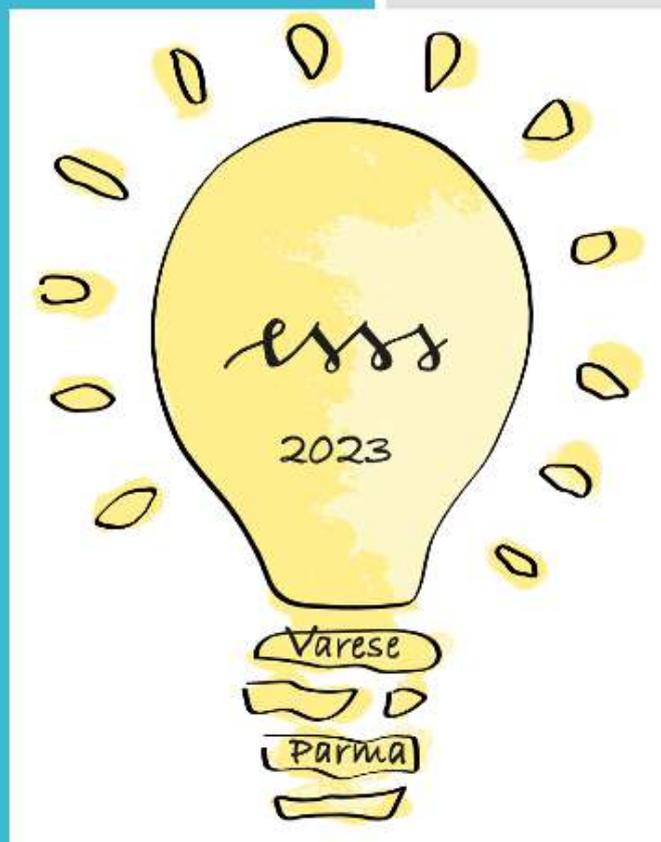


**EUROPEAN
SCHOOLS
SCIENCE
SYMPOSIUM**



**VARESE
26th - 29th MARCH, 2023**

European School of Varese



with the collaboration of the Scuola per l'Europa di Parma



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Welcome notes

Welcome to the 18th edition 2023 European Schools Science Symposium.



The European School of Varese and the accredited school of Parma and our supporters at the JRC are delighted and honoured to host you this year. It is truly wonderful to be able to host so many pupils, teachers, judges, scientific experts and all stakeholders and contributors from across the full network of all our European school network. A special thanks to our partner EPO for sponsoring the symposium, their financial support making the event more sustainable. This is a truly multicultural and-multinational event with over 145 pupils taking part with the support of some 37 teachers from across the European

Schools. It offers such an exciting opportunity for our young scientists to experience and share their learning journey with their peers and the professional scientific community.

Here they will present the fruit of their scientific endeavours, as each group will present their research briefly with the results of their scientific studies and explorations. Thus, demonstrating their ability to use their acquired knowledge, to conduct experiments and make conclusions on their results. Such skills are the core scientific discovery and innovation.

Another purpose of the science symposium is to give our young learners a showcase platform to demonstrate their enthusiasm and knowledge of the world around them. By hosting this event we can encourage and motivate our pupils to pursue their studies further. As participating in these events helps them to make the connection between their learning experiences in schools and the wider world beyond the classroom and how these experiences could lead on to possible future careers in the scientific community.

This event is exciting as our pupils share with us their personal journeys into scientific discovery. It gives each pupil the opportunity to collaborate, acquire new knowledge, to widen their cultural experiences, to spark their curiosity to make them want to know more.

As educators our role is to light the fire, to fuel the sparks of their curiosity and encourage them in their pursuit of knowledge and success.

The projects presented here achieve several pedagogical goals, through their application of learned knowledge and skills, they are showing their capacity to contribute to a wider scientific community and world beyond the classroom walls and see how they can shape the world and the future that lies before them.

We are proud to host an event that shows the skills our learners have developed, opening up their imaginations, creating and thinking about an idea, making hypotheses and suppositions and testing to see if they are correct. We are giving our students the opportunity to become actively engaged in their own learning process.

At the science symposium, we see our students learning made visible.

A special and heartfelt thanks to our two coordinators (Charlotte Dudal and Fenia Tsompanopoulou) who have worked tirelessly for several months to make this event a success.

We hope this event is a positive collaboration for everyone involved.

I wish you all the best, positive collaborations, beautiful discoveries, fruitful meetings, and new friendships during your time here in Varese.

In the realization of your projects. May you find here some building blocks for the foundations of your own future.

In the meantime, all my best wishes.

Buon lavoro,
In bocca al lupo!

Ariane Farinelle

Welcome to the 18th edition 2023 European Schools Science Symposium

The Scientist is not a person who gives the right answers, he's one who asks the right questions' – Claude Levi-Strauss

Rethinking the purpose and content of education in our century doesn't mean only focusing on learning to learn, but also on learning by doing and on learning to do. Fostering and encouraging curiosity and creativity in our students is fundamental. Thanks to opportunities like the European School's Science Symposium, pupils are given the possibility to solve real life problems in a co-operative and innovative way. They come away from the experience equipped to deal with the complexity of tomorrow in a critically aware manner whilst allowing them to discover their talents and their passions. An Italian writer – Italo Calvino – maintains that rationality is a stimulant of the imagination: creativity and rationality are the basis of this adventure that we are about to live: the adventure of discovering and building together our knowledge. The experience of learning by 'trial and error' and by doing so as a 'team' is what makes this event truly unforgettable not only for pupils but also for their teachers.



My hope is that occasions like these organized by European Schools will inspire our pupils – and especially girls – to move towards STEM studies and careers, that Europe needs more and more.

Schools cannot just be subjected to challenging transformations and innovations: we as teachers and educators must also be able to manage, help and direct them. European schools are definitely ready and excited to respond to these new challenges.

It has been a pleasure and privilege for the Scuola per l'Europa di Parma to collaborate, for the first time, alongside the European School of Varese in the organization and hosting of the 18th edition of the European Schools Science Symposium 2023.

I hope you enjoy this experience and come away from it feeling enriched and even more motivated and driven to search and discover.

Roberta Fantinato



Note from the ESSS Inspector

Chers élèves, chers jeunes scientifiques,
Chers participants au Symposium des Sciences des Écoles européennes,

Cette 18^e édition du ***Symposium des Sciences des Écoles européennes*** promet d'être à nouveau un grand succès. Des élèves et enseignants d'un nombre croissant d'écoles



européennes vont se rassembler du 26 au 29 mars 2023 à l'EE de Varèse pour présenter leurs projets scientifiques. L'école de Varèse a organisé cette édition avec le soutien de l'EEA de Parme. Ceci est le reflet d'une belle coopération, telle qu'elle est aussi de coutume dans le domaine de la recherche scientifique.

Je dois mon respect à vous les élèves qui vous vous êtes engagés, de manière exemplaire, bien avant d'arriver au Symposium. Mon respect parce que vous étiez prêts à fournir un travail supplémentaire, à vous investir. De plus en plus d'écoles organisent des événements et des compétitions scientifiques internes au préalable de l'ESSS. Cela permet d'impliquer et de motiver un maximum d'élèves. Une initiative à développer davantage.

Lors de ce concours, votre créativité est stimulée. Vous étiez obligés de travailler de manière efficace et ciblée, de communiquer et de collaborer. Pour développer vos projets, il fallait avoir l'esprit d'initiative, de l'imagination, être en mesure de résoudre des problèmes tout en restant critique par rapport à sa propre démarche.

Quand on jette un coup d'œil sur les projets qui ont été soumis au Symposium on peut se rendre compte d'une imagination et d'une créativité insatiables. Vous avez travaillé sur des sujets et thématiques qui sont d'actualité et qui vous ont interpellés.

Est-ce que ce ne sont pas de telles initiatives, comme ce symposium, qui permettent de développer les compétences du 21^e siècle chez nos jeunes, à savoir créativité, esprit critique, entrepreneuriat, résolution de problèmes, innovation pour n'en citer que quelques-unes.

Continuez à travailler avec passion, et vous allez constater que beaucoup de filières vous ouvriront leurs portes. N'ayez pas peur d'approcher d'autres personnes, d'échanger vos idées et d'apprendre des autres. Entourez-vous de mentors plus âgés et plus

expérimentés. Soutenez-vous réciproquement. Mais dans tout cela, n'oubliez jamais de chercher une manière de vous évader, pour trouver un domaine que vous adorez et qui vous passionne.

J'aimerais aussi remercier les enseignants qui ont consacré leur temps libre afin de guider les élèves dans leurs démarches. Sans leur engagement de telles initiatives ne pourraient pas avoir lieu.

Un très grand merci à la direction des deux Écoles hôtes, l'association des parents ainsi qu'à toute l'équipe organisatrice (Charlotte Dudal, Fotoula Tsompanopoulou, Eliette Germain, Lucia Liviero) pour leur travail insatiable tout au long des deux dernières années.

Mes remerciements vont aussi à tous toutes les institutions et autorités qui contribuent au succès de cet événement phare des écoles européennes. La ville de Varèse ainsi que le JRC. L'EPO vient de rejoindre ceux qui s'impliquent de manière active afin de soutenir l'ESSS.

L'équipe qui remportera l'ESSS ira représenter les EE au prestigieux **EUCYS** (*European Union Contest for Young Scientists*), qui aura lieu du 12 au 17 septembre 2023 à Bruxelles (<https://eucys2023.eu>). Ce concours est la vitrine des meilleures performances scientifiques des élèves. Il s'agit d'une initiative de la Commission européenne lancée pour promouvoir la coopération et l'échange entre jeunes scientifiques. Profitez de cette occasion unique pour entrer en contact et vous échanger avec des jeunes du même âge, venus des quatre coins de l'Europe.

Or le but de l'ESSS n'est pas de pouvoir envoyer une minorité d'élèves à l'étranger, mais d'éveiller l'intérêt pour les sciences chez une majorité de nos jeunes. Ce sont bel et bien de telles initiatives qui permettent de transmettre une image positive des sciences. L'enseignement scientifique doit rester une priorité dans notre système éducatif.

Pour le moment il me reste de féliciter tous les participants au symposium. Bravo pour votre engagement et vos travaux. Beaucoup de plaisirs avec les sciences et à l'année prochaine à l'EEA de Bad Vilbel!

Max Wolff
Inspecteur des Écoles européennes



Invited Keynote Speakers

Jutta Thielen-del Pozo



Jutta Thielen-del Pozo is head of the Scientific Development Programmes unit at the European Commission's Joint Research Centre (JRC). By leveraging on research gaps, new scientific evidence and technological advances, the unit contributes to anticipating future policy demands. Jutta is an atmospheric physicist by training and obtained her PhD in Environmental Science at Lancaster University, UK, on the topic of extreme rainfall events. She developed her scientific career in the field of severe weather events.

Nikolaos Stilianakis



Nikolaos Stilianakis is a mathematical epidemiologist at the European Commission's Joint Research Centre (JRC) and Associate Professor of Epidemiology and Biomathematics at the University of Erlangen-Nuremberg. His research interests are infectious disease epidemiology, immune system-pathogen dynamics, and environmental epidemiology.

Luca Carra



Luca Carra, journalist and editor of the online magazine *Scienzainrete*. He is the author of numerous books. Among them are *Prevenire* (Einaudi, 2020, with Paolo Vineis and Roberto Cingolani) and *Il capitale biologico* (Codice edizioni, 2022, with Paolo Vineis). He is secretary of the 2003 Group for Scientific Research and was scientific advisor to the Minister for Ecological Transition, Roberto Cingolani.

Dialekti Athina Voutyrakou



Dialekti Athina Voutyrakou holds a Diploma in Electrical Engineering and Computer Science from the National Technical University of Athens and a Master of Science in Biomedical Computing from the Technical University of Munich. In addition, she carries several awards from Robotics Competitions (National, European, and International) and Olympic Distinctions. Since she was 18, she has worked as an Educational Robotics instructor for school teams, preparing the students for national and

international robotic competitions. She also co-authored a book with educational robotics scenarios for greek students. In 2016, she founded an NGO called Unique Minds, which aims to fill the gap between school and university. Up to now, more than 20.000 students have been helped to identify their ideal academic path through this NGO through our events. Additionally, she is an EU Ambassador of G(irls)20 for empowering women in STEM. For the last 3 years, she worked in several companies and research institutes in the fields of medical and life science robotics.

All the above led her to earn the Greek International Women Award, a Distinction as "Young Greek Woman of the year", the Education Leaders Award, and to win the Worldwide Campaign "Women doing Businesses for Good". Forbes also included her in the Forbes 30U30 GR list 2019.



Judging Panel

Dr. Silvia Casati



Dr. Silvia Casati has a university degree in pharmacy and a PhD in biomedical sciences from the University of Nottingham (UK). She joined the Joint Research Centre of the European Commission in 2001. Since then, she has been working in the area of alternative methods (*in chemico*, *in vitro* and *in silico*) to animal testing with a specific focus on methods for assessing the potential of chemicals to induce skin allergies. She has followed all the steps involved that lead to regulatory adoption of these methods at

international level. She has co-authored about hundred publications in scientific journals, and she is serving on several scientific expert groups.

Dr Christina Corbane



Christina Corbane is a senior researcher in remote sensing applied to earth sciences. She received her Ph.D. degree in remote sensing applied to the study of soil surface features in agricultural landscapes from the Université Montpellier II, France.

She developed processing chains and AI-driven applications for mapping and monitoring of human settlements with remote sensing imagery at European and Global scales in the framework of the Copernicus Earth Observation Program.

She also worked on maritime security, monitoring of the conservation status of natural habitats, rapid emergency mapping and the use of Earth Observation for supporting the indicators framework of the 2030 international agendas.

She is currently the leader of the Disaster Risk Management Knowledge Centre of the European Commission. Her main role is the coordination of the different projects, IT platforms and activities meant to provide scientific support for the efficient and coherent implementation of EU policies and international agreements in the field of Disaster Risk Reduction and Conflict Prevention.

<https://www.researchgate.net/profile/Christina-Corbane>

Domenico Golzio



Domenico Golzio, holds a degree in Physics. He has worked for 15 years as an electronic engineer in the telecom, car and aerospace industries. He was involved in research and development projects for fibre optics, electronic instrumentations, measurement of electromagnetic fields, and electromagnetic compatibility, authoring about 25 technical papers and getting three patents.

In 1990 he moved to where He worked at the European Patent Office (EPO), Munich, Germany, as a patent examiner, searching and examining patent applications in the field of Basic Electronic Circuitry, Telecom and Digital Computers later becoming a Director of a Search and Examination Unit in the area of Electricity Technology. He also served as Technical Co-ordinator for the International Technical Co-operation Activities in The Hague Branch of EPO, He has led the IT teams in designing Knowledge Management and Search Tools for Patent Prior Art Search and Patent Information and setting up an AI department. Currently, he is a director in the CTO Office.

He designed an interactive experience “Introducing Patents and Innovation” which led to the production of the “EPO Patent Teaching Kit”.

He has done research into various aspects of IPRs, including the relationship between patents and innovation, patent information, international patent portfolios, and comparison between different patent systems.

Simon Hiscock



Simon Hiscock graduated with a degree in Zoology from the University of Sheffield before working for a number of government environment schemes as Ecologist. His education degree was from Sheffield Hallam University and he spent many years teaching Science and Biology in a state school in the U.K. before taking a position at the European School of Varese teaching Biology and Integrated Sciences. He was responsible for organising the E.S.S.S. in 2007 and helped write the guidelines still in use today. He presents

wildlife programs but only in his own mind as he usually wakes up before anyone sees them! Simon has, on the other hand, produced a couple of single records back in the 80's!

Naouma Kourti



Naouma Kourti joined the European Commission in 1996 working as a researcher in nuclear safety. Later she became a group leader and pioneer in using remote sensing for the detection and identification of fishing vessels fishing illegally. She then moved in aspects of security focusing in the protection of EU's critical infrastructures. She launched the European Network for Critical Infrastructure Protection (ERNICIP) consisting of expert in Critical Infrastructures from all over the world. In 2014/15 was associate affiliate professor of the Georg Mason University (VA) in the subject of security research. From 2016 to 2021 she is the deputy head of the "Technology Innovation for Security" unit. Since recently she works for JRC's science and art SciArt project, where she launched the theater play "Feeling Science" with the aim to connect female scientists with the public by using artistic practices. She is author of the trilogy "Homer's wives: Helen, Penelope and Clytemnestra" published in Amazon

Dr. Gianluca Lombardo



Gianluca Lombardo pursued his secondary studies at the European School of Varese and pursued a bachelor in Life sciences and technology at the University of Insubria, He completed a Master's degree in Evolutionary biology with major in Population genetics at the University of Milan. He carried out his Ph.D. at the University of Pavia where he worked on animal and human Population genomics with a thesis on mitochondrial molecular phylogeny and relationships between barn swallows which was funded by a PRIN (Research Project of National Interest). During these years he taught both secondary school science and mathematics, as well as lectures on genetic conservation at the University of Pavia. Currently Dr. Lombardo is employed at the University of Insubria as a postdoctoral researcher and assistant professor in Genetics in the population genetics laboratory. He studies genetic conservation of forest species such as the Turkey oak (*Quercus cerris*), Chestnut (*Castanea sativa*) and the endangered Grey leaved rock rose (*Cistus albidus*) together with the CNBC (National Carabinieri Centre for Biodiversity) and Regione Lombardia. Dr. Lombardo is a member of AGI (Association of Italian Geneticists), SMBE (Society for Molecular Biology and Evolution) and SIBE (Italian Society of Biological Evolution).

Enrico Pisoni



Enrico Pisoni works as a scientific / technical project officer in the Air and Climate Unit, JRC of the European Commission. He graduated in Environmental Engineering from the Politecnico Milano in 2002, and obtained a Ph.D. in Information Engineering from the University of Brescia in 2007. His research interests include modelling and simulation of nonlinear systems, system identification and optimisation techniques. He is mainly concerned with air quality applications, considering monitoring, forecasting and Planning.

Nikolaos Stilianakis



Nikolaos Stilianakis is a mathematical epidemiologist at the European Commission's Joint Research Centre (JRC) and Associate Professor of Epidemiology and Biomathematics at the University of Erlangen–Nuremberg. His research interests are infectious disease epidemiology, immune system–pathogen dynamics, and environmental epidemiology.

Dr. Gabriele Tamborini



Gabriele Tamborini has been working at the Joint Research Centre of the European Commission in Karlsruhe since 1995. He studied Environmental Chemistry at the University of the Studies in Milan (Italy). He moved then to France at the University of Paris Sud–Orsay where he got the PhD developing a novel technique for the analysis of radioactive particles in the environment and for the characterisation of U and Pu particles for safeguards and security investigations. For more than 10 years he has developed and implemented advanced techniques for the High–Performance Trace Analysis and Environmental Monitoring program, leading the group of environmental particle analysis at JRC. In the field of environmental monitoring and trace analysis, he was acting as consultant for many Institutions worldwide.

In 2006, he was nominated communication officer of the JRC-ITU institute, assisting different Directors in this task, and since few years, he is acting as JRC nuclear communication manager.

He is author with collaborators of many scientific articles, mainly published on Analytical Chemistry and Environmental Science and Technology. In April 2007, he was awarded "The Outstanding Young Persons" as best young Italian researcher from the Junior Chamber International (Worldwide Federation of Young Leaders and Entrepreneurs).

Flavio Zanovello



After graduating in nuclear engineering at the Politecnico di Milano with a thesis on superconducting cables, Flavio Zanovello joined the JRC in 2003 in the nuclear decommissioning unit in Ispra. For more than 10 years he managed radioactive waste management projects, from thermal treatment of radioactive waste to safe storage of liquid waste as well as being involved in the development of waste acceptance criteria. He collaborated in several international fora as OECD, IAEA and the European Commission to draft

guidance on the management of low level waste and share experience on decommissioning and waste management projects. He more recently moved to the programme management aspects decommissioning programmes, dealing with project coordination, budgeting and risk management.



ESSS Assessment criteria and competition rounds

Each school can submit **3 projects plus 1 reserve**.

Projects will be grouped according to pupils' year level:

- Junior Projects: **Years 1 - 4**
- Senior Projects: **Years 5 – 7**

Projects may be submitted by an individual or a group of **maximum 3 students**.

- A project will be judged as a senior project if at least one member of the group is in years 5 – 7.

Projects should demonstrate that the student(s) has/have undertaken some significant original work. Originality is exceptionally important. Examples must include a practically based experimental investigation carried out by the students, original design of an item or process, or survey based investigations involving the first-hand collection in 2 preliminary rounds to select the five best junior or five best senior projects.

1. PRELIMINARY ROUND

a) 1st preliminary round: Report work

The student/groups will present their written scientific report of their project. The jury members evaluate these papers by giving 50% of the total preliminary points.

Find below the information given to the participants about guidelines for writing their scientific report:

The final report should be a document which describes the investigation carried out by your group. As a suggestion, you can go through the steps in the scientific process including a detailed description of your work and findings.

There is no minimum or maximum length of the report, but the student(s) should be concise and very precise in what they write. The student(s) should not be satisfied with a first draft. The report needs to be written in English, French, or German. The report will be evaluated by the judges according to specific criteria shown in the following table

SCORING SHEET – REPORT WORK

Name of the jury member: _____

Title of the project: _____

N° of the project: _____

Motivation and Originality: /10

- Motivation and ultimate aim
- Originality

The Process /20

- Planning and organization
- Quality of the research work
- Use of relevant experiments/data/statistics – Level of innovation and creativity
- Variety of scientific skills used

Data analysis and conclusion /15

- Presentation of data
- Achievement of aims / Answering of research question
- Drawing of conclusion

Significance /5

- Global significance

Short comments on the project if it is applicable:

Total points: /50 points Signature of the jury member: _____

b) 2nd preliminary round: Oral presentation

The student/groups will present their scientific project orally to the jury (a panel of judges composed of two experts). The oral presentation could be supported with a slideshow presentation, and/or any technological equipment that the pupils have developed. A poster will be present in the classroom, which students may or may not wish to use in their oral presentation. Each member of the project groups should be able to provide additional information on their project work and answer questions. The oral presentation will be limited to a maximum of 10 minutes and the panel of judges will be invited to ask questions for a maximum of 5 minutes.

40% of the total preliminary points will be attributed by the jury members to the oral presentation itself.

10% of the total preliminary points will be attributed by the jury concerning the readability of the project through the poster.

The criteria for the oral presentation are shown on page 4.

The scores of the written and poster presentations will be added and the highest scored projects (5 from each category) will be qualified to participate in the final round. If the final points are equal, the panel of judges will need make to take a decision.

SCORING SHEET – POSTER PRESENTATION

Name of the jury member: _____

Title of the project: _____

N° of the project: _____

Evaluation of the oral presentation /40

- How easily did student(s) express themselves?(15)
- Has the use of supports (slideshow, poster and/or equipment) been done clearly and the aim of the project been explained? (10)
- How clear were the answers? (15)

Evaluation of the poster /10

- How well planned and organized was the poster? (2)
- How well does the poster describe the aim of the project? (4)
- How well were experiments/data/statistics presented? (2)
- How high was the students' level of creativity (2)

Short comments on the project if it is applicable:

Total points: **/50 points** Signature of the jury member: _____

2. FINAL ROUND – PLENARY STAGE PRESENTATION

The best 5 junior and 5 senior projects (selected in the preliminary rounds) will be invited to present their work on stage in front of a bigger audience for a **maximum of 10 minutes**. The audience may be composed of students and teachers, parents of presenters... The jury members will be invited to pose questions for a maximum of 5 minutes after each project presentation.

The stage manager will indicate when the final minute of the presentation/questions-answers starts. The timing must strictly be kept for all participants. Student staff helping in the organisation of the event may be involved in passing the microphones and/or managing the time.

All points and rankings that have been previously attributed are disregarded for the final round.

The jury will attribute rankings to the projects. The projects will be evaluated according to the following criteria:

- **The concept** – What was the motivation behind your project and what were your aims? How original is your project?
- **The process** – How well did you plan and organize your work? What research did you do? What experiments did you undertake? Were you innovative or creative in your approach? What skills did you use?
- **The outcome** – How well did your project achieve its aims? What conclusions did you draw? Personal skills –how well did you deal with any problems or challenges you encountered, individually or as a group?
- **The presentation** – How well is your project communicated? Do you demonstrate understanding and reason clearly? Is your final report of the high quality?
- **The significance** – What is the wider impact of your project? Final rankings for each category will be added. In the event that projects have identical

rankings, the panel of judges will arbitrate to reach a final common decision.

The three best projects in each category will be attributed the 1st, 2nd or 3rd price. The 4th and 5th places will be rewarded with an 'ESSS finalist certificate'.

The winner of the senior project of ESSS 2018 will participate at the **European Contest for Young Scientists (EUCYS)** and need to be **registered by the EUCYS representative**.

3. PRIZE FOR THE BEST POSTER (election by the audience)

During the poster session, the participants and accompanying teachers can choose their preferred junior or senior project. The choice of best project will be based only on the poster. The choice of method by which the vote is carried out is left to organising school (e.g. electronic vote, voting tickets that will be collected during the event in a voting box...).

The vote will be open on days 2 & 3 during which the posters hang out. Each category (junior and senior) will be awarded a "*Best Poster Prize*". Each project group will need to be present during the morning of day 2 next their poster where they will present their work to the audience, while waiting for their turn for the oral presentation.



General Programme

DAY 1: Sunday 26th March 2023

2:00 PM – 4:30 PM	Participants' arrival and bus transfer to Salone Estense – Registration
4:30 PM – 8:00 PM	Welcome Aperitivo and Opening Ceremony
8:15 PM – 8:30 PM	Bus transfer to UNA Hotel
9:00 PM – 10:00 PM	Buffet Dinner
10:00 PM – 11:00 PM	Disco and Karaoke Evening

DAY 2: Monday 27th March 2023

7:00 AM – 8:00 AM	Breakfast – JRC check-in
8:00 AM – 9:00 AM	Bus transfer to JRC – ISPRA
9:00 AM – 12:00 AM	Posters set-up Individual project presentations and Science labs visits. (1 st session) Participants vote for best posters.
12:00 AM – 1:30 PM	Buffet lunch
1:30 PM – 4:30 PM	Individual project presentations and Science lab visits. (2 nd session) Participants vote for best posters
4:30 PM – 5:30 PM	Bus transfer to European School of Varese
5:30 PM – 8:00 PM	Pizza aperitivo and activities (exhibitions, games, concerts, international dances)
8:00 PM – 8:15 PM	Bus transfer to UNA Hotel
8:30 PM – 9:30 PM	Buffet dinner UNA Hotel / Formal dinner at Royal Ascott Hall
9:30 PM – 11:30 PM	Ice-skating fun night

DAY 3: Tuesday 28th March 2023

7:00 AM – 8:00 AM	Breakfast – JRC check-in
8:00 AM – 9:00 AM	Bus transfer to JRC – ISPRA
9:00 AM – 12:00 AM	Presentation in the plenary of the finalist projects
12:00 AM – 1:00 PM	Lunch
1:00 PM – 1:30 PM	Transfer to Angera ferry terminal
2:00 PM – 3:30 PM	Lago Maggiore tour
3:30 PM – 4:30 PM	Isola dei Pescatori
4:30 PM – 6:00 PM	Ferry to Angera imbarcadero
6:00 PM – 7:00 PM	Bus transfer to Varese Teatro Santuccio
7:00 PM – 8:30 PM	Teatro Santuccio: Feeling Science: Performance for the Senior participants/ Multisala Impero: Night-Sky Guided Observation for the junior participants
8:30 PM	Bus transfer to UNA Hotel
9:00 PM – 10:00 PM	Buffet dinner
10:00 PM –	Royal Ascott Hall Entertainment night (student band performance)

DAY 4: Wednesday 29th March 2023

7:30 AM – 8:30 AM	Breakfast – JRC check-in
8:30 AM – 9:30 AM	Bus transfer to JRC – ISPRA
10:00 AM – 1:00 PM	Closing ceremony – Awards
1:00 PM – 2:00 PM	Buffet Lunch
2:30 PM – 3:30 PM	Bus transfer to Varese or MXP. Participants' departure



Opening Ceremony Programme



ESSS 2023 – European Schools Science Symposium
PROGRAMMA CERIMONIA DI APERTURA

Domenica 26/03/23 Comune di Varese: Salone Estense

16.30 – 17.30 Aperitivo di Benvenuto ai Giardini Estensi di Varese

17.30 - Cerimonia di Apertura
La corale della Scuola per l'Europa di Parma accompagnerà l'evento
in collaborazione con la corale della Scuola Europea di Varese

Interventi:
Direttrice ESV Ariane FARINELLE
Presidente del Consiglio Comunale di Varese Dott. Alberto COEN PORISINI
Deputy OSG Manuel BORDOY
ES Ispettore Max WOLFF

Intermezzo musicale
Dirigente Responsabile del JRC - Sito di Ispra Rien STROOSNIJDER
EPO rappresentanza Direttore Domenico GOLZIO
Direttrice Scuola per l'Europa di Parma Roberta FANTINATO
ESV alumnus e ESSS vincitore Vassilis PAPADOPOULOS

Intermezzo musicale
Pannello dei relatori principali:
Science in or for Society: How to make a difference
Dr. Jutta THIELEN – DEL POZO
Prof. Nikolaos STILIANAKIS
Dr. Luca CARRA

Intermezzo musicale
ESSS 2023 coordinazione

Finale musicale
20.00 -Fine della Cerimonia

Responsabile Cerimonia:
Fenia Tsompanopoulou
tsompafi@teacher.eursc.eu

Le co-Coordinatrici del Simposio:
Fenia Tsompanopoulou e Charlotte Dudal

Closing Ceremony Programme



**ESSS 2023 – European Schools Science Symposium
PROGRAMMA CERIMONIA DI CHIUSURA**

Mercoledì 29/03/23 - Centro Comune di Ricerca: Auditorium

10.00 – Benvenuto musicale

Interventi:
JRC rappresentanza Krzysztof MARUSZEFSKI
EPO Direttore e rappresentanza della giuria Domenico GOLZIO
ES Ispettore Max WOLFF

Intermezzo musicale
Prefetto di Varese Salvatore PASQUARIELLO
AGSEV rappresentanza Joao BARROSO

Intermezzo musicale
2023

Youth and Robotics: The Future of New Technologies
Oratrice principale: Diana VOUTYRAKOU

Intermezzo musicale

ESSS 2023 Awards
Direttrice ESY Ariane FARINELLE
ESSS 2023 Coordinatrici

Finale musicale

12.00: Fine della Cerimonia

Responsabile Cerimonia:
Fenia Tsompanopoulou:
tsompafi@teacher.eurssc.eu

Le co-Coordinatrici del Simposio:
Fenia Tsompanopoulou e Charlotte Dudal



List of participating schools and titles of projects

JUNIORS' PROJECTS	SCHOOL
<p>J1 CAN DRONES SUPPORT BEES' POLLINATION? COMPARATIVE STUDY BETWEEN DIFFERENT WAYS OF ARTIFICIAL POLLINATION <i>Harriet James and Ioana Nicorescu,</i></p>	Bergen
<p>J2 THE TEM PEN: AN ECOLOGICAL PEN <i>Titouan Jacolin, Emilie Thomas and Maéva Lecaillet</i></p>	Bergen
<p>J3 DOES THE POPULATION OF A TOWN AFFECT THE AMOUNT OF RUBBISH ON THE GROUND? A ROBOT IS GOING TO GIVE US THE ANSWER. <i>Stanley Johnson, Danyal Akhtar and Alex Vandor</i></p>	Bergen
<p>J4 SLEEP, BUT WHY? <i>Bajnóczi Boglár and Hauk-Botycai Júlia</i></p>	Brussels I
<p>J5 AERODYNAMICS – WIND TUNNEL <i>Luka Kobe and Dimitrij Doktorič</i></p>	Brussels I
<p>J6 VERBALIZATION OF SCIENCE – MAGAZINE AND ONLINE QUIZ <i>Eliza Slavova, Etain O'Mahony and Maja Limantaitė</i></p>	Brussels I
<p>J7 BIOHEAT <i>Castellarin Fabio Thomas</i></p>	Brussels II
<p>J8 PLANT SURVIVAL WITH DIFFERENT FLUIDS <i>Eva Jankūnas and Rūtilė Senkutė</i></p>	Brussels II
<p>J9 TRANSDERMAL DRUG DELIVERY PATCH <i>Marina Cioponea and Jan Kokalj</i></p>	

		Brussels II
J10	AIR QUALITY AND HEALTH IN EEB3 <i>Eilidh Bordes, Emma Dunphy and, Leonie Goodchild</i>	Brussels III
J11	TARDIGRADES, ASTRONAUTS OR NOT? <i>Henneuse Sofia and Marescaux Marianne</i>	Brussels IV
J12	IMPACT DES DIFFÉRENTS TYPES DE LUMIÈRES LED SUR LE COMPORTEMENT ET LA SURVIE DES <i>Drosophiles</i> <i>Rafaël Mattiussi, Giacomo Frosio Roncalli and Oscar Köppen</i>	Brussels IV
J13	THE EFFECT OF VISUAL STIMULI IN FOOD AND DRINK ADVERTISEMENTS <i>Anastasia-Maria Patatu</i>	The Hague
J14	THE PHYSICS BEHIND THE RECORDER <i>Léontine Summerer and Polina Apanas</i>	The Hague
J15	WHAT ARE THE BEST CONDITIONS FOR PRODUCING OIL USING MICRO-ORGANISMS (MICROALGAE) <i>Lukas George Bolangiou</i>	The Hague
J16	PRESSE BOUTEILLES ET CANETTES <i>Loïc Kosohryz and Quentin David</i>	Gaston Thorn
J17	RENDRE UN OBJET TRANSPARENT INVISIBLE <i>Josephine Binet-Ravel and Maria Victoria Escobar Barberi</i>	Gaston Thorn
J18	SENSORY MACHINE <i>Beatrice Ella Hill and Gabriella Waicman Goncalves</i>	Gaston Thorn
J19	QU'EST-CE AIDE LES PERSONNES À SE CONCENTRER ? <i>Hippolyte François et Rémi Crowley</i>	Gaston Thorn
J20	ANALYSING AIR POLLUTION USING A SELF-MADE SPECTROSCOPE <i>Izabela Źochowska,</i>	Frankfurt

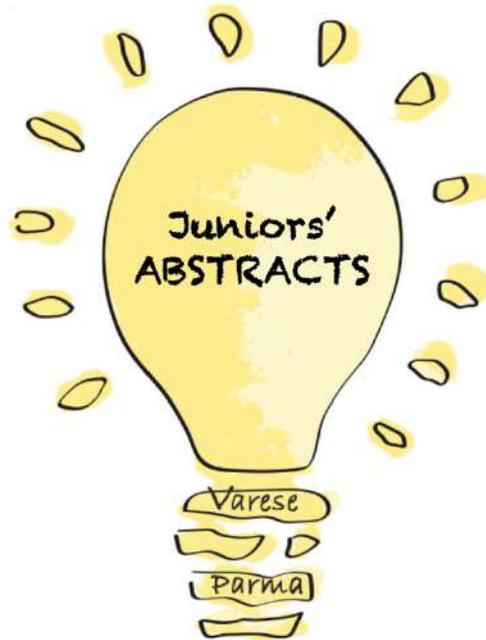
- J21** SMART YARD
Jakub Kranz, Linus Sauer and Laura Szendrey Frankfurt
- J22** COULD FUNGI REPLACE STYROFOAM?
Lauren Christensen and Rachel Christensen Frankfurt
- J23** WHICH APPLE SHALL SNOW WHITE CHOOSE?
Laura Vargas Aguiló, Isabella Renz and Florence Hieber Karlsruhe
- J24** LOCK DOWN & FRESH AIR:
IS THE AIR OF MY BEDROOM GOOD FOR ME?
Emilie Sniter-Revest and Clara Capy-Pietrzak Luxembourg I
- J25** DELEX
Margherita Cardini, Rebecca Kranjec and Giulia Viaggi Luxembourg II
- J26** ONE MOVE A LIGHT
Shamiran Di Brindisi and Philippine Collot Luxembourg II
- J27** LE BRACELET « MAGIQUE »
Ambre Tiepolo, Marwa Berrichi et Maher Berrichi Luxembourg II
- J28** CONSCIOUSLY HANDLING FOOD
Lize Belckx, Sara Nielsen and Caline Pribylla Mol
- J29** THE EFFECT OF PROPOLIS ON BACTERIA AND FUNGI
David Hateley and Leon Alink Munich
- J30** MÉTHODE MIRACLE
Paima Anahelle, Feuchio Camilla et Peracchi Serena Parma
- J31** LA FONTAINE COLOREE
Milo Falala Frati et Emil Dujardin Parma
- J32** FROM L-DAC AND S-DAC TO B-DAC
Sclep Jasper and Harrington Saisha Parma
- J33** USING DISEASE IDENTIFYING SOFTWARE TO PREVENT
DAMAGE IN FARMING

- | | | |
|------------|---|------------|
| | <i>Junkyu Park, Leo Schmitt and Levin Echtermeyer</i> | Rhein Main |
| J34 | DOES CULTURE EFFECT TASTE?
<i>Robin Baelen, Beljatski Nikita and Peksen Toran</i> | Tallinn |
| J35 | BODY DYSMORPHIC DISORDER RESEARCH
<i>Eva Liudvinavičiūtė and K. Elisabet Lindma</i> | Tallinn |
| J36 | THE EFFECT OF HOME-MADE FERTILISERS ON PLANT GROWTH: A SYSTEMATIC EVALUATION
<i>Sanna Ovaskainen,</i> | Varese |
| J37 | ENERGIESPAREN IM HAUSHALT: DER KUHLSCHRANK – TIEFKUHLSCHRANK
<i>Enea Rapisardi,</i> | Varese |
| J38 | TRASH MACHINE: HOW CAN WE ENCOURAGE PEOPLE TO RECYCLE PLASTIC?
<i>Francesco Fantoni, Philip Kotsev and Karolina Kucera</i> | Varese |

SENIORS' PROJECTS		SCHOOL
S1	BUTTERFLY PROJECT <i>Clara Gras, Evelina Vilkaitė and Lucía Pérez</i>	Alicante
S2	WHO TASTE THE BITTER? <i>Anaïs Marie, Camacho Rouiller and Máximo Mareque Fernández</i>	Alicante
S3	OMEGA DRONE <i>Ramón Gil Sato, Giulia Putin Francés and Manuel Putin Francés</i>	Alicante
S4	THE PERFECT HOUSE <i>Olga Czarnecka, Diana Tsonkova and Mireia Gras Olmos</i>	Alicante
S5	THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE IN THE NETHERLANDS <i>Aimée ten Have</i>	Bergen
S6	BANANAS WITH A 'K'. SYNTHETISING POTASSIUM FROM BANANAS <i>Helena Domańska</i>	Brussels I
S7	TECHNICAL ANALYSIS OF LNG GAS SUPPLY USING THE EXAMPLE OF GERMANY <i>George Eggers, Julius Goerres, Dimitris Tsitsopoulos, and Jonas Grigoleit</i>	Brussels III
S8	TO WHAT DEGREE DO ECO FRIENDLY ALTERNATIVES LIMIT WASTE AT OUR SCHOOL ? <i>Veronika Valisova, Natalia Vass and Lena Meunier</i>	Brussels III
S9	THE CHALLENGE OF CLIMATE CHANGE: A STUDY OF CROP GROWTH IN SOILS OF DIFFERENT HEAT CAPACITIES <i>Christos Soukos, Valeria Palumbo, and Valia Patri</i>	Brussels III

- S10** VOL CONTRÔLÉ D'UN AVION EN PAPIER
Barbier-Kerp Aaron, Chiovari Marc, Krieger Arthur, Meyssonier Jean and Védrine-Le Goff Elliot Brussels IV
- S11** RENEWABLE ENERGY
Yara Cojocariu, Lucia Putz and Katarina Wenig Brussels IV
- S12** ANALYSIS OF WATER QUALITY OF THE RHINE-MAIN AREA
Aglaia-Anastasia Karamani, Emilia Holmes Teixeira and Karolina Košak Frankfurt
- S13** WHEN IS RUNNING REALLY HEALTHY RUNNING .
HOW DOES MUSIC AFFECT PERFORMANCE AND STRESS?
Layla Brugger and Mila Stojanovic Karlsruhe
- S14** RED BULL TOXICITY STUDY
Arman Perrier and Isaia Petrucci Karlsruhe
- S15** CASE STUDY: URBAN MINING, PLATIN AUS KONTAKTLINSENBEHÄLTERN
Laura Palumbo Karlsruhe
- S16** ARTIFICIAL DATA GENERATION USING QUANTUM PHYSICS AND WAVE FUNCTION COLLAPSES
Kresemir Hyzyk Luxembourg I
- S17** VARIABLE THICKNESS AIRPLANE WING
Arturo Rull Nomen and Carlos Cortes Clausi Luxembourg I
- S18** INVESTIGATING THE EFFICIENCY AND SUSTAINABILITY OF THIN-FILM CIGS SOLAR CELLS
Dimitrescu Ana Maria and Trofilova Anastasia Luxembourg I
- S19** BATIMENT AUTO-SUFFISANT
Juliette Masson-Deblaize and Léa Neumeister Luxembourg II
- S20** THE AUTONOMOUS PEN
Ayaan Mekrani and Dries Caers Mol

- S21** DO ESSENTIAL OILS HAVE DISINFECTING PROPERTIES?
Hristina Strumelieva Mol
- S22** EQUALITY POINTS IN COOPERATIVE GAMES
Ogor Adrian Munich
- S23** HOW MUCH TIME DOES THE HUMANITY HAVE LEFT?
HELIUM- ACT WHILE THE CLOCK TICKS
Marta Kotarba and Shineyu Chandra Rhein Main
- S24** FACTORS THAT AFFECT OUR MEMORY
Abrahamova Julie, Coll Perez Nahia and Yaroshevskaya Yelizavieta Strasbourg
- S25** PROFIL DU MEILLEUR PROF
Margarita Ramazanova Ela et Lucilla Manciocchi Strasbourg
- S26** DATA ANALYSIS
Niklas Ilmari Tikka and Sulo Pietari Hintsala Tallinn
- S27** RELIEVING PAIN WITH MUSIC
Elmi Ahonen Tallinn
- S28** HOW VIABLE IS ELECTROMAGNETISM AS A LAUNCHING SYSTEM?
Marija Bogucarska, Santiago Colón-Zolikoff and James Hayman Varese



CAN DRONES SUPPORT BEES' POLLINATION? COMPARATIVE STUDY BETWEEN DIFFERENT WAYS OF ARTIFICIAL POLLINATION

Harriet James and Ioana Nicorescu

European School Bergen

S3EN



About 90% of wild plants and 75% of crops rely on pollination. In the absence of pollinators, practically every living organism would eventually disappear. In the past few years, bees have been under huge stress not only due to climate change but also due to intensification of agricultural practices, such as the use of heavy machinery and pesticides. A recent study shows that there has been a 12.8% decrease in the number of bees in Europe from 1990 until 2020. Therefore, we would like to find a temporary solution to the bee problem. Hopefully, this experiment will supply a way to pollinate flowers using drones that cannot be harmed by pesticides. These pollination methods may even be faster and more efficient. Of course, this is not intended to become a permanent solution, however, it could be a solution until the bees have had a chance to recover and increase in numbers.

In this experiment, three methods will be tested. The first method uses brushes attached via tail-like structures to brush over the flower, leaving some of the pollen behind. The second method will use sugary bubbles to pollinate flowers; when in contact with a flower, they will pop and deposit the pollen. The third method involves spraying a solution of sucrose, boric acid, water, and pollen into the air, which then falls on the plants/crops like rain and pollinates them.

This experiment aims to improve and even find alternatives for pollination in the absence of bees. These methods all have advantages and disadvantages that will be evaluated during this study. In order to find the most efficient way of artificial pollination, the accuracy of pollination will be evaluated, taking into account different aspects such as the flower type, the humidity in the air and the time needed.



THE TEM PEN: AN ECOLOGICAL PEN

Titouan Jacolin, Emilie Thomas and Maéva Lecaillet

European School Bergen

S3F



We named it the TEM pen as an acronym of our names (Titouan, Emilie, and Maéva).

Our project came from the idea that pens and pencils used every day are not eco-friendly and not biodegradable nor recyclable (1,6 billion pens are thrown out annually in the U.S.¹ and 82,000 trees are cut down annually for pencils²).

We considered a more ecological way of writing instead of resorting to electronics since the blue light³ from screens is bad for your eyesight and using electricity is not such an eco-friendly solution⁴.

Using eco-friendly and recyclable inks like coffee, beetroot juice for instance seemed the best available and feasible option. So far, we have already tried out several such substances and our results are promising as can be seen in the photo below.



Most of our inks gave nice results but seemed to lack some concentration. Moving forward, we need a wider range of colors and a better user-friendly pen in order to have a real eco-friendly solution.

References:

1. <https://www.conserve-energy-future.com/are-pens-recyclable.php>
2. <https://earth911.com/home-garden/infographic-sustainable-pens->
3. <https://preventblindness.org/blue-light-and-your-eyes/#:~:text=Digital%20eyestrain%3A%20Blue%20light%20from,irritated%20eyes%20and%20difficulty%20focusing.>
4. <https://www.eia.gov/energyexplained/electricity/electricity-and-the-environment.php#:~:text=Although%20electricity%20is%20a%20clean,have%20larger%20effects%20than%20others.>

DOES THE POPULATION OF A TOWN AFFECT THE AMOUNT OF RUBBISH ON THE GROUND? A ROBOT IS GOING TO GIVE US THE ANSWER.



Stanley Johnson, Danyal Akhtar and Alex Vandor

European School Bergen

S3EN

Our objective for this project is to quantify and analyse the amount of rubbish left on the ground in various streets of different municipalities with the help of our designed robot. This research will help determine whether the amount of trash in an area is impacted by population size, activity level, or the effort taken for waste management.

Our experiment could help keep the town cleaner by identifying areas that need to be prioritised for cleaning and suggesting new policies.

Method:

The robot consists of a microcontroller board **Arduino Uno**, a **distance sensor**, multiple motor shields, **motors**, manipulators, motor drivers, and **waste containers**. The distance sensor will help the robot navigate and detect walls or obstacles and avoid big objects that are in its way.

Our designed robot can significantly improve the efficiency and effectiveness of waste management operations, reducing the need for manual labour and increasing the speed and accuracy of trash collection.

Busiest: Heerweg 1871 EJ Schoorl:



Variables and the experimental design

- **Independent:** Street traffic level.
- **Dependent:** Amount of rubbish collected by the robot in fifteen minutes.
- **Controlled:** Robot, collecting time, time of the day, day of the week.

We will execute the experimental design in **3 different** municipalities, **Schoorl, Bergen and Alkmaar**. Schoorl is an example of a **quiet, small village** with a population of approximately 4,700. Bergen

is an example of a **fairly busy** town with an estimated population of approximately 30,000. Lastly, Alkmaar is **the busiest** town, with an approximate population of 110,000 (1).

We shall find three roads in each municipality: **quiet, fairly busy, and busy**. The robot will collect as much rubbish as possible on every road within 15 minutes. To ensure accuracy, we will repeat this procedure three times. Data will be represented and statistically analysed to compare all test groups.

(1) Duidelijke informatie in cijfers en grafieken. <https://www.allcijfers.nl/>

SLEEP, BUT WHY?

Bajnóczi Boglár and Hauk-Botykai Júlia

European School Brussels I

S4 HUA S4 HUB



Our goal was to find out more about the importance of sleep, the sleeping habits of secondary students in our school, raise awareness to all and help students improve their sleep schedules. We observed how much students sleep and how much they need to sleep. Students' quality of sleep, and what they can do to achieve good, quality sleep, and how their sleep affects their everyday life.

For our project, we have not observed each student individually, instead we have sent out a survey with questions about their sleep habits. We relied on the answers given by the students to make statistics and compare them to our hypothesis, and scientific research (external sources).

Hypothesis:

1. Students who don't sleep enough find it harder to concentrate.
2. Students who use devices that release blue light find it harder to fall asleep, stay asleep and have a worse quality of sleep.
3. Students' sleep schedules change on weekends.

Research:

Survey conducted in our school (via Forms). The survey reached 219 students, mostly between the ages of 14–17 years old.

Study research done on existing scientific studies (books, talks, presentations).

Conclusion:

In our hypothesis our 1st statement was proven right by the students.

Our 2nd statement was proven false by the students, but it is scientifically proven that devices releasing blue light have a negative effect on our sleep. It might be because students don't recognise the effect of these devices on their sleep, or maybe our method was not the best way to prove this statement.

Our 3rd statement was also proven right by the students.

We have learnt a lot about sleep during this project, and managed to reach many students during our presentation, and we hope to reach many more.



AERODYNAMICS – WIND TUNNEL

Luka Kobe and Dimitrij Doktorič

European School Brussels I

S4ENB and S4FRB

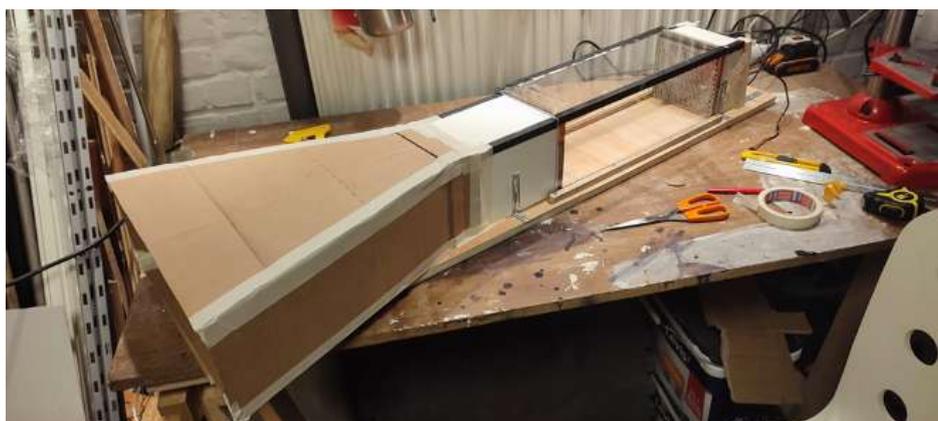


Our project is about aerodynamics and building a miniaturized wind tunnel for testing the aerodynamics of different objects. We chose this topic because from a young age both of us were fascinated by cars and how they were able to go so fast. One of the most important factors to going fast is aerodynamics. Car manufacturers use wind tunnels to test their car's aerodynamics, and we built one, in a small form factor.

We were inspired by a video on YouTube about a truck made by the U.S. Energy Department, trying to make a more energy efficient truck. In this video they used the largest wind tunnel in the world. After, we looked at some other homemade wind tunnels and decided that it was a good topic for a science project.

Another reason we chose this is because aerodynamics are important even in our daily lives. When we drive a car, on a flight or on public transport, all of these vehicles have taken aerodynamics into heavy consideration when designing. Even tall skyscrapers or buildings have to be very careful when designing, so that wind will not affect the building as much.

We made the wind tunnel from mostly repurposed materials we already had at home. The main purpose of this wind tunnel is to visualize the airflow around an object using a stream of smoke. It can also be modified to measure lift, downforce or drag.



VERBALIZATION OF SCIENCE – MAGAZINE AND ONLINE QUIZ

Eliza Slavova, Etain O'Mahony and Maja Limantaitė

European School Brussels I

S1ENA S1ENB



We have chosen to enter our project in the Verbalization of Science category at the Science Festival. For a lot of people, science is difficult to understand, and we want to make it easier by explaining different topics in a fun way to help children become interested in science.



Our project has two parts, one is a magazine, and the other is an online quiz. The magazine will have an originally designed cover, a fun facts page and comic strips. The comic strips will be the main idea of our effort to explanation, and a comic illustrating it.

The quiz will be simple and is available to students if they scan a QR code that will be put up around the school. We hope to get both younger and older children interested in science through our project.

We propose to the school to follow our idea with the magazine and the quiz and release at least one every year. We think it is a good idea for the children to contribute to the magazine with their own science comics.

BIOHEAT

Castellarin Fabio Thomas

European School Brussels II

S4FRB



Introduction : Ce projet a été élaboré à partir de l'hypothèse suivante :« Peut-on chauffer notre maison en recyclant et en réduisant le gaz et l'électricité ?». J'ai donc cherché un moyen innovatif de réchauffer la maison de manière écologique, en utilisant ce que chaque humain peut produire: un compost !

Matériel utilisé :

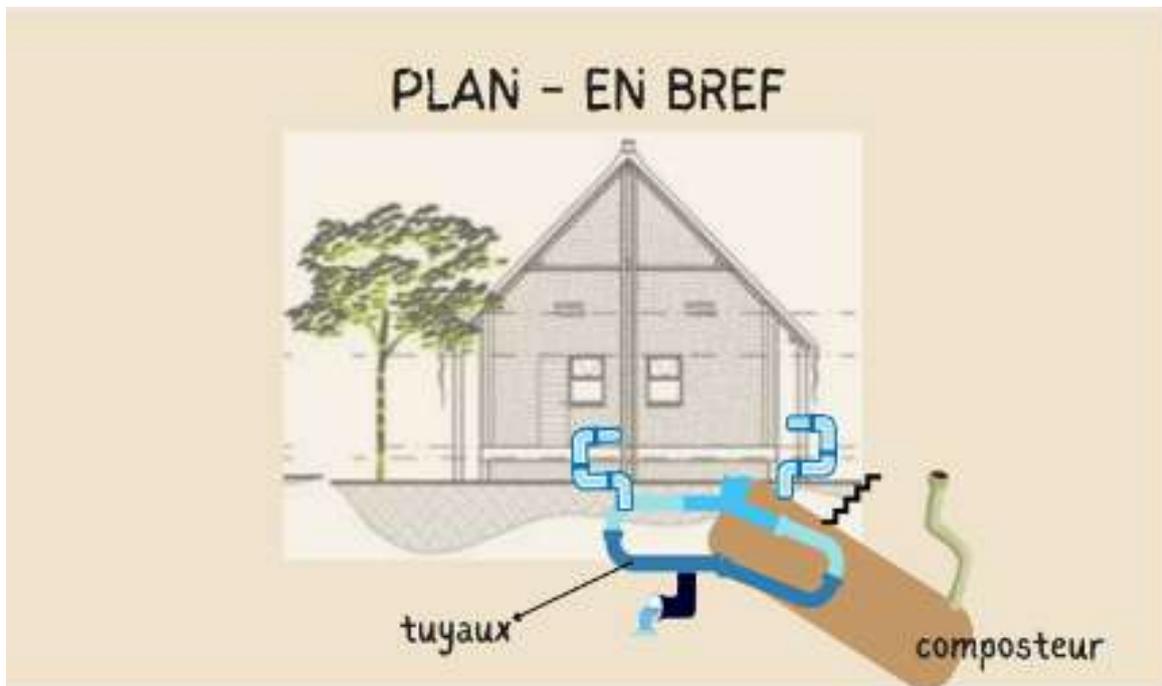
- Un Tupperware contenant des déchets organiques alimentaires
- De l'isolant pour stabiliser la température
- Un thermomètre pour avoir des relevés journaliers



Méthode : Pour stabiliser la température, j'ai placé dans la cave un Tupperware rempli de déchets organiques et isolé le tout avec un matériau isolant. J'ai ensuite fait un petit trou dans l'isolant pour pouvoir y placer le thermomètre. Pendant deux semaines, j'ai relevé la température et encodé les données sur Excel. Enfin, j'ai fait des recherches pour trouver des projets similaires et j'ai interviewé deux architectes pour savoir si mon projet était réalisable au niveau architectural-urbanistique.

Résultats : D'après les données (du 25/10/22 au 09/11/22), la température à l'intérieur du Tupperware avait une moyenne de 19.9 °C avec un pic de 22.9 °C. Pour des résultats plus significatifs, il faudrait refaire l'expérience pendant les autres saisons et utiliser un composteur de plus grande taille, placé dans le sol, car d'après mes recherches, la température d'un composteur industriel de plusieurs tonnes peut atteindre les 80°C ! Les architectes m'ont aussi confirmé que ce projet est tout à fait réalisable à plus grande échelle.

Conclusion : Le projet est réalisable en utilisant un grand composteur qui pourrait contenir plusieurs tonnes et plusieurs tuyaux (d'évacuation, d'eau...) dans les fondations d'une maison. L'eau serait réchauffée par la chaleur du composteur et emmenée vers la maison. Ceci créerait un système écologique de chauffage au sol.



PLANT SURVIVAL WITH DIFFERENT FLUIDS

Eva Jankūnas and Rūtilė Senkutė

European School Brussels II
S2LTA



Flowers are a common gift for any of life's special occasions and even the moments in between. Then flowers are received; most people want to enjoy them for as long as possible. There are guidelines and little-known tips that help ensure the flowers' longevity. Such examples are cutting the stems, preventing pruning by removing any leaves below the water line or adding flower food, which contains bleach, sugar and acid.

Our experiment goal was to test out different fluids and see if they keep the flower from dying longer than in regular water.

Method

We did a couple of experiments and in the first one the flower that was used was a "Gerbera daisy" (the fluids are mentioned below). The first thing we did was cut the flowers to an even height. Then, the liquids were measured, poured into the cups, and added to the flowers. We put the flowers in the same place to get the same amount of sunlight. We checked how they were doing every day at 8 p.m.



For the 2nd, 3rd, and 4th experiments, we mixed 50 ml of the fluids with 100 ml of water. After that, we prepared the flowers by cutting 2–3 cm of their ends. Then, we put the flowers into their corresponding liquids.

The 5th experiment was made differently: tulip bulbs were placed into some vases with the liquids and rocks. The rocks are supposed to make the tulip bulbs not fully touch the water. We checked them every day at 5 p.m.

Results (starting from left)



Sugar free coca-cola, Kombucha, Schweppes, Coca-cola, Water (sugar solution was removed)



Sugar solution, Bleach, Kombucha, Energy drink, Pepsi, Plant freshener, Water (control sample).

Conclusions

Energy drink was the best fluid for most of the flowers. We have come to a conclusion, that sugar, energy, and water are the most important things for a flower.

TRANSDERMAL DRUG DELIVERY PATCH

Marina Cioponea and Jan Kokalj

European School Brussels II

S4ENA, EEB2



Everybody needs a daily dose of vitamins to be healthy and have a strong immune system. Every day, 4.8 billion people take medicine and vitamins. A quarter of that number is composed of the elderly (from 65 onwards) and children (15 and under).

Both the elderly and children have difficulties to swallow pills because of the size and bad taste.

Due to the difficulty of swallowing these pills, 16.3 million people misuse their vitamins. Now the question is how to solve that?

During our project, we talked to doctors and experts, and learnt that vitamins are better absorbed through the skin (trans dermally). We wanted to take this form of administering medication and make it more accessible.

Transdermal patches exist already but can only be used with certain medication and under prescription.



Our idea is a patch; a bandage that you stick on your skin.

The patch is made of three main layers:

1. A hydrophobic⁵ exterior with a small hole (radius=0.5mm)
2. A hydrophilic⁶ interior
3. An adhesive bottom layer

A droplet of the desired amount of vitamin is placed with a pipette in the small hole. The liquid then spreads through the hydrophilic interior and then enters the skin trans dermally.

The patch will facilitate the intake of vitamins for children and elderly. In the future other types of medication can be administered in a similar way using this patch.

⁵ Hydro = water, phobic = fear, materials that cannot absorb water

⁶ Hydro = water, philic = love, materials that absorb water

Figure 1: https://cathe.com/wp-content/uploads/2019/09/shutterstock_1458730910.jpg

AIR QUALITY AND HEALTH IN EEB3

Eilidh Bordes, Emma Dunphy Leonie Goodchild

European School Brussels III

S1ENa S4ENa



Why do people have migraines? What are the effects they have on students' everyday lives? Could air quality provoke these severe headaches? After having asked ourselves these questions and finding no clear answer online, we decided to carry out our own survey to find out more about this topic.

In this project, we survey EEB3 students about their experience with migraines. We aim to discover the main causes for migraines as well as learn their effects on students' lives. More specifically, we want to find out whether factors such as sleep, noise, stress, exercise, nutrition, screens, and luminosity trigger migraines among students. One potential factor we wish to investigate more thoroughly is the air we breathe. After the COVID-19 lockdown, we became much more aware of the surrounding air quality due to the installation of sensors in our school buildings. To study the possible link between indoor air pollution and migraines, we first need to measure and evaluate the situation in school, which we will do using CO₂, PM_{2.5} and PM₁₀ sensors located around the campus.

Not only will we use these measuring devices, but we will also measure the air quality in different places using Vaseline slides to provide a more visual result. We will make these by spreading Vaseline (petroleum jelly) on a slide and drawing out a square with a dotted line down the middle. Next, we will spread Vaseline all over the square and cover one section with plastic film. This is our negative control, which shows what our experiment would look like if the air was perfectly clear. We will then leave them to gather particles and dust in the different places.

After leaving the samples for 4 days, we will observe and compare them using a microscope.

By doing this project, we hope to learn more about both migraines and air quality at school. Only once we know the data can we improve the situation in school, and thereby our health.

Vaseline plate:



TARDIGRADES, ASTRONAUTS OR NOT?

Henneuse Sofia and Marescaux Marianne

École Européenne de Bruxelles IV

S2



Our research is about studying how tardigrades survive in space. We will simulate space conditions to observe if tardigrades can survive in extreme conditions. Tardigrades are collected from different areas, combined, and then split into two groups: active tardigrades and tardigrades in anhydrobiosis (dried-out state). We will induce the anhydrobiosis state. First, we will expose the tardigrades to a two-week cold period at -18.0°C , followed by a one-hour heating period at 82.7°C . This will cause a thermal shock. Then, we will expose the tardigrades to radiation for 20 minutes. Both groups are subjected to the same conditions. After each experiment the tardigrades that were in anhydrobiosis are re-hydrated. All the experiments are done on the same tardigrades so we will be able to study the cumulative effect of extreme conditions on the tardigrade survival rate. We will use optical light microscopy to observe the samples (actives and those who were in anhydrobiosis but re-hydrated), count how many tardigrades survived in each sample and observe their behaviour compared to before the exposure to extreme conditions. The percentage of surviving tardigrades over the initial number of tardigrades will give an indication of the survival rate.

Figure 1 Active tardigrade found in the public par Cinquantenaire, Brussels



Resources:

1. Neves, R.C., Hvidepil, L.K.B., Sørensen-Hygun, T.L. et al. 2020. *Thermotolerance experiments on active and desiccated states of Ramazzottius varieornatus emphasize that tardigrades are sensitive to high temperatures*. SCl rep. 10, 94 (accessed October 2022)
2. Soemme, LAURITZ. "Anhydrobiosis and cold tolerance in tardigrades." *European Journal of Entomology* 93 (1996): 349–358. (accessed October 2022)
3. Jönsson Kl. Radiation Tolerance in Tardigrades: Current Knowledge and Potential Applications in Medicine. *Cancers* (Basel). 2019 Sep 9;11(9):1333. Doi: 10.3390/cancers11091333. PMID: 31505739; PMCID: PMC6770827. (accessed October 2022)
4. Altiero T, Guidetti R, Caselli V, Cesari M, Rebecchi L (2011) Ultraviolet-B radiation tolerance in hydrated and desiccated eutardigrades. *J Zool Syst Evol Res* 49:104–110 (accessed 8 January 2023)
5. The European Space Agency, "Space Bears: Lab-experience with Tardigrades | Teach with space B10", (accessed 8 January 2023)

IMPACT DES DIFFÉRENTS TYPES DE LUMIÈRES LED SUR LE COMPORTEMENT ET LA SURVIE DES *Drosophiles*

Rafaël Mattiussi, Giacomo Frosio Roncalli and Oscar Köppen

École Européenne de Bruxelles Iv

S3ENC,



Facteur choisi : Colonie des drosophiles sous différentes lumières couleurs (LED)

Introduction :

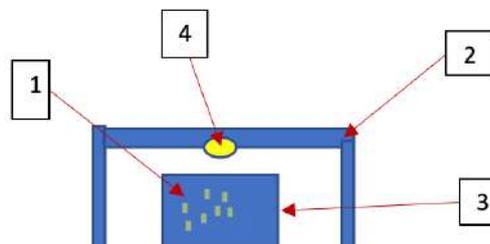
Le but de notre projet d'étudier l'effet de lampes LED (permettant des économies d'énergie) en lien aux lumières de nos villes (enseignes lumineuses et lampadaires).

Mode opératoire :

Pour faire cela, nous allons utiliser des boîtes (de 23 x 15,5 x 16,5 cm) dans lesquelles nous allons élever des drosophiles dans des boîtes avec contrôle de l'éclairage nocturne.

Dans chaque boîte qui contiendra les drosophiles nous disposerons donc des LED de couleurs différentes sauf dans la boîte témoin en guise de contrôle qui sera laissée avec la lumière naturelle.

1. Les drosophiles 2. Boîte en carton 3. Boîte (drosophiles) 4. Lampe LED



Ici 7 ci eux photographiés le 25 septembre 2022 entre 22h et 22h30 dans l'ordre suivant : Manchester, Bergame, Kyoto, Berlin, Naples, village près de Berlin et Paris. Comme vous le voyez sur ces photos, la pollution lumineuse touche tout le monde et il faut agir vite (images prodiguées par nos soins).



Notre objectif : Nous souhaitons donc étudier l'impact de la pollution lumineuse par les ampoules LED sur les insectes des écosystèmes urbains.

THE EFFECT OF VISUAL STIMULI IN FOOD AND DRINK ADVERTISEMENTS

Anastasia-Maria Patatu

European School the Hague

S3ENC



Scientific Concept:

Visual stimuli play a key role in an advert, a role that can influence one's decisions towards buying a product. The colors of a product packaging can have huge effects on the way people react towards it – colors are associated with certain emotions that generate a positive or negative feeling towards the product, which can lead the consumer to either buy or not buy the product. Color is not the only factor that makes you want to buy a product, though – the shape is an important factor, too. A package's shape differentiates itself from the other products on the shelf and stands out, sometimes having an odd shape that makes us remember it. How do colors and shapes influence our feelings and decisions toward a product? This is what I plan to further investigate and find out.

What will I be learning about?

I will be learning about the impact of visual stimuli on our decisions, and how visual effects like colors and shapes are strategically used in advertisements.

Research Question:

How do visual stimuli like colors and shapes influence the choice of a food or drink to a consumer?

Hypotheses:

H1: The package color will have a significant impact on the consumer's decision to buy a product.

H2: The shape of the product will have an influence on the consumer's decision in buying a product.

Materials:

- Various food and drink containers in different colors and shapes

Procedure:

To examine my hypotheses, I will present different food and drink products to teenagers, and they will need to answer some questions about their choices in a questionnaire.

For examining the effect of the color of the product packaging, I'll use food and drink containers in different colors which will be presented to the teenagers, and they will be asked to answer different questions on why they chose a specific product.

To examine the effect of the color of the product packaging, I'll use different shaped food and drink containers which will be presented to the students, and they will be asked to answer different questions on why they chose a specific product.

THE PHYSICS BEHIND THE RECORDER

Léontine Summerer and Polina Apanas

European School the Hague

S3 ENa



Background knowledge:

From our music knowledge, we know that:

- a higher airflow increases the frequency, and if the airflow is too high, it produces the same note one octave higher;
- longer recorders produce lower frequencies (a tenor recorder produces two octaves lower frequencies than a soprano, but it is not two times larger; an alto recorder produces 1.5 octaves lower frequencies than a soprano);
- Opening the back hole of a recorder increases the frequency but not always by the same difference;
- For a specific recorder, grips producing higher notes (with more holes open) require a higher air flow than grips producing lower notes (e.g., with all holes closed). Every note has an ideal air flow, which a recorder player learns to do automatically.

Research Question:

We want to investigate how and why the size, airflow and grip affects the result of sound produced by a recorder.

Hypothesis:

Our hypothesis is that we can find with our measurements some formulas which explain the relation between the geometry, the airflow, and the sound.

Method:

We intend to research this by using three differently sized recorders, an air pump, an anemometer, a stopwatch, and a microphone connected to a computer.

To perform this experiment, we need to measure

- the lengths and diameters of the central holes through which the air passes in our recorders; the size of the labium and the size of the window, and the distances between the labium and the holes;
- the volume of air passing through the recorders in a certain amount of time; and
- how loud (the amplitude) and how high the tone (the frequency) of the sound produced by the recorder is.



WHAT ARE THE BEST CONDITIONS FOR PRODUCING OIL USING MICRO-ORGANISMS (MICROALGAE)

Lukas George Bolangiou

European School the Hague

S2EN

Introduction

In the 90s already, it has been discovered that micro-organisms, such as microalgae, can produce microbial oil and made into biodiesel. This will avoid the extraction of fossil fuels that is detrimental to the Earth's environment. A well-controlled process to produce this biodiesel via micro-organisms has another advantage of being clean (no pollution) and it is unlimited since you can grow algae infinitely. However, you cannot do that with fossil fuels. Examples of this type of micro algae which can be used are the *Spirulina maxima*, *Chlorella zofingiensis*, *Microcystis aeruginosa*, etc.

Goal

The aim of this project is to test out the different conditions of growing the algae, such as nutrients, pH, temperature, luminosity, oxygenation, etc. This is in order to obtain the best conditions for growth under which the algae are the most productive in amount of oil.

Research Question

The question this lab is trying to answer is what the best condition is to grow microalgae and produce the most biofuel using said microalgae.

Hypothesis

My prediction is that the algae strains that receive sufficient light, good amount of oxygenation and adequate nutrients will do better than the algae strains which receive only one or two of these or none at all.

Materials

- 1) Algae that produce biofuel
- 2) Multiple glass flasks (For a controlled growing environment/each flask should be able to receive variable amount of light)
- 3) Agitators (Magnetic Stirrer/for oxygenation)
- 4) Incubator (To control temperature)
- 5) Growth Media (Ingredients)
- 6) pH meter (to measure acidity)
- 7) Alkaline or acid solution (to control pH)
- 8) Means to control light (Different lamps with different light intensities)
- 9) Means for oil extraction (centrifuge)
- 10) Means to measure the amount of cells (spectrophotometer)
- 11) Ingredients to open the membrane cell via osmotic stress (NaCl solution)

Procedure

In this lab you will put the same amount of algae in each of the flasks, each flask will have different amount of each growing condition. The algae must be left in their flasks for the same period of time. At different times samples should be taken from each flask, from each sample the amount of cells and the amount of oil produced should be measured. The conditions All these results should be presented on comparative graphics in order to determine the best conditions.

PRESSE BOUTEILLES ET CANETTES

Loïc Kosohryz and Quentin David

Ecole Int. Gaston Thorn

S1FR1



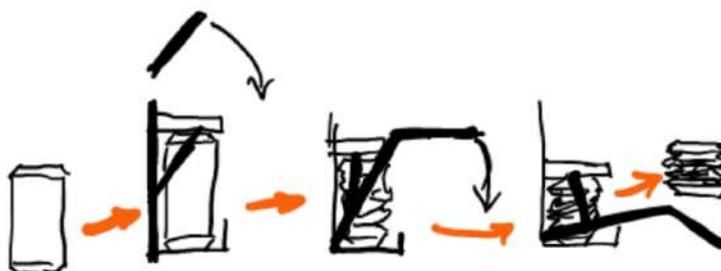
Objectif du projet : Créer et construire une presse pour compresser les canettes et les bouteilles en plastiques

Pourquoi ce projet ?

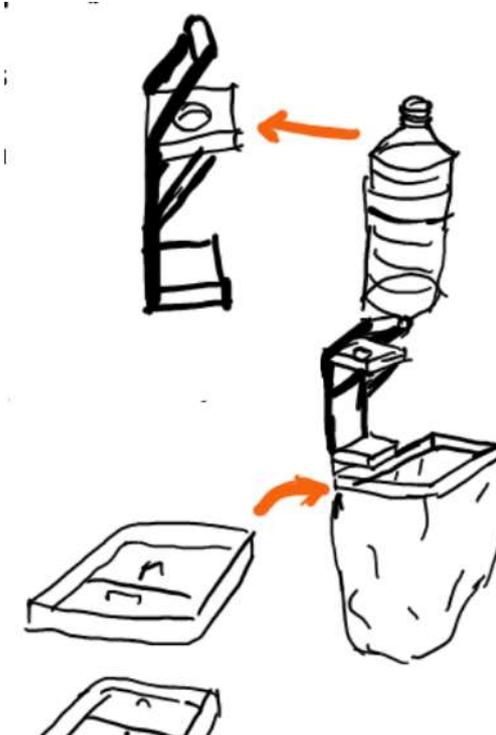
La presse servirait à compresser les bouteilles en plastique et les canettes pour prendre moins de place dans la poubelle. Nous aurions ainsi moins de volume de poubelle qu'avant pour la même consommation.

Protocole :

Pour compresser les canettes il faut tirer le levier vers le bas, ce qui fera descendre la plaque du dessus.



Pour compresser les bouteilles il faut enlever le bouchon et placer le goulot dans le trou dans la plaque du dessus et faire la même chose qu'avec les canettes.



Pour récolter les emballages compactés, on utilise un sac plastique fixé sur un support au dessous de la presse.

Le sac plastique est fermé par un couvercle coulissant (pour des questions d'odeur).

RENDRE UN OBJET TRANSPARENT INVISIBLE

Josephine Binet-Ravel and Maria Victoria Escobar Barberi

École Internationale Gaston Thorn

S2FR



Avec la réfraction de la lumière, un objet placé dans l'eau est comme brisé. Ceci est dû à une différence de vitesse de la lumière entre l'air et l'eau. En effet, la lumière étant ralentie lorsqu'elle passe de l'air à l'eau alors la lumière change de direction entre les 2 milieux, ce qui s'appelle **la réfraction**.



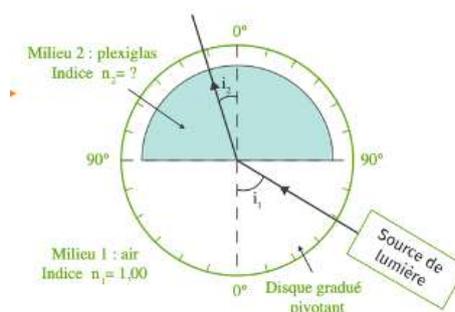
Ainsi notre idée serait de trouver un liquide qui fera que la réfraction n'aurait pas lieu, c'est-à-dire que la lumière continuerait sa ligne droite sans être déviée. Ainsi, l'objet placé dans le liquide apparaîtrait invisible.

Pour réaliser cette expérience, il faut une que l'objet soit **transparent**

En effet, si l'objet est opaque il va absorber et renvoyer la lumière, ce qui sera impossible de le rendre invisible.

Expériences que nous souhaiterions réaliser

- Nous partons sur le principe que la vitesse de la lumière dans l'air est égal à 300 000 km/s et dans l'eau à 225 000 km/s, ainsi le phénomène de réfraction est dû à la collision de l'air entre les deux milieux, alors, pour que la réfraction n'ai pas lieu il faudrait que la lumière ai la même vitesse dans les deux milieux.
- Afin de rendre un objet invisible par réfraction, il faut que celui-ci ait un indice de réfraction identique ou très similaire au milieu qui l'entoure. Si l'indice de réfraction du milieu entourant l'objet que l'on souhaite faire disparaître est le même que ce dernier, alors les rayons lumineux ne seront pas réfractés.
- Il faudra donc déterminer l'indice de réfraction de l'objet transparent par l'expérience suivante :
→
- Puis déterminer, l'indice de réfraction du liquide avec le réfractomètre
Puis tester les manipulations avec le liquide et l'objet transparent.



SENSORY MACHINE

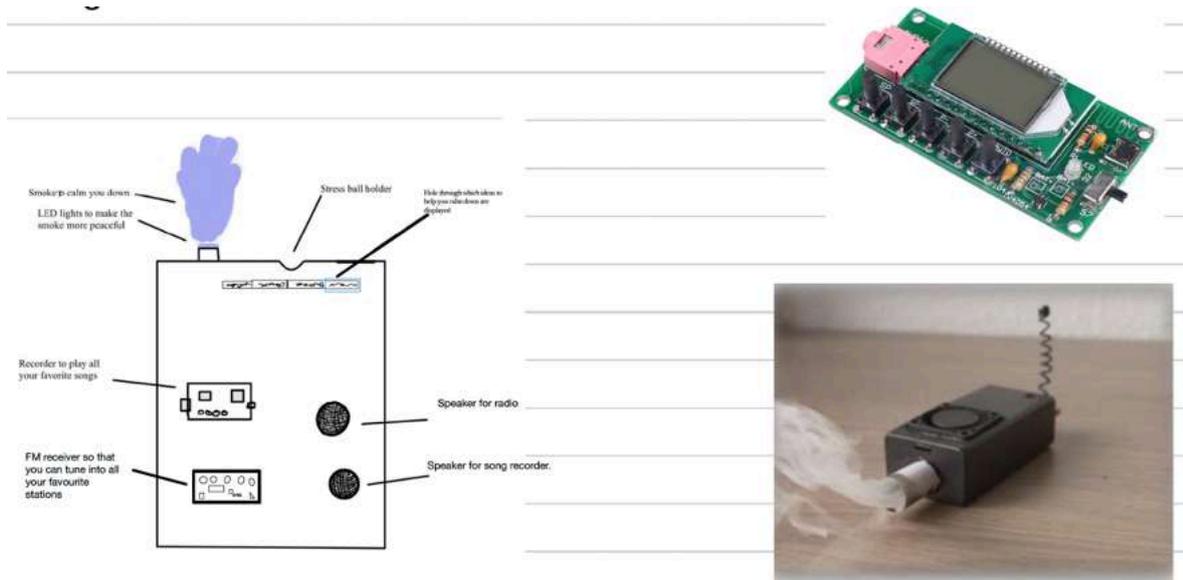
Beatrice Ella Hill and Gabriella Waicman Goncalves

École Internationale Gaston Thorn

S2EN



Have you ever felt stressed? Well, I'm pretty sure most people have and although the reasons for stress can vary, the feeling is often the same. So we looked at the things that help you relax. One of the first things we found was music. Music can help your brain recharge, clam down and just make your day better, that's why our machine will have a radio, song recorder, speaker and a headphone port. The next thing on our list was a steam machine to help your muscles relax and for the third function it will suggest idea of things that could help relieve stress like going for a walk or reading a book. Once we have built it we will trail the sensory machine on people when they rate feel stressed and record their stress level before and after using the machine.



QU'EST-CE AIDE LES PERSONNES À SE CONCENTRER ?

Hippolyte François et Rémi Crowley

École Internationale Gaston Thorn

S1FR1 S1FR2



Dans ce document, nous allons vous dire les étapes du projet : Alors d'abord on a créé un questionnaire qu'on va poser aux élèves et au profs a partir de ca on va:

1. Tout d'abord on a créé un questionnaire récapitulant ce qui pourrait les aider a les concentrer.
2. Ensuite, on va proposer ce questionnaire a différents élèves (de différentes section et différents ages)et a des adultes (d'autres écoles et enseignants)
3. Ensuite, on va mettre en pratique leurs réponses lors de tests réalisés en classe
4. Puis, nous analyserons les résultats récoltés sur les différentes personnes lors de tests
5. Enfin, nous pourrons conclure sur ce qui aide (balle anti-stress, chewing-gum, séance de relaxation...) ou non les personnes dans les tests.



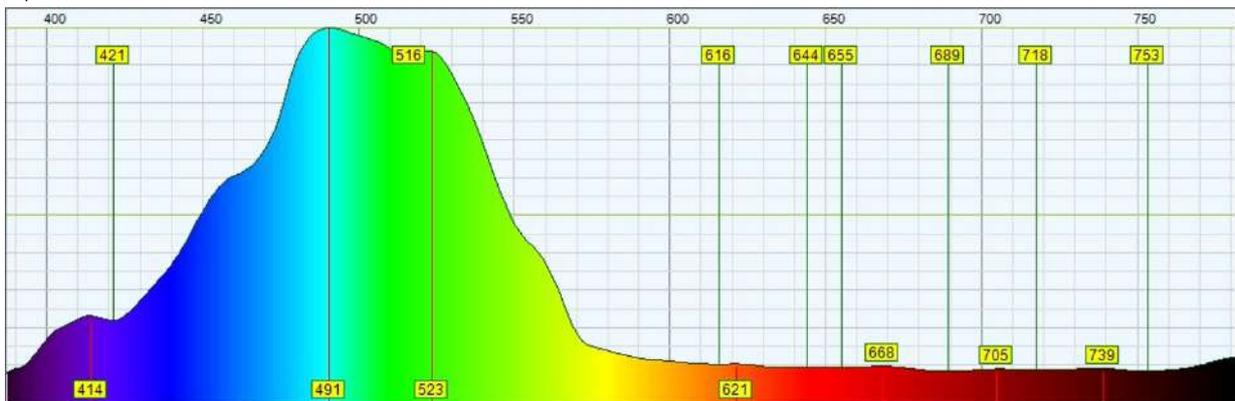
ANALYSING AIR POLLUTION USING A SELF-MADE SPECTROSCOPE

Izabela Źochowska,
 European School Frankfurt
 S3EnA

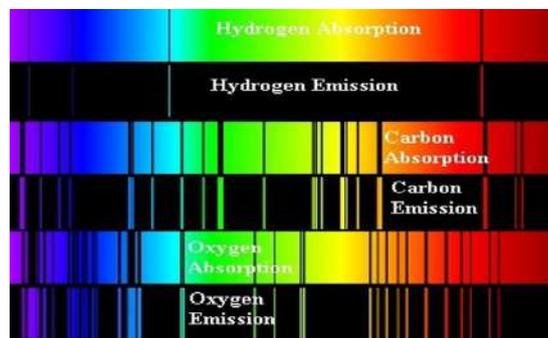
The aim of this project is to see if a self-made spectroscope can be used to analyse air pollution. In order to do this, I built a simple spectroscope and connected the webcam inside it to a laptop. Then, as a comparison, I took a picture of a light spectrum near a fireplace and one from a clear sky. I uploaded these pictures onto Theremino Spectrometer, a light analyser application. The light analyser translates the light spectrum into wave lengths, so I used this information to compare it to the emissions and absorption spectrums of Carbon and Oxygen to identify whether there are any patterns between the light spectrums.

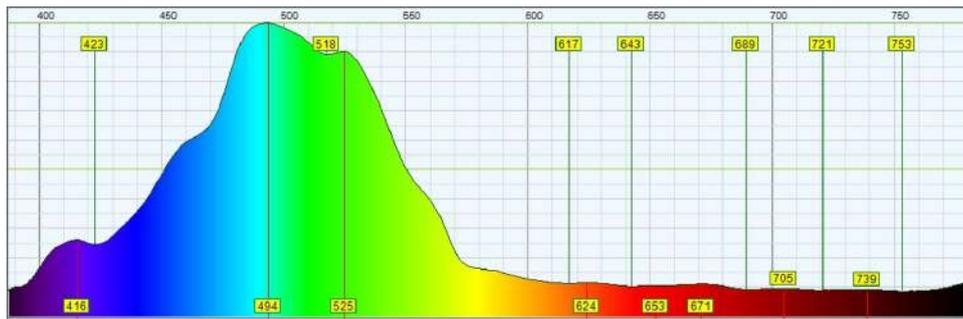
Here are the results of the two light spectrums:

Fireplace (smoke)



Clear Sky (no smoke)





On the 'Fireplace (smoke)' graph, one can see that the dips and peaks move to the left and the peaks are lower at the colours purple, yellow and green compared to the 'Clear sky (no smoke)' graph. By comparing the graphs to the carbon absorption spectrum, one sees that the reason for those higher peaks in the 'Fireplace (smoke)' graph might be due to the purple, yellow and green absorption by carbon.

Having proven that the spectroscope is sensitive enough to varying air conditions, I am visiting selected areas, differing in degree of air pollution, available on the Apple Weather application. Not only I am using this app to find areas where I can use my spectroscope, but also to compare my results and see whether they are accurate.

SMART YARD

Jakub Kranz, Linus Sauer and Laura Szendrey

European School Frankfurt

S4



The use of robots in our daily lives eases our tasks both at home and at work, making many mundane activities in our daily life safer, enjoyable, and more productive. Innovative application of robotic systems is a topic of research, and this project proposes an idea on how to make use of robotic automation such as a smart garage, a smart trash can, etc. in the front yard of a house. That way, whether you are parking your car or throwing away garbage, you reap the benefits of robotics.

The Smart Yard is a STEM Robotics project, meaning it integrates Science, Technology, Engineering and Mathematics to represent and solve real-life problems. Using microcontrollers like Arduino Mega and Esp32 programmed in C language, creating circuits with motors, sensors, and wireless communications, and making constructions and mechanisms with everyday materials, the idea of the Smart Yard becomes a reality.

The development of the project is made using the process of iteration, i.e., creating an initial prototype in Tinkercad, building the constructions – mechanisms to simulate the environment and implementing the Arduino circuits that controls those constructions. After that, the project was improved and polished until it becomes something remarkable.

The Smart Can is an automated trash can that opens automatically when it senses that someone is nearby. It is mounted on wheels and can come to you when you want it to. It is “smart” enough to detect when it is full and inform the user. The Smart Garage simulates a normal garage enhanced with many add-ons and useful upgrades. For example, it interacts automatically with the car, it can be controlled by placing a code on a keyboard or with a telecontrol and it can be operated from distance using your smart phone.



COULD FUNGI REPLACE STYROFOAM?

Lauren Christensen and Rachel Christensen

European School Frankfurt

S3EN



“By 2050, there will be 12 billion metric tons of plastic in landfills. That amount is 35,000 times as heavy as the Empire State Building.” (Laura Parker, 2022). Upon further reading of this article, one can also learn that out of 8.3 billion tons of plastic waste approximately 3/4 of it ends up in landfills, the ocean or it is roaming around poisoning our Earth. This *needs* to stop. We immediately tried to find a replacement ... and then we found a potential answer. *Mycelium*. Mycelium is a part of fungi that can make easily biodegradable Styrofoam, leather, etc. But is it worth making it? Can it replace some plastics?

We have decided to make safe biodegradable mycelium Styrofoam. To make this we used natural materials like cornhusks or woodchips. Then, we added mycelium spores or simply mycelium fungi. This is put into a mold, water is added, and it grows. Once we had our Styrofoam, we conducted tests with three diverse types of Styrofoam like materials: our homemade mycelium, store-bought mycelium and finally store-bought Styrofoam. We tested durability, if it is waterproof, weight, heat, strength, expense etc. Finally, we will see if fungi could completely replace Styrofoam.



References

- Laura Parker. 2022. National Geographic. [A Whopping 91 Percent of Plastic Isn't Recycled | National Geographic Society \(04/10/2022\)](#)

WHICH APPLE SHALL SNOW WHITE CHOOSE?

Laura Vargas Aguiló, Isabella Renz and Florence Hieber

European School Karlsruhe

S3E



In this experiment apples from various sources were examined regarding their shelf-life. Apples from organic farming in Germany were compared with apples treated with fungicides, pesticides, and herbicides from the US, as well as the mystery apples our canteen feeds us. The non-organic apples are from the US because the US allows their apples to be treated with more toxic chemicals than in Europe. The apples were stored under controlled conditions and temperature and humidity were recorded at the end of each week at a set time using a weather station. We tested the durability, weight loss, and decline in water content of the 3 groups. Furthermore, spoilage or rotting on the surface of the apples was examined visually and captured in photos.

LOCK DOWN & FRESH AIR: IS THE AIR OF MY BEDROOM GOOD FOR ME?

Emilie Sniter-Revest and Clara Capy-Pietrzak

European School Luxembourg I

S2FRC



COVID, lock down, telework: we are staying more and more time at home. With the high energy costs, we tend to lock ourselves up, turning down the ventilation and closing the windows to keep warm. What are the consequences on the air we are breathing?

Air pollution is invisible, odorless, and therefore often underestimated. Our exposure to home air pollution is increasing with our new habits. Our bedroom was already the place where we spent most of our lives, sleeping. Now it has also become a home office. What can we do to improve air quality in our bedrooms?

We have decided to turn our bedrooms into laboratories. We will measure the concentrations of Particulate Matter (PM), of formaldehyde and of other VOCs (Volatile Organic Compounds) and compare them with reference values considered safe for our health. We will test the effects of various methods to improve air quality: opening the window, depolluting plants and an air purifier. We will also look for sources of pollution in our homes and explore ways to reduce them.

Finally, we would like to define a protocol to optimise the ventilation of our flat and be able to build “the air quality adviser”. This device will integrate an Arduino platform connected to sensors measuring inside and outside the air quality and capable to recommend the best possible solutions to maintain a good air quality within our home.



DELEX

Margherita Cardini, Rebecca Kranjec and Giulia Viaggi

European School Luxembourg II

S4 ITA



Selon le sondage qu'on a lancé dans notre école au mois de septembre, le 80% des étudiants et des professeurs utilisent au moins 1 tipp-ex par an (liquide ou pas).

Le tipp-ex, dans ses deux formes (liquide et solide) est composé d'une enveloppe en plastique et d'un liquide qui est composé de substances chimiques qui s'avèrent être toxique ou dangereuse pour l'environnement.

En vue de trouver une alternative à cette forme de pollution on a eu l'idée de créer un tipp-ex écologique rechargeable, composé à partir d'ingrédients naturels.

Le tipp-ex parfait, selon nous, doit absolument avoir ces 3 caractéristiques :

- Il doit sécher vite
- Il ne doit pas laisser des traces sur le papier
- Il doit couvrir l'encre du stylo et être blanc

Après nombreuses recherches et la sélection de différents ingrédients, on les a mélangés jusqu'à obtenir le mélange parfait : DELEX.



ONE MOVE A LIGHT

Shamiran Di Brindisi and Philippine Collot

European School Luxembourg II

S4FRC



Nous projet vise à économiser de l'énergie lorsque les devantures de magasins sont éclairées la nuit. Notre idée consiste à créer un système de détecteur de mouvement qui permettra d'illuminer les vitrines seulement lorsque nous nous en rapprocherions et s'éteindront lorsque nous nous éloignerons. Cela nous permettra de limiter nos consommations d'électricité et d'utiliser seulement l'énergie nécessaire sans même nous en rendre compte.

Un système plus responsable pour récupérer l'énergie électrique (des éoliennes et des panneaux photovoltaïques) serait aussi installé afin d'économiser encore plus d'énergie.

Pour conclure, les enseignes auront la possibilité de produire leur énergie renouvelable, la stocker pour que leurs vitrines soient allumées la nuit à la demande du client et permettra :

- De réduire la pollution et protéger l'environnement
- D'attirer l'attention des clients aux vitrines
- De diminuer leur facture d'énergie



CONSCIOUSLY HANDLING FOOD

Lize Belckx, Sara Nielsen and Caline Pribylla

European School Mol

S3NLA,

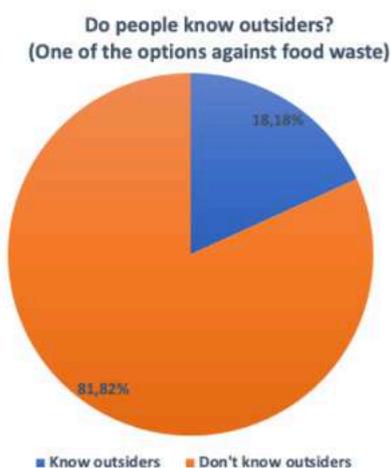


Our research question is: “Do people handle food consciously?” This question is important because food waste is a big problem nowadays. For that reason, we are going to investigate whether people can handle food or if there are other options. That’s why we have three categories; supermarkets’ behaviour; consumers behaviour and aquaponics.

For our first category supermarkets’ behaviour, we interviewed the managers of two supermarket companies: the Albert Heijn (originated in the Netherlands) and the Delhaize (originated in France). We found a big difference between these two, the Albert Heijn does a lot more against food waste than the Delhaize. We also found out that the Delhaize has a different system, namely they get their food from the main headquarters and the Albert Heijn gets their food from local farmers and bakeries. This gives the Albert Heijn the option to sell outsiders which is good against food waste. Our second category is consumers behaviour, for this category we did a survey with different consumers. Our results show that the people know the basic things to prevent food waste such as not throwing away food items when it isn’t necessary, reusing leftovers and so on. What they don’t know is there are creative and better solutions with less energy waste. Our final category is aquaponics, for this category we built two different aquaponics systems; one with fish and one without. Aquaponics is a system using fish faeces to make plants or in our case herbs grow. So far, we see that the one with fish grows better. Aquaponics is a very easy system to let plants grow with less food waste.

Our conclusion is that the world must educate people more about ways to fight food waste.

One of our results of the survey with the consumers



THE EFFECT OF PROPOLIS ON BACTERIA AND FUNGI

David Hateley and Leon Alink

European School Munich

S2DEC



Propolis is a resinous mixture produced by honeybees by mixing saliva and beeswax with exudates from trees and flowers. It has been used for centuries to treat respiratory infections in people. Our question to be answered is **how** does propolis affect bacteria, fungi and especially mould?

We came to this idea because when people have a cold, they often use propolis by spraying it in their throat or swallowing drops of it, in order to recover faster.

There are various propolis formulas available: hydro-alcoholic propolis solution, glycolic propolis solution, aqueous propolis solution and pure propolis.

For our experiments we tested propolis extracts on various bacterial and fungal cultures. Initial results suggest a bacteriostatic activity of hydro-alcoholic propolis solutions, as well as an inhibitory effect on mould growth.



MÉTHODE MIRACLE

Paima Anahelle, Feuchio Camilla et Peracchi Serena

Scuola per l'Europa di Parma

S3FR



Notre projet consiste à comprendre quelle méthode d'étude est la plus "fiable" entre les fiches de révision et l'audio/vidéo du cours pour étudier de la manière la plus efficace possible. Nous savons déjà depuis quelques temps que certaines personnes se concentrent plus sur la beauté des fiches de révision que sur leur contenu alors que d'autres préfèrent regarder des vidéos du cours sans comprendre ce qu'ils écoutent. Voilà pourquoi nous voulons faire ce test aux élèves de première et de deuxième qui ne savent peut-être pas encore quelle méthode d'étude ils préfèrent. Cela pourrait les aider à comprendre quelle méthode d'étude leur correspond le plus. Nous voudrions avant tout cibler notre public car nous pensons que l'efficacité d'une méthode peut varier suivant le genre et l'âge.

Dans un premier temps, nous voudrions connaître les habitudes des élèves et leurs façons de travailler. Pour cela, nous avons créé un test que nous avons soumis aux élèves (toutes les sections).

Ensuite, nous allons sélectionner 50 élèves (25 mémoire auditive et 25 mémoire visuelle car nous voudrions ensuite comparer les résultats des deux groupes). Nous leur proposerons une leçon de mathématiques et des exercices. Un groupe écoutera plusieurs fois le cours, l'autre étudiera avec les fiches de révision que nous leur donnerons.

Après ça, nous voudrions faire des statistiques pour pouvoir comparer les deux groupes et éventuellement dissocier suivant l'âge et le sexe. Ainsi nous pourrions peut-être en déduire une méthode infaillible pour apprendre et rendre la vie des élèves plus simple.

LA FONTAINE COLOREE

Milo Falala Frati et Emil Dujardin

Scuola per l'Europa di Parma

S2FR



Notre projet consiste à voir s'il est possible de faire une fontaine colorée avec le principe de la fibre optique. Le principe est simple : faire un trou dans une bouteille en plastique et à l'opposé du trou, mettre un laser qui serait assez puissant pour colorer l'eau. Le laser traverse l'eau grâce à réflexion totale interne. La lumière change de direction quand elle voyage à travers une matière transparente. La direction de la lumière dépend de sa vitesse et de la matière.

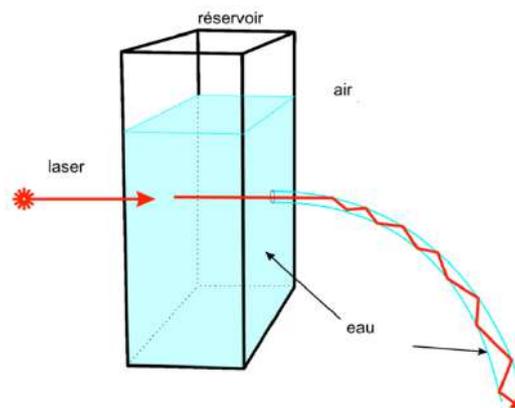


Schéma sur la réflexion totale

On a également imaginé le principe suivant, comme on ne dispose que d'une couleur de laser (rouge), on pense que peut-être en coloriant l'eau avec du colorant ou de la peinture, la couleur du jet d'eau sera celle du mélange du rouge et de la couleur de l'eau. On va faire nos expériences et on vous présentera notre progrès au Symposium.

FROM L-DAC AND S-DAC TO B-DAC

Sclep Jasper et Harrington Saisha

Scuola per l'Europa di Parma

S4FR



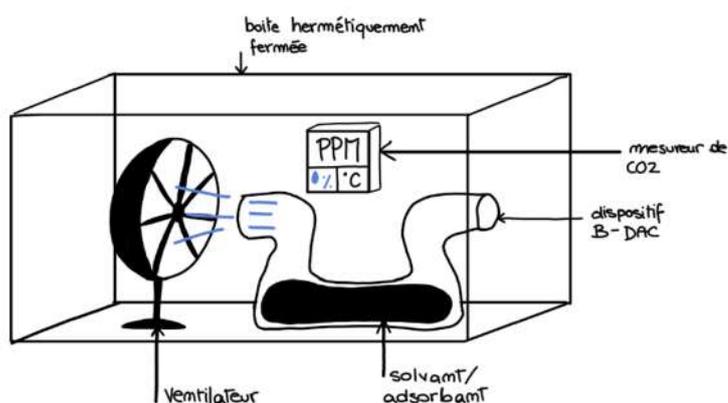
Nos émissions de CO₂ et d'autres gaz à effet de serre sont aberrantes et obscurcissent notre avenir. La situation empire chaque jour, on doit y remédier!

Pour diminuer le taux de CO₂ dans l'air, plusieurs solutions existent. Un nouveau processus captant directement le CO₂ de l'air est apparu: le DAC (Direct Air Capture)

Nous voudrions rendre le DAC accessible à tous, en l'intégrant à nos vélos (Bicycle DAC). Cette « Science participative » permettrait de capturer une grande quantité de CO₂ et de sensibiliser le grand public aux efforts à faire . On exploitera le vent généré par le mouvement du vélo pour ne pas utiliser d'électricité.

Deux types de DAC cohabitent: le L-DAC, à base de solvant liquide, et le S-DAC, filtre rempli de matériau adsorbant solide. Nous avons choisi d'expérimenter les adsorbants à base de zéolites 13X, et les absorbants Na₂CO₃ et NaOH pour leurs efficacité et accessibilité.

Nous voudrions comparer les deux types entre eux en réalisant deux dispositifs : avec un filtre L-DAC et un filtre S-DAC. Pour faire nos essais de faisabilité en vue du prototype sur le vélo (nos principaux tests), on a pensé à la configuration suivante. Le ventilateur simule le vent théorique sur le vélo. On utilisera des sortes de chiffons éponge dans un tube plastique pour contenir les solvants.



On mesurera la différence de CO₂ dans la boîte avant et après avoir fait marcher le ventilateur. Pour valider ces mesures, on essaiera de mesurer également par titrage pour les solvants et par adsorption à pression modulée pour les zéolites, ne pouvant pas réaliser les mesures embarquées sur la bicyclette.

On a hâte de vous présenter nos résultats en mars en espérant avoir capté un peu de CO₂ d'ici là ;).

USING DISEASE IDENTIFYING SOFTWARE TO PREVENT DAMAGE IN FARMING

Junkyu Park, Leo Schmitt and Levin Echtermeyer

Europäische Schule Rhein Main

S3ENA



A great fraction of global crop production is lost annually by diseases. With the correct technology, the number of damaged crops around the world could be decreased. Our project aims to collaborate through using a mobile application that is designed to help solving the problem of diseases invading and harming agricultural land. Our app offers simple and easy-to-access ways for users to be able to correctly identify certain diseases affecting their plants.

The idea for this app originated from the “Tiny Forest,” which is a project our school has started in which trees are planted inside of the school yard to help keep our environment clean and healthy. We have identified certain diseases that are harming our environment here at the “Tiny Forest” and have implemented them into the database of our app. Our app grants the users with the ability to take pictures of the diseases that are affecting their plants. After the picture has been taken, the app informs the users about the methods of getting rid of the specific disease.

Our app uses machine learning technology and image recognition software to identify the diseases proposing a solution to ensure the health of the species we want to grow. We started with an initial data base that we improved with our own data and we trained an image recognition model to detect with a decent confidence the main diseases we may have to face . All the code is built using MIT App Inventor.

Although the software is designed for our local environment, the Tiny Forest, it can be adapted to other species and environments.



Figure 1.-Segment of the App's code

DOES CULTURE EFFECT TASTE?

Robin Baelen, Beljatski Nikita and Peksen Toran

Tallinn European School

S4B



The purpose of our project is to find out what is taste, and research on how smell and genetics affect our taste. We started of our journey by researching on what are the 5 types of tastes; how taste functions; how genetics affect our taste and how smell affects our taste. Then, we plan to have an experiment investigating how smell affects taste. The method of the experiment was to have 20 participants which would be divided into two groups, one group could smell, yet the other group could not smell, but both groups would have their eyes closed. We would put food in their mouths and the participants should try to figure out what food they have in their mouth and tell us how intense was the taste (e.g. sweetness), how hard was it to recognise it, and how did they recognise the food, was it by texture or taste? Our hypothesis states that it will be harder to recognise the food and they will recognise the food more likely by texture as the sense of taste is not as sharp/sensitive for group B (the ones that cannot smell), but it will be easier to recognise the food for group A because they will most likely recognise by smell and taste.

BODY DYSMORPHIC DISORDER RESEARCH

Eva Liudvinavičiūtė and K. Elisabet Lindma

Tallinn European School

S4B



Our project for the science symposium is about body dysmorphic disorder. It is a mental health condition where people's perception of themselves is often distorted from what they actually look like. For our experiment we will conduct a survey. In the survey we will ask students in different school's various questions about their body image. This will help us recognize any patterns of body dysmorphia in adolescence. We will primarily focus on things like gender. We expect to see that body dysmorphia occurs more in girls than boys as we feel like girls in school tend to be more insecure. We hope our experiment results will help prove this hypothesis either right or wrong.

THE EFFECT OF HOME-MADE FERTILISERS ON PLANT GROWTH: A SYSTEMATIC EVALUATION

Sanna Ovaskainen,

European School of Varese

S2ENB



Natural fertilisers are increasingly used in home gardening, as they have several benefits over the store-bought chemical products. They are cheaper, contain only natural ingredients and are more friendly for the environment. Several recipes for home-made fertilisers can be found online, however choosing the best recipe may be challenging and depends on the plant type.

The aim of this project was to investigate the effects of different home-made fertilisers on beans (*Phaseolus vulgaris*) in a systematic and controlled way.

The plants were seeded in identical conditions in small biodegradable pots and divided into five groups of six pots. Four groups were assigned a natural fertiliser and one was the control without nourishment (distilled water). The fertilisers studied included 1) rice water, 2) coffee grounds, 3) vegetable broth made from zucchini and carrots, and 4) a 1:1:1 mixture of the three solutions. Fresh solutions were prepared once a week and kept in the fridge to avoid bacterial contamination. The plants were given equal volumes of the fertilisers/water every two days.

The pots were placed on a windowsill, with good exposure to the sun. Temperature and humidity were monitored, and the pH of the soil was measured every two days. Plant growth was assessed by registering the first day of sprouting, monitoring the height of the plants and the number of leaves. The solutions were analysed chemically in the laboratory for pH, content of Nitrate and Nitrite, Phosphate, Sulphate, Ammonium, Potassium, Iron, Calcium, and Active O₂.

Preliminary results show that there is a difference between the beans' growth and health depending on the fertiliser. The best conditions for plant growth were provided by the 1:1:1 mixture indicating that this solution was the most nourishing. In conclusion, such a systematic evaluation is recommended when deciding on the best fertiliser for your plants.

ENERGIESPAREN IM HAUSHALT: DER KUHLSCHRANK - TIEFKUHLSCHRANK

Enea Rapisardi

European School of Varese

S3DEA



Als Gegenstand meiner Recherche habe ich einen Kühl-Tiefkühlschrank gewählt, weil ihn fast jeder zu Hause hat und vor allem, weil, wie wir teilweise sehen werden, der Energieverbrauch auch davon abhängt, wie man ihn nutzt.

Dieses Experiment beginnt mit zwei einfachen Beobachtungen zur Funktionsweise dieses Geräts, schlägt eine praktische Lösung vor und misst schließlich den Vorteil, der sich aus dieser Änderung ergibt.

Ursprünglich hatte ich die Idee dieses Experiment mit einem Kühlschrank durchzuführen, aber da dies erfordert hätte, dass er für längere Zeit nicht geöffnet werden durfte, habe ich mich für einen Tiefkühlschrank entschieden (das Funktionsprinzip ist das gleiche, nur dass er mehr Kalte erzeugt). Im Allgemeinen benötigt jede Maschine Energie, um zu funktionieren. Wir verwenden Energie für verschiedene Zwecke, von der Fortbewegung über den Transport von Gütern und die Produktion von Gütern bis hin zum Wohnen zu Hause.

Es gibt verschiedene Energiearten: Sonnenenergie, Windenergie, Kernbrennstoffe, fossile Brennstoffe, usw. und unter diesen

Es gibt verschiedene Energiearten: Sonnenenergie, Windenergie, Kernbrennstoffe, fossile Brennstoffe, usw. Unter diesen sehen wir uns heute genauer den Strom an, der immer noch hauptsächlich aus der Verbrennung von Kohlenwasserstoffen, also Erdöl-, Gas- und Kohleerivate, gewonnen wird, weil sie CO₂ in die Umwelt freisetzen, eines der Gase mit dem größten Treibhauseffekt. Man kann also sagen, wenn ich jeden Tag etwas mache, um weniger Energie zu verbrauchen, bewirke ich nicht nur einen positiven Effekt für meinen Geldbeutel, sondern ich mache auch etwas für die Umwelt.

Der Strom im Haus ermöglicht uns, Haushaltsgeräte wie Fernseher, Kühlschrank, Waschmaschine, Föhn, Computer usw. zu betreiben. Manche Geräte werden häufiger genutzt als andere, aber eines funktioniert (wenn auch nur sporadisch) das ganze Jahr über und meist viele Jahre: Das ist der Kühl -Tiefkühlschrank.

T

RASH MACHINE: HOW CAN WE ENCOURAGE PEOPLE TO RECYCLE PLASTIC?

Francesco Fantoni Philip Kotsev and Karolina Kucera

European School Varese

S2ITa, S2Enb



We have created a device that measures the amount of plastic inside a box that then converts it to CO₂ saved by recycling the plastic that is inside. It takes 6 kg of CO₂ to produce 1 kg of plastic from scratch meanwhile when you recycle 1 kg you only use 4.465 kg of CO₂, which means that by recycling 1 kg of plastic you save 1.535 kg of CO₂. We decided we would make a trash can type container in the form of a box which we could throw some plastic in, then there would be an electric circuit which would be programmed to do the calculations to turn it into CO₂ saved. Then it would send the results to a screen which would display the amount.



BUTTERFLY PROJECT

Clara Gras, Evelina Vilkaité and Lucía Pérez

Escuela Europea de Alicante

S6EN



Introduction:

This project will examine the emotional and scientific reasons behind feeling "butterflies in your stomach". We will use surveys to see and acknowledge how people view and understand the concept of falling in love, being angry and feeling anxious/nervous and what are the different things that they feel while experiencing these emotions.

Aim:

Our aim is to see whether people's body temperature and heartbeats increases and/or they feel a butterfly motion-like feeling in their stomach when they are feeling certain emotions, like anger, love, stress, etc. We will also build a model that depicts the relationship between the gut and the brain to further prove the reasons behind feeling butterflies in your stomach.

Our methods:

We are also already measuring our heartbeats on ourselves and others to see if there's any change in our hearts before and after exams, while staring at our lovers, and many other things.

Background research:

When people say they have butterflies in their stomach, they don't mean they actually have a living butterfly inside their stomach, but they sense some sort of 'fluttering' around their stomach. In reality, what's happening is that the blood vessels surrounding your stomach and intestines constrict and the digestive muscles contract. And it's that drop in blood flow that makes you feel like butterflies are fluttering around in your stomach.

It has also been proven by psychologists, physicians, and psychiatrists that the role our gut bacteria plays on our mood. They are also finding evidence that irritation in the gastrointestinal system may send signals to the central nervous system (CNS) that trigger mood changes, which explains why more than half of the people with IBS (irritable bowel syndrome) have (or has experienced) depression and anxiety.

WHO TASTE THE BITTER?

Anais Marie Camacho Rouiller and Máximo Mareque Fernández

Escuela Europea de Alicante

S6FR



The goal of this project is to investigate the ability to taste bitterness, the accuracy of the detection and try to link it to the origin of the participants. The ability to detect bitterness being indeed linked to the presence of a gene.

For this, we will use three diluted solutions of different PhenylThioCarbamide (PTC) concentrations, from low to high, in addition to a placebo of pure water.

European schools offer a great diversity of candidates (students and teachers) to whom we will collect data (age, sex and origin), and link it to their ability to taste the different solutions using statistic.

Electrophoresis analyses will then be carried out to show the presence or not of the allele in some of the participants.

DR Ω NE

OMEGA DRONE

Ramón Gil Sato, Giulia Putin Francés and Manuel Putin Francés

European School Alicante

S5 ES - S7ES



We developed a drone from parts that we managed to collect from different places (some of them reused). We were able to assemble the drone from the base plate, manually soldering each of the different parts that make up the internal structure. After the construction of the drone, we programmed the base plate so that it would be well oriented in the x, y and z axes and in this way the drone could fly straight and vertically. The applications we used for the programming process were BETAFLIGHT and BLHeli - Configurator. At the end of this long process the drone successfully took off and made its first flight, reaching a height of more than fifteen meters. Next, we added an antenna, which can broadcast the frequency of the drone's video camera. This frequency is picked up by an Eachine-receiver ROTG01 Pro and processes the image on any Android mobile phone live. In addition, we have been developing a computer system (mainly with Arduino and with parts designed with Blender modelling software and printed on a 3D printer) which will allow us to control the drone with head movements. This system is quite mechanical, as it uses an accelerometer and a gyroscope (IMU) which, by measuring the angle of rotation, is able to communicate this information to servos, which directly control the joysticks of the drone controller. This system is almost complete, and we have yet to review and test its full functionality.

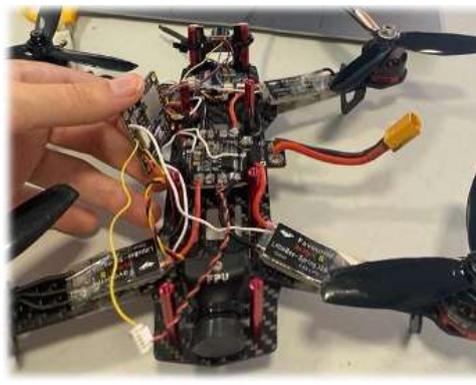
Bibliography

Biomakers. (4 de Julio de 2019). ARDUINO DRONE - Filtro Digital - Acelerómetro MPU6050 .

Obtenido de Youtube: https://www.youtube.com/watch?v=O7GcR_42rmk

deDrones. (9 de Abril de 2019). COMO MONTAR UN DRONE DE CARRERAS PASO A PASO.

Obtenido de Youtube: <https://www.youtube.com/watch?v=Nk0nlfrLExY>



THE PERFECT HOUSE

Olga Czarnecka, Diana Tsonkova and Mireia Gras Olmos

Escuela Europea de Alicante

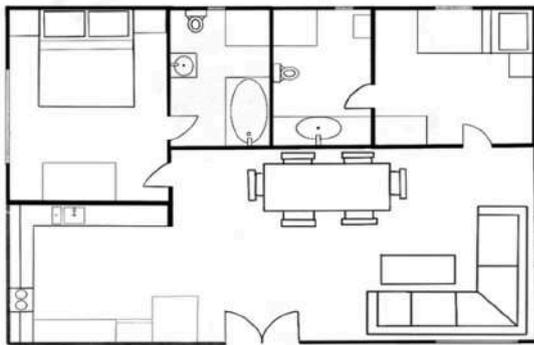
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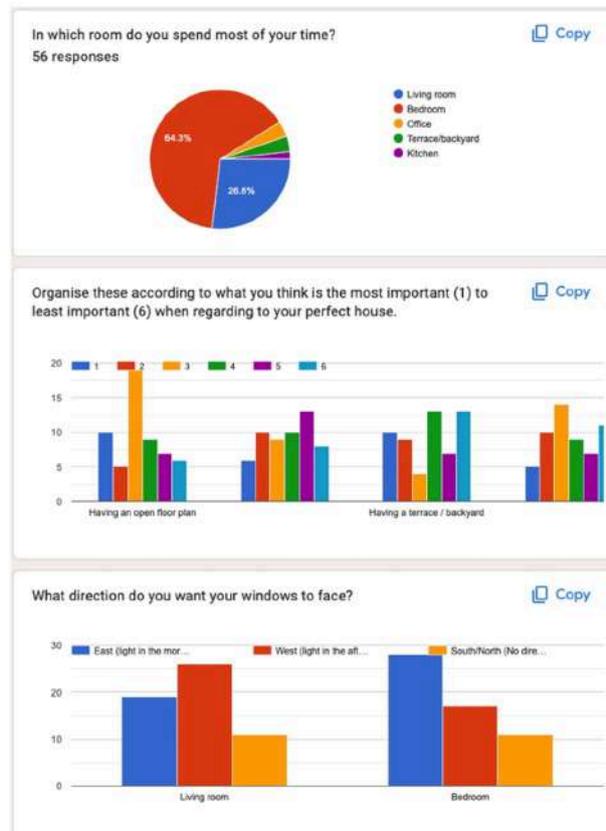
We chose to do this project, as we were interested in finding out what the perfect house for the majority of the people would be. We realize that there is no house that is ideal for everyone, but we wanted to try to make this possible by implementing flexible features and customizable interior design.

We aim to create a virtual model that will represent said house by using our own data we've collected from our survey. This model will include the bird's eye view and the interior designs of the perfect house. The model will also include how the flexible features will work. We will create this model using Sketch Up and Procreate.

So far, we have conducted the survey and are working on sorting out the data. We have done extensive research on which type of material is possible to use and the inner workings of the flexible features.



(What you see shown above is still not completed.)



THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE IN THE NETHERLANDS

Aimée ten Have

European School Bergen

S6EN



The purpose of this project was to investigate variables affecting bean cultivation. The idea for the experiment came from research I carried out concerning sustainable agriculture in the Netherlands. This research examines the differences that climate change will cause to agriculture in the Netherlands, the significance of this change, and discuss possible solutions. It considers change in temperatures and water type (acid rain, tap water, rainwater); the major elements which climate change influences and will influence further. My hypothesis is that increasing the temperature will increase the rate of growth. The pH of water will affect the rate of growth.

To test how the rising temperatures affect crop growth, three groups of two plants will be grown at different temperatures (see table).

Group 1 ('Inside')	19.4°C - 20.9°C
Group 2 ('Barn')	7°C - 15°C
Group 3 ('Shed')	-3°C - 6°C (night), 8°C - 17°C (day)

The second experiment will examine how the pH level of water influences crop growth (see table).

Group 1 (Acid rain solution)	pH 4.1
Group 2 (Rainwater)	pH 5.4
Group 3 (Tap water)	pH 6.6

The constant variables are soil type, quality and volume, volume of soil above and below the beans, number of beans, bean type, volume of water given, temperature (pH experiment) and pH of water (temperature experiment). The plants in each experiment will be compared by length, sturdiness, and appearance to discern health.

The inside plants were observed to grow much faster and taller than the barn and shed plants. The growth was very linear for each of them. Considering the water type experiment, the plant growth followed a sigmoid-type curve. The effect acid rain had in terms of height was less than expected. Increasing the temperature increased the rate of growth.

BANANAS WITH A 'K'. SYNTHETISING POTASSIUM FROM BANANAS

Helena Domańska

European School Brussels I

S5 pla



Bananas and potassium, at first glance, have nothing to do with each other. But have you ever wondered how much do they really have in common?

During physics class, I have learned about radioactivity and antimatter. One of their sources are well-known bananas due to being rich with isotopes of potassium K^{40} and carbon C^{14} . Therefore, bananas emit beta (β) and gamma (γ) radiation as well as antimatter, positrons e^+ . I am interested in chemistry and because potassium is one of my favourite elements, I have decided to try extracting it from bananas.

My project is quite complicated in terms of chemical reactions. I have already done it at home, but I run into some issues like the quality of my sample. That can be easily fixed if done in my school's laboratory. After improving my methods, I will check the quality of synthesised potassium sample. Thus, I will try to answer the question if this method of extracting potassium is worth the effort. My presentation will be enriched with information about the radiation mentioned before and its impact on human health.



Bunch of bananas – the greatest ingredient of success in my experiment, photo done by me

TECHNICAL ANALYSIS OF LNG GAS SUPPLY USING THE EXAMPLE OF GERMANY

George Eggers, Julius Goerres, Dimitris Tsitsopoulos and Jonas Grigoleit

European School Brussels III

S6 DE



- Gas trade and market – example: Germany (dependency on Russia)
 - I. Natural gas is the second most important primary energy source in Germany, Germany imports 55,2% of its Gas from Russia, 30,6% from Norway and 12,7% from the Netherlands.
- Russia-Ukraine
 - I. Russia invaded Ukraine in early 2022 (February)
 - II. This invasion is seen as unprovoked and unjustified by most EU states and therefore most have cut ties with Russia and are trying to boycott Russia
- What is LNG and how does it work?
 - I. LNG -> Liquified natural gas.
 - II. LNG is cooled down to a temperature of -163°C .
 - III. LNG needs 600 times less space than normal gas.
 - IV. LNG is transported by ship.
 - V. In special terminals the LNG gas from the ships is converted to normal gas.
- Why change to LNG?
 - I. It is a suitable alternative to gas transported from pipelines (e.g., Nordstream 1) which many countries (like Germany) heavily depended on. As most of this gas came from Russia, Europe's countries searched for an alternative shortly after the beginning of the Russo-Ukrainian War (Feb. 2022) as they are trying to boycott Russia.
 - II. It is the cleanest-burning fossil fuel
 - III. It is an efficient energy source
 - IV. It is non-toxic, non-corrosive and odourless
 - V. It improves local air quality and reduces global warming
- LNG terminal in Germany (example Wilhelmshaven)
 - I. The Wilhelmshaven LNG terminal was opened on 17 December 2022, the terminal is a leased floating storage and regasification unit (costing 200.000€ per day) and is expected to supply 8% of German gas demand.
- Costs of switching to LNG

- I. The transition to LNG's seems to be extremely expensive – Germany's efforts to diversify away from Russian gas will cost more than double earlier estimate (about 6.56 billion euros instead of 2.94 billion euros)
- II. In the long run, though, the use of LNG's are economically more efficient than the use of normal gases
 - Ecological aspect
- I. The construction of LNG gas terminals is disturbing the ecosystem. In Wilhelmshaven for example the porpoises are chased out of their habitat because of the construction of the LNG gas terminal.
 - Comparison LNG – Gas pipeline (example NS 1 and 2)
- I. Economic Aspect: In the long-term LNG is economically more viable than Gas pipelines like the Nord Stream 1, this can be explained by the cost of building the pipelines needed and maintaining them whereas to transport and use LNG only LNG carriers and a regasification unit is needed and not much other infrastructure like long distance pipelines.
- II. Ecological comparison: The transportation of LNG to Germany consumes a lot of energy as Germany gets its LNG by ship. As LNG must be cooled for it to stay liquified (which consumes a lot of energy), the transportation process of LNG to Germany has a bigger environmental footprint than non liquified natural gas. On the other hand, the transport of natural gas requires more infrastructure compared to LNG, this means that big pipelines like the Nord Stream 1 damage many ecosystems and lead to the destruction of many habitats.
 - Future prospects

The new pipelines used to connect the LNG terminal to the gas network can also be used for the green hydrogen. This means, that if usage of green hydrogen will increase, the pipelines will also be able to transport green hydrogen.

TO WHAT DEGREE DO ECO FRIENDLY ALTERNATIVES LIMIT WASTE AT OUR SCHOOL ?

Veronika Valisova, Natalia Vass and Lena Meunier

European School Brussels III

S6 CS



Paper waste is an ecology problem that we encounter in all schools, and it is even more prominent in one as big as the European school. We investigated the use paper and possible alternatives in EEB3.

We followed the ways paper is used in EEB3. We interviewed teachers about the amount of paper that they consume and alternatives that they find reasonable. In general, the majority agreed that their paper consumption needs to be reduced. An often suggested «eco-friendlier alternative» is uploading materials online and using laptops/PCs as an alternative to textbooks, papers and notes, however, some teachers insist that there are materials that need to be printed and not shown online. The big questions now are: is using technology really better? And could it negatively the students learning? Our research shows that we have already learned to use technology for education purposes during the quarantine. If we adapted then, we can do so now too to reduce paper use.

When it comes to paper, a lot of its components can be harmful to the environment. These include sodium hydroxide (a strong base) and bleaching chemicals such as sodium dithionite or hydrogen peroxide. Production of paper releases these chemicals and we are contributing to the issue with our mass consumption.

When it comes to laptops and PCs, they contain many components such as mercury, lead and chromium. If these are not properly recycled they can contaminate groundwater or affect the environment in other negative ways. Other than that, technology of course consumes electricity.

Read more to learn the specific comparisons.



THE CHALLENGE OF CLIMATE CHANGE: A STUDY OF CROP GROWTH IN SOILS OF DIFFERENT HEAT CAPACITIES

Christos Soukos, Valeria Palumbo and Valia Patri

European School Brussels III

S6EN



Vegetation, growth, flowering and seeding were measured in plants of the species *Phaseolus vulgaris* which were cultivated in soils of different heat capacity. The plants were grown under constant conditions of temperature, photoperiod and humidity. Growth rate was measured by measuring shoot length per unit time (every two days). Accordingly, the appearance of the first flower and seed as well as the amount of flowers and seeds per plant were recorded. The results show a clear effect of soil heat capacity, mainly on plant growth speed. For a specific soil heat capacity there seems to be an effect on the growth and flowering of the plant.

VOL CONTRÔLÉ D'UN AVION EN PAPIER

Barbier-Kerp Aaron, Chiovari Marc, Krieger Arthur, Meyssonier

Jean et Védrine-Le Goff Elliot

École Européenne de Bruxelles IV

S6FRA S6FRC S6FRD



Rien d'extraordinaire à faire voler un avion en papier, mais prolonger son vol sur au moins 8 minutes et pouvoir le diriger dans les 3 dimensions présente un caractère innovant.

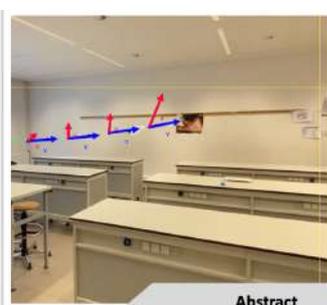
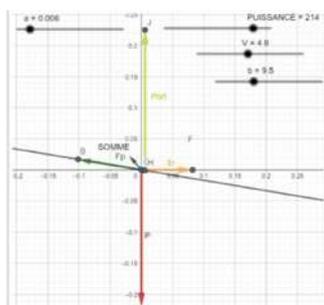
Le but de ce projet est de créer un système motorisé contrôlable à distance, capable de se fixer sur un avion en papier et pouvant voler au moins 8 minutes. C'est un rêve pour beaucoup d'enfants (compte tenu de l'accueil reçu par notre prototype en S3) et d'adultes. Le dispositif sera ensuite utilisé pour éveiller et/ou motiver les élèves de S3, S4 et S5 aux sciences (cinématique, dynamique, électricité, énergie et ondes...) de manière ludique.

Nous avons donc collecté toutes les mesures nécessaires à la compréhension du vol de l'avion, pour ensuite s'en servir lors de la conception du système. Ce projet très intéressant va nous amener à réfléchir comme un ingénieur. Force, vitesse, accélérations, frottements, lois de Newton, vitesse de rotation, programmation, incertitudes de mesures, chaîne de transmission de données, optimisation... L'idée est d'utiliser une soufflerie faite maison, des capteurs (forces, lumière, accélération...) pour prédire les conditions de vol et choisir les composants permettant la programmation, la propulsion et le contrôle à distance pendant une durée satisfaisante.

Une fois cette phase de conception réalisée, nous passerons à la réalisation complète et effectuerons des tests. Viendra enfin la phase d'optimisation qui nous permettra la plus grande autonomie possible.

Nous avons mesuré les diverses forces qui agissent sur l'avion : la portance, le poids, la traînée ainsi que la poussée. Le graphique ci-dessous à gauche représente ces forces et la résultante s'appliquant sur l'avion en fonction de la puissance du moteur.

Et dernièrement nous avons commencé à filmer nos vols afin qu'ils puissent être analysés, pour comparer nos résultats à ceux obtenus en soufflerie.



RENEWABLE ENERGY

Yara Cojocariu, Lucia Putz and Katarina Wenig

École Européenne de Bruxelles IV

S5



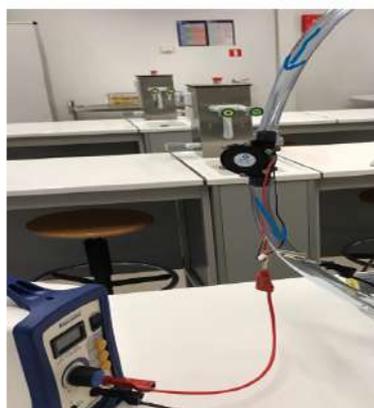
In the framework of our project – as part of the ESSS Science Competition – we, focus on renewable energy, which we can easily produce through everyday activities.

On average, a person consumes 130 litres of water per day for shower, toilet flushing, washing, cooking and certain appliances such as washing machines or dishwashers, etc. Generally, the wastewater is simply discharged into the sewage system.

Our idea is to install a small water turbine in the pooled sewage pipes of washbasins, showers and bath tubes. The turbine is driven by wastewater activated by water pressure and gravitational forces and thus generates kinetic energy, which is stored in a small energy storage, via a generator connected to the turbine.

The turbine, as shown in the figure, can generate up to 12 V with sufficient hydropower. It is thus possible to use this force in order to supply a 12 V socket, which provides enough energy to heat, for example, a water boiler or a coffee maker, to charge certain batteries or to drive small lamps or light bulbs. Depending on the size of the turbine and hydropower, more or less electricity can be generated.

This method could be envisaged as an electricity-saving method in public and private institutions such as swimming pools, hospitals, hotels or other buildings, where there is a constant high volume of wastewater. In this way it would be possible to save energy in the long term and thus contribute to environmental and climate change objectives. In addition, wastewater is a by-product of everyday activities, requires little installation effort and is therefore a cost-effective way of saving energy.



ANALYSIS OF WATER QUALITY OF THE RHINE-MAIN AREA

Aglaia-Anastasia Karamani, Emília Holmes Teixeira and Karolina Kořak

European School Frankfurt

S5enAB



In the last decades activities such as urbanization, farming, industrialization and air pollution have not only affected global warming and the state of our nature, but have had a major impact on the ecosystem of rivers as well. A lack of clean fresh water is a rising issue and this grabbed our interest in finding out the state of the river ecosystems around us.

Our aim is to investigate the river's pH-level, ammonium, phosphate, nitrate, nitrite levels, along with other substances; we also intend to look into the hardness of the water as well as the fauna and flora and how they can be bioindicators of water quality. We also want to raise awareness about the pollution in rivers.

These procedures are being carried out using the chemical set for the analysis of water and apps that help us with the identification of flora.

We want to see how these things differentiate between various rivers which all flow into the same course. The water bodies being investigated are the source of Urselbach and the rivers Urselbach, Nidda, Main and Rhine. Our intention is also to compare our results to the ones that have already been done by a professional institution for water analytics.



The creek Urselbach, close to flowing into the Nidda



Google maps: Main flowing into

Our hypothesis is that the water quality and pollution levels will be at their worse near urbanized areas such as the centre of Frankfurt and best in an area where nature is preserved. We also predict that if we get to compare our results to the ones from the professional institution, they will be relatively similar.



WHEN IS RUNNING REALLY HEALTHY RUNNING . HOW DOES MUSIC AFFECT PERFORMANCE AND STRESS?

Layla Brugger and Mila Stojanovic

European School Karlsruhe

S6DE



Running is one of the most common physical activities, with 621 million people participating in it globally. It is known as an effective and immediate stress-reducing activity, as it releases “happy” hormones.

Running is a form of “good” stress, which can be called **productive stress** because of the positive results it creates.

But running can also cause “bad” stress as you put strain on your body and mind. Stress from other life areas can also gradually erode the body’s ability to recover from running. Psychological stress, like worry, anxiety and feelings of overwhelm, can be called **unproductive stress** because they cause fatigue, irritability and many other problems.

Whether you’re experiencing stress from upcoming exams or a really hard workout, your body responds the same way; you have increased levels of the stress hormone cortisol, along with testosterone and adrenaline, which are key components of the endocrine system’s response to stress designed to help you fight or flee. The problem is that modern lifestyle exposes us to stress constantly. This shows that running isn’t always healthy and won’t always reduce stress.

Most people listen to **music** while running, but the genre of music listened to varies. Some say that quick beats increase their speed, while others argue that music doesn’t influence them.

Using a **sensor** that measures stress with **Heart Rate Variability** (HRV) and speed, we will measure and evaluate our own running data.

We want to show that our everyday stress affects us even during a so-called “stress-reducing” activity.

Our results will show how running and listening to different types of music while running affects performance and in turn stress.



RED BULL® TOXICITY STUDY

Arman Perrier and Isaia Petrucci

European School Karlsruhe

S6EN



Energy drinks and tonic beverages have always been popular all around the world leading to questions about their effects on consumers. The aim of this study, done at the Karlsruhe Institute of Technology, was to evaluate the toxicity of Red Bull, as well as some of its main ingredients (caffeine, sucrose and taurine).

The analysis was carried out on two batches of Zebrafish derived PAC 2 cells which were incubated in a range of concentrations of each substance. One batch was to be used for imaging (Fig.1), and the other for DNA quantification as a measure of cell proliferation using bismenzimidazole (Hoechst 33258).

However, as results were reviewed iteratively throughout, intrigue led to additional analysis of cell viability using DAPI and Trypan Blue (Fig.2). The pictures obtained after 24 hours yielded results displaying living cells, despite a major change in shape, in 100% Red Bull, seemingly unaffected cells in 50% Red Bull, and apparently dying cells in 10% Red Bull. The follow up tests with DAPI demonstrated that the cells in 10% Red Bull were dead, while reinforcing the idea that the cells found in higher concentrations were indeed alive. Additional Trypan Blue tests confirmed again the dead state of cells in 10% Red Bull as well as highlighting that, despite being alive, cells in 50% and 100% Red Bull were not completely uncompromised. On the second plate, the Hoechst tests indicated cell loss in 100% Red Bull, maintenance of cell mass in 50% Red Bull, and cell death as well at 10%. Other individual chemicals had positive impacts on cell growth at low concentrations, but negative impacts at higher concentrations. Ongoing tests on zebrafish embryos are currently performed to investigate Red Bull's toxicity at the organism scale.

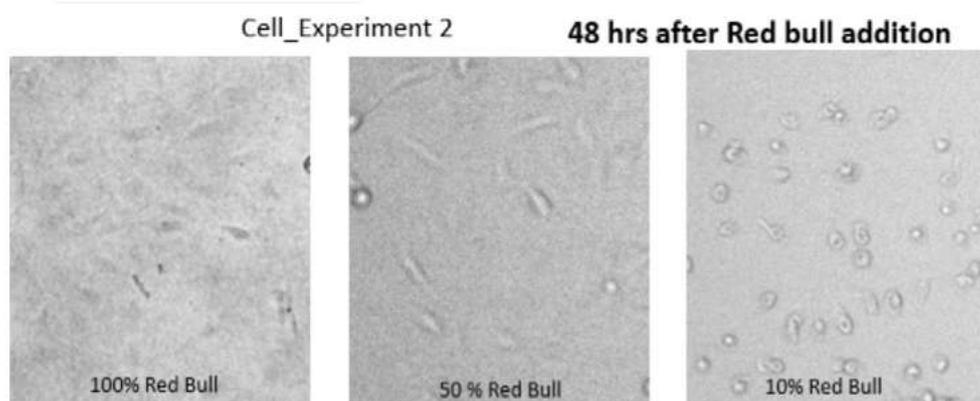


Figure 1- PAC2 cells treated with RedBull

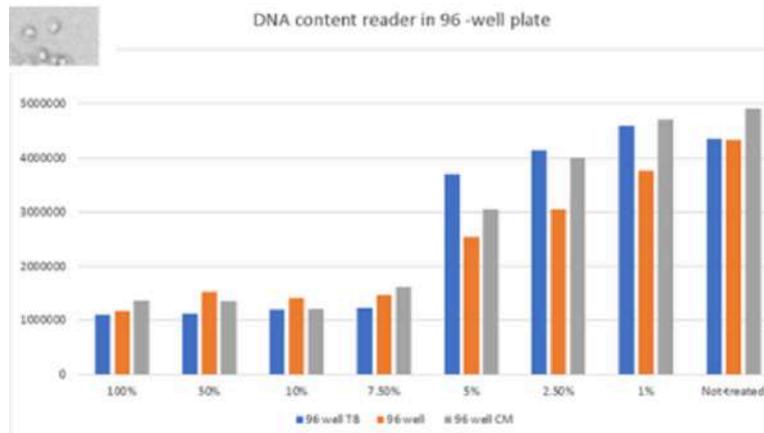


Figure 2: DNA content of PAC 2 cells treated by Red Bull measured by Trypan Blue exclusion

Our results so far showed that Red Bull does have some effects on living cells due to the clear elongation of the cells and their deaths even at low concentration (10%), as well as the ambiguity in their ability to even survive the 100% Red Bull. This is totally confirmed by the final Hoechst test on the second plate, which showed how toxic high concentrations of Red Bull really were.

CASE STUDY: URBAN MINING, PLATIN AUS KONTAKTLINSENBEHÄLTERN

Laura Palumbo

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S6DE



Hintergrund:

Platin wird zur Herstellung von Schmuckwaren, Fahrzeugkatalysatoren, Laborgeräten und Kontaktwerkstoffen verwendet. Wegen seiner Seltenheit werden jährlich nur geringe Mengen gewonnen. Darüber hinaus gibt es keine Abbaustätten für Platin in Europa. Auch weltweit gibt es nur wenige relevante Abbaugelände. (1) Dem gegenüber steht ein steigender Bedarf. Speziell der Wachstum der Brennstoffzellentechnologie im Rahmen der Energiewende sorgt für eine steigende Nachfrage. Laut einer Prognose des Hanauer Technologie- und Metallkonzerns Heraeus wird sich die weltweite Nachfrage nach Platin für Wasserstofftechnologien in den nächsten zehn Jahren wohl versiebenfachen. (2) Platin wird zurzeit mit rund 950 Euro pro Kilogramm gehandelt.

Idee:

Kontaktlinsenbehälter zur Desinfektion mit Wasserstoffperoxid enthalten eine sogenannte Katalysatorscheibe, die Platin enthält. Da die Behälter oft getauscht werden, werden jedes Mal neue Behälter von den Kunden angeschafft. Die Kunden werden auch aufgefordert, den Behälter monatlich zu wechseln. Auf diese Weise fallen im größeren Stil kleinere Mengen an recyclingfähigem Material an. Wir haben es also hier mit einer Platinquelle im Sinne des „urban minings“ zu tun. Auch in diesem Fall ist der Rohstoff zunächst umsonst.

Schritte:

In einem ersten Schritt wurde bereits ein Experte zu dem Thema befragt. Er konnte helfen, das Thema wirtschaftlich und politisch einzuordnen. Christian Schaudwet ist Fachjournalist für Energiewirtschaft für den *Tagesspiegel Background*. Er beschäftigt sich unter anderem mit der nahenden Metallrohstoffkrise und den dazugehörigen wirtschaftlichen Aspekten. „Urban mining“ werde immer wichtiger und die Suche nach Verfahren, die diese besagten Metalle recyceln, sei endlos. Sowohl politisch als auch wirtschaftlich werde nach immer mehr Unabhängigkeit gestrebt, bei der aber der Versorgungsgrad der besagten Stoffe erhalten bleiben müsse. Und da liege es nahe, Rohstoffe aus eigenem Verbrauch wiederzuverwenden.

In einem zweiten Schritt wurde an Hersteller und Händler herangetreten um Informationen über das Produkt und die Bereitschaft zum Recyceln zu bekommen.

In einem dritten Schritt werden wir zusammen mit spezialisierten Firmen schauen, wie der eigentliche technische Recyclingvorgang ablaufen könnte.

Am Ende soll einen Recycling Kreislauf für das Material stehen und die Machbarkeit abgeschätzt werden.

Quellen:

(1) [Platin – Wikipedia](#)

(2) [Brennstoffzellen und Platin: Wieso der Bedarf steigen könnte | Degussa Goldhandel \(degussa-goldhandel.de\)](#)

ARTIFICIAL DATA GENERATION USING QUANTUM PHYSICS AND WAVE FUNCTION COLLAPSES

Kresemir Hyzyk

European School Luxembourg I

S6PLA



In the modern era of computing, speed and efficiency are key. This project explores a new artificial data generation method rooted in Quantum Physics and Wave Functions. The algorithm is able to generate self-similar data, constructed by replicating parts of the source image at a higher scale. Superpositions consisting of multiple eigenstates are sequentially observed in an isolated environment, consequently generating regions of the targeted image. The presented method of data generation provides a simpler and more efficient interface to realistic data generation and imitation.

VARIABLE THICKNESS AIRPLANE WING

Arturo Rull Nomen and Carlos Cortes Clausi

European School Luxembourg I

S6ESB



In this project we will design, test and build a wing from scratch, in which the thickness of the wing can be modified in mid-flight of an airplane.

Thanks to being able to adapt the thickness of the wing profile, the lift force also varies and the air resistance as well. For example, our wing can be thick at the time of takeoff of an airplane to cause greater lift, but in mid-flight, it can be compressed so that the air resistance force is lower, since, in full flight, our interest is not to obtain greater lift, but greater speed, or also, a lower use of fuel. Both are achieved due to the lower air resistance, and this is achieved by reducing the thickness of the wing.

In our study we will demonstrate that the model works, through physical principles, for example, Bernoulli's principle, and the Venturi effect, which are very present in the physics of our modifiable wing.

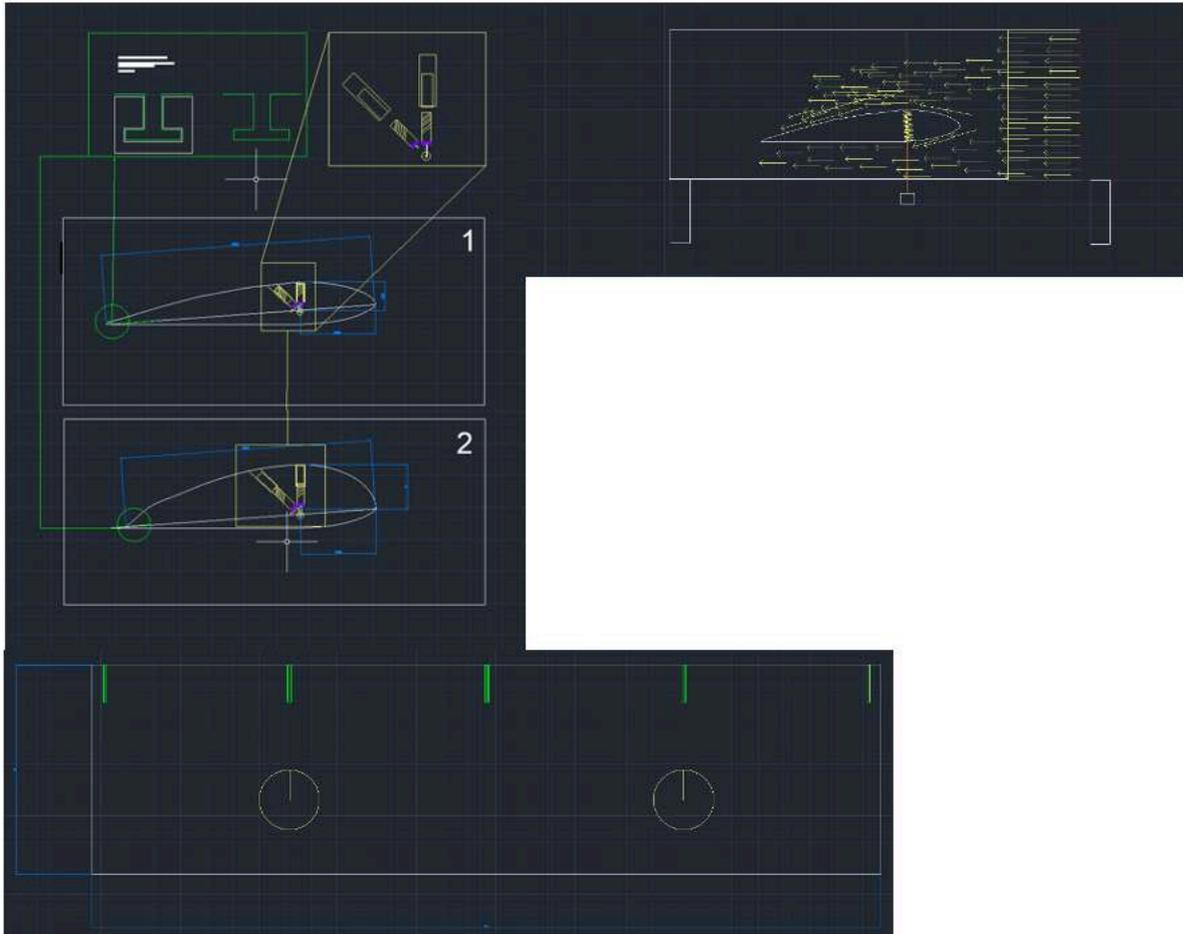
We will also demonstrate it in a practical way using a wind tunnel, we will fix the wing on the X and Z axis, using of a rope that crosses the wing, that lets the wing move only on the Y axis because that is the axis that matters to us, and we will measure the values of lift of the wing with different thicknesses with a constant wind speed. (Wind tunnel plans in images on page 2)

To measure it we will rely on Newton's 1st law, if the result of the forces acting on a body is 0, the body will not suffer an acceleration, therefore it will remain fixed in the air in, because we will fix 2 strings stuck to the inner surface of the wing, so that they come out below the tunnel through a hole from which weights hang. Thanks to these weights we can determine the lift, if we put a weight for example of 500 grams and the wing lifts them and stays still, it means that their lift is equal to the weight, and in this case, if it lifts 500 grams corresponds to 4.9N of net lift.

We will also use a dynamometer because is way more accurate and practical when measuring a lot of data.

At the moment we have already designed the wing plans (there may be slight changes with respect to the final model) and we have already done tests in digital simulators. The materials we have in mind are polypropylene for the extrados and polystyrene for the intrados and We will print the special pieces with a 3D printer with polyethylene plastic

Images of the blueprints in the next page.



INVESTIGATING THE EFFICIENCY AND SUSTAINABILITY OF THIN-FILM CIGS SOLAR CELLS

Dimitrescu Ana Maria and Trofilova Anastasia

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S6ENA



Silicon solar cells have an energy-intensive and costly production method, therefore other materials are preferable, such as CIGS (Sulfur Indium Gallium Diselenide) solar cells. The CIGS compound has a tunable band gap of ca. 1.02–1.68 eV, leading to a good match to the solar spectrum. CIGS solar cells use thin-film technology – which requires a thickness of a few microns, whereas silicon, which is predominant in the industry, requires 200 microns to absorb incident light sufficiently. This allows for the reduction in semiconductor material used, and lower consumption of energy and material during production, resulting in a cost reduction. The absorption coefficient is higher in materials of these second-generation devices, which gives the potential for high efficiency. Likewise, specific applications such as a flexible substrate or semi-transparency can be achieved with thin-film technologies. Another benefit of CIGS cells is the low-cost processing which includes nonvacuum solution-coating approaches. However, currently silicon cells are still more efficient than CIGS. This research will therefore study 3 distinguished processes within CIGS cell production that relate to efficiency and improvement of these cells. Firstly, we want to analyze buffer layer deposition process via a chemical bath deposition (CBD) method vs an inkjet printing method, and how these two methods impact the efficiency of a cell. Secondly, we want to compare cadmium with Zn (O, S) which have similar band gaps; these could replace cadmium, given that it is a toxic element (carcinogenic). Lastly, we want to study the relation between the performance of the CIGS cells and the roughness of the CIGSe absorber surface by using a chemical etching technique.

Steps:

CdS buffer layer deposition on a CIGS solar cell using chemical bath deposition → thin-film deposition through formation of a solid film on a substrate when the value of ionic product exceeds the solubility product.

CdS buffer layer deposition on a CIGS solar cell using Inkjet printing

Analyzation of the homogeneity of the layer (using SEM);

Testing efficiency of the cell after buffer layer depositions using PL to see quantum efficiency in different parts of the cell (emission peaks)

After finding the more optimal buffer layer deposition method, CdS will be replaced with Zn (O, S) using that method

⇒ We expect Zn (O, S) to be a good alternative for CdS as its larger band gap would allow for potentially higher current. CdS has a lower bandgap value (2.42 eV) so we

expect a part of the photons to be absorbed in the buffer layer before reaching the CIGS

⇒ By using a material with a higher energy gap, we hope to overcome photocurrent losses that persist in CdS

The effects of surface roughness on the CIGS absorber layer:

The deposited rough CIGS surface is smoothed using a chemical etch, and the bare CIGSe surface is characterized by SEM, (AFM) and Reflectivity.

1. The Cu(In,Ga)Se absorber is chemically deposited on molybdenum covered glass.
2. It is then etched for 4 minutes using an aqueous solution of HBr/Br₂
3. The surface morphology of the sample is studied using SEM
4. Electrical properties of solar cells are characterized by current voltage measurements under illumination

BATIMENT AUTO-SUFFISANT

Juliette Masson-Deblaize and Léa Neumeister

European School Luxembourg II

S7FRC – ESL2



La crise climatique est l'enjeu principal de notre génération. Des mesures drastiques sont à prendre à l'échelle mondiale, étatique et individuelle. Comment réduire au mieux, de façon simple et pratique notre empreinte carbone tout en repensant notre lien à la nature qui nous entoure ?

Nous proposons une combinaison intelligente des bienfaits de la végétation et de l'environnement afin de garantir l'auto-suffisance d'un bâtiment. Rendre un bâtiment auto-suffisant tout en respectant une démarche écologique, c'est donc repenser autrement :

- **La régulation de la température** : Mur végétal à base de graines de chia et autres plantes à pousse rapide et simple.
- **L'utilisation des déchets** :
 - Déchets ménagers : Compost, à combiner avec d'autres engrais naturels (voir Urine)
 - Urine : Utilisation de l'urine comme engrais. À répartir selon le type de surface végétale (potager ou mur) et le type de plantes/légumes.
- **La conservation des aliments** : différentes options de réfrigération et conservation des aliments sans électricité.
- **L'économie des ressources** : meilleure utilisation de l'eau de pluie. À utiliser pour les toilettes, voir la douche.

THE AUTONOMOUS PEN

Ayaan Mekrani and Dries Caers

European School Mol

S6ENA – S6NLA



Purpose:

Our research, work, investigations, and experiments aim to eventually construct a pen that writes (uses ink tip to place ink) without human support.

Summary of Project (Method + Results):

As stated previously, our research objective was to construct a pen which writes without any kind of living support. Our drafts and brainstorming involved ideas using diamagnetism, but we eventually agreed upon using permanent magnets for the pen, and motors/sensors for the plotter. Theoretically, we have applied Earnshaw's theorem, and the opposite of Oersted's law. For the pen, we used the north-south attraction principle – as the pen is constructed of a marker (ink), and is surrounded by 4 permanent magnets. These magnets are attached to the marker by a plastic frame (4 layers). Every magnet has been drilled into the frame, and this each layer of this frame has been glued together using a glue gun. Currently, the pen is operational whilst being guided by its controller magnet (under the table). When the north of the pen controller is facing upwards, and the south of the magnets attached to pen are facing downwards; the pen is moveable and writes (or vice versa; south of controller, and north of magnets). We expect to reach stage 3 by the ESSS event; which involves the programming of the magnet controller, and its association to the mechanism of the plotter. The plotter itself – consists of a motor for the x-axis, a motor for the y-axis, and a motor to move the platform up and down. The motors of the x and y axis are responsible for the movement of the pen on the paper. The motor which controls the platform is responsible for the magnitude of the magnetic force (the further the magnets, the weaker the magnetic force). For the movement of the pen, gears and a rack have been utilized. The project is a combination of the autonomous pen (which writes with a controller), and the plotter (which writes as a follow-up of a programming code).

DO ESSENTIAL OILS HAVE DISINFECTING PROPERTIES?

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European School Mol

S6EN



In our daily life we use essential oils in many different ways, e.g. in bath bombs, candles, perfumes, shower gels and etc. Their anti-microbial and anti-fungal activity has been described in the scientific literature. Studies were aiming to investigate their activity as an alternative for pathogen control. During the last years and as an outcome of the COVID pandemic the importance of disinfecting hands was highlighted and awareness was raised on this simple process. Meanwhile some of the newly developed guidance documents state that “an alcohol-based hand sanitizer that contains at least 60% alcohol” should be used to effectively kill viruses and bacteria.



However, despite their disinfecting properties, disinfectants that contain a high concentration of ethanol that presumably disinfect but also dry our hands.

The aim of this experiment was to assess the efficiency of essential oils as hand sanitizers. The project involved a preparation of the bacterial colonies, which were spiked with the different solutions of essential oil mixed with NaOH. Three different essential oils were used based on their anti-microbial and anti-fungal activity: Lavender, Eucalyptus and Sumac. The study was performed under reproducible conditions. The effect of the three essential oil solutions were checked against different ethanol concentrations. Results were evaluated after 24 hours of incubation at 36°C temperature.

The outcome of the study is that essential oil solutions can be used as alternative applying their main inhibitory properties.

EQUALITY POINTS IN COOPERATIVE GAMES

Ogor Adrian

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S5FRB



The overall purpose of this research is to understand the variety of social behaviours in mathematical terms. Therefore, this research introduces the notion of *equality point* to cooperative game theory and develops methods to transfer this concept to social interactions.

In general, the notion of *equality point* corresponds to a situation in cooperative games where it is no longer in a player's interest to change behaviour unilaterally. Thus, the major mathematical result of this research is the proof of the existence of at least one *equality point* in cooperative games.

A comprehensive example of this concept is, for instance, a situation where two pupils want to buy a large amount of ice cream on a hot summer day. For this, the two pupils have 3€ and 2€ separately, with ice cream priced at 2.50€. A possible solution to this problem would be to pool their money together, buy the maximum amount of ice cream possible, and divide it in half. This solution would then correspond to an *equality point*. After all, the pupil with the original 3€ would get the same result without the cooperation of the other pupil. Hence, he would not have to change his behaviour towards the other pupil.

HOW MUCH TIME DOES THE HUMANITY HAVE LEFT? HELIUM- ACT WHILE THE CLOCK TICKS

Marta Kotarba and Shineyu Chandra

Europäische Schule Rhein Main

S5ENA



The motivation, knowledge, means, and drive are the main things that hold people back from confidently acting against climate change. Our project aims to change that, through using a mobile application that encourages and drives sustainable living in the community.

The users of the App will be made aware of how common certain daily practices, product usage, and consumption strengthens the effect of Climate Change, and ultimately affects the longevity of humanity on Earth. Motivated individuals willing to make the smaller changes in their life to positively affect the future of the planet will be given challenges of their choice, that they can complete and thus make a small but important step toward improving their future chances. They will always get to know how much time they 'gave back' to the Earth by preventing these emissions and damages. The time goals will refer to and derived from the 'Climate Clock' (<https://climateclock.world/>)

A representative example is the consumption of burgers- which use up 2498,37 liters of water each- thus decreasing the consumption of burgers make a significant impact on water wastage.

This project will be a Mobile application, which will run on a Python backend and will use React Native as a frontend framework. Data Analysis and Database modules on Python such as Pandas and SQL will support the backend algorithm.

The application aimed to have a goal-oriented and user-friendly user-interface, that maximizes fulfillment and thus encouragement to continue consistently making a difference. A potential addition is a multi-user aspect, where the results of a combined team effort can be enjoyed.



**We guide you to making
a big change,
through small steps everyday**

FACTORS THAT AFFECT OUR MEMORY

Abrahamova Julie, Coll Perez Nahia and Yaroshevskaya Yelizavieta

European School of Strasbourg

S5EN



For our science symposium project, we will be exploring two different factors that affect our memory and that both play an essential role in memorization. The factors we'll focus on are the **interest** and the **emotional state**. The question that we would like to answer is the following: **Do these two factors truly affect our memory, and do they play an essential role in memorization?** In order to answer this question, we will create a questionnaire that will consist of a variety of questions related to these two factors. The questionnaire will be sent to students (ranging from S1-S7) and teachers. For further analysis, the subjects will also be asked to submit their ages. After obtaining the results, we might also compare them with "tested memorization," where we will test the ability of the memorization of a student who likes the subject they're quizzed on with a student who doesn't. We might also add external factors (such as music or a countdown) that will create a stressful environment.

PROFIL DU MEILLEUR PROF

Margarita Ramazanova Ela et Lucilla Manciocchi

European School of Strasbourg

S5FR



En tant qu'élève nous avons tendance à accuser le professeur, en le tenant coupable de notre échec.

Ainsi à force d'entendre des élèves se plaindre de leurs mauvaises notes nous nous sommes dit qu'il fallait vérifier si les raisons étaient valables. Après maintes réflexions et notre implication dans cette problématique, nous avons décidé qu'il était temps d'apporter des réponses à ce projet jamais abouti, pourtant très important pour la vie scolaire de tous.

Notre problématique est de voir si nos notes et nos capacités à apprendre varient selon le prof et l'environnement dans lequel nous nous trouvons.

Pour déterminer les critères que doit avoir le meilleur prof, pour plaire à ses élèves et aussi les faire progresser nous avons envoyé et distribué un formulaire de plusieurs questions à tous les élèves du secondaire, pour qu'il réponde en caractérisant les méthodes de travail du prof choisi, si elles leur plaisent ou non et leur moyenne.

Nous ne voulons en aucun cas comparer les profs de notre école, ni voir lequel est le meilleur, mais trouver une méthode propice à la progression des élèves. Bien sûr ce sont des questionnaires anonymes, les noms des élèves et des profs ne seront pas demandés.

Grâce aux réponses obtenues nous pourrions créer le "profil" du prof idéal.

Les résultats obtenus pourraient aussi aider certains élèves à trouver leur conditions optimales de travail ou certains profs à changer la façon dont ils captivent l'attention des élèves pour un meilleur résultat.

En addition nous avons distribué un questionnaire personnalisé pour les professeurs, de façon à avoir leur point de vue. Nous comparerons les résultats des deux questionnaires afin de voir si les visions des profs et celle des élèves coïncident et pour que notre résultante soit la plus authentique possible.

Aperçu de notre questionnaire distribué aux élèves :



SYMPOSIUM 2023 : Questionnaire pour le meilleur prof
Soyez le plus honnête possible(c'est pour la science :)

1. Quel est la moyenne de vos notes avec un/une de vos prof?
___ / 10

2. Est-ce que vous aimez ce/cette prof
 Oui
 Non

3. Est-ce que le/la prof est drôle?
 Oui
 Parfois
 non

4. Il/elle parle :
 fort
 doucement
 entre les deux

5. Il/elle parle :
 beaucoup
 peu
 entre les deux

6. Il/elle parle :
 en articuland
 sans articuler

7. Est-ce qu'il/elle réexplique lorsque vous n'avez pas compris ?
 oui
 non
 Autre :

8. Est-ce que le/la prof est :
 assis(e) pendant le cours sur une chaise devant la classe
 assis(e) devant l'ordinateur

debout devant la classe mais ne bouge pas
 debout devant la classe et bouge
 Autre :

9. Est-ce que le cours est :
 projeté sur le tableau et vous recopiez
 dicté
 écrit au tableau sur ordinateur
 écrit au tableau à la main
 distribué et lu avec la classe
 juste distribué
 Autre :

10. Il y a :
 beaucoup de devoirs (pour chaque cours)
 des devoirs de temps en temps
 peu de devoirs
 rarement des devoirs
 pas du tout de devoirs

11. Est-ce que vous avez des tests surprises avec ce prof?
 oui, beaucoup
 oui, de temps en temps
 oui, peu
 non, pas du tout

12. Est-ce que, les devoirs sont notés?
 oui, ils sont tous notés
 oui, quelques uns sont notés
 parfois
 non, jamais

13. Les devoirs, sont:
 longs et difficiles à faire

courts et faciles à faire
 Autre :

14. Qu'est-ce que le/la professeur(e) pourrait faire pour vous faire progresser? _____

15. Quel est la qualité principale qui définit votre professeur? _____

16. Quelle est la meilleure qualité que doit avoir un(e) prof, selon vous ? _____

17. Comment noteriez vous votre prof sur 10 ?
___ / 10

18. Aimez - vous la matière indépendamment du/de la prof ?
 Oui
 Non

19. Aimez - vous la manière d'enseigner cette matière par ce/cette prof ?
 Oui
 Non
 Autre :

20. Quelle est le niveau sonore de la classe, avec ce/cette prof ?
 bruyant
 calme
 entre les deux

21. Combien d'élèves y a t'il dans la classe de ce /cette prof?
 moins que 10
 entre 10 et 20
 entre 20 et 30
 plus que 30

22. Quelle est l'ambiance de la classe ?
 propice au travail
 moins propice au travail
 pas propice au travail

23. Meilleurs qualité de votre prof?

	1 ^{er} score	2 ^{em} score	3 ^{em} score	4 ^{em} score	5 ^{em} score	6 ^{em} score	7 ^{em} score	8 ^{em} score	9 ^{em} score	10 ^{em} score
Original										
Précis										
A l'écoute										
Charismatique										
Déris										
Direct										
Patent										
Optimiste										
Organisé										
S'adapte à l'élève										

merci beaucoup !



DATA ANALYSIS

Niklas Ilmari Tikka and Sulo Pietari Hintsala

Tallinn European School

S6



Our project is a Python algorithm that can evaluate data automatically using a number of techniques. It provides the user with precise and significant facts about the distributions, outliers, ect. And can visualize this with Q-Q plots and graphs.

The user has 2 options for Analysis. The first one being simply fitting the optimal distribution to a data set. The different distributions are ranked on a fitness scale with a K-S test.

The second analysis tool is a gaussian mixture model which can separate data sets from each other through BIC (Bayesian Information criteria) or simply said log likelihood. This measures fitness of different numbers of subsets whilst simultaneously favoring smaller numbers of subsets.

to prevent any errors or false results the program removes outliers that are further than 3 standard deviations. whilst also transforming to make it more flexible and keep as many important data points as possible.

One example of a usage of this algorithm is for analyzing whether higher and/or lower quality oils have been mixed based on sulfur contents.

RELIEVING PAIN WITH MUSIC

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Music is used as treatment in certain hospitals to increase comfort in patients through dopamine release. However, there is a way to produce music suitable for pain relief purposes. This would be one of the first harmless ways of relieving pain. It would be useful for patients suffering with chronic pain and the quality-of-life worsening side effects of pain medication, such as opioids, but also common ones like ibuprofen.

The technique uses a similar principle when it comes to comfort as the current treatments, but uses electromagnetic waves and the electromagnetic field as its basis. In the track of pain-relieving music there would be sound waves that would create the hearable side and support the harmony. The base “note” would be the electromagnetic wave. The method would include the obtaining of the information on the electromagnetic field through EEG. The EEG graph can be used to detect the pain signals, which then again can be converted into frequencies matching certain sounds and electromagnetic waves that through destructive interference will cancel out the pain signals.

The reason why electromagnetic fields are looked into takes us down to the definition of pain. As pain is an emotional and physical feeling. In general, the emotions that one experiences are a part of the consciousness. New theories of consciousness suggest that its root is in the electromagnetic field of the brain. Therefore, to relief the emotional sense of pain, electromagnetic waves could be used. The musical track would emphasize emotional sense of well-being, therefore decreasing the discomfort caused by pain.

HOW VIABLE IS ELECTROMAGNETISM AS A LAUNCHING SYSTEM?

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The aim of our project was to explore the concept of electromagnetism as a launching system. This could have potential to later be used in space rocket launching to reduce the toll of CO₂ emissions on our planet's atmosphere. This is especially important due to eventual growth in the popularity of space tourism.

Through a multitude of tests and design prototyping, we concluded that the best approach towards the execution of this concept was through the use of either copper or aluminium rails, connected to a capacitor bank of parallel placed capacitors to maximise capacitance. To give the projectile initial momentum, two working variants were looked into: a simple attachment made from an elastic band and a door lock, and an incline with a pull trigger mechanism (shown in Figure 1).

In our final test, we managed to launch our projectile using 210V and 2.7 A. The projectile followed a parabolic trajectory and reached a height of approximately 1 metre and distance of approximately 2 metres. This report shows that through the testing of this concept that electromagnetic launching systems have future applicability in the aerospace field and applications.

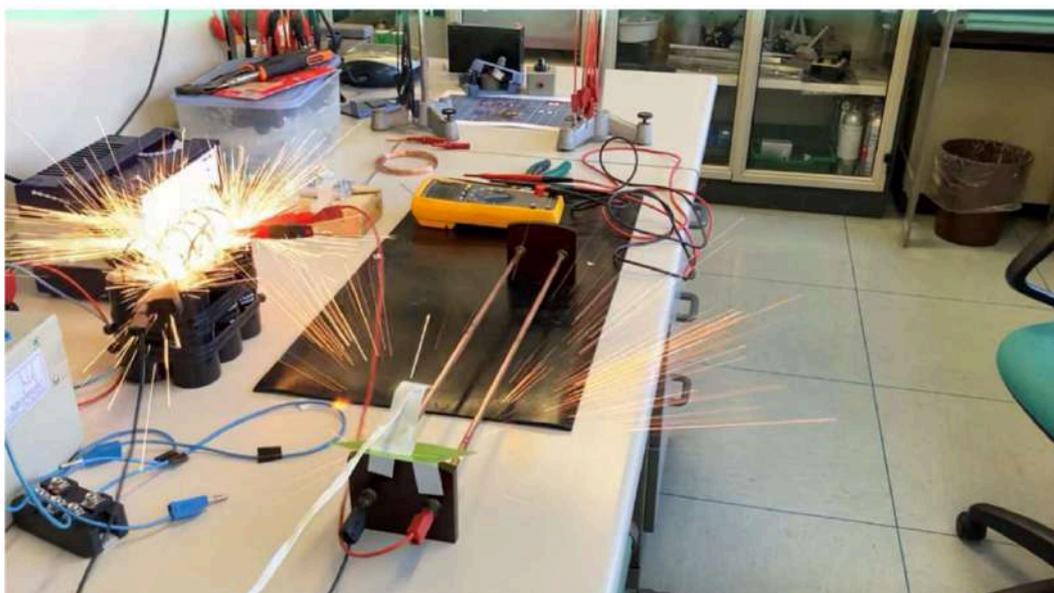


Figure 1 – Successful firing of the electromagnetic launching system

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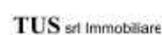
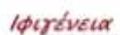
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