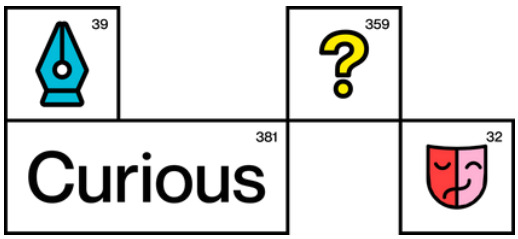

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Methodology on creating AUGMENTED LECTURES

Culture as a Unique Resource to Inspire, Outreach and Understand Science

Funded by the Creative Europe - Culture Programme, 2020-2023

Project CURIOUS - Methodology on creating Augmented Lectures

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Credits

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CURIOUS is a project carried out by Arditodesìo (IT), Arte Urbana Collectif (BG), the Interactive Arts Laboratory of the University of Arts in Belgrade (RS) and the Arenberg Theatre (BE).

This document has been written by Andrea Brunello with the help of Pierre Echard, Dimitar Uzunov, Monica Murano and the support of all the partners of CURIOUS.

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A treatise on Augmented Lectures has also been presented in chapter 12 of the book *Science & Theatre: Communicating Science and Technology with Performing Arts*.
The chapter has been written by Andrea Brunello and Stefano Oss. The book is © 2022 by Emma Weitkamp and Carla Almeida and published under exclusive licence by Emerald Publishing Limited.

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GENERAL OVERVIEW

Augmented Lectures are an art-science stage performance between an artist and a scientist. This document presents what they are, why they can be useful and how to construct them. The first experimentations with Augmented Lectures were created under the guidance of Dr. Andrea Brunello, with both scientific and theatrical training, with the involvement of university researchers. Further Lectures were created by other art-science practitioners as further discussed.

Augmented Lectures are, both conceptually and concretely, a work in progress. They have been the object of extensive experimentation since 2017, on the one hand in terms of the creative process and on the other, in terms of the topics and creative personalities involved. Both the creative process and the content / protagonists can lead to wildly variable results. Our aim here is to bring forth our experience and produce a set of basic indications that can be viewed as a "recipe" to help with the construction of an Augmented Lecture. As our learning journey progresses, so will the methodology and guidance in subsequent versions of the methodology. Nevertheless, this first edition of the manual represents a solid starting point for those willing to give Augmented Lectures a try.

Who is this "manual" for?
This document is a general manual on how to construct Augmented Lectures. It is meant for any theatre company, university, school or scientific organisation interested in pursuing such creations. We would like to stress that here we can only provide a general overview of the creative process which should be tailored to individual specific needs. Schools, museums and festivals will also find this material useful in their own creations involving teachers, communicators, researchers and students.

Where is the novelty?
There is no novelty in turning science lectures into performances involving both scientists and artists. This is done regularly in settings like science shows and festivals, sometimes with really good results too. But in the great majority of cases the following conditions do exist:

- The lecture is a one-shot experience, based on an extemporaneous need or intuition and not on a creative process based on previous experiences. In other words, there is no continuity and therefore there is no building on past experiences.

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- The relationship between scientist and artist is often not on an even ground, the artist acting more of a support to the scientist, a sidekick than a real creative partner. Said differently, the artist's presence is mainly functional to the scientist and the artist does not really participate in the scientific lecture, his or her role being limited to a creative performance.
- The scientist and the artist do not co-create the lecture together failing to connect science with art in a bi-directional way. Often the scientist will direct the artist and ask them to "do something" like play some music, recite a poem or read a passage but the focus of the lecture is entirely on the scientist.

What we propose here is a different paradigm in the relationship between the artist and the scientist, a co-creation process leading to a joint performance on stage, that can produce some surprising results.

A common question is why not working with more traditional sciencetheatre plays performed only by artists? Why involve the researchers on stage when regular "theatre about science" has been successfully used as a tool to communicate science? We will explore this issue in the next section and try to make the case for what makes Augmented Lectures a unique and powerful means for communicating science in an emotional and competent way.

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THE CASE OF AUGMENTED LECTURES

Humanity will need to make radical changes if it is to continue thriving. Our models of production and consumption, of democracy and governance, education and social inclusion, of cultural and natural heritage preservation are clearly inadequate in addressing our challenges, and must be rethought entirely. Culture and the Arts are essential ways of helping society engage in the inevitable transition we face. Science is also part of the solution but there exists a troubling knowledge gap between those who understand the methods and implications of science, and those who don't. This poses the risk of "fake news" and "science negationism" with alarming negative impacts on democracies, economies, cultures and societies. Performing arts can play a key role to bring science closer to society, rendering it more credible, empowering citizens as well as policy makers to be more curious, aware, engaged and critical. [1]

The difficulties of Theatre About Science

Finding good "theatre about science" is hard. This statement may seem a bit tranchant, so let's delve into it. First of all let's define what we mean by "theatre about science" which, to simplify, we will call from now on sciencetheatre. One possible definition is that a sciencetheatre play is a stage performance, with some scientific content, that generates emotions while at the same time providing a certain level of science literacy. Such stage events are typically created by one or more stage artists with the help of one or more scientists who act as consultants.

This definition sounds reasonable, but what is science literacy? [2]

[1] This was the ambition incipit of the CURIOUS project, of which this document is integral part. We strongly believe that to know science and its methods means being better able to understand where society is going and how to take advantage of the many opportunities that this awareness provides.

[2] For a substantial discussion on Scientific Literacy and its different interpretations, consult the PISA 2003 Assessment Framework - Mathematics, Reading, Science and Problem Solving Knowledge and Skills (Copyright OECD 2003).

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Is it the capacity to understand science, or is it also the ability to make use of scientific findings, interpreting one's life through them. This question is rather important because the way science is traditionally taught in schools is mostly geared towards providing the basic knowledge of it, and not how science impacts in our existence, our lives. In other words, what is often missing in formal education is the personal, human connection to science. As a matter of fact it is our personal opinion that science literacy should be interpreted as the ability to navigate through the most basic ideas of science, making good use of them, being able to judge what is scientifically sound and believable while at the same time identifying what is not. This entails developing the skills of awareness, ownership and critical thinking about science. This set of abilities is often defined as critical science literacy.[3] Finding good "theatre about science" is hard because very little of it satisfies the two requirements: to entertain with powerful emotions while at the same time providing the skills to improve critical science literacy.

Regular Lectures, the Deficit Model and all that

It is granted that a good sciencetheatre production can have the sole honourable aim to entertain the audience. But if we agree that one of the objectives is also to raise the level of critical science literacy, then one could question the efficacy of mainstream sciencetheatre. One could then opt for the time tested way of delivering a regular albeit well crafted expert frontal lesson, maybe with a performative twist. This is the typical method of imparting information from a knowledgeable source to a less knowledgeable general audience. It is a very straightforward method that is easy to produce and reproduce and can achieve good results in terms of content delivery. This lecture format falls into what is often called the Deficit Model, also known as the Diffusionist Vision.[4] The main drawback of this method is that a regular lecture may not be able to consistently provide the level of emotional involvement that is needed in order to really create a connection with audience: Too often the lecture appears as a formal, authoritarian, paternalistic and top down event that can put off part of the audience. Most importantly, it often fails to create a real empathetic relationship with the public and those that really connect with this format tend to have a pre-emptive interest in the contents. In other words, the regular lecture format based on the diffusionist vision often fails to excite and generate audience development.

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3 Medvecky, F. Public Understanding of Ignorance as Critical Science Literacy. Sustainability 2022, 14, 5920. https://doi.org/10.3390/su14105920

4 The literature on the pros and cons of the Deficit Model (DM) is quite rich. For an interesting review on the issue, including why the DM is often the top choice in science communication, see Molly J. Simis, Haley Madden, Michael A. Cacciatore and Sara K. Yeo. (2016), 'The lure of rationality: Why does the deficit model persist in science communication?' Public Understanding of Science, Vol. 25(4) 400 – 414 DOI: 10.1177/0963662516629749.

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Storytelling in the communication of science - connecting with the audience

In the previous section we argued that some sciencetheatre does not improve critical science literacy because it is too edulcorated on the science, while a regular "deficit model" lecture, albeit spectacularized, may fail short of generating emotions and therefore a real connection with an audience that is not already convinced.

One way to overcome this double limitation in a consistent way is to develop a sort of storytelling approach where the rigorous scientific content is delivered in a narrative, more engaging, if less direct, way. This is the way of storytelling that theatre audiences know very well, but that has been used somewhat sparingly in the field of formal, informal and non formal education. Yet, storytelling has been shown to be a very efficient way to engage with the audience, to create emotional and empathetic links.[5, 6, 7] In other words, to create connections that are based on shared experiences and, from those, move to a level of understanding that is also factual and cognitive.

When we talk about "science storytelling" I mean the construction of narratives that include science as a necessity, a content that cannot be overlooked or else the story itself is not credible or even understandable. Because of this, the science needs to be explained in the story. This is a hybrid connection between regular theatre and a deficit model lesson. The storyteller needs to master the scientific content but also possess an understanding of the human dimension. The audience needs to feel that what they are witnessing is an emotional journey of understanding and not just a lesson, even if the declared intent is to provide critical science literacy.

Choosing the conveyor

In our research we investigate how these special hybrid lectures should be structured. How are they built? And who should deliver them? In other words, since we are stepping into a hybrid territory where science meets storytelling and the performing arts, who should take charge of conveying it? A scientist or a performing artist? This question is quite relevant since the scientist is usually quite proficient at delivering the content but at the same

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5 Dahlstrom, M. F. (2014). 'Using narratives and storytelling to communicate science with non-expert audiences'. Proceedings of the National Academy of Sciences 111(Supplement 4), pp. 13614–13620. https://doi.org/10.1073/pnas.1320645111

6 An entire issue of JCOM was devoted to storytelling in science. See as a reference: Marina Joubert, Lloyd Davis and Jenni Metcalfe (2019) Storytelling: the soul of science communication. Journal of Science Communication 18(05) https://doi.org/10.22323/2.18050501

7 Susana Martinez-Conde et al. (2019). 'The Storytelling Brain: How Neuroscience Stories Help Bridge the Gap between Research and Society'. The Journal of Neuroscience, October 16, 39(42):8285–8290. https://doi.org/10.1523/JNEUROSCI.1180-19.2019

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time the artist possesses the skills to generate emotional responses in the audience. In this case the form is just as important as the content, otherwise the content may fail to provide emotions! This conundrum ceases to become a problem when we realise that there are no limitations on who should be on stage: both the artist and the scientist should be entitled to do it, together. That is what we are describing here and their creation is what we call an "Augmented Lecture" (AL). In the following section we will connect with the creation process of the ALs providing details to those interested in trying their own hand at the creation process.

BOX: The origins (Arditodesio)

ALs have been at the core of our research over the past five years. The first ALs were created appositely for the Teatro della Meraviglia (Theatre of Wonder) Festival, held in Trento (Italy) beginning in 2017.[8] The main idea of the festival is to create opportunities to explore the field of science communication by means of artistic contents, to scout the state of the art of Italian sciencetheatre and to identify novel techniques of informal education and improving the scientific literacy of the audience. In planning the first edition of the Festival we believed that finding good theatre about science would have been easy, but very quickly we ran out of options: too often what we found was superficial, simply biographical with very little science or borderline metaphysical in content (sometimes science was mixed up with pseudo-science or even science fiction). To overcome this limitation, we started looking for stage lectures based on solid scientific background but we did not want to fall into the trap of the Deficit Model, by having a scientist entertain the audience in a lecture-like manner. That is why we started tinkering and experimenting with a hybrid format, inviting artists to be on stage with the scientists. And that is how the first ALs were born.

The real step forward in the AL creation process was triggered by the pan-european project CURIOUS (Culture as a Unique Resource to Inspire, Outreach & Understand Science), co-funded by the Creative Europe Programme of the European Union .[9] Within the CURIOUS framework the four project partners produced eight Theatre of Wonder Festivals (two in each country involved: Italy, Bulgaria, Republic of Serbia and Belgium (Flanders)) and 22 original Augmented Lectures in five languages (the four 'native' languages, plus English). Some of these ALs have had the chance to tour

[8] Teatro della Meraviglia is a joint effort of the Arditodesìo Company and the University of Trento with the support of Opera Universitaria. More information can be found at www.teatrodellameraviglia.it

[9] CURIOUS is a joint venture between Arditodesio Company (IT), Arte Urbana Collectif (BG), the Interactive Arts Laboratory of the University of Arts in Belgrade (RS), and the Arenberg Theatre (BE) and runs from 2020 until early 2023. Agreement Number 616819-CREA-1-2020-1-IT-CULT-COOP1. More details can be found at: projectcurious.eu

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internationally among the partner festivals and be seen by a wide array of audiences. [10] CURIOUS has provided us with the opportunity to explore and experiment the AL creation and delivery process, and tailor it to different contexts, approaches and needs. [11]
The outcomes have opened up a wide array of results that we continue to explore and analyse. These experiments have provided us with further proof on the value of this novel format, its reproducibility and how it can be expanded. The final aim of CURIOUS has been to set up a strategy to turn Augmented Lectures into a way to do outreach but also to create real artistic performances, elevating the level of scientific literacy of (novel) audiences while at the same time creating emotions around science.

[10] CURIOUS aimed to step up the quality and the experience of AL creation and transnational touring.

[11] For example, adapting the format to access inner city youths, or creating immersive theatre events.

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So, finally... What is an Augmented Lecture?

At its core, an AL is an art-science theatrical interaction, a dialogue, between a scientist and an artist. By dialogue we mean an encounter on stage where the two "performers" find ways to connect around a scientific topic by means of their own special abilities and, together, create an emotional as well as cognitive bridge with the audience. The artist and the scientist need to negotiate a way of elevating the scientific content from a lesson to a story, from scientific talk to an existential dimension. Their roles on stage are fully equal, none should prevail on the other and their common aim is to raise the level of scientific awareness in the audience while, at the same time, creating the environment for an emotional connection. In this quest, the scientist carries the scientific knowledge, but the artist is needed in order to consistently open up communication channels with the audience, to generate the conditions for real bi-directional trust and connection that is needed. Of course the performers need to show profound qualifications in the science they portray. Yet, at its most intimate level, trust needs also powerful emotions, empathy and image sharing.[12,13] These are typically expressed by the artists while often scientists do not explore such qualities in their lecturing. In an Augmented Lecture we try to change this situation. The scientist and the artist should be complementary on stage, putting each other off balance, inviting into each other's game field.

BOX: An example of an Augmented Lecture - "What is Life?"

This Augmented Lecture was produced for the 2021 edition of the italian Teatro della Meraviglia festival and has toured extensively throughout Europe since. On stage are professor Gianluca Lattanzi (Department of Physics, University of Trento, Italy) and Italian actress Maura Pettorruso. Andrea Brunello directed them. The title was originally that of a series of lectures given by the famous physicist Erwin Schrödinger, who took refuge in Ireland during WWII. Surrounded by reports of death, Schrödinger questioned the processes that allow life to proliferate on our planet. The principles of physics and chemistry must account for this. But how? Why is it so? Does it have to be so?
And ultimately: what is it, really? While we can hold out reasonable hopes of being able to explain how life works, we are a long way from answering the real existential question: why?

12
Emma Engdahl and Rolf Lidskog (2014). 'Risk, communication and trust: Towards an emotional understanding of trust'. Public Understanding of Science, Vol. 23(6) 703–717
DOI: 10.1177/0963662512460953

13
Jack Barbalet (2011). 'Emotions Beyond Regulation: Backgrounded Emotions in Science and Trust', Emotion Review Vol. 3, No. 1 (January) 36–43
DOI: 10.1177/1754073910380968

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This is the dramatic question that both Maura and Gianluca, whose characters are siblings, try to answer by means of a story. The plot makes its moves from the death of their grandfather to whom they haven't been able to talk for many years because of their cultural distance: a humble and unschooled man who could not possibly understand Shakespeare, Checkov, thermodynamics and quantum mechanics. Grandfather's funeral offers the occasion for a final reconciliation and the two siblings finally find the courage to tell him what they have been doing with their lives, delving into the details of what is life after all: from a scientific point of view as well as the artistic side. This catharsis allows them to come to terms with their guilt feelings and, most importantly, to reconcile with life and their kinship.
'What is Life?' is a well crafted production that opens up existential questions but that, at the same time, allows professor Lattanzi to explain some deep concepts such as non stationary physical processes, the law of large numbers, chaos, entropy, order and disorder, making them vital for the understanding of his own personal journey. The character played by actress Maura Pettorruso makes a real effort to try to understand these concepts (she has no formal training in science) while at the same time putting Gianluca off balance with her own view on life and a solid sense of humour. The end result is a deep and touching play that never fails to charm audiences while at the same time providing a real science lecture. For a video recording of this Augmented Lecture please go to: https://www.youtube.com/watch?v=uUeHS1i2QLE

What types of science?

Because of the way they are created, ALs can be created irrespective of the topic that needs to be explored. We use the verb "to explore" because that is actually what is done as both the artist and the scientist move outside of their comfort zone. Keeping this in mind, ALs can be created around rather obscure and difficult topics, and this is one of the strengths of the process being proposed here. As a matter of fact, the more obscure and difficult the topic is, the more challenging but also rewarding the creative process becomes. ALs can support just about any topic coming from the world of research. What is needed is solid competence in the science and in the tools of theatre. The creators need to develop the ability to connect the topic to a story, so that artist and scientist can work together in a constructive way.

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The AL crew

Since 2017 more than 30 ALs[14] have been produced. The first ones were done in Italy but then the experience expanded to Bulgaria, Serbia and Belgium thanks to the CURIOUS project . This experience has helped us fine tune the creation process and also come up with ways to streamline the process. We will now describe the process in detail.

The ideal production team is composed of a scientist, a performance artist and a play director. The scientist can come from any field of study since the overall process does not depend on the content of the lecture, as long as it is scientifically sound.[15]

The artist should be someone with good familiarity with being on stage. Although we have experimented with all kinds of artistic fields (from acting to singing, from painting to cooking), we have discovered that the most powerful ones, for this type of art science format, are theatre spoken word actors because they connect with more immediacy with the audiences compared to artists coming from other art forms. But more importantly, the scientist typically has more familiarity and therefore relates more easily with spoken word contexts than with any other art form. Because of this, the connection between the scientist and the actor is greatly facilitated.

The director should be able to guide the creation process and s/he should possess playwriting skills too. The director should also have some understanding of the scientific concepts being dealt with, because s/he acts as a link between the two performers both from a point of view of art but also from that of science.

Start with a workshop

We will present here a procedure that has proven successful in training the scientists and artists involved in the creation of our ALs. Of course, ours is just one of the many possibilities and it should be taken as a suggestion.

In order to get the researchers up to speed, a starting point for us is typically a science storytelling workshop geared specifically for them. The artists and the directors will be involved only after that the scientists have received basic training in the art of storytelling. This is done by means of a workshop that not only provides training in the storytelling process, but it also helps identify those scientists who will actually be willing and able to go through the AL creation process.

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14 Augmented Lectures have dealt with all kinds of scientific issues ranging from the study of maps, the clothing of astronauts, the world of exotic plants, future studies, gravitational waves, Dante's divine comedy, the chemistry of foods, pandemics, the double slit experiment in quantum mechanics, brain sciences, interstellar exploration, evolution, fake news, 3D bioprinting, love and more.

15 Even if the original concept has been developed to communicate science, an AL can be created on just about any subject, including pseudoscience and metaphysics! It depends on connecting an expert with an artist regardless of the discipline. Of course we don't endorse such deviations!

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BOX: Description of the workshop. The creative triplet: scientist, artist and director
Creating an Augmented Lecture means providing an opportunity for a scientist to experiment with their artistic dimension. The workshop that we refer to in the main text has the aim to transfer knowledge so that the scientist acquires the basic elements of stage work and of storytelling. The workshop is typically open to 20 people maximum and lasts anytime between 12 to 20 hours divided in 3 hour sessions. Its contents are both theoretical as well as practical.
On the theoretical side, these are:

- What is critical science literacy and its importance
- Examples of science communication
- The structure of a simple story and the Hero's Journey [16]
- How to transfer the science into the story
- Inserting universal and existential themes into the scientific topic

The more practical side of the workshop involves:

- Writing personal science stories to be shared with the group
- Developing body awareness
- Connecting with the audience, courage and trust
- Time management
- Basic elements of public speaking

At the end of the workshop the scientists are asked to present a 5-minute short personal story to be delivered to their fellow participants but also to a group of artists and directors that have been invited to the final presentation. These people have been invited to act as an audience but also to be potentially involved in further developments of the Augmented Lectures.
The short stories delivered by the scientists should contain some elements of the science that they would like to deliver in the AL.
At the end of the delivery, the invited artists and directors are asked to consider whether they would like to pursue a connection with at least one of the researchers and explore a potential collaboration for the creation of an original AL. At that point the most favourable connections are made and the AL creative triplet is complete and ready to work.

16 More on this later in this document. Nevertheless, much information can be found online on the Hero's Journey. For a quick reference go to https://en.wikipedia.org/wiki/Hero%27s_journey

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Explore the topic and create a story

Once the creative triplet has been identified, the real AL creation can begin. The first step in the preparation is to ask the scientist to deliver a real frontal lecture to the other two creative partners, so that the scientific content of the AL is made explicit and discussed. After this step, the artist should take some time to metabolise the scientific content and further explore the topic on her/his own so that she/he can gain some basic competency in the science being discussed. This process can take some time and is entirely subjective. Nevertheless, we suggest that, if possible, everything is done within days from the workshop, so that the topics being treated can remain "hot" in the mind of the people involved. When ready, the artist will propose her/his creative approach to connect to the topic. It is important to note that this is only one possible approach. Here we rely on the creativity of the artist, she/he will bring their individuality into the picture. There is no recipe here, and there is no right/wrong answer. Here the artist could propose possible connections such as a personal story somehow related to the topic, a reference to a book or a movie, a song, a dramaturgical construction, or any idea that connects somehow with the topic. The basic concept here is that the artist is invited to identify personal connections to the scientific topic.[17] These connections will be used in the construction of the AL.
Finally, after the topic has been processed, with the help of the director, the overall dramaturgical construction and a possible storyline is created. Here is where the Hero's Journey[18] comes in handy. Its elements should appear in the overall story: status quo, complication, resolve, return with a deeper understanding (the so-called elixir).

Rehearse and scenography

Once the structure of the AL has been devised the team moves to the creation process. We have discovered that the most that we can really ask the scientists to devote to the AL is about 40 hours of rehearsal, divided in 2- or 3-hour sessions. This rehearsal time is significantly shorter than for regular plays but it actually works to the advantage of the production: on the one hand it allows the overall result to remain somewhat improvisational and therefore highly adaptable to various situations and needs, on the other hand, it prevents a "rehearsal burnout" on the side of the scientist who is typically not used to the gruelling repetitions of the play staging process.

17 Here the possibilities are truly endless. They depend a lot on the artist's inclination, on the topic and on the final outcome that is desired.

18 Refer to the Hero's Journey box later in this document.

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The staging should also include minimal technical and scenery requirements because one of the aims of ALs is to be performed in all kinds of venues and situations, schools included, where regular theatres may not be available. The agility of ALs is a fundamental characteristic that, in time, we have found out to be extremely valuable for touring. Because of this we have learned to limit ourselves to using simple objects like tables, chairs, a video projector, musical instruments. Anytime we tried to add complexity to the ALs (by means of technical elements and/or scenography) we have had trouble touring them mainly because the venues may not support them (ALs often end up in locations that are not theatres, like conference rooms, museums, science festivals, universities, schools). Our suggestion is therefore to keep the scenographic elements and technical requirements to a bare minimum.

How long should an AL last?

This question has only one reasonable answer: it depends. The duration of the AL is a function of the motivations and needs of the creative team, and one should answer the following questions: Where will it be most likely performed? What will be the occasions? And what will the audience be?

It can be said that an AL should last as long as possible given the constraints. In our experience we have created ALs of varying durations. For example, if the AL is meant for youths that have very short attention spans,[19] then they can be made to last 10-20 minutes. Other times, when the conditions allowed, the ALs have lasted close to two hours. Each AL has its own personality and objectives so there is no general rule on the duration.

Having said that, as a general benchmark and if we don't have any particular constraints, we suggest that a typical AL should last about an hour because this time span allows one to fully develop a story and, at the same time, to explore the scientific contents. Also, if the AL is to be performed in a university or a school setting, one hour is the typical time allotted for a class and so the overall engagement of the students could be that of two hours: one for the performance and one for the Q&A session. One final note needs to be made if it is known that the AL will be touring. In that case it could be easier to motivate and justify the expenses of touring if the AL has a reasonable duration, one hour or more. This depends on a lot of variables, of course, but in general it may prove difficult to justify the touring expenses for a short performance.

19 Such as inner city youths, but pretty much many youths (and adults) these days!

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Further ingredients of an Augmented Lecture

The Hero's Journey Vs. the Documentary

As mentioned before, the Augmented Lecture has a special characteristic: it moves away from a straightforward lecture and shifts into the territory of the story. Lots has been said and written regarding stories. It has been argued that we are storytelling animals, that we have developed as a species because of stories and our brains have collectively developed in order to facilitate this evolution. Questions abound: are our brains like this because of processes of evolution or have we evolved as a species because of how special our brains are? Is our intelligence the product of stories or are stories the product of our intelligence? Regardless of the answer, the fact is that we have a special relationship with stories but, at the same time, many don't really have the basic skills to construct them. To overcome this problem we go through educational processes and rely on structures that have been time-tested for their effectiveness. One of them, probably the best known, is the so-called Hero's Journey.

BOX: The simplified Hero's Journey

The basic structure of a story is quite simple: a "hero" encounters an obstacle that s/he needs to overcome. S/he will hesitate, meet a mentor, meet some allies and enemies and learn that if s/he wants to find some satisfaction s/he needs to accept the challenge. S/he needs to enter the "belly of the whale", so to speak. In there, the hero will encounter the so-called shadow and this will teach her/him a really deep and existential lesson, so that s/he can be a better person.

This really simple structure is at the basis of the Hero's Journey first put forward by the American professor Joseph Campbell in his seminal book "The Hero with a Thousand Faces". The basic idea is that all stories from all kinds of cultures and times present the same basic ingredients starting from that of the Hero, the fundamental character archetype. The Hero has to overcome one or many complications and, in the process, learns deep and existential lessons. A plethora of stories, theatre plays, and pretty much all blockbuster movies are built around this structure and a good storyteller should be intimately familiar with it.

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Another possible structure, quite different from the Hero's Journey, is that of the documentary,[20] with a series of facts and factoids linked together with a long series of metaphorical "and, and, and". This is how many nature documentaries are made (hence the name). University lessons too are typically created this way, linking the contents with a series of conjunctions... and now the lion, and now the giraffe, and now the wolf, and now the turtle.... This works when the audience is already interested in the contents or when such contents are truly exciting and awe inspiring. In this case they can generate a sense of wonder even if there is no real story being told. But generally this is mostly the exception and not the norm.
In order to create a solid story, we suggest sticking with the (simplified) Hero's Journey structure.

Putting the science into the story

This is probably the single most difficult part of the creative process. How to include the science into the AL without at the same time making it seem like a regular lecture? The answer to this question is easy to state but quite difficult to implement and it depends a lot on the creativity and experience of the team. What needs to be done is to create a dramaturgy where the characters, the "heros", need the science in order to solve their "complication". Therefore, the audience will also need to understand the science and that is where the science lecture part comes in. In other words, the science must be worked into the mechanism of the story and it needs to become a necessity. For example: a young researcher meeting her very old and frail grandmother who asks: "You never took the time to talk to me about what you do... what is it that you do exactly... tell me before I die", or a scientist that is accused (falsely) to have plagiarised an article, and has to defend himself in front of the audience (his peers). There are countless ways to work the science into the story, but it always needs to be done in a credible and seamless way. What should not happen is that the lecture part comes in as a science info dumping, as a "contractual requirement" to have to talk about science. The real test is to try to remove the science from the story, if it still works, if it still makes sense as a story, then the science was not a necessity and it probably sounded like a lesson. If, on the other hand, the story seems incomplete, if it is hard to follow, then the science was well inserted and it complements the story. In doing this exercise one needs to practise critical thinking and be a bit harsh with her/himself!

20 SuchDocumentaries often lack a real narrative structure, most notably nature documentaries. This is due to the fact that often documentaries do not have a well defined "hero", there isn't a storyline to follow, and they rely on stunning, peculiar or rare footage. Audiences are already interested in the contents and that is enough to make documentaries interesting.

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The improvisational character of the AL

As mentioned before, one of the qualities that we search in the ALs that we have produced so far has always been their portability. This is achieved by limiting the scenographic and technical requirements.

But another key element is the ability to adapt and update the contents to the specific needs of the situation. For example, if the same AL is performed twice: once for young students (say 13 years old) and then for doctoral students in a University. It is clear that these two age groups have different needs when it comes to language and content exposition. If the Augmented Lecture has some improvisational leeway then both the language and the contents may easily be tweaked to suit the situation.

Because of this, we have always pushed for granting a certain degree of dramaturgical freedom to both the scientist and the artist and this has resulted in their ability to somewhat improvise the content, when needed. Improvisation means that the AL is not fully scripted, and it is based on the notion of a "canovaccio". The two performers have specific starting and landing points but how they get there is to be negotiated on stage. This allows for flexibility but also for a lively energy on stage, never dulled by the typical repetition of a staged play.

BOX: Target audiences

It should be clear by now that Augmented Lectures are a highly versatile tool able to connect complex topics with a wide array of audiences, by means of an art-science dialogue. For this reason any audience can become the target depending on how the AL is created. Over the years we have experimented with audiences ranging from elementary school students to university researchers. There is no limit as long as the target audience is well known from the beginning. Having said that, we must admit that the preferable target is a generic audience with a basic knowledge of science and lots of curiosity for the topics being treated.

BOX: An example of an Augmented Lecture - "The Long Way to the Stars"

The Long Way to the Stars is an Augmented Lecture produced in 2018 by the Bulgarian Company Arte Urbana Collectif in collaboration with Arditodesio of Italy and the University of Sofia. The creative ensemble was University of Sofia's astrophysicist Vladimir Bozhilov, actor and director Dimitar Uzunov and director Andrea Brunello. The videos were curated by Nikola Nalbantov, music by Alexei Nikolov and the visual identity by Elena Gamalova. Alexandrina Djassem provided a brief cameo appearance. The AL premiered at the 2018 Sofia Science Festival and since then it has enjoyed a very successful tournée in many venues both in Bulgaria and Europe.

The Long Way to the Stars introduces us to the latest scientific theories about the origins of the solar system and life in the universe. In a funny, inventive and accessible manner, it immerses us in scientific ideas and makes us think about where we are going and what needs to be done if we are to survive as a species.

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With presidential elections coming up, a popular television talk show invites the favourite candidate, astrophysicist John L. Ivanov (played by Vladimir Bozhilov), to present his ambitious ideas on space exploration. But the host, Denes Nagy (played by Dimitar Uzunov), isn't afraid to ask the real questions. As the civil debate turns into a verbal boxing match, startling ideas about the future of humanity will be revealed. For a video recording of this Augmented Lecture please go to: https://www.youtube.com/watch?v=7jUV0_HJ0ME

Working with scientists [21]

We are aware that what we are proposing here is complex: putting together art and science is nothing to be taken lightly. Most importantly because the creative process is more familiar to the artists than the scientists, therefore there is a certain degree of imbalance in the creative team. Yet, our experience of working with scientists has been extremely positive so far, with some notable exceptions that we'll try to describe here.

- *The scientist does not quite understand the creative process*

It happens at times that the scientist will not be in tune with the process of a stage creation. By that we mean that the scientist will be happy with their part of the lecture and will not look for a real dramaturgical creation. In other words, the scientist may not feel the need for setting up a real art-science dialogue. At times scientists are so used to teaching and delivering talks that they don't see the point in adding the scaffolding of a story to their lecture. This (admittedly rare) problem is typically overcome by running a pre-emptive workshop with the scientists to test their willingness to engage with the creative process. Another possibility is to make a series of preliminary demo-experimentations of the AL with invited audiences. The scientist will very quickly understand the power of having an artist on stage and creating a lecture that goes beyond the Deficit Model.

- *The scientist does not quite understand the need for rehearsing*

The rehearsal process can be quite tiring. Stage artists know this very well. Nevertheless, it could be the case that the scientist will be quite satisfied with just one or two rehearsals saying that everything is "good enough". The artist and the director (typically used to the creative process) will know that further work is needed, but the scientist may lose interest in it. What to do? Well here the solution is necessarily very subjective but it is our experience that with a little bit of nudging even the hardest of scientists will understand the need for more rehearsals. Again, this issue is overcome by having a very clear understanding of the creative process, having agreed to a rehearsing schedule to begin with. But the very nature of the ALs leads to the need for rehearsals because they are constructed like a real story (a play) and not a traditional lecture. Scientists quickly realise that "practice makes perfect".

[21] We use the world scientist but really what we mean is anybody with a very good command of the topic. It can be a researcher, a professor, a high school teacher or even a very proficient communicator.

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- *Objectifying the artists*

Another real issue that has come up regarding artists is the risk of "objectifying" them, using them as sidekicks of the scientists. This is a very concrete risk that should be addressed because of how easily it can happen. After all, we are preparing an AL and the "star" is the scientists right? Wrong. The star is the "art-science dialogue", [22] and the artist and the scientist bring forward their arguments in order to feed the dialogue with content. If this is the case, then there is no risk that the artist becomes a secondary figure, because her/his presence will be needed just as much as that of the scientist, so that the dialogue can continue (a dialogue needs two characters!). Of course, in a dialogue it could happen at some point that one character is more silent than the other, but in this case the silence is just as important as the words being spoken, and both the scientist and the artist can have silent moments, while the other takes the spotlight.

Working with Artists

One issue that we want to raise when working with artists is that they may lack the effort to truly enter into a relationship with the science that is a fundamental part of every AL. This is only a theoretical problem, because in practice the artists choose the scientists during the initial workshop and so they declare an interest in the topic. Yet, it could happen that after the first initial rehearsals the artists may find it difficult to relate with the scientists and a rift could happen. We have had this happen on an occasion where a painter just could not fit her art with the science being explained. At the same time the scientist could not find any connection with the artistic proposals. The result was a very polarised AL that lacked the initial ingredient: to be an art-science dialogue. For that reason we started working mostly with spoken word actors, to facilitate this connection.

We should also contemplate the risk of the artist considering the stage presence of the scientist in a demeaning manner. In our experience this issue has happened only once, but in that case it managed to disrupt the creative process. The artist seemed to consider the stage presence of the scientist as a nuisance, because the scientist did not have the skills to perform on stage as expected. Of course this turned into an opportunity that was fixed with some stage training but in this case it led to a rather toxic creative environment, resulting in a crisis. The situation was solved when all parties involved managed to explain their point of view and a new effort was made to carry on the creation. As it turned out, the final product was quite successful. This example goes to show that the relationship art-science can be difficult at times precisely because it is so rich.

[22] By dialogue we don't mean the classical series of sentences spoken in alternating fashion by one and then the other character. The concept of dialogue here is more abstract and it means an interaction between two characters with the aim to open up a specific topic, bringing out a series of universal themes. The two characters are members of the same team with the aim to drive forward the "conversation".

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Experimenting with different formats

The first ALs have been somewhat straightforward in their construction, but with time we started experimenting with other stage formats such as immersive plays[23] and forum theatre. As a general rule, we avoid any limitations on what format an AL should have, and we welcome experimentations as long as the basic elements remain: at the end of the AL the audience should have an increased understanding of a scientific topic and a deeper level of critical science literacy, having experienced a story and emotions which result from its narration.

Adapting to audiences

We mentioned before that ALs can address all kinds of target audiences. Furthermore, the same AL can also be adapted to different audiences (hence the improvisational nature of the format, that can be adapted to the needs of different audiences). As a general suggestion and although each AL can be adapted as needed, in order to make the creative process more straightforward it is quite useful that one knows what audience will be targeted first, when preparing the AL. This allows for an initial tuning of key words and level of scientific depth.

It may also be interesting to note that ALs can be quite powerful tools to connect scientific ideas with all kinds of audiences that typically may not be interested neither in theatre nor in a regular science lecture. One notable example for us has been the preparation of ALs for inner city youths. In this case we had to deal with attention span issues and a language that had to be accessible while at the same time not patronising. The artistic language that was chosen was that of rap music, slam poetry and hip-hop dance.[24] Also, the ALs were kept quite short (approximately 15 minutes) to provide for the very short attention span of an audience not used to more regular theatrical events.

ALs can find interested audiences in schools, libraries, science festivals and museums, universities and, in the right circumstances, in theatres too. In schools and universities they may be used as tools to open up specific topics, getting the students interested in alternative ways. Having said that, it should be clear that ALs are not full theatre productions, they retain a certain level of pedagogical aim, they are somewhat improvisational in nature and should not be confused with other forms of (science)theatre. It is our experience that they can attract many different audiences and, at the Theatre of Wonder Festivals in Italy, they tend to be more popular than the invited shows.[25]

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23 CURIOUS partner Interactive Arts Laboratory of the Faculty of Dramatic Arts at the University of Arts in Belgrade in Serbia has experimented with a so-called nano-play, an immersive experience for a single spectator. The topic was communication and the scientist was professor Mirko Stojkovic.

24 This experimentation was carried out most notably by CURIOUS partner Arenberg Theatre in Antwerp (Belgium).

25 Ticketing statistics at the Theatre of Wonder Festivals in Italy show that Augmented Lectures consistently have higher audience participation than the more traditional theatre shows.

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Possible dramaturgies for Augmented Lectures

There are endless possibilities for creating original dramaturgies for the ALs. It really depends on the topic and the themes that want to be developed. It also depends a lot on the interaction artist/scientist that is being created and on how much time they are willing to devote to the project.
Having said that, we can suggest here some archetypal macro-plots that can provide a good starting point for those interested in creating an original AL.
All of these possible macro plots provide the opportunity for the researcher to explain her/his science in a seamless way with respect to the plot. The explanation is *needed* in order for the scientist to solve the situation she/he is in.

- *A justification: The scientist has to explain why he/she has chosen science as a profession*

This works well when the scientist is put in the position of having to justify their choice: a father with his daughter who accuses him of having neglected her, a daughter scientist with her mother, who wanted something else for her... unfulfilled expectations... possibilities abound regarding this macro-dramaturgy. All of them run around the need to find justifications for the choices made by the scientist.
Alternatively, the same can be done with the artist, who has to justify his/her choices... and maybe the two on stage can have a discussion on what is a better choice: art or science?

- *A provocation: giving a prize for the science*

Here a possible plot is that of a scientist being invited on stage by the artist to pick up a prize, but this prize is not what she/he expected... and maybe the artist challenges the scientist on the science, on the ethics, on the money being spent for the research, on the opportunity to fund other lines of research.

- *A plea: I need you to understand*

In this case the scientist has the urgency to make herself/himself understood by someone (played by the artist) before something important happens: the death of a loved one, a child being born, or anything that will profoundly change their life. A plot could be: a grandmother is about to die and asks her grandchild (the scientist) to go with a beautiful image, and can science provide that beauty...? Similarly, she could ask the artist to do the same... and they both work together to make grandmother's last moments full of beauty and harmony...

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THE “BUSINESS CASE” for AL creation and performance / Financial considerations

Producing Augmented Lectures is relatively inexpensive as compared to more traditional shows, but touring with them has been somewhat complicated. They are a hybrid artistic format that fits only partially with a regular theatre season while at the same time they are not regular lessons to be programmed in science courses.

If ALs are produced for commercial reasons (as are most theatre plays), the producing company needs to be aware of such limitations and plan accordingly.

With this in mind we can attest that over the past few years we have been able to sell ALs to Universities and other research institutions as well as schools, science festivals and science museums. The market for ALs can be quite large if they are produced with their touring in mind. This means that they must develop popular and universal themes together with popular scientific topics and they must provide a solid and engaging story.

But more importantly, an expertise in AL creation can be sold to those institutions that are willing to invest in their creation. Research groups are increasingly asked to disseminate their results, structural fundings are provided with the understanding that a percentage of them will be devoted to communication practices. ALs can be formidable tools in the communication strategy toolbox.

Schools too can be interested in producing ALs involving their teachers and maybe some artistically inclined students. This way they can become teaching tools for informal education practices, and most schools are moving in that direction nowadays.

Another possible business case can be made by providing the AL expertise to private companies that need to promote their scientific innovation and company narrative. While ALs have been originally invented to communicate academic science, the methodology can really apply to all topics, as long as a connection to our existence can be made (and as long as one is willing to put up with the market oriented attitude)!

The bottom line is that even though so far we have only partially developed a business model for Augmented Lectures, this is due to the fact that they are still a rather new artistic product. We are confident that in a few years, when the format will become more widespread and accepted among artistic and scientific circles, companies and institutions will be able to produce them with some form of certainty on their financial returns.

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In any case, if we agree that ALs have the intention to raise science literacy, it is natural that these dramaturgies leverage on some sense of urgency to explain the science. This forces the researcher to find ways to justify their work while at the same time explaining it. The result is a poignant explanation that is part of the hero's Journey, and allows the artist and the audience to find connections to science. In this case the artist is truly a spokesperson for the audience, their beacon into a topic that can be really hard to understand.

For those interested in accessing the performances that have been created during the CURIOUS project, all ALs have been recorded and are available for free in the dedicated YouTube channel: https://www.youtube.com/@projectcurious6219/featured

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Acknowledgments and Copyleft

The methodology presented in this documenti can be considered as “open source” but more importantly a work in progress. For this reason we would like to know if and when it has been used, what results have been achieved and more generally how the methodology has proven useful and what could be done to improve it.
If you need to get in touch with us, please write to one of the authors: Andrea Brunello - direzione@arditodesio.org

Finally, if you use this methodology in any meaningful way in creating your Art-Science project please acknowledge its usage by referring to Project CURIOUS with the following wording:

“This Augmented Lecture was produced following the methodology as developed and explained in project CURIOUS - Culture as a Unique Resource to Inspire, Outreach & Understand Science (Agreement Number 616819-CREA-1-2020-1-IT-CULT-COOP1 - www.projectcurious.eu)”

Thank you!

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