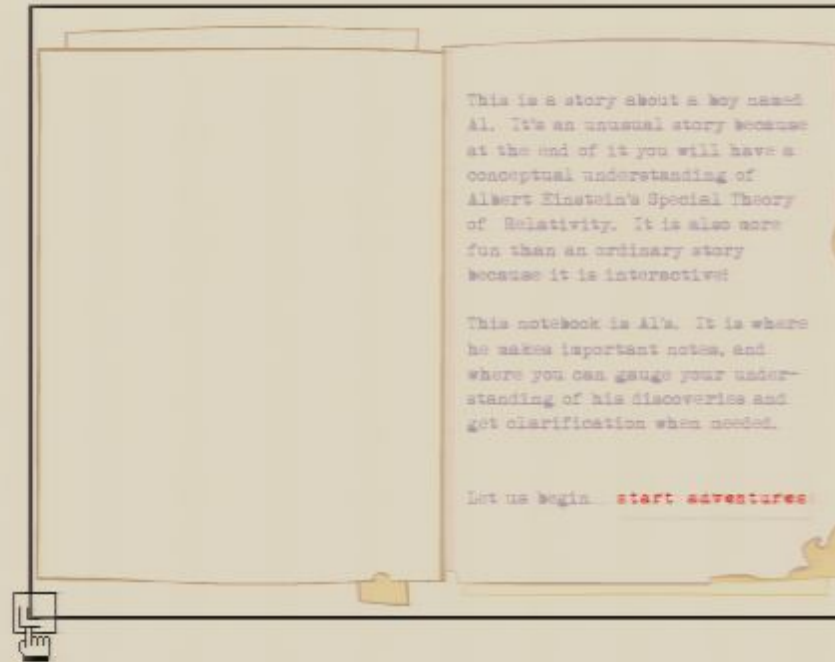
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CAN YOU SEE IT IN YOUR CLASSROOM?

Why are we here?

Our award-winning interactive animation is a successful way to educate the average person in modern physics...



CAN YOU SEE IT IN YOUR CLASSROOM?

This is a story about a boy named Al. It's an unusual story because at the end of it you will have a conceptual understanding of Albert Einstein's Special Theory of Relativity. It is also more fun than an ordinary story because it is interactive!

This notebook is Al's. It is where he makes important notes, and where you can gauge your understanding of his discoveries and get clarification when needed.

Let us begin... **start adventures**













click



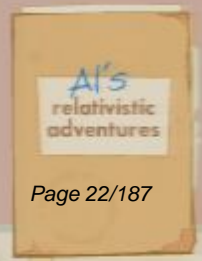










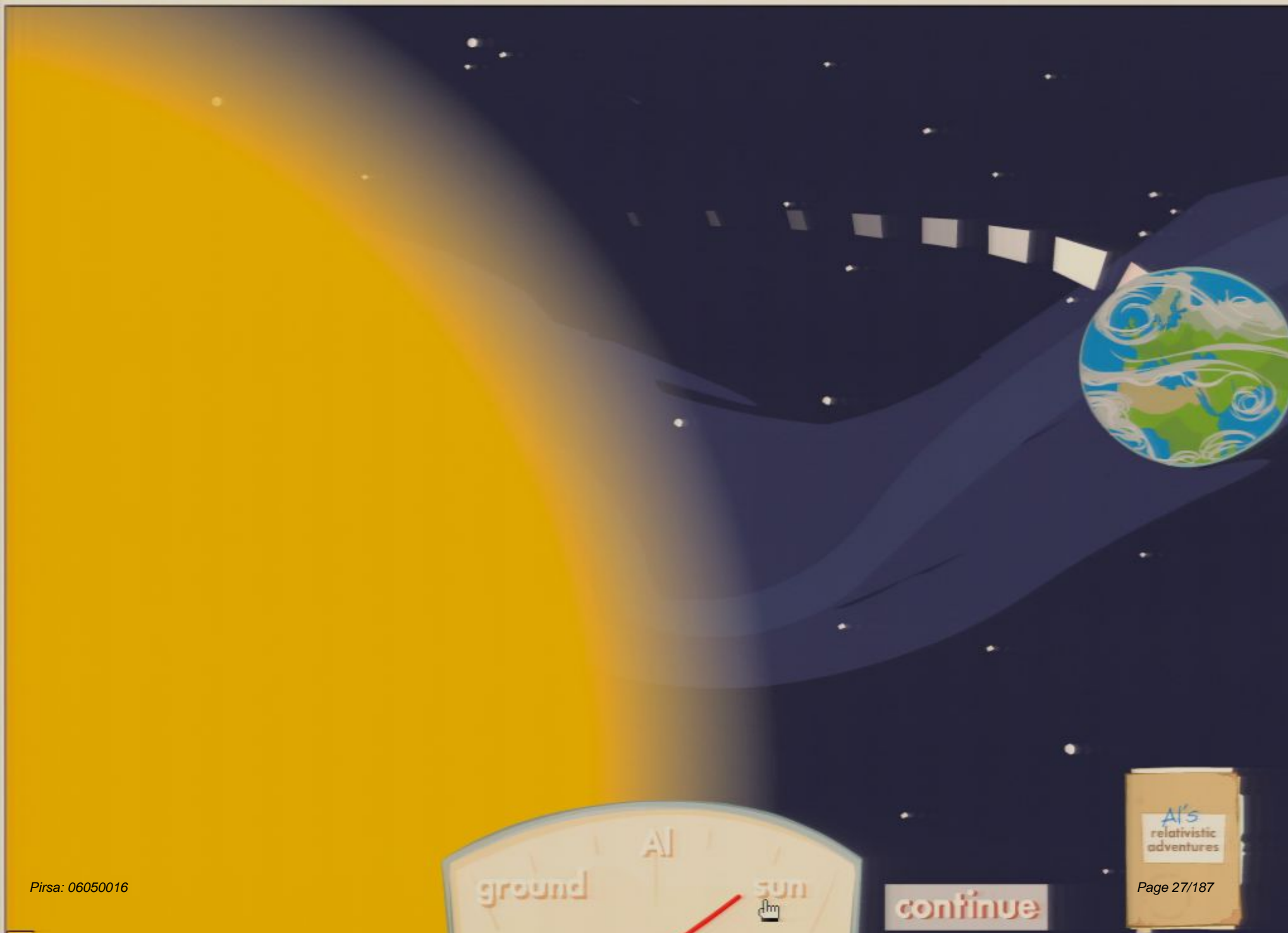




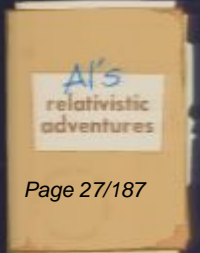








continue





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Al has made an important discovery and he wants to take note of it.
What is it?

A. Everyone everywhere in the universe agrees on my speed.

B. My speed depends on your perspective, motion is relative.

ⓑ My speed depends on your perspective, motion is relative.

Right!

1. My speed depends on your perspective, motion is relative.




1. My speed depends on your perspective, motion is relative.

From my perspective the ground is zooming by and I'm standing still.

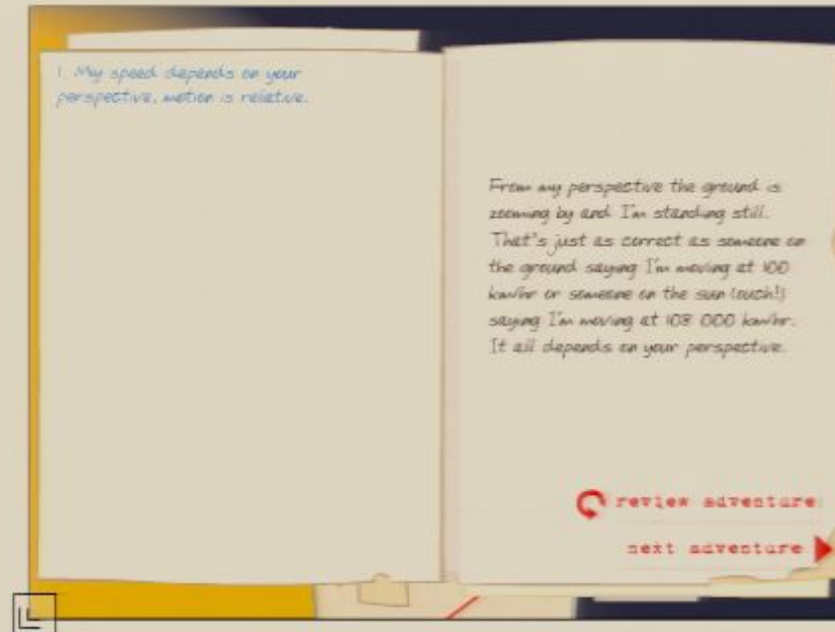
That's just as correct as someone on the ground saying I'm moving at 100 km/hr or someone on the sun (ouch!) saying I'm moving at 108 000 km/hr. It all depends on your perspective.

 review adventure

next adventure 

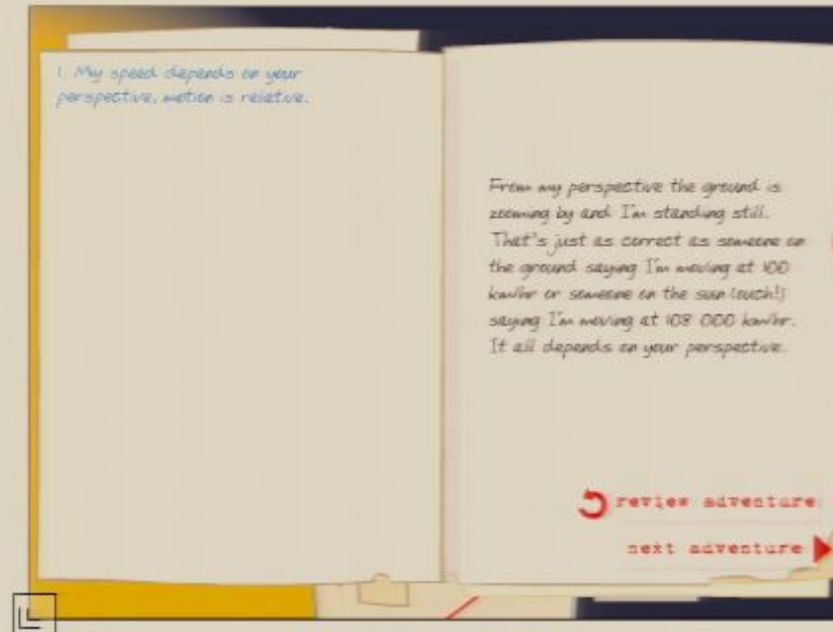
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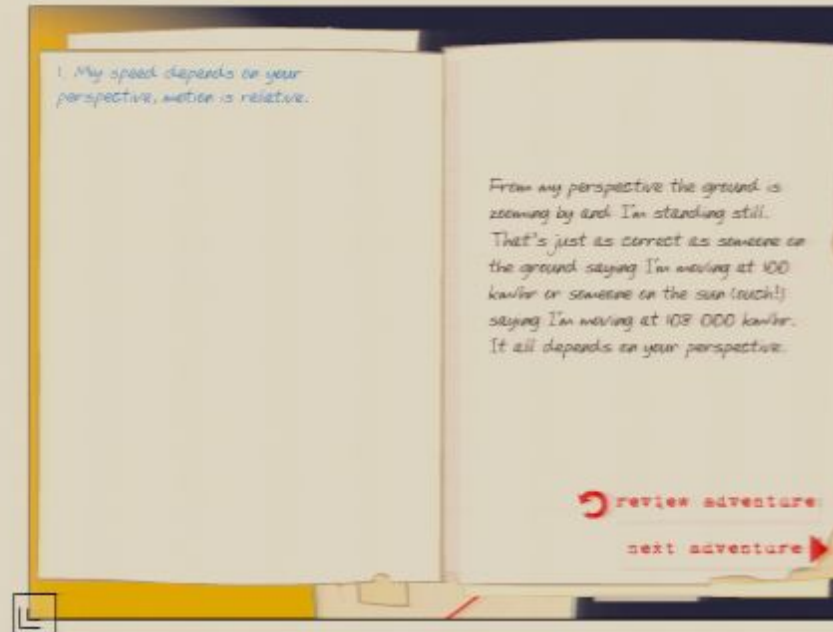
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- Giving you a personal experience
- Empowering your imagination
- Engaging and entertaining you

Personalised Learning




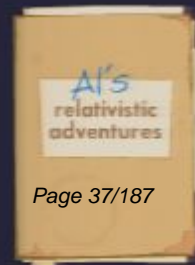
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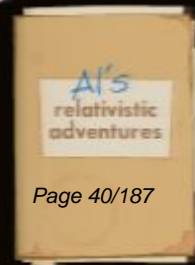
next adventure 

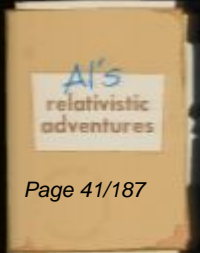


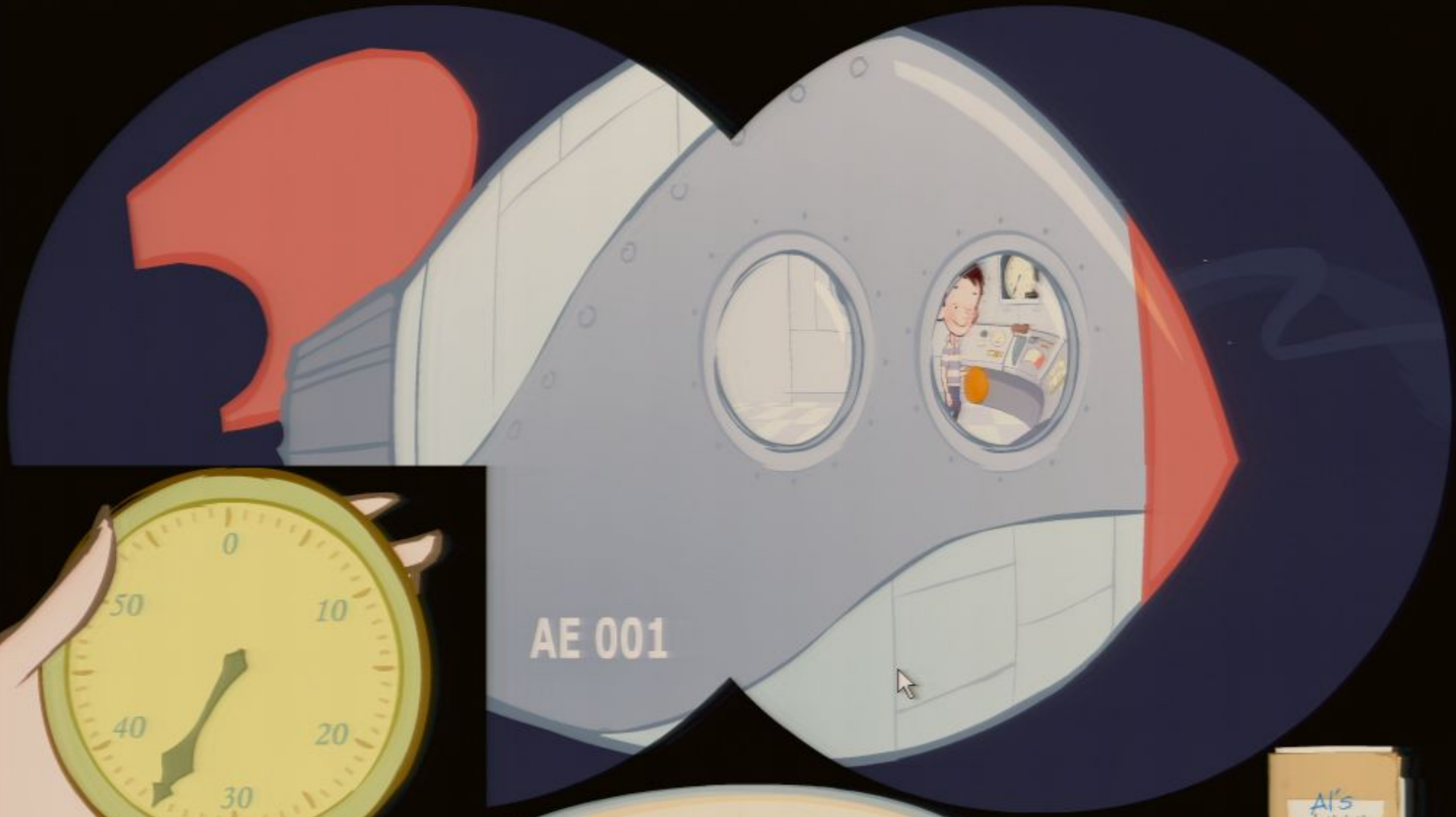
INTERSTELLAR GIFT SHOP

AI's
relativistic
adventures









mom's clock

~~mom's perspective~~

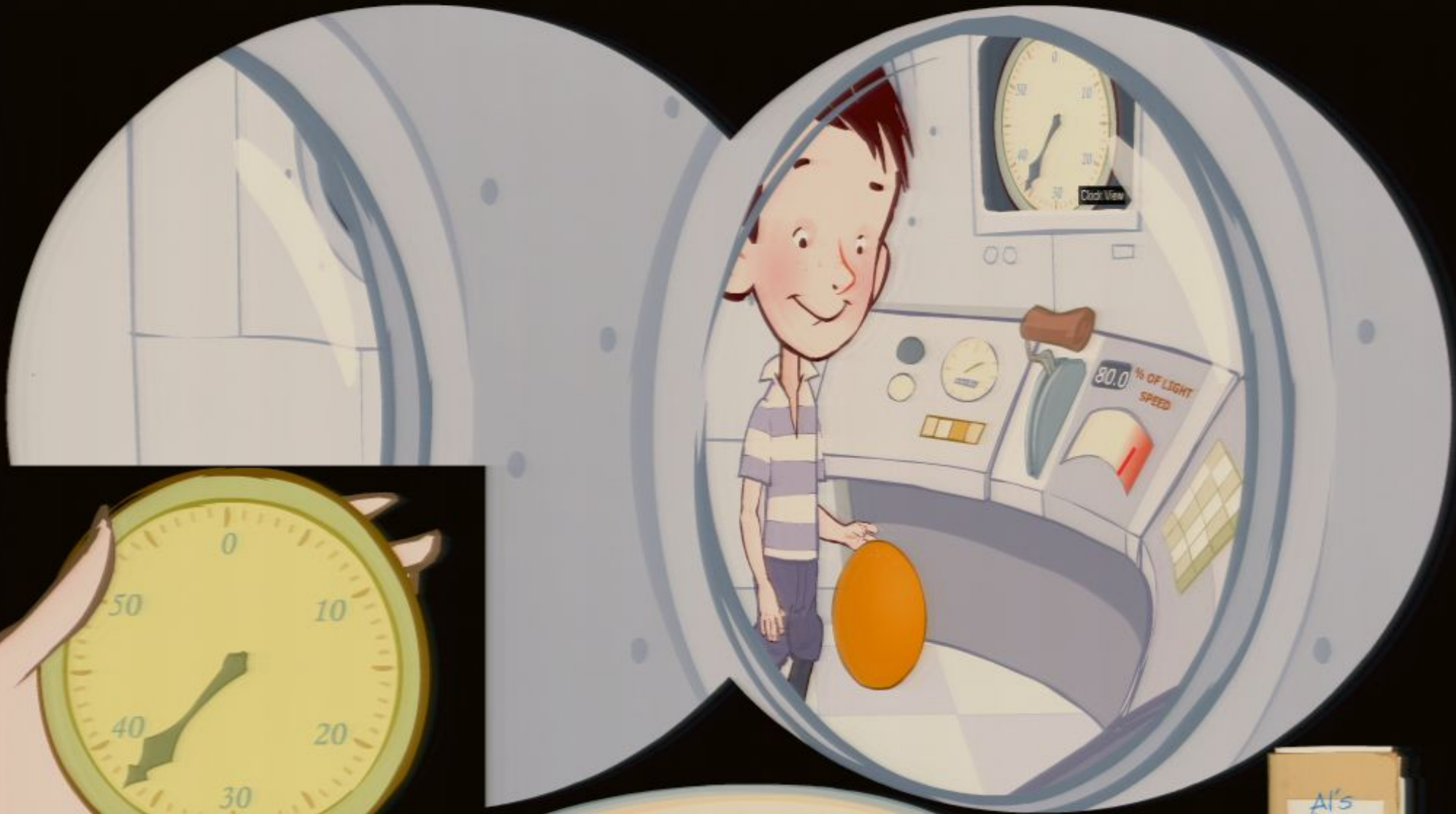
al's perspective

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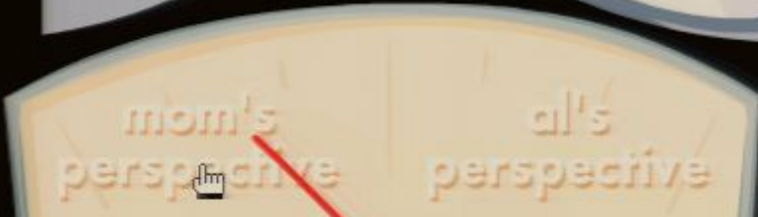


Al's
relativistic
adventures

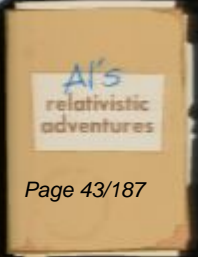
Page 42/187



mom's clock



continue

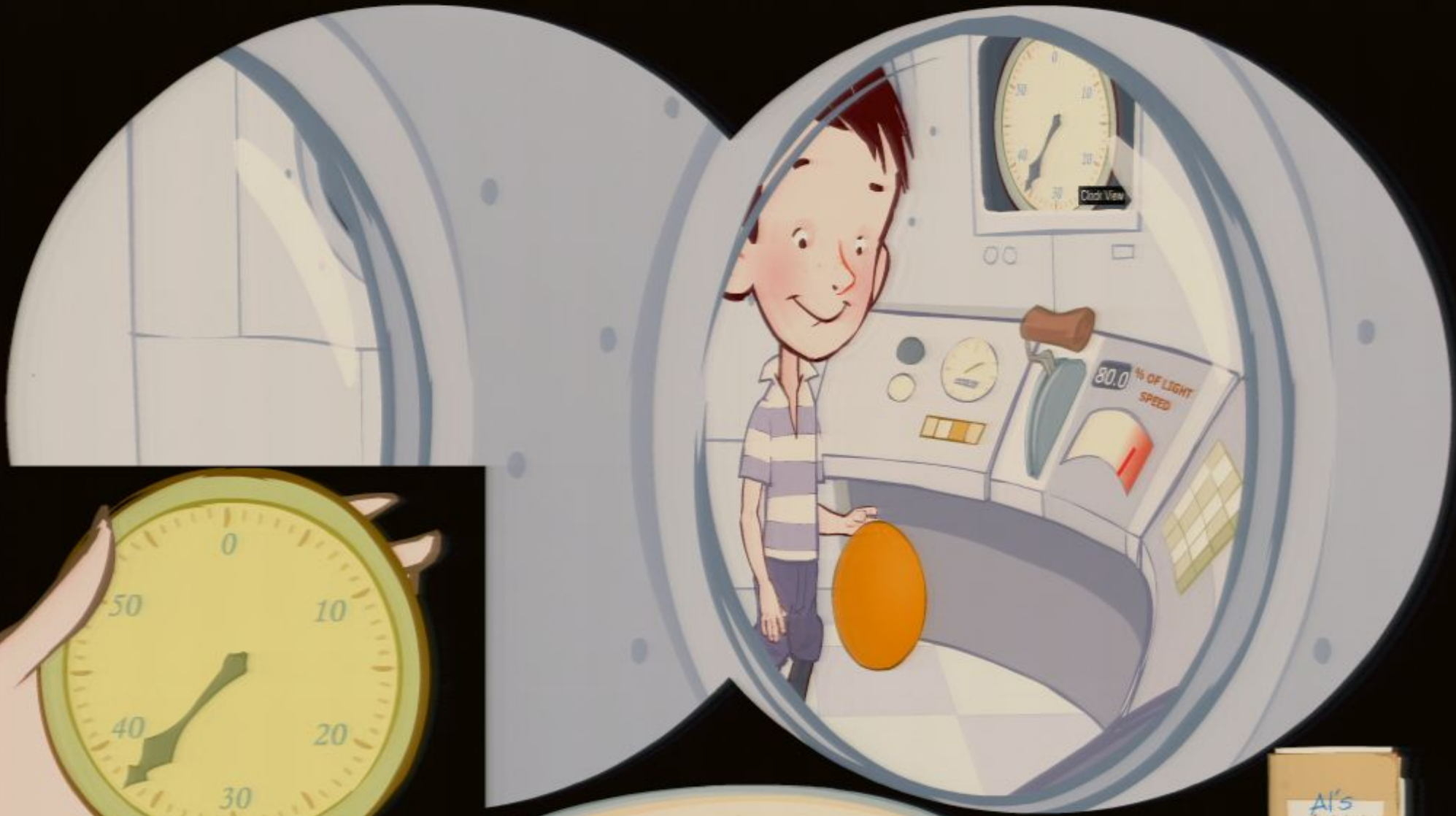




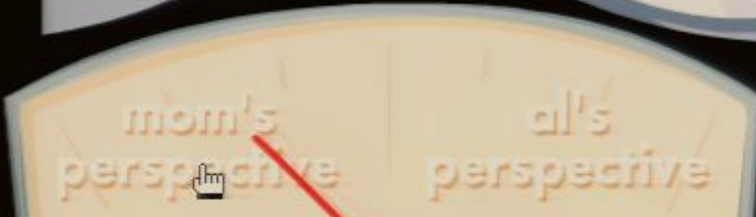
mom's perspective ~~al's perspective~~

continue



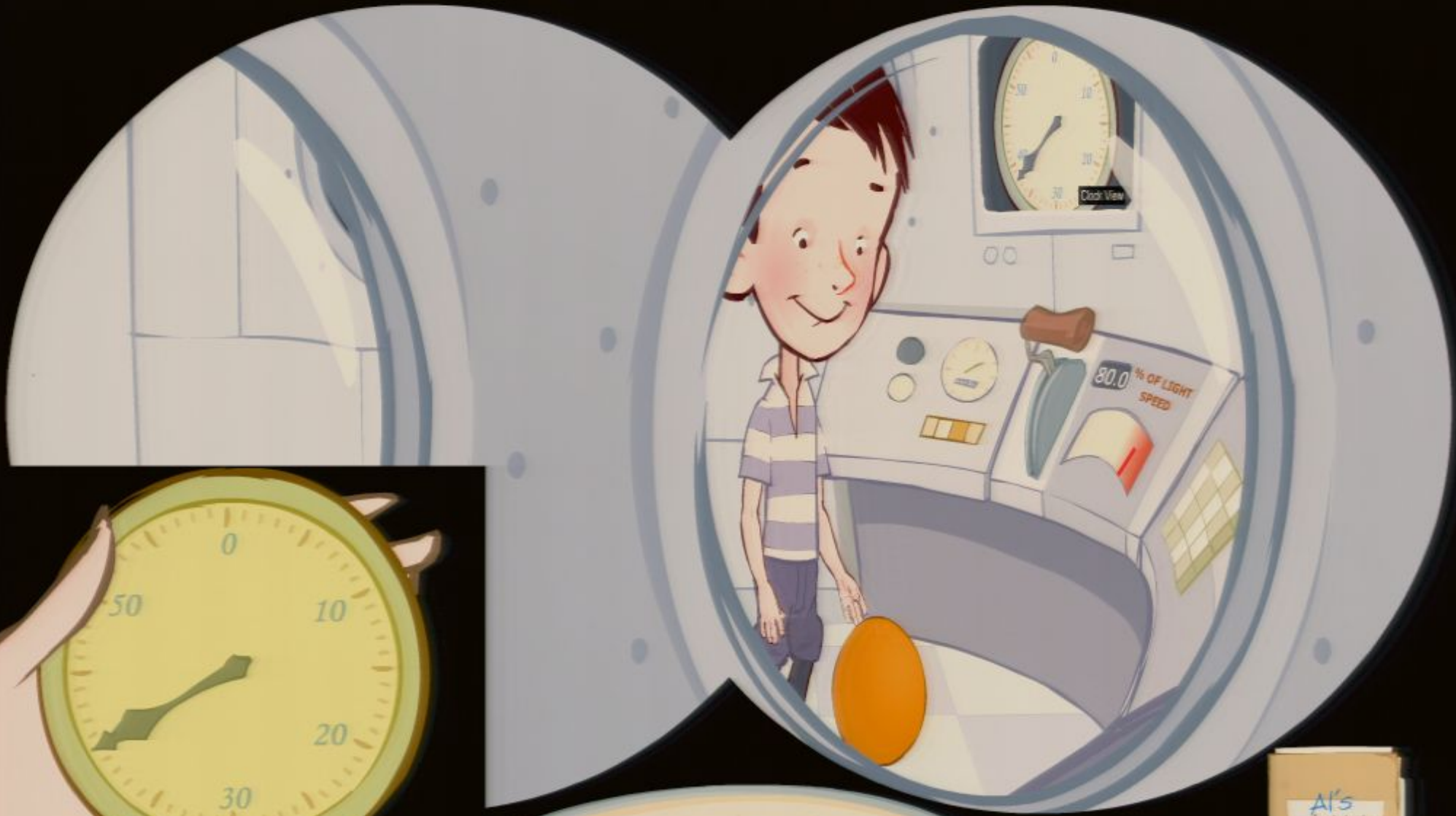


mom's clock

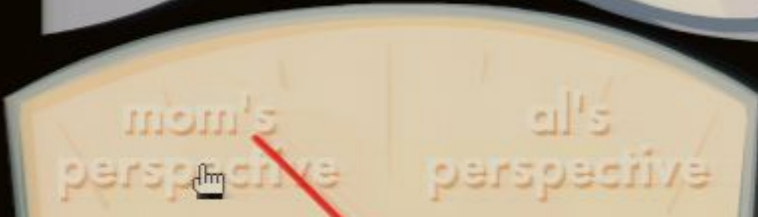


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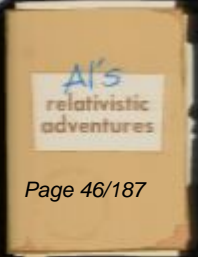


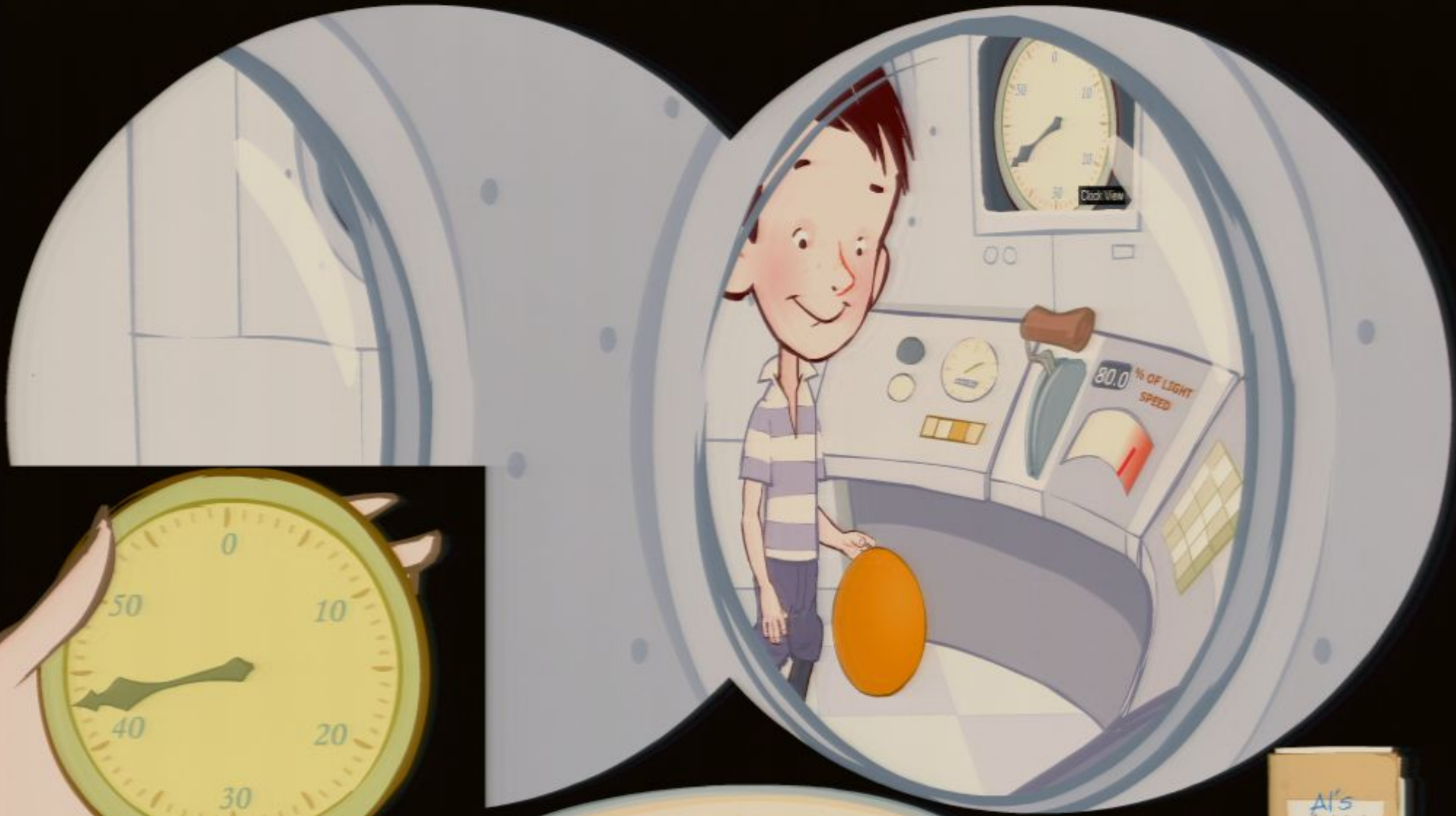


mom's clock

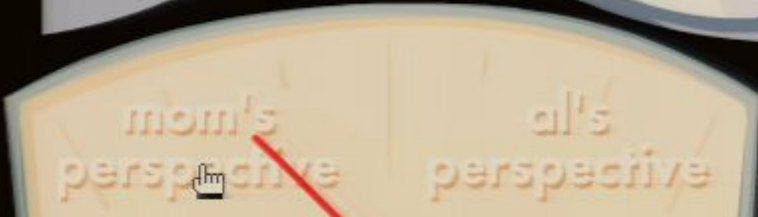


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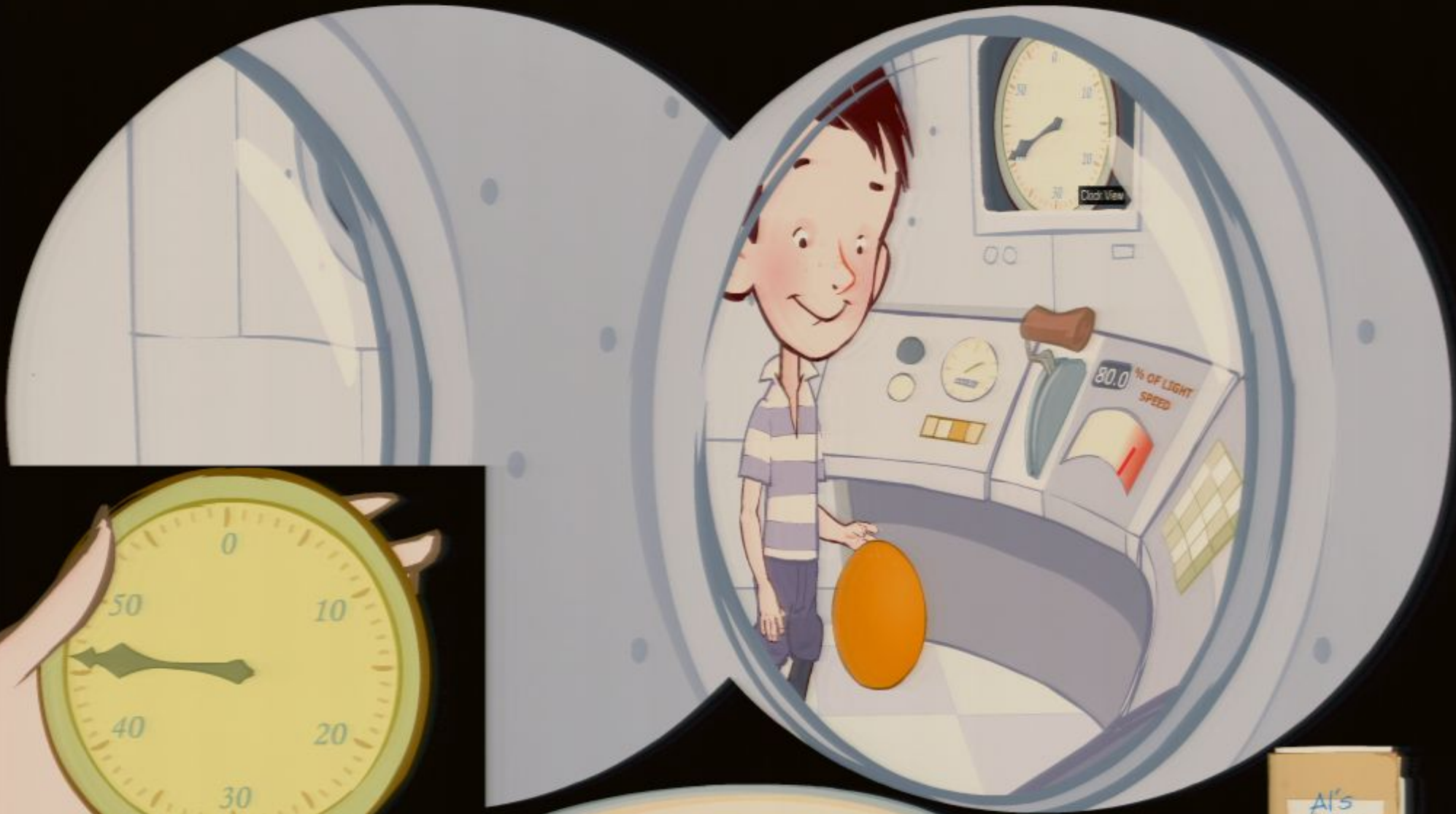


mom's clock

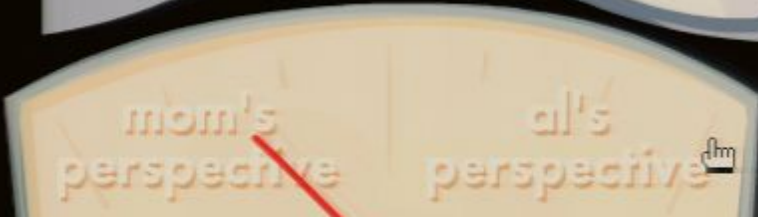


continue





mom's clock



continue



1. My speed depends on your perspective, motion is relative.
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3. I wouldn't notice if time got slower.
4. I wouldn't notice if space got squished.
5. I always see light move through space at "c" (approximately 300 000 km/s)

What has Al discovered?

- A. If I move fast away from my mom, she sees my time slow down.
- B. If I move fast away from my mom, I feel like I'm in slow motion.

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A. If I move fast away from my mom, she sees my time slow down.

Right!

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6. If I move fast away from my mom, she sees my time slow down.

From my mom's perspective my time slows down when I'm moving fast away from her. I, as always, feel like everything in my spaceship is normal.

(you can click the notes on the left hand page to review them at any time)

 review adventure


next adventure 

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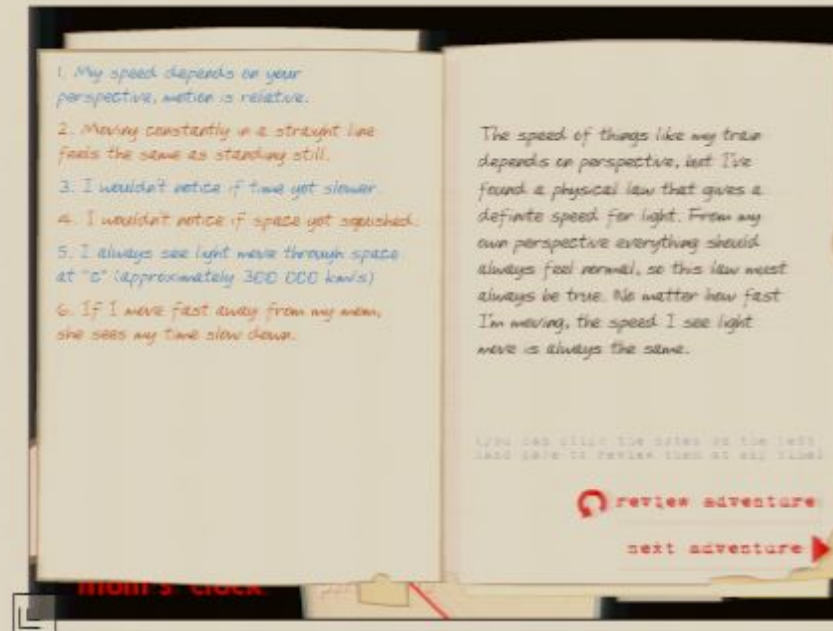
The speed of things like my train depends on perspective, but I've found a physical law that gives a definite speed for light. From my own perspective everything should always feel normal, so this law must always be true. No matter how fast I'm moving, the speed I see light move is always the same.

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 review adventure

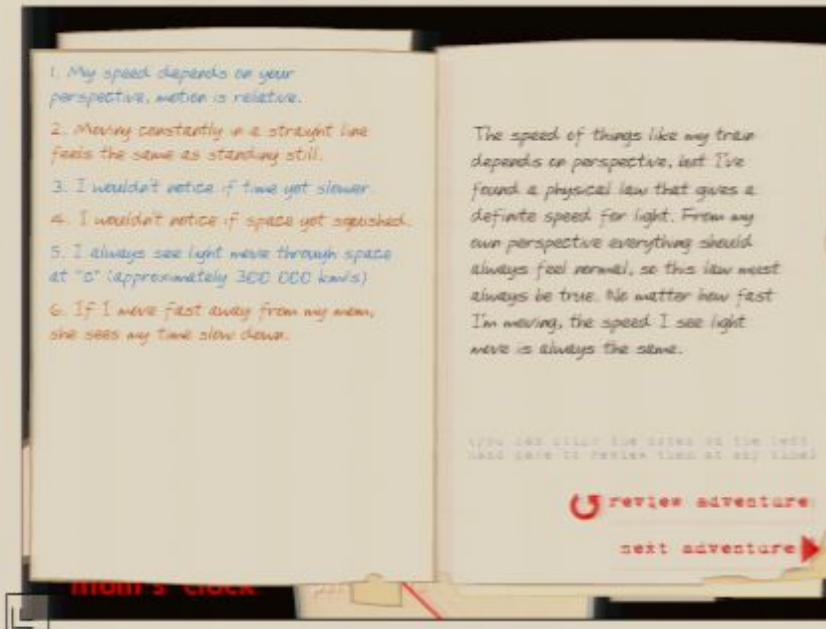
next adventure 

Personalised Learning



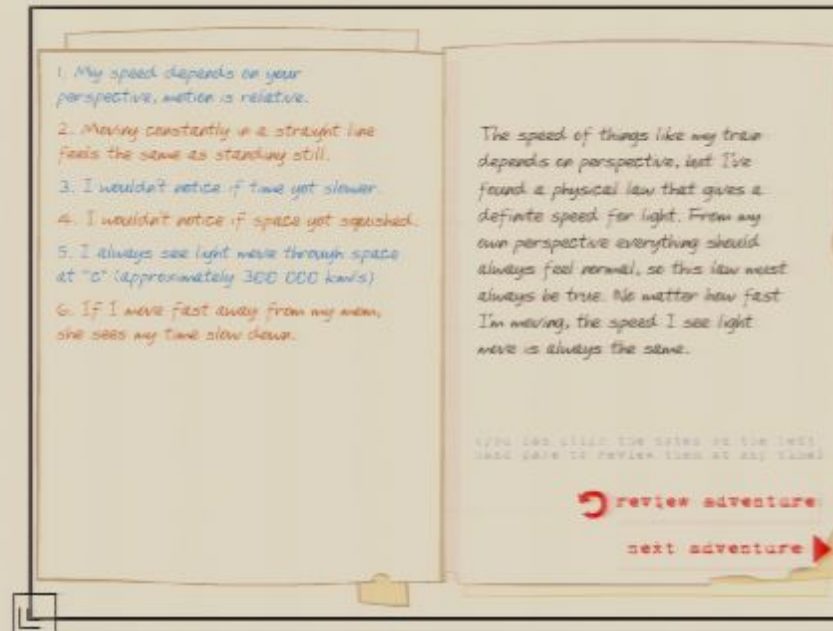
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Empowering Your Imagination



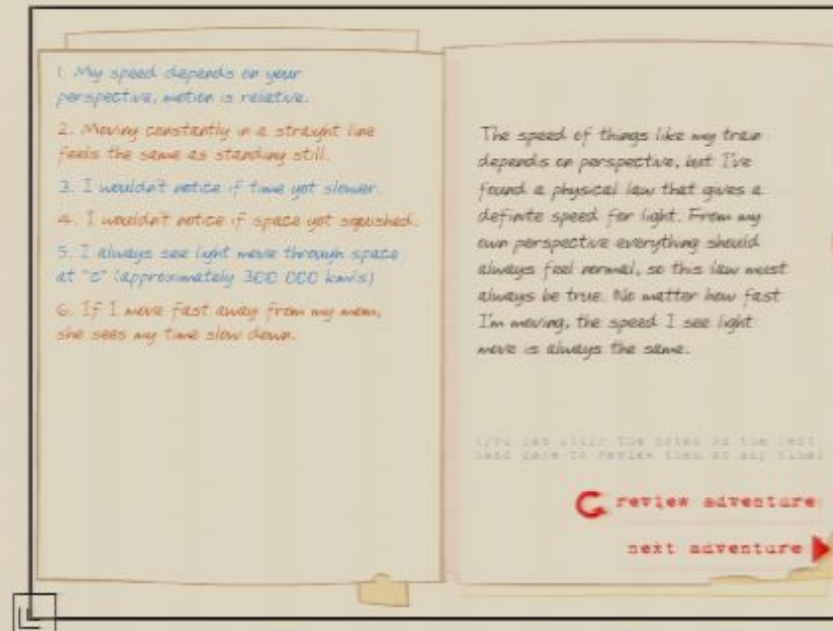
- Animation lets you SEE things that are difficult to describe, draw or demonstrate
- Animation uses both time and space
- Removing the math requirement for conceptual understanding lowers the minimum age for learning modern physics
 - Eg. PI's children's exhibit at Einsteinfest

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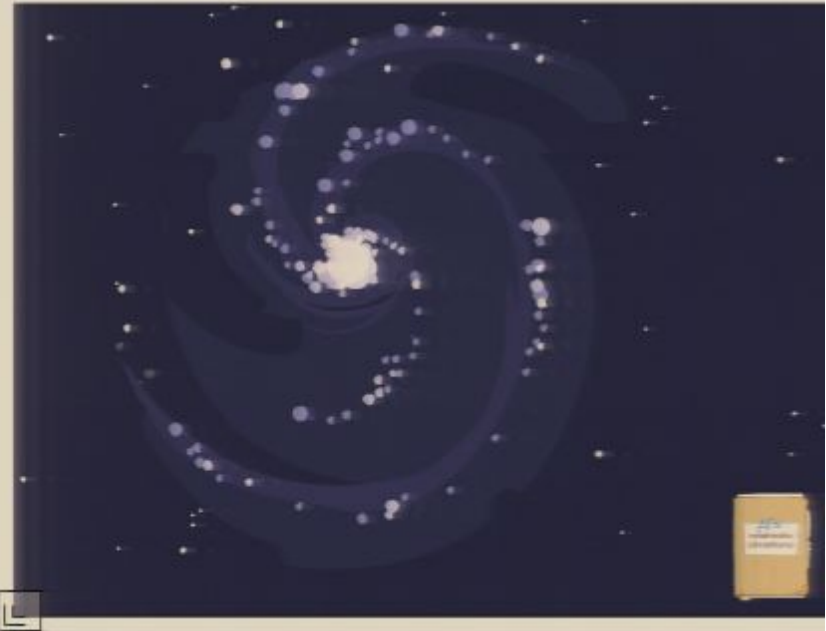
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Engaging and Entertaining

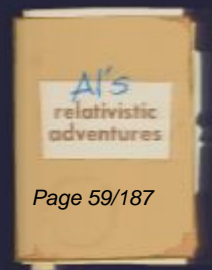
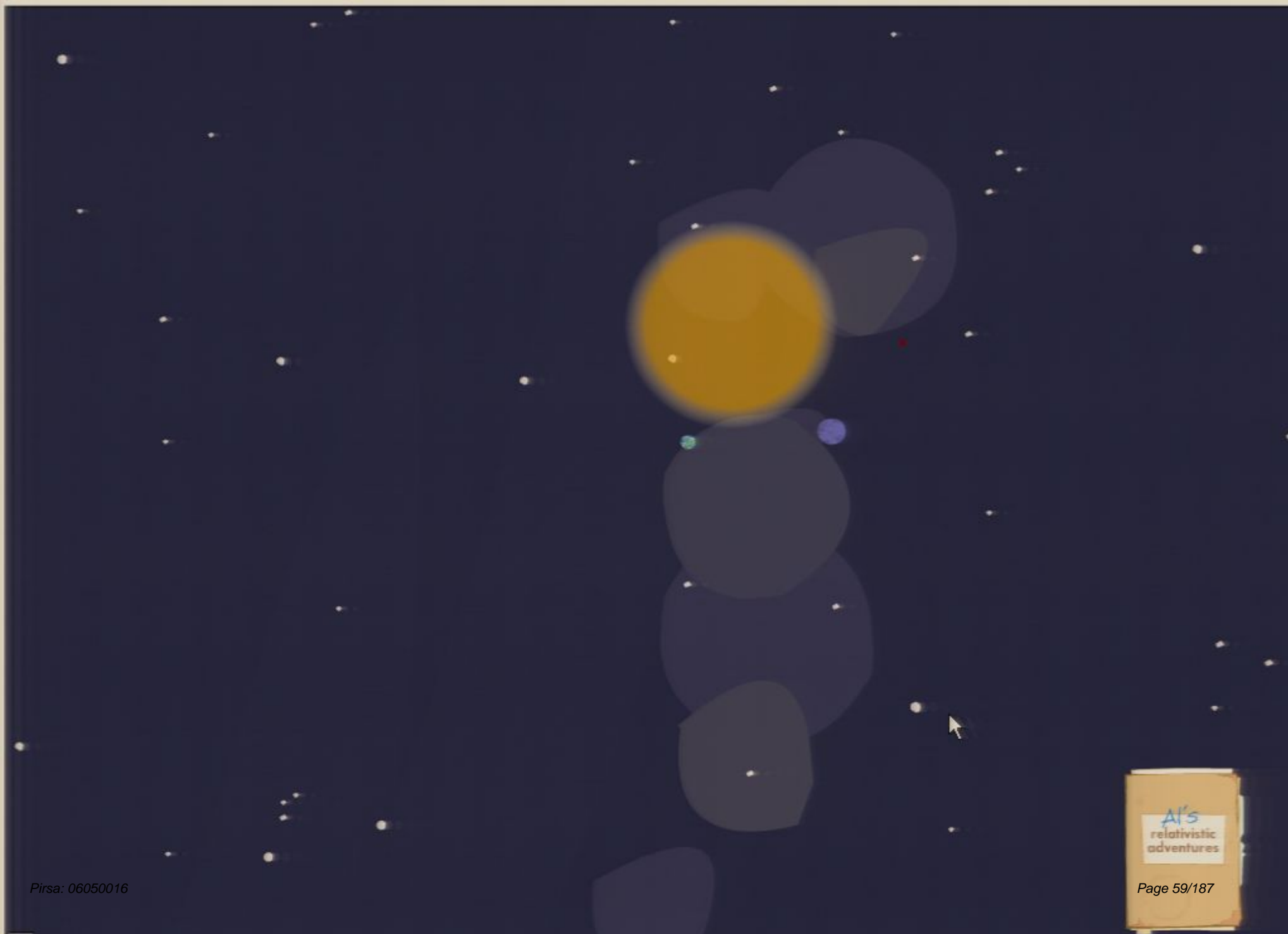


- The audience can relate to a single main character, Little Al, on his journey
- A narrative story lets you identify with the protagonist
- The story takes you through Einstein's thought experiment for special relativity
- This approach is applicable to any concept

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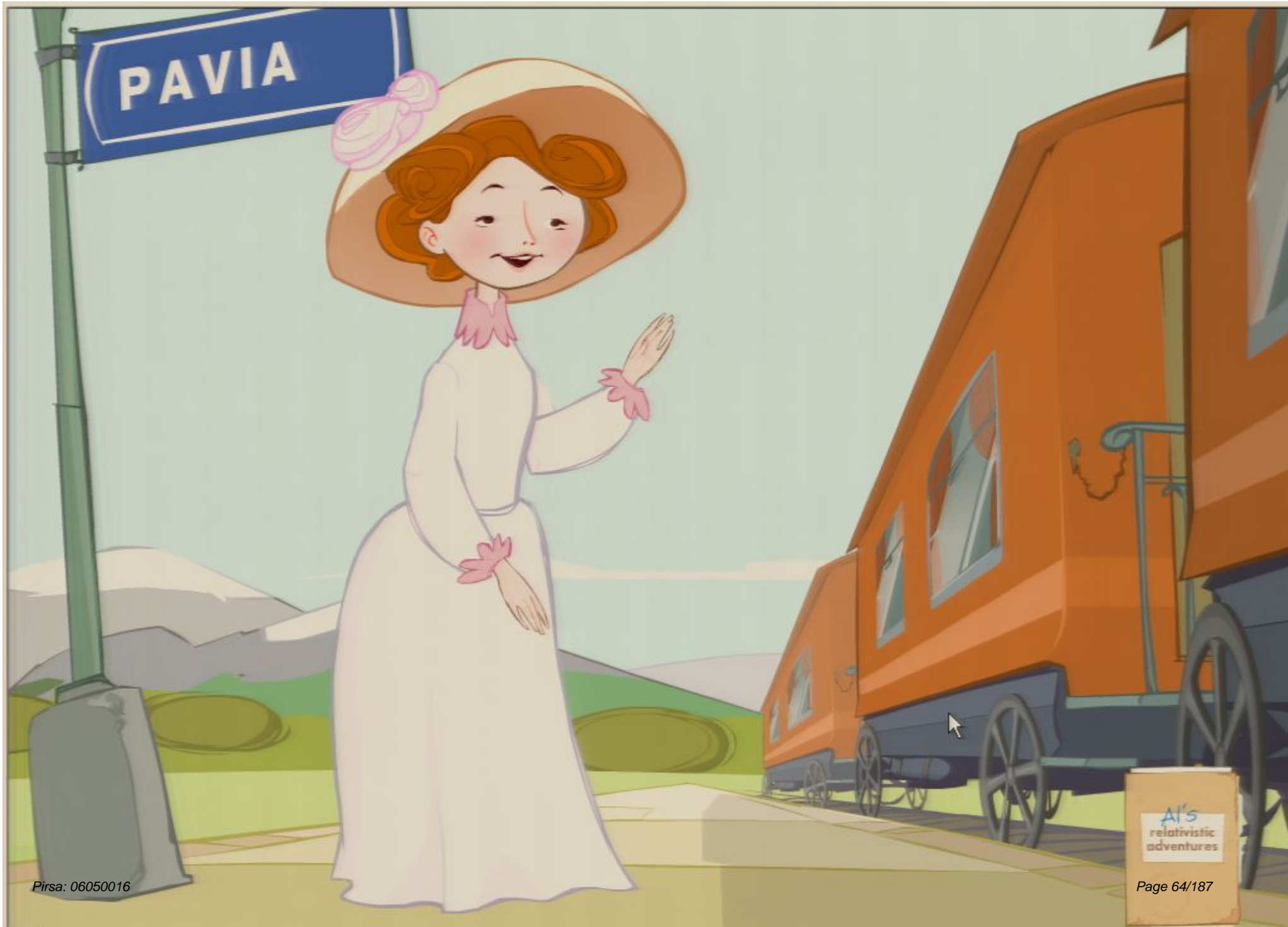












PAVIA

PAVIA



PAVIA













$$\nabla \cdot \vec{E} = 0$$

$$\nabla \cdot \vec{B} = 0$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$\nabla \times \vec{B} = \frac{1}{c^2} \frac{\partial \vec{E}}{\partial t}$$

where $c = 299792.458 \text{ km/s}$



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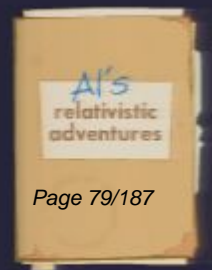
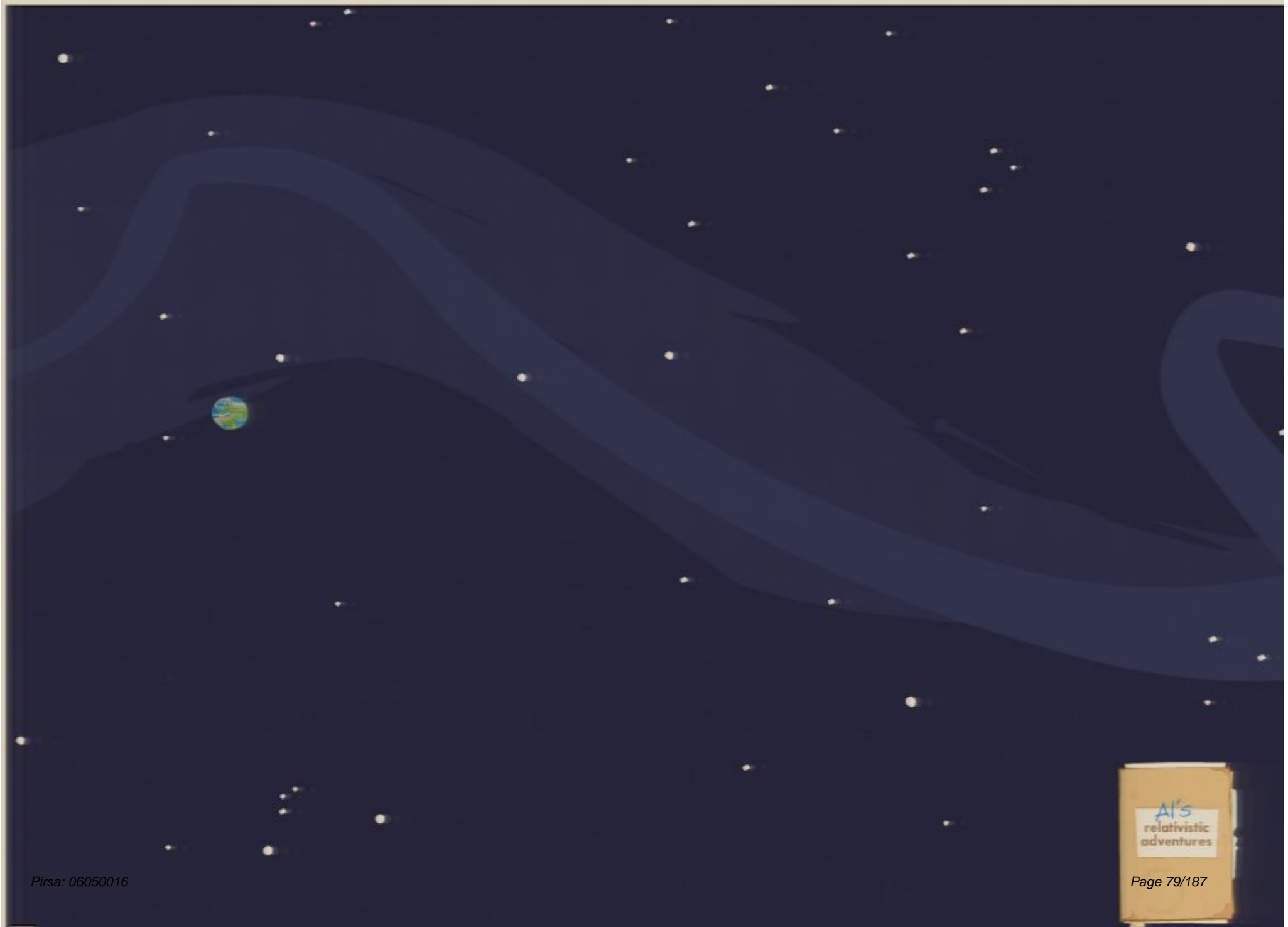
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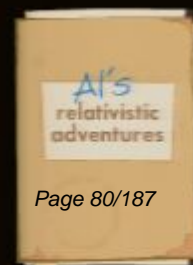
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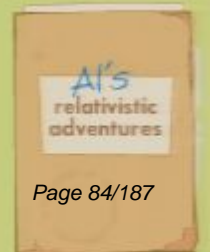


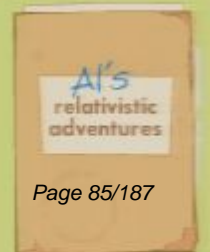










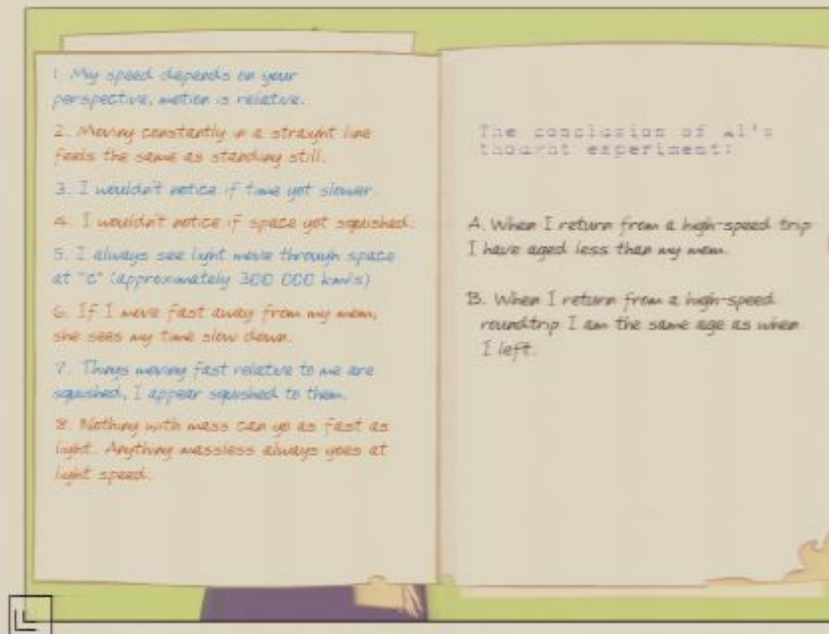


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6. If I move fast away from my mom, she sees my time slow down.
7. Things moving fast relative to me are squished, I appear squished to them.
8. Nothing with mass can go as fast as light. Anything massless always goes at light speed.

The conclusion of Al's thought experiment:

- A. When I return from a high-speed trip I have aged less than my mom.
- B. When I return from a high-speed roundtrip I am the same age as when I left.

Engaging and Entertaining



- The audience can relate to a single main character, Little Al, on his journey
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What do you think...

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CAN YOU SEE IT IN YOUR CLASSROOM?

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9. When I return from a high-speed trip I have aged less than my mom.

From my mom's perspective I travelled 20 light-years at 99.5% the speed of light, so it took me over 20 years to come back.

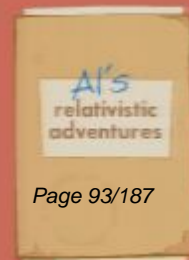
From my perspective I travelled at 99.5% the speed of light, but the total distance was only 2 light-years so my trip lasted just over 2 years.

So it didn't simply appear like my clock was slow, and it didn't just look like space was squished, space and time actually changed!

(you can click the notes on the left hand page to review them at any time)

 review adventure

next adventure 











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Diploma Bonus Features Credits

The End

Diploma Bonus Features Credits

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[Diploma](#) [Bonus Features](#) [Credits](#)

this

Diploma of Special Relativity

certifies that _____ has completed
Al's relativistic adventure and can now be
considered an expert in the subject



Al Einstein

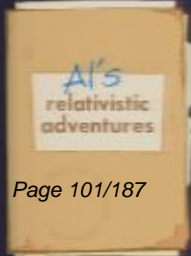
print

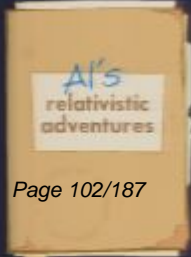
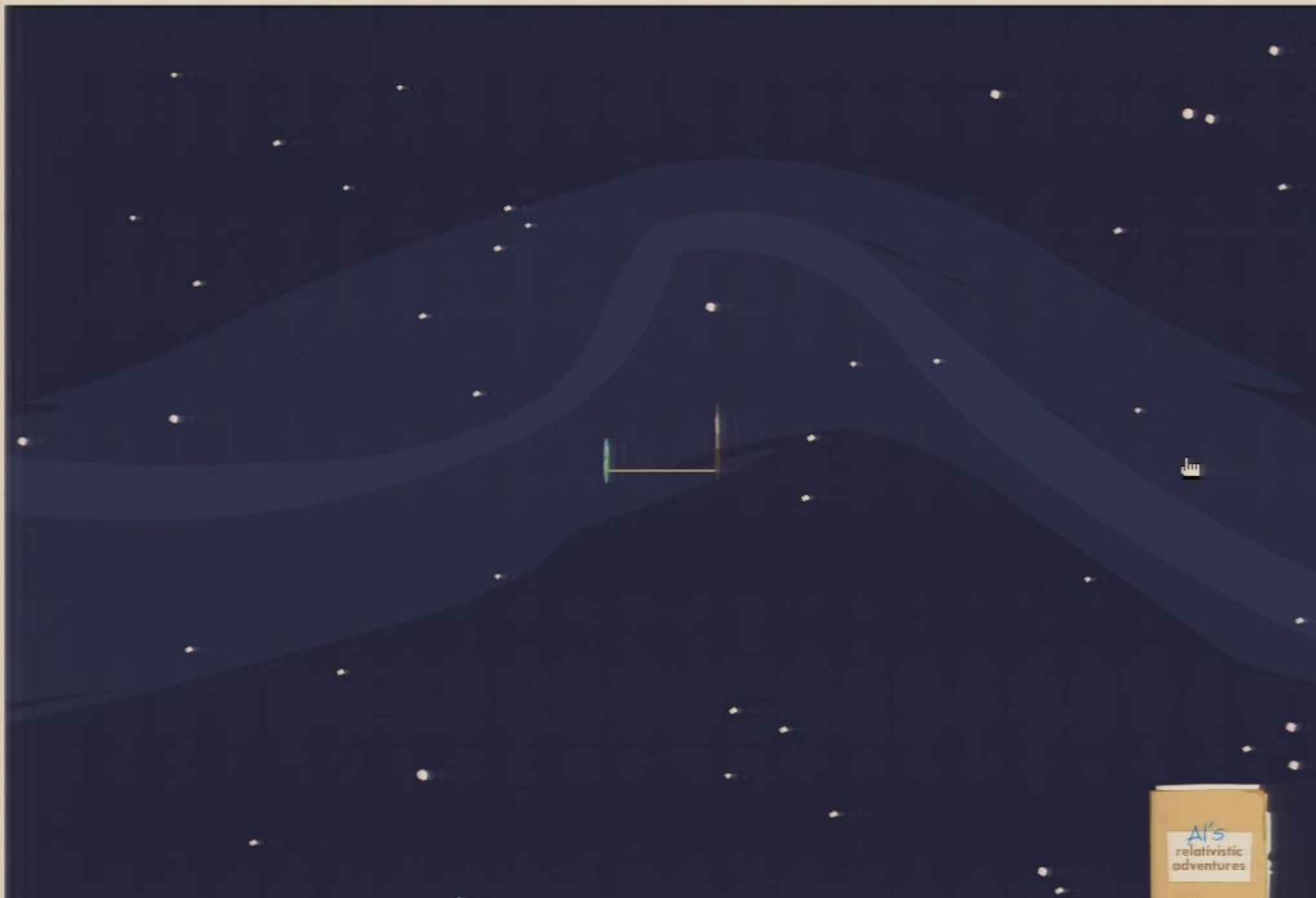
1. My speed depends on your perspective, motion is relative.
2. Moving constantly in a straight line feels the same as standing still.
3. I wouldn't notice if time got slower.
4. I wouldn't notice if space got squished.
5. I always see light move through space at "c" (approximately 300 000 km/s)
6. If I move fast away from my mom, she sees my time slow down.
7. Things moving fast relative to me are squished, I appear squished to them.
8. Nothing with mass can go as fast as light. Anything massless always goes at light speed.
9. When I return from a high-speed trip I have aged less than my mom.

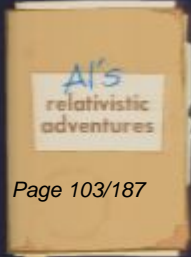
Diploma Bonus Features Credits

Bonus Features:

1. Paradoxes and the Doppler Effect
2. What does a photon look like?
3. What about gravity?
4. $E=mc^2$



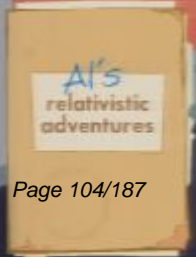






TAPE MEASURE

AE 001

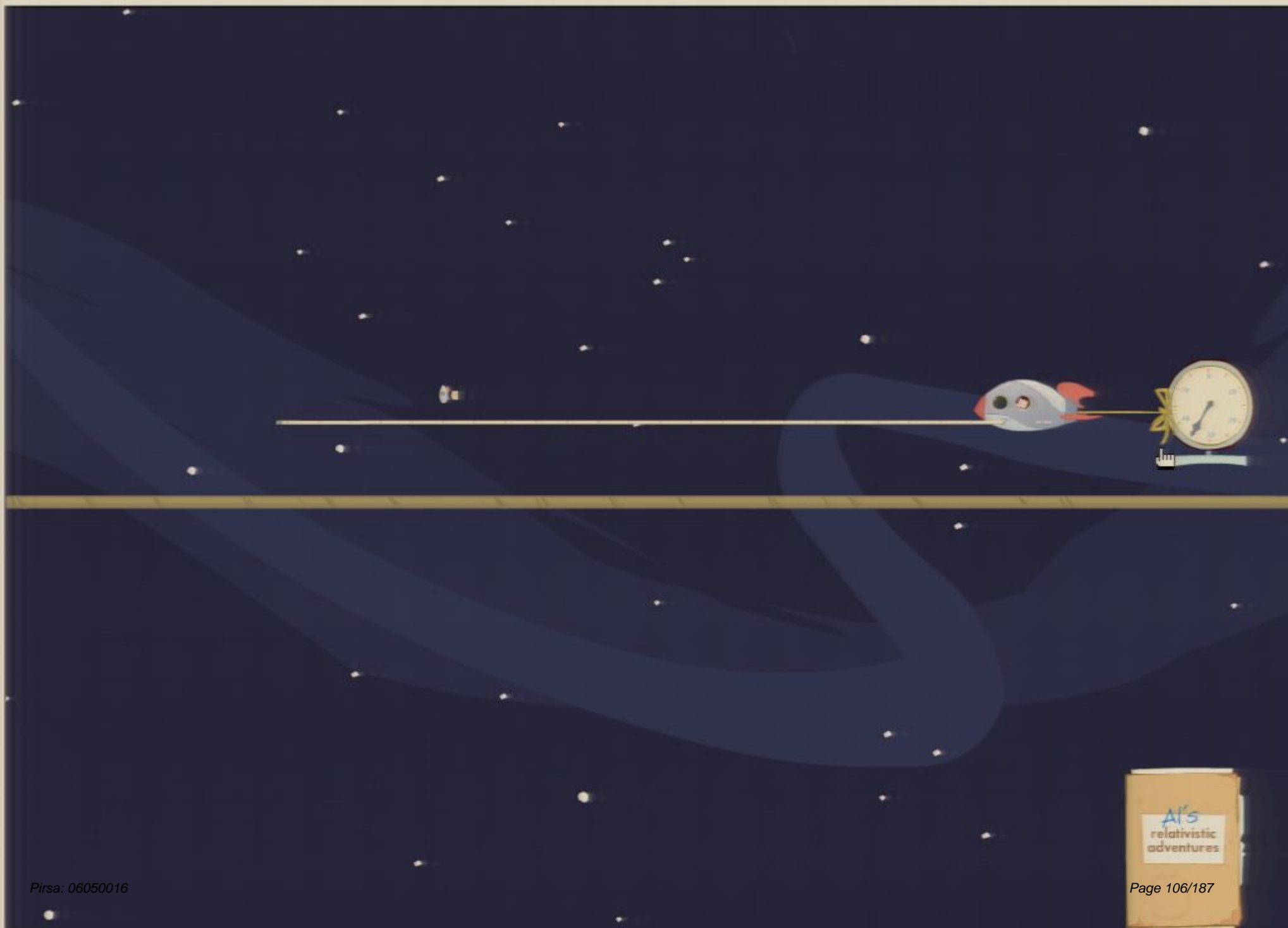


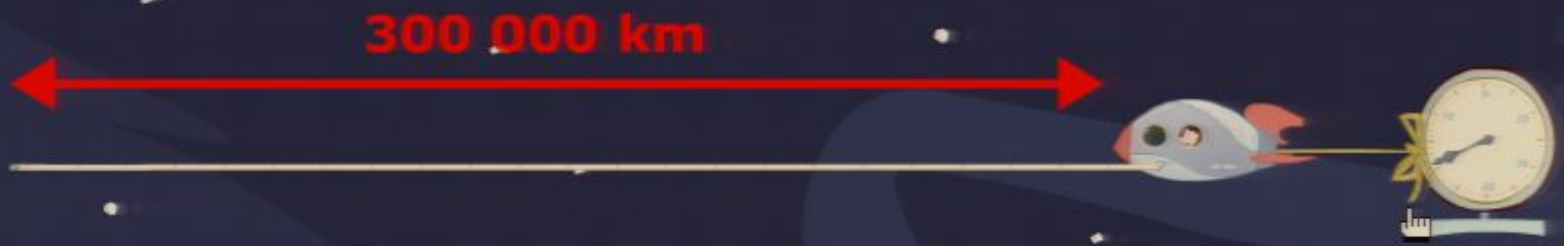


TAPE MEASURE

AE 001

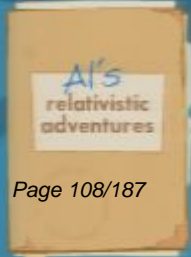






300 000 km

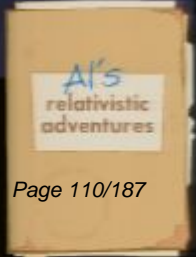






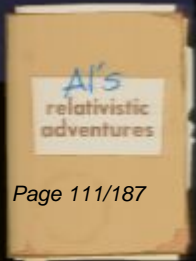
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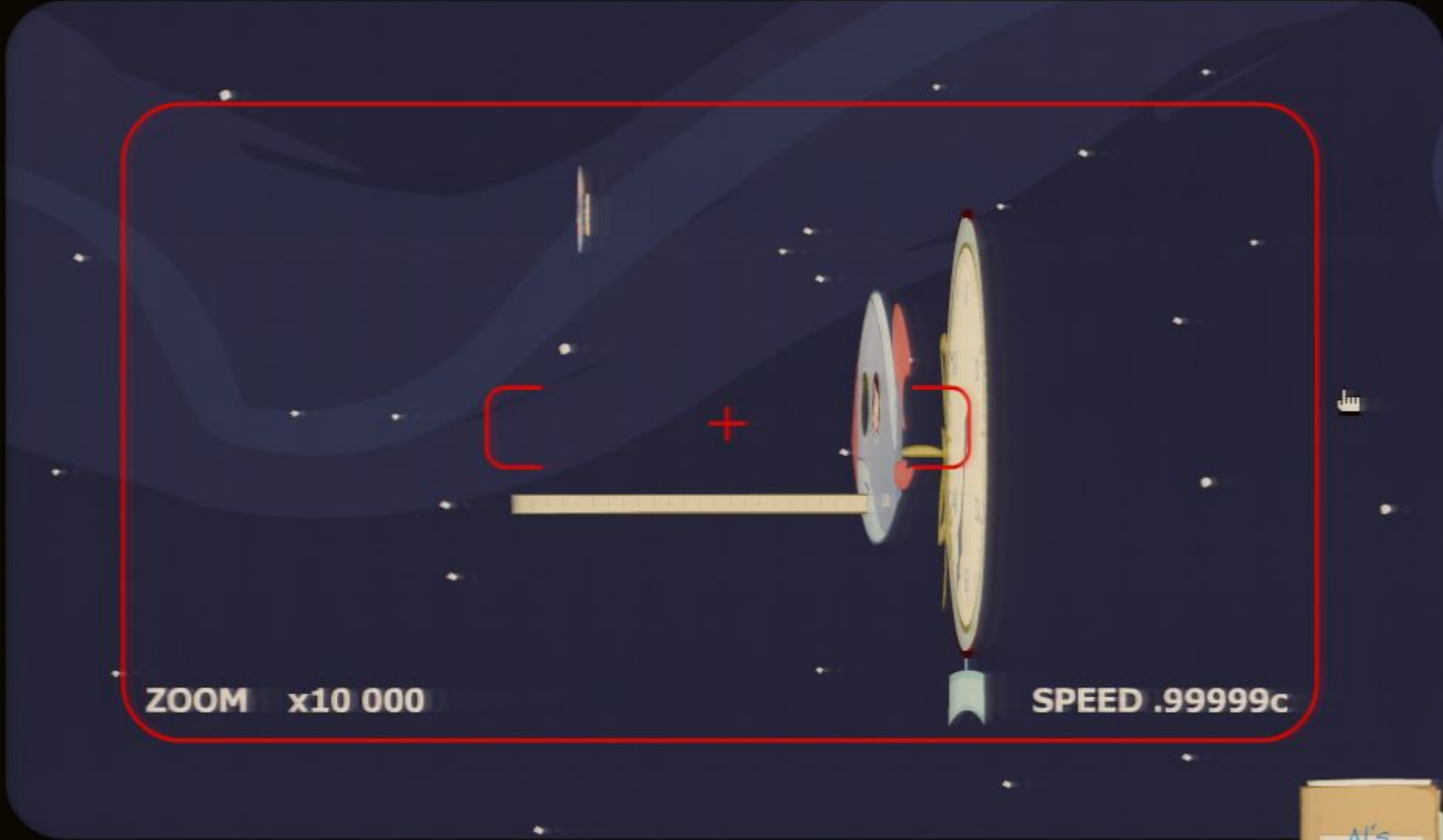
SPEED .99999c



ZOOM x10 000

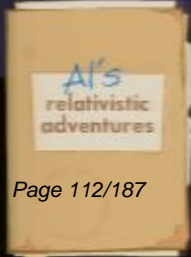
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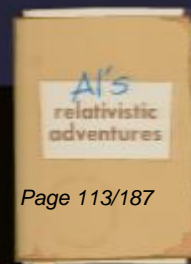
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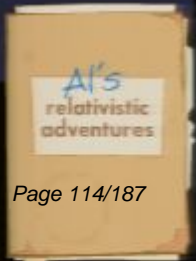
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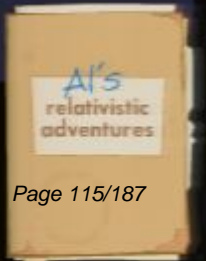
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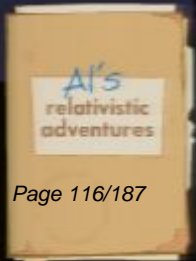
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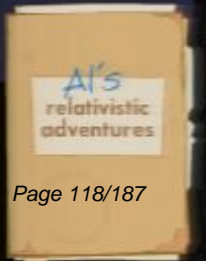


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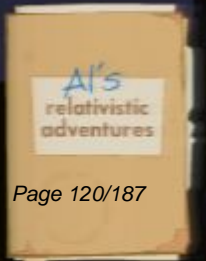
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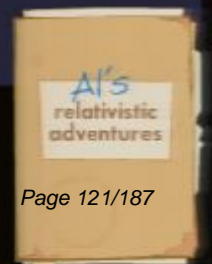
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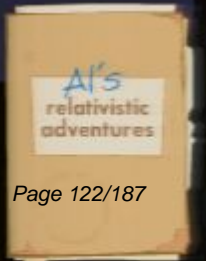
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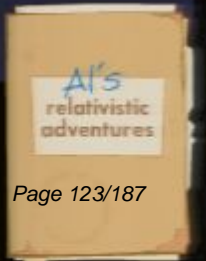
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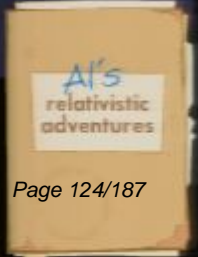
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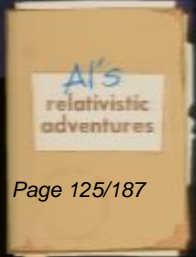
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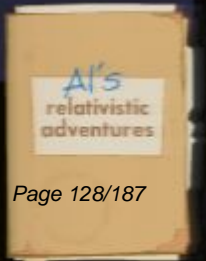
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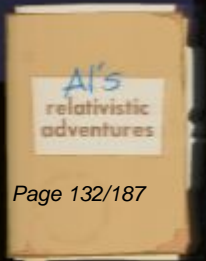
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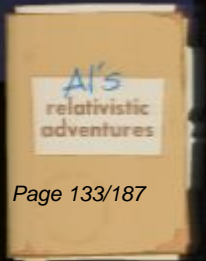
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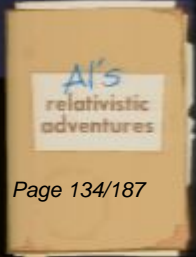
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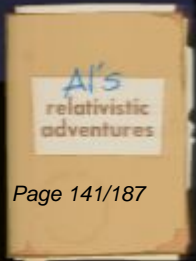
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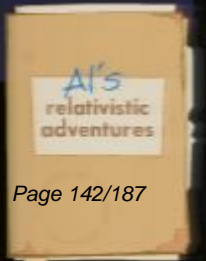
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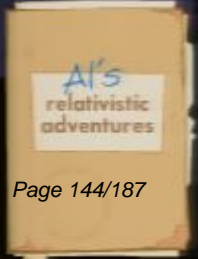
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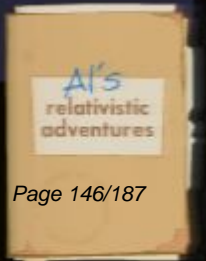
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What do you think...



CAN YOU SEE IT IN YOUR CLASSROOM?

Thank you!



Thank you to Damian Pope and the Perimeter^{dm} Institute for inviting us to your conference!

Thank you to Elzbieta Muir for contacting us about the conference.

And thank you all for your time!

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OAPT Presentation...
Lecture Night Agenda - J...
OAPT presentation

Maple 9.5
Lunch Scanning

Mozilla Firefox
PHYSICAPH...

MSN Messenger 7.5
RSC and OECD Dip Presenta...

SSH Secure File Transfer Client
Windows Media Player

SSH Secure Shell Client
ARA

Win Install
SLIDESHO

Johnson - Extro Pó...
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Johnson Pre-Shio...

Recycle Bin

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Ad-Aware SE Personal

Adobe Reader 7.0

Classic Worksh...

PI Logo

InterVideo WinDVD

PI INSTITUTE FOR THEORETICAL PHYSICS



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ITP INSTITUTE FOR THEORETICAL PHYSICS

Outline Slides

- 1 Curriculum Review: Supporting students and teachers by keeping Ontario's K-12 curriculum current and relevant
Overview of the Process
- 2 Table of Contents
• Science and Technology, Grades 1-4
• Science, Grades 5-12
• Technological Education, Grades 9-12
- 3 Curriculum Review
• Supporting students and teachers by keeping Ontario's K-12 curriculum current and relevant
• Includes an increased focus on literacy and numeracy across the curriculum
- 4 Current State of Curriculum Policy
• The Ontario curriculum documents (English and French) Grades K-12 include:
- 22 elementary curriculum documents
- 22 secondary curriculum documents
- Program Planning and Assessment (PPA)
There are also several program and curriculum (PPA) and PPA.
- 5 What is Curriculum Reform?
A major priority to reform Ontario's K-12 curriculum documents by designing them that:
• build on the quality curriculum currently in place
• ensure that the curriculum remains current and relevant
- 6 Rationale for Curriculum Reform
• ensure ongoing high quality education and contribute to government's student achievement
• ensure the effectiveness of Ontario's curriculum framework in a knowledge-



Curriculum Review

Supporting students and teachers by keeping Ontario's K - 12 curriculum current and relevant

Overview of the Process

Curriculum and Assessment Policy Branch
Ministry of Education

May 2006



Curriculum Review

*Supporting students and teachers by keeping
Ontario's K - 12 curriculum current and relevant*

Overview of the Process

Curriculum and Assessment Policy Branch
Ministry of Education

May 2006

Year 3



- Science and Technology, Grades 1-8
- Science, Grades 9-12
- Technological Education, Grades 9-12

Curriculum Review



- Supporting students and teachers by keeping Ontario's K – 12 curriculum current and relevant
- Includes an increased focus on literacy and numeracy across the curriculum

Current Status of Curriculum Policy



- The Ontario curriculum documents (English and French) Grades K – 12 include:
 - 20 elementary curriculum documents
 - 62 secondary curriculum documents
 - Program Planning and Assessment-2000
- These were introduced/implemented between 1997 and 2002.

What is Curriculum Review?



A staged process to review Kindergarten to Grade 12 curriculum documents by discipline area that:

- builds on the quality curriculum currently in place
- ensures that the curriculum remains current and relevant

Rationale for Curriculum Review



- ensures ongoing high quality education and continuous improvement in student achievement

Rationale for Curriculum Review



- ensures ongoing high quality education and continuous improvement in student achievement
- sustains the effectiveness of Ontario's curriculum for students in a knowledge-based society

Rationale for Curriculum Review



- ensures ongoing high quality education and continuous improvement in student achievement
- sustains the effectiveness of Ontario's curriculum for students in a knowledge-based society
- assures curriculum coherence and age-appropriateness from Kindergarten through Grade 12 in all disciplines

Rationale for Curriculum Review



- supports students, teachers, schools and boards by identifying targeted areas in need of support

Rationale for Curriculum Review



- supports students, teachers, schools and boards by identifying targeted areas in need of support
- allows lead time for development or updating of related support materials as required (e.g., textbooks)

Rationale for Curriculum Review



- supports students, teachers, schools and boards by identifying targeted areas in need of support
- allows lead time for development or updating of related support materials as required (e.g., textbooks)
- supports continual improvement to the curriculum



What Remains the Same

- high standards for all students



What Remains the Same

- high standards for all students
- the framework of grade-by-grade overall and specific curriculum expectations
- destination-related secondary school course types



What Remains the Same

- criterion-referenced assessment based on four levels of achievement as described in the achievement charts



What Remains the Same

- criterion-referenced assessment based on four levels of achievement as described in the achievement charts
- standardized provincial report cards
- diploma requirements under Ontario Secondary Schools (OSS)
Grades 9 to 12

Curriculum Review and the Achievement Charts



- Subject specific achievement charts will be “draft” until each subject/discipline is reviewed as part of the ongoing cycle of curriculum review
- When the new curriculum policy documents that are under review are published, new achievement charts will be finalized in the documents

Process Principles for Curriculum Review



- review of elementary and secondary curriculum policy documents will be integrated

Process Principles for Curriculum Review



- review of elementary and secondary curriculum policy documents will be integrated
- parallel revision processes for English and French language curriculum policy documents

Process Principles for Curriculum Review



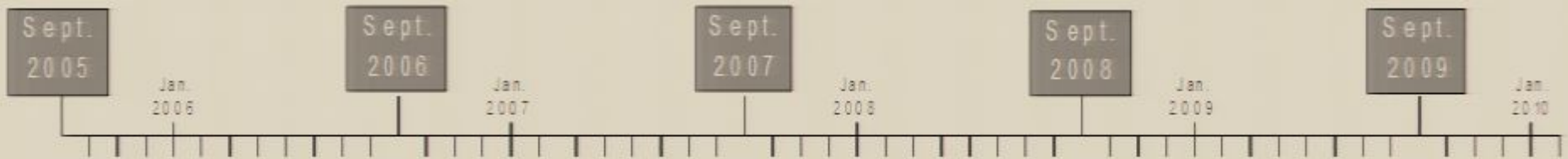
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- parallel revision processes for English and French language curriculum policy documents
- only changes to the curriculum if the evidence demonstrates a need

Process Principles for Curriculum Review



- review of elementary and secondary curriculum policy documents will be integrated
- parallel revision processes for English and French language curriculum policy documents
- only changes to the curriculum if the evidence demonstrates a need
- teachers, principals, board staff, subject experts, education stakeholders, parents and students will have opportunities to participate

Stages of Review Process (Year 3)



Science and Technology 1-8		*
Science 9-12		*
Technological Education 9-12		*

- Analysis and Synthesis
- Revision and Feedback Consultation
- Editing, Publication and Distribution
- * Mandatory Implementation

Process for Curriculum Review



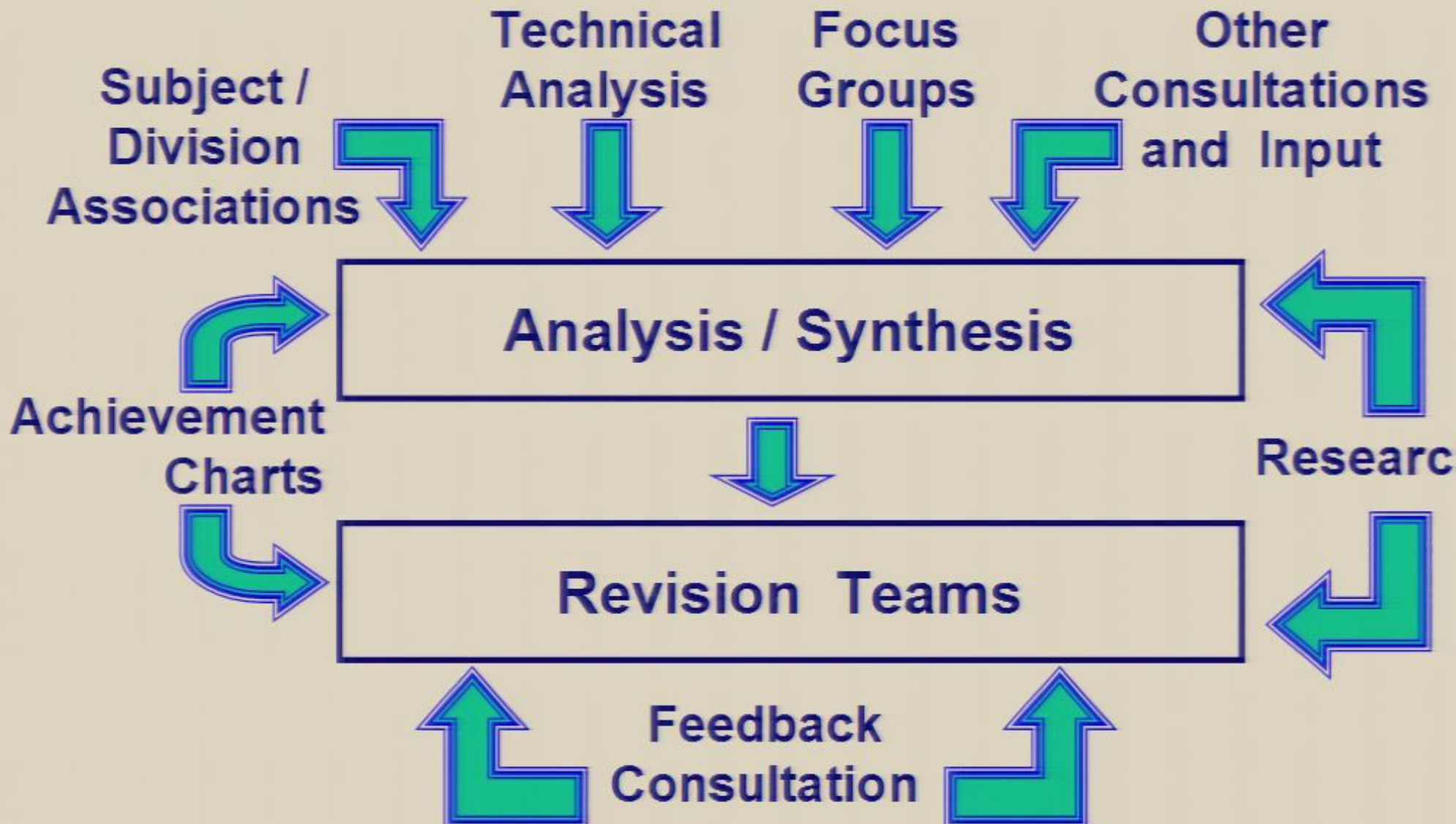
- The review process includes:

Process for Curriculum Review



- The review process includes:
 - **Analysis and Synthesis**
 - **Revision and Feedback Consultation**
 - **Editing, Publication and Distribution**
 - **Implementation**

Opportunities and Routes for Input





Review Process

Analysis includes:

- Technical Analysis by educators from Provincial Subject Associations



Review Process

Analysis includes:

- Technical Analysis by educators from Provincial Subject Associations
- Focus Group sessions- Content Analysis of information gathered from educators province-wide



Review Process

- Consultations with the Minister's Advisory Council on Special Education, faculties of education, parents and students, universities, colleges, workplace organizations and sectors, and other Ministries

Review Process





Review Process

- Benchmarking of the Ontario curriculum against other provinces and international jurisdictions



Review Process

- Benchmarking of the Ontario curriculum against other provinces and international jurisdictions
- A Research Report of literature pertinent to science and technology education

Review Process



Synthesis/ Recommendations

- Information from all of the Analysis Sessions is analysed for the curriculum review process

Review Process



Synthesis/ Recommendations

- Information from all of the Analysis Sessions is analysed for the curriculum review process
- Research, data and professional/public input are summarized and used as a basis for recommendations for revision to the curriculum policy documents
- Recommendations are written in conjunction with the French language policy branch

Review Process



Revision and Feedback Consultation

- Parallel English/French writing teams of educators from across Ontario, with curriculum expertise, draft revised documents based on the recommendations

Year 3: Opportunities for Input



Educators will have opportunities for input through

- Focus Groups in Fall 2005
- Technical Analysis in Fall 2005
- Consultations with Faculties of Education, Colleges, Universities, and Workplace organizations in Fall 2005/Winter 2006
- Revision Writing in Summer 2006
- Consultation and Feedback in Fall 2006
- Publication Spring 2007