

Inspiring Entrepreneurship by Spreading New Technologies and Innovative Methods that Popularise Science and Art

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Abstract: In recent years a new term related to *GPT (Generative Pre-trained Transformer)* has become very popular among professional society members who develop and use computing applications. This trend has inspired entrepreneurship in education in the following aspects: *Academic* – in the Computer Science and Management Departments *Non-academic* - studies for high school pupils and for adults who wish to enrich their education. The purpose of these studies is to popularise science, technology, and art using innovative methods to make these subjects attractive. Academic *entrepreneurship* requires students to be innovative, namely, to create a project using their acquired professional skills. The work, called the *final project*, is a part of the students' academic requirements at universities. As a promoter of these projects, I have been giving the students proposals, suggestions, and inspiration for the subjects of their projects. The article mentions and describes a *database* with hundreds of recommendations for subjects for projects as well as projects completed by students who previously finished their *final project*. This project's database is used as a model for the current students. The *database* includes the project's hierarchical classification along with subsections, according to their theme, *innovation level*, and completeness, indicating their practical or theoretical properties. The following projects are a sample demonstrating the variety of the final projects, for example: "*Analysing the voiceless languages*", "*Double buffer economic boiler*", and "*Creating the most consensual coalition*". The second aspect of the entrepreneurship being developed is a series of lectures "*The Popularisation of the Science and the Art*". This collection of lectures includes an innovative method for preparing and presenting the lectures, connecting attractively the way in which science and art are popularised together for an audience in a wide spectrum of society. The *Power-Point* presentations contain built-in programs, demonstrating dynamic and user-friendly theoretical issues that are accessible using artistic, visual, and acoustic effects, such as known clips, classical and modern paintings, sculptures, music, and other artistic creations. Some of the subjects in this series of lectures are as follows: "*Cryptology*", "*Illusions*", "*Architecture and Mathematics*", and "*Polarisation index in the society*". The main difference between the two above *entrepreneurships* is that in the first case, the main innovation lies in finding the subject of each final project, whereas in the second case, the innovation relies on its *implementation*, namely, its multi-media and multi-disciplinary presentation.

Keywords: GPT (generative pre-trained transformer), Entrepreneurship, Final project, Database, Science and art popularisation, Implementation

1. Introduction

Encouraging the *entrepreneurship* presented in the article is performed at two levels: (1) the academic level, where students mentor and (2) popularising science and art. Both ways inspire *entrepreneurship* in different populations. Entrepreneurship is technologically a relatively new domain mainly based on computer science and the business sector. There is rich related literature in this area, for example, Wilkinson A. (July 2024) and Dung L. T. and Dung T. T. (2024).

The purpose of this article is, on the one hand, to popularise and integrate the following three domains: science, technology, and art into a wider population and on the other hand, to get computer science students closer to these three domains. The wider population represents the passive side of this concept, whereas students must be active, and as an entrepreneur, to be inventive, to be well informed about what is new, and to improve prospects for humanity.

The article consists of two main parts related to its purposes. Each part describes the different modules according to the type of its user: the consumer, for whom it is dedicated, the students in the academic case, or the wide audience in the non-academic case. In the first case the emphasis is on novelty and usefulness, whereas in the second case the emphasis is on presenting examples of the audio-visual merging of art, science, and technology.

A detailed description of these two ways is given next.

Table 1: Classification of project subjects in the data base by divisions and categories

- The divisions used in this classification
- A sample of some categories along with their corresponding ID number
- A partially reduced list of subjects
- The hierarchical schematical description of partial data base classifications.

(a)

ID	Division
1	Administration
2	Application
3	Engineering
4	Humanities
5	Life
6	Science
7	Sociology

(d)

Hierarchy		
Division	Category	Subject
Engineering	3D	3D Brain Map 3D Letters 3D Movies 3D No Glasses
	CAD - CAM	Cricket Reliability Requirement Engineering Models Rings Round Cutting
	Communication	Bus Comparison Bus Transportation Traffic Education Traffic Warning
	Electronics	Alarm Generator - ESD Electronic Components Electronics' Circuits Generation
Life Science	Biochemistry	Brain Energy Cycle B. Model's Loop Genetological Tree Genom
	Biometry	Biometric Identification Movement Body Language Body Movement Analysis - Physiotherapy Finger Wheel
	Medicine	Bill Creativity Dramatizing Learning Dustbin
Science	Data Structures	Associative Searching A Star Automatic Proof Construction with Viter Gift Me Normal Game
	Chemistry	Crystal as Football (L&E) Electrons_Morpheme_Configuration Jewels Configuration Jewels morpheme's configuration Jewels morpheme's configuration
	Cryptography	Coloring Pictures - Biognography Honey Code Prime Numbers - Cryptography RSA Coding Biognography Biognography

(b)

c_ID	Category
c_63	Music
c_25	Natural Language
c_67	Network, Graph
c_66	Nondeterministic
c_61	Numerical Analysis
c_29	Operating System
c_39	Optimization
c_02	Organization
c_55	PC Fundamentals
c_31	Phylosophy of Science
c_06	Physics
c_22	Positioning

(c)

Subjects
Associative Searching
Authenticity Checker of a Digital Picture
Automatic Proof
Backgammon
Biliard
Bioinformatics
Biometric Identification Moovement

Klein bottle 3D Model

Submitted by Nikolai Tiukov
Supervisor: Dr. Dan Ofir

Introduction

The Klein bottle is an amazing example of a two-dimensional manifold which is not orientable. It is a closed surface and has no border and an enclosed interior nor exterior (Figure 1).

Klein bottle was described by German mathematician Felix Klein in 1882. Klein bottle model can be physically realized only in four dimensions, since it must pass through itself without the presence of a hole.

Klein bottle in Creative arts

Designer for 3D printing Bathsbeba Grossman (Somerville, USA) has created the 3D Klein Bottle Opener in stainless steel and bronze (Figure 2). Jessica Rosenkrantz and Jesse Louis-Rosenberg (Somerville, USA) from a generative design studio Nervous System designed the Infinite Galaxy Puzzle (Figure 3). The puzzle doesn't have fixed borders, pieces from one edge could be flipped and attached to the opposite side. The image is continuous from one side of the surface to the other.

Klein bottle in science

In ferromagnetism in statistical mechanics, Lu WT and Wu FY have used it with a Möbius strip for the partition function of the Ising model. Another example of using is in the Ethernet network. Fuliang Lu in his paper have shown application of Klein bottle boundary condition to computed the numbers of spanning trees. Theoretical physicist Hong-Hao Tu with colleagues have shown that $(1 + 1)$ -dimensional nonchiral rational conformal field theory exhibits a universal entropy on a Klein bottle and they have devised a Klein twist procedure to extract such universal entropy, which found excellent agreement with CFT predictions for quantum XY and Ising chains.

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3. Tu HH. Universal Entropy of Conformal Critical Theories on a Klein Bottle. PhysRevLett. 2017 119(26) 261603-1 - 261603-5.

The goal

The project aim is to program an easy and user-friendly interface for visualization of Klein bottle 3D model.

Methods

The software was implemented in Python on web page www.pythonanywhere.com. 3D model was scalable according to the user input entered into the dialog box. Numpy-stl package was used to create files for 3D printing.

Software solution

The workflow consist of following steps:

1. Enter in your browser web site <http://klein3d.pythonanywhere.com>
2. Choose the model of Klein bottle (Program settings allows the user a choice of three models)
3. Choose a size of the Klein bottle model (Available in sizes from 5 to 15 cm)
4. Download the .STL file for 3D printing

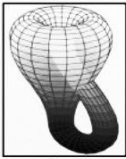


Figure 1
3D Klein bottle model



Figure 2
3D Klein Bottle Opener



Figure 3
the Infinite Galaxy Puzzle



Figure 4 - Print screen of web page: <http://klein3d.pythonanywhere.com>

Figure 1: An example of a poster prepared by a student, Nikolai Turkov, as one of the requirements of the Final Project, a Klein Bottle. The Klein Bottle is a topological special figure in which the inner and the outer parts are encountered in an astonishing manner. The aim of the project was to construct such a bottle using solid modeling and a 3D Line Printer

There is a time limit for working on the final project. However, this limit does not prevent it from being completed in a reasonable time. The research limitation related to the popularisation of science, technology. and art lies in the difficulty of matching a suitable audience to the type and level of the subject.

2. Academic Level

At this level, mentoring the students in their final project is described. One of the obligations of students in scientific and technological orientations in academic institutions is completing final projects. The students who

completed final projects with me were required to present an original problem, without a known solution, and to solve it by writing code for the algorithm in order to solve the problem. The steps for submitting a dissertation follow:

2.1 Choosing a Topic

The procedure for choosing topics for the final project consists of the following three stages:

- *An Interview*: A short interview with the student about himself: the courses he took, his hobbies, his interests, etc.
- *Suggestions* - My topic suggestions from a selection of open topics and final projects that match the student's background, which may inspire similar topics. The relevant topics offered are organised hierarchically by divisions (see Table 1 (a)), categories (Table 1(b)), and subjects (Table 1(c)) (see a hierarchical classification in a partial data base collection - Table 1 (d)).
- *Decision and Project Proposal* – The third stage is to reach a decision regarding selecting a project. The decision can be immediate, on the spot, or soon afterwards in writing. After the decision, the student writes a detailed project proposal that includes the following sections:
 - *Project name*
 - *Its purpose*
 - *The finished product - its target audience and the way it is used*
 - *The development method - tools for its development.*
 - *Prerequisites - the background required by the developer.*



Figure 2: Gallery of Zoom participants



Figure 3: The chosen Logo: “Brain vs. Fear” (Ophir D, (2003) “Brain’s Fear”)

2.2 Guiding a Project and its Implementation

Meetings are held at times when the student reports on the progress of his work in writing and orally and receives feedback from his supervisor. Repeated feedback includes encouragement for action, advice on dealing with difficulties that appear along the way, and referral to the relevant reference materials and professional literature.

2.2.1 Final project results

Final project results are presented to various forums until the final weighted grade is generated. The final products are as follows:

- Poster - One of the milestones in developing the project is Poster Day. On this day, all students doing final projects in the department present their projects as a poster (see Figure 1) in a concise, visual way to the public: students, lecturers, and faculty members. A team of judges consisting of three moderators give a score on the poster, accompanied by notes.
- Thesis - a student summarises his thesis according to a predetermined format and submits it to his supervisor and the supervisor responsible for managing the students' final projects.
- Project Presentation - the student prepares to present his project and is tested on the project while presenting his project to a panel of judges.

2.2.2 By-products

Some of my projects were used by the instructors as inspiration and as a starting point for an idea presented in articles and presentations at international scientific conferences such as Mesika L. & Ophir D. (2012), Ophir D. & Pomerantz I. (2012), and others. A small part was submitted as a patent at the National Patent Institute.

3. Non-Academic Level

The social media network development tools, such as Facebook and ZOOM, which enable individuals to appeal to a wide audience around the world, motivated the *entrepreneurship* to develop the methodology of popularising science and art. Figure 2 illustrates the ZOOM meeting participants' gallery.

3.1 Modules of the popularisation pattern

3.1.1 Brand

Logo

The logo of the template will run in various media; it should be relevant to the popularisation of science, and attract attention, i.e., catch the eye of a potential user. The logo should have several characteristics to attract attention, be easy to remember, and be relevant to the topic it represents.

The logo we chose meets these requirements (Figure 3). It depicts a huge brain and a small person next to it, which gives the impression of some kind of intimidation: man fears the brain. There is symbolism here; the mind represents reason, knowledge, and science; man, on the one hand, is afraid and on the other, he is curious. A series of popularisation lectures is introduced here, with the aim of combining them.

The anomaly of the logo is expressed in the disproportion in size between the size of the brain and the size of the person; the logo is easy to remember because it represents only two objects: the brain and the person.

Website

A website is used to automatically prepare a list of participants with their preferences, which allows the lecturer to upgrade his contacts with potential participants (see Ophir D. (2021))

There are two types of interactivities:

- Real-time interactivity: During the lecture, the lecturer asks the viewers questions and receives immediate answers, for example, in a lecture on illusions the lecturer gives a test to a reality tester.
- Long-term interactivity: Viewers initiate their contact with the lecturer by asking questions or making comments at the end of the lecture or at a time convenient via email or through a website. This allows the lecturer to interact with the viewers, who send him relevant lecture materials.

3.1.2 Open a Facebook profile

Constructing a Facebook profile requires ensuring a wide exposure. One of the tools that fulfill this requirement is opening the Facebook profile with something suitable so that other users will discover your background.

3.1.3 The lecture outlines

Title

The title of a popularised lecture should be intriguing and should capture the viewer's attention. For that purpose, the title should be exceptional; for example, the title may imply ambiguity, as in the title "*The Illusion of Art or the Art of Illusion*" (see Sekel AI (2006)). The title can allude to elements whose connection is as distant as in the title: "*Architecture, Art, and Mathematics*". At first glance, these concepts are distant, and the viewer may be interested in the connection between the three factors. The title "*Logic, how does it deal with paradoxes?*" (see Baronett S. (2018)) is another type of headline that can entice a potential viewer. Another way to capture potential viewers' attention is to mention useful aspects of the lecture: "*Game Theory and Their Contribution in Everyday Decision-Making Process*" (see Neumann J. Von and Morgenstern O., (2020)).

A title that contains a question mark is often a good title because it indicates the lecturer's appreciation of the viewer. Here the lecturer thinks that the viewer will know how to deal with the question at the end of the lecture. A title that hints, e.g., gives tips on easy financial gains, appeals to the audience, as in the headline: "*Understanding Bitchain, and its Impact on Optimal Digital Currency Investments.*"

Mystery and secrecy disguised within the headline can add interest to the lecture, as in the headline: "*What are covert encryptions and what damage can they cause?*" Here we encounter another factor that attracts attention in the title, namely, the element of intimidation: if you do not go to the lecture, you will not know how to deal with external threats. Finally, we will present counter examples of a boring title that does not pretend to attract attention, for example, in titles such as "*Game theory*", "*Encryption and Identification*" (see Burette S. and Paine S., (2001)), "*Bitcoin*", and "*Computer Games*".

Lecture's Abstract

The abstract accompanies the invitation to the lecture. The role of the abstract is to briefly tell the target audience about the content of the lecture. On the one hand, the abstract should attract potential viewers, and on the other hand, it is advisable to leave the factor of surprise to the lecture itself, for example, by presenting a connection between two different areas. As an example, we have shown an association between encryption and genetics (see Piercer B. A., (2016)). The summary also explains how the current lecture fits into the series of lectures as part of the popularisation of science. Thus, it is possible to advertise the entire series.

Opening and closing remarks

The opening contains the following components: (1) thanking the organisers of the lecture series for their contribution to the initiative, the organisation, and for inviting the lecturer to give a lecture; (2) a description of the factors that led the lecturer to develop a series of lectures, and an overview of which lectures have already been given as part of the series; (3) a reference to the audience's responses to lectures given so far; and (4) conclusions to the above

After the opening remarks, it is recommended that the opening slide, which explains the motivation for the lecture, will appear. The slide will contain a direct description of events that were effectively dealt with thanks to the means described in the lecture. For example, the first slide showed World War II videos on the music of Richard Wagner (*Cabalgata de las Valkyries*) (see Wagner R., (1851)) and explained the crucial function of the enigma cipher in this event. It began with fireworks against the backdrop of Rossini's impressive music of William Tel's opening "*Gallop*" (see Rossini (1829)).

Concluding remarks to the viewers: thanking them for listening, directing them to a slide containing the contact details of the lecturer, in case there are any questions and comments, along with follow-up lectures in the series; referring viewers to a penultimate slide containing the lecture's punch line, expressed with familiar musical accompaniment, conveying the message of the lecture in a pleasant and relaxed atmosphere, for example, Frank Sinatra's famous song "*I do it my way*" at the end of the lecture entitled: "*Poland-Israel stories*

In the context of culture, science, and what connects them"

3.1.4 Table of contents

The table of contents is built hierarchically, as a tree with several levels of detail. Each node in the tree is a link to relevant material in the lecture.

If we look, for example, at a genealogical tree of the lecture topics: "*Time, Space, and Art*" (see Figure 6, Dainton B. F., (2010)), we see a branching tree with five levels of detail. An arbitrary route in the tree was chosen: [World > Space > Cosmos > Space-I].

The following features will help popularise science, preferably through visualisation and sound effects. There is extensive use of videos, animation, graphical interfaces, supported by programming languages integrated into the middle of the presentation. Several examples presented below are contained in presentation lectures popularising science and art given so far in the lecture methodology described here.

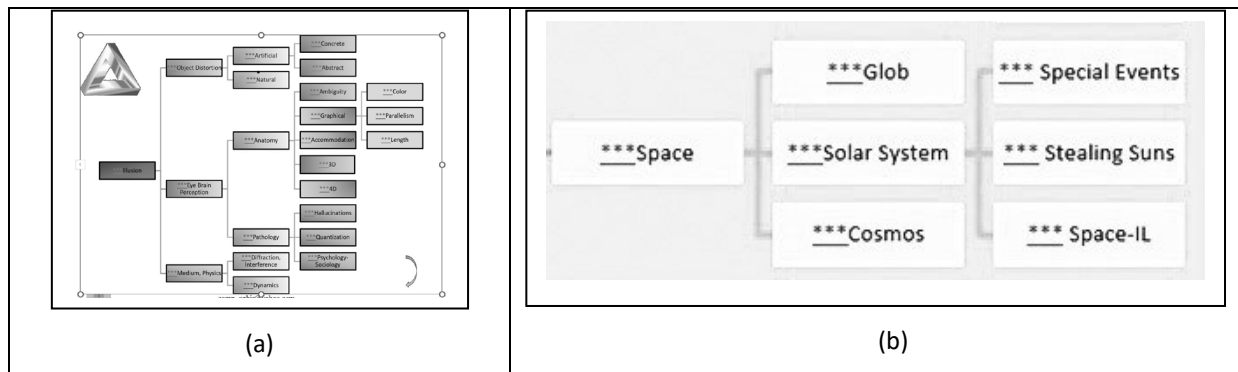


Figure 4: Tree of Contents (a) The whole tree in a miniature size; (b) A partial tree contents



Figure 5: Charlie Chaplin in "The Gold Rush" demonstrates hallucinations as a type of illusion in the lecture: "The Art of Illusions or the Illusions of Art"

Videos

In a lecture entitled: "*The Art of Illusions or the Illusions of Art*", Charlie Chaplin's video "*The Gold Rush*" was presented, in which the protagonists suffer from exhaustion, accompanied by hallucinations, a kind of illusion. A soundtrack of Chopin's "*Nocturne*" accompanies the video. The video is supposed to evoke in the veteran viewers' feelings of nostalgia, an indulgence in the past - a period in which the film was shown in cinemas (Figure 5, Chaplin C., (1925)).

Sometimes the videos are critical to understand a dynamic phenomenon, as in the case of a description of a folding bridge in a lecture: "*Architecture, Art, and Mathematics*". It is impossible to accurately describe the details of the bridge's folding.

Audio Features

Audio was brought up in a lecture on encryption in the context of the mutual identification of two listeners talking to two telephone line hunters and attempting to identify each other.

Animations

Animations were used in the lecture: "*Space, Time, and Art*" (Figure 6), in a humorous description of the Time Traveler Paradox (see Campbell, J.W. (1935)) the Theory of Special Relativity.

Simulation

Simulations were presented in the lecture: "*Game Theory and Their Contribution in the Decision-Making Process*". The simulation shows the decision tree and the control panel from one node to another node in

another branch, depending on the decision made. Another example of simulation is simulating the Roulette game in the casino in the lecture "*The Art of Illusion or the Illusion of the Art*".

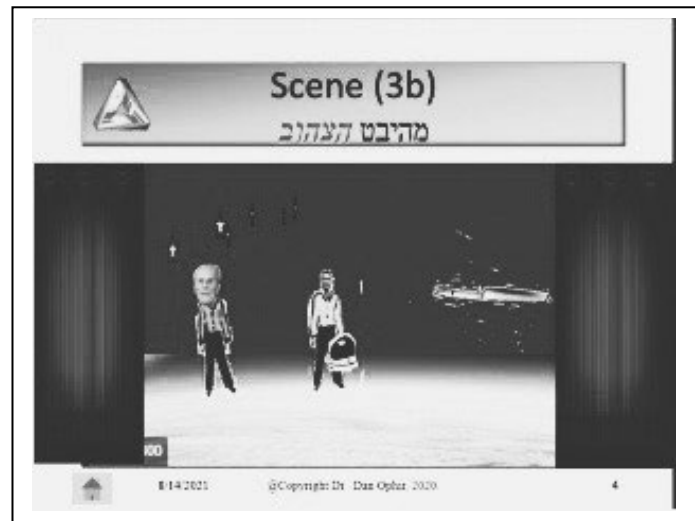


Figure 6: Twins' space encounter, according to the *Twins Paradox* of the *Relativistic Theory*

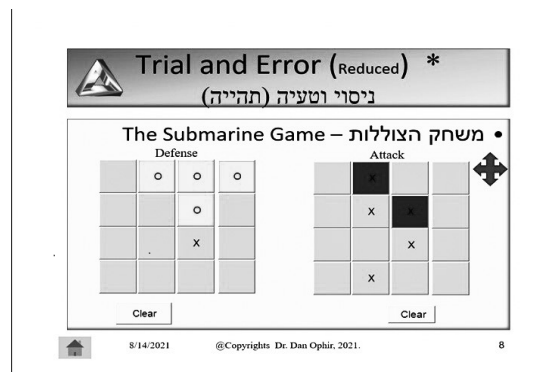


Figure 7: The *Submarine Computerized Game*, embedded in the slide presentation. The left and the right big squares represent the battle fields seen from both opponents' points of view, respectively

Computing-Programming

Computer programming is incorporated in a presentation in the lecture entitled "*Computer Games, Do They Improve Our Thinking Capability?*" The graphical interface to the software in the presentation allows the user to play the submarine game and to experience it in real time (Figure 7).

The above demonstrates how in an entertaining, humorous, interactive, and pleasant way, with the help of built-in musical accompaniment, adapted in rhythm and sound to the nature of the content, something can be presented on the slide, consciously and sometimes subconsciously, allowing popular information to be conveyed to the listener's satisfaction.

3.1.5 Subjects

Exact Sciences

- Bioinformatics - The field of genetics, the structure of the gene, is composed of four nucleotides - amino acids, in a lecture on encryption
- Mathematics - Concept series, Fibonacci series, the concept of the limit, the golden ratio, in the lecture: "*Architecture, Art and Mathematics*"
- 4Biology - Blood Types - ABO, mentioned by Prof. Leopold Hirschfeld, of Jewish-Polish descent, who helped discover our blood types - in a lecture: "*My Story in the background of Polish Israeli Cultural and Scientific Relations*".

The Humanity and Social Sciences

- Communication - The concept of fake news, disinformation (in "*Cryptography and Identification*")
- Psychology - The concept of a reality test – a reality test, verbal and performance intelligence, CBT (Cognitive Behavioral Therapy) (in "*Illusion of Art and Art of Illusion*")
- History - The crucial event of May 26-27, 1941, Atlantic Ocean, west of Brest, the Allied victory over the Nazis, turning points in World War II battles (in "*Cryptography and Identification*")
- Literature - Shaul Tchernichovsky, one of Israel's national poets, wrote in his poem: "A man is not, but a pattern of the landscape of his homeland." This quotation was mentioned in the lecture "*Childhood in the background of Polish Israeli cultural and scientific relations*".

Art

- Painting - Pictures of Francisco Goya, Van Gogh, Escher, Vasarely, Einhorn, and Dali Salvador (in "*Illusion of Art and Art of Illusion*").
- 4Sculpture - The Rapaport sculpture of the Warsaw - Ghetto Uprising (in "*Childhood, Poland-Israel Culture, and Science*").
- 4Music - Gallop in the William Tell Overture, by Rossini; Giovacchini Antonio (in "*Illusion of Art and Art of Illusion*").
- Cinema - "Obscene Proposal" - Robert Radford, "Gold Rush" - Charlie Chaplin (in "*Illusion of Art and Art of Illusion*"). In *Cryptology* – the history of *Enigma* was described using the background of "*Ride of the Valkyries*" (see Wagner R., (1851)).

Technology

- Image Processing - The meaning of the pixel and the RGB primary colors were explained in lectures: encryption, and in a lecture on graphics, respectively.
- Optical Instrumentation - *Sextant* - an instrument for measuring spatial angles; the *Hubble-Space-Telescope*, a telescope built for space exploration; the Helmet-Mounted Display (HMD) – another optical tool. The instruments were included in the lecture: "*Time, Space and Art*".

4. Conclusions

In science, technology, and art two-level entrepreneurship methods were described above. Both were intended to cover a wide spectrum of the audience's interests considering the subjects and their levels. Their purpose was both educational and practical: to make life easier and more pleasant. The mentor/lecturer's advantages were mainly regarding satisfaction in contributing to society, along with some profit.

Regarding the first type of usage, in the academic world there is a term called "lecturer evaluation", in which the students evaluate the lecturers' performance, and in the final project for which I have received the highest possible grade, which is an indication of this kind of activity. Additional academic recognition of these projects is reflected in the high number of citations and viewings of the papers, which were motivated by the *students' final projects*. The publication of those articles, which appear in the references, is evidence of their originality and their academic value, (for example, Mesika L. & D. Ophir D. (2012) and Ophir D. & Pomerantz (2012)).

In the non-academic case, its popularity may be indicated by the *satisfaction index* of the series of the lectures, measured by the number of superlatives, relative to the number of participants in the lectures. These superlatives are included in the feedback received and by the repeated participation of the same individuals in the next lectures in the series.

It appears that the academic and the non-academic parts in this paper have been largely approved. It turned out that the final projects of the students in the computer science and in the management industry departments contribute to their successful employment in industry; for example, one student advanced to the position of vice-director in the Google-Israel development wing.

The series of lectures popularizing science, technology, and art were received with great appreciation, mainly in two public sectors: workers' committees and retired workers. Their satisfaction was expressed in their feedback and very positive questionnaire results. This kind of activity is a kind of entrepreneurship and novelty.

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