30 MINUTES TO INTRODUCE AI TO KIDS

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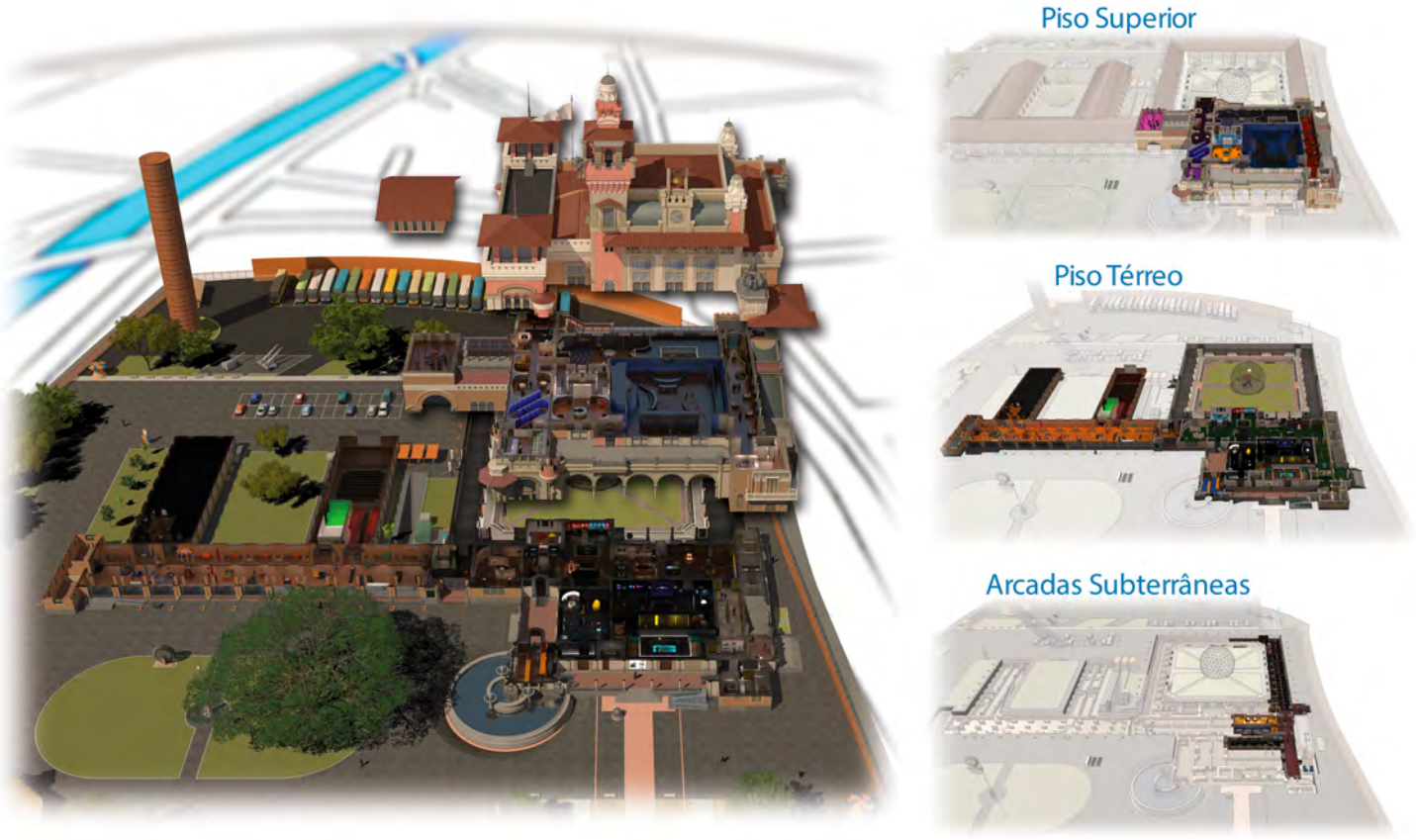
IBM **Research**

The Catavento Museum in São Paulo, Brazil

Museum devoted to science, with a hands-on space aiming to provide social & educational experiences.



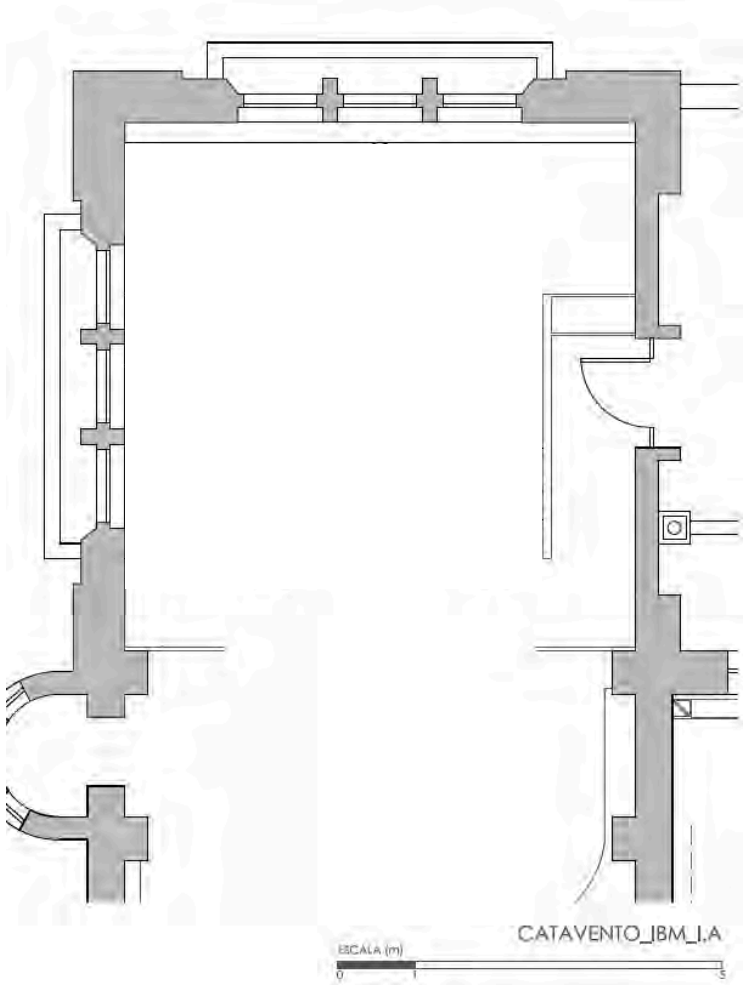
- 250 exhibits + 11 closed session exhibits
- 700K visitors per year

- **42 guided school visits:**
  3 sessions per visit,
  30-40 min each session

Visitor’s experience

- Include
- Connect
- Science as a familiar subject
- Instigate
- Create
- Explorer
- Interact
- Enchant

Starting with a space + an interactive exhibit



5x7m space at *Catavento*

+

Santiagos exhibit at Itau Cultural

[H. Candello et al. "The Effect of Audiences on the User Experience with Conversational Interfaces in Physical Spaces." CHI 2019.]

From literature to AI

Teaching AI to Kids: Exhibit Goals

What?

Explain and bring **awareness about what AI is**.

How?

Hands-on exhibit for K-12 kids who can read and write.

For what?

Introducing AI to **30,000 kids** every year.
Providing a **sandbox for teaching experiments** in AI.

What to teach about AI to kids?

from how AI works ...

- history of AI
- how neural networks work
- how AI may transform work and society
- issues of bias and privacy

... to AI for citizenship

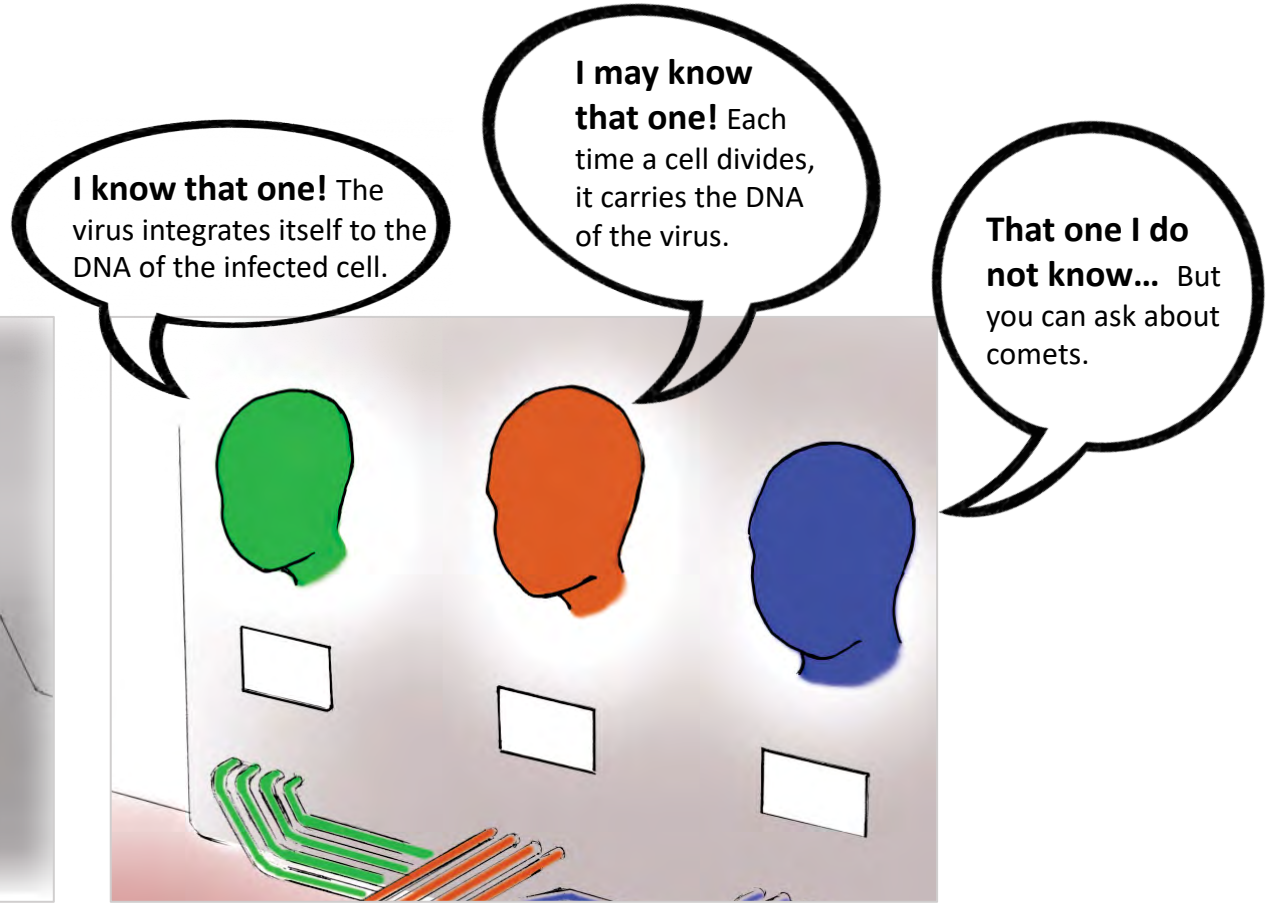
- minimum understanding of AI to enable citizens to make better decisions about AI and society
- questioning of the black-box nature of many AI systems

What kids should learn about AI to inform their decisions about its use in society?

1. AI systems use knowledge acquired from human beings.
2. AI systems do not know everything and make mistakes.
3. AI systems are corrected and improved by human beings.

Inspired by pioneer work of IBM …

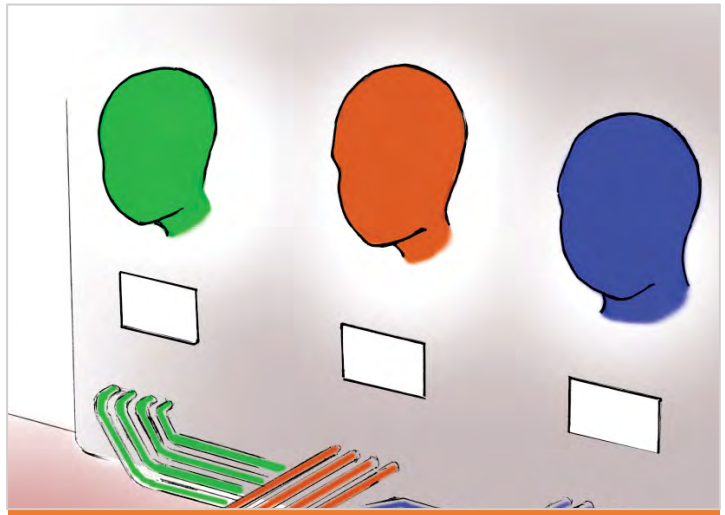
A Q&A game show based on the knowledge about science the kids have just learnt ...



Aabhas Sharma

... where the bots can be taught what they do not know

Multiple versions according to the audience



OFFLINE MODE

The bots talk to each other when there is not anyone interacting with the exhibit.

SPONTANEOUS VISITORS

Spontaneous visitors can be part of bots conversation and suggest topics and ask questions about the museum content.

TEACHING MODE – GUIDED VISIT

Guided school visitors will teach the bots to help improve the bot’s performance. Visitors are divided into 3 groups and bots compete to give the answer and earn points.

Research activities

Observation studies at the museum environment

Observation studies of guided sessions

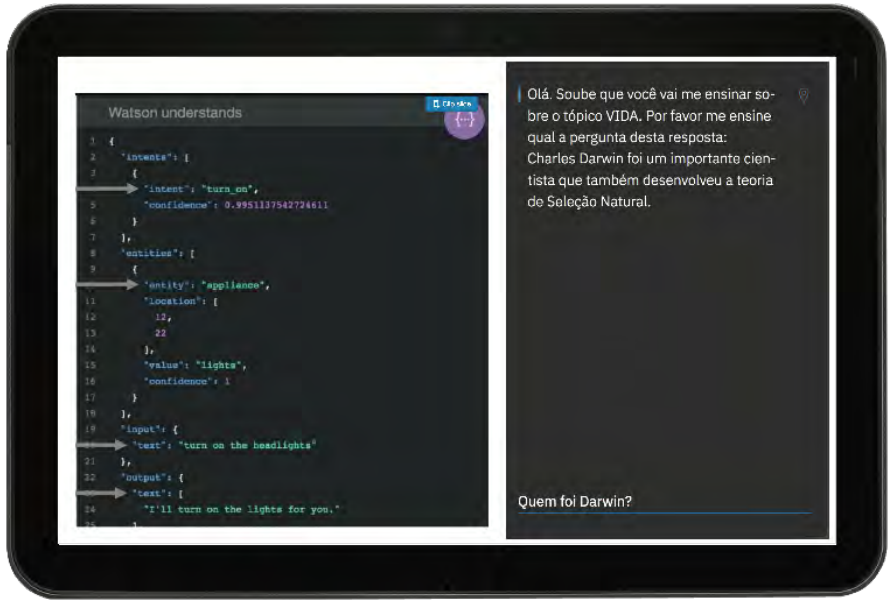
Semi-structured interviews with museum guide supervisors

Semi-structured interviews with museum guides

Design Fiction and pilot studies

Datathon – chatbot training session to build corpus

Exploring the teaching version with theatrical workshops



Publications about design process

IBM Research

Teaching Machines to Show Science

A Study with Museum Guides

Heloisa Candello, Claudio Pinhanez, Mauro Pichiliani, Paulo Cavalin
IBM Research

ABSTRACT

How do domain experts with a minimal understanding of machine learning expect to teach a machine their discipline? This paper describes a study with museum guides asked to imagine how to teach a companion chatbot. Based on the thematic network analysis of their answers, five basic teaching paradigms were identified which seem to reflect their different mental models of the machine.

THE CONTEXT: SCIENCE MUSEUM

Catavento is a museum devoted to science located in São Paulo, Brazil. Its mission is to educate by enchanting all of its visitors in science topics such as biology, material sciences, and physics throughout more than 250 exhibits spread across three floors of a late 19th century castle-like building. Besides traditional walk-in visitors, the museum also provides visit tours for groups of 20 to 22 students who follow a guide across the museum and learn about selected exhibits. When a group of visitors arrives a museum guide is selected to lead the tour to specific museum areas, explain the exhibit, talk about the topics related to the area being visited, and answer questions. The museum provides about 42 guides visits per day served by a rotating staff of 120 museum guides, which are undergraduate intern students who received training on how to perform the guided visits.

Figure 1: Museum guides with a group of visitors.

THE EXPERIMENT

In November 2018, 30 museum guides participated in the experiment. They were between 19 to 25 years and graduate students in Chemistry and Biology. Half of the participants have been working in the museum for more than ten months and the remainder for less than six months. Participants were expert guides in two of the museum spaces: the Life space, covering themes such as the origin of life and biodiversity; and the Earth space, consisting of topics such as chemical elements.

They were divided into 15 dyads, sharing a computer, pairing guides with less experience with ones with more (Figure 2). This mix gave a fresh view of the experience from the novice guides to the experienced ones. Each pair had to come to an agreement about how to answer the two following questions:

(RQ1)
How would you teach a topic from your museum section to a future guide robot?

(RQ2)
How would you validate the robot learned enough to answer a museum visitor?

MACHINE TEACHING EXPECTATIONS

The analytical approach highlighted the expectations participants had when invited to discuss this activity. According to our global theme, machine teaching is based on teacher beliefs about machine learning capabilities and evaluation outcomes.

Participants when envisioning themselves as machine teachers created several myths, speculations, and assumptions on how a student machine works and its capabilities. Those mental models of future teachers influenced the way they reported teaching procedures and machine learning evaluation outcomes.

Figure 2: Thematic Network for Machine Teaching expectations of Museum Guides.

TEACHING PARADIGMS

The organizing themes in many ways suggest the kind of mental model of the machine the participants seemed to have when being in the role of machine teachers. This is captured by the 5 teaching paradigms: Multiple-choice questions, Pairs of examples, Text interpretation, Key-words and Incremental teaching. All the teaching paradigms are conversational system-based.

FURTHER WORK

This experiment has provided initial insights on the teaching paradigms which reflect the participants' mental models, which later may be assimilated by machine learning algorithms through machine teaching systems.

For instance, for paradigms 1 and 2 a broader choice of machine learning algorithms are applicable (for instance, neural networks), which may result in accurate chatbots. On the other hand, paradigm 4 allows for systems where decisions can be more explainable, using for example, decision trees and naïve Bayes classifiers. We are also conducting design fiction studies with the museum guides to further their expectations, values, and concerns about teaching machines.

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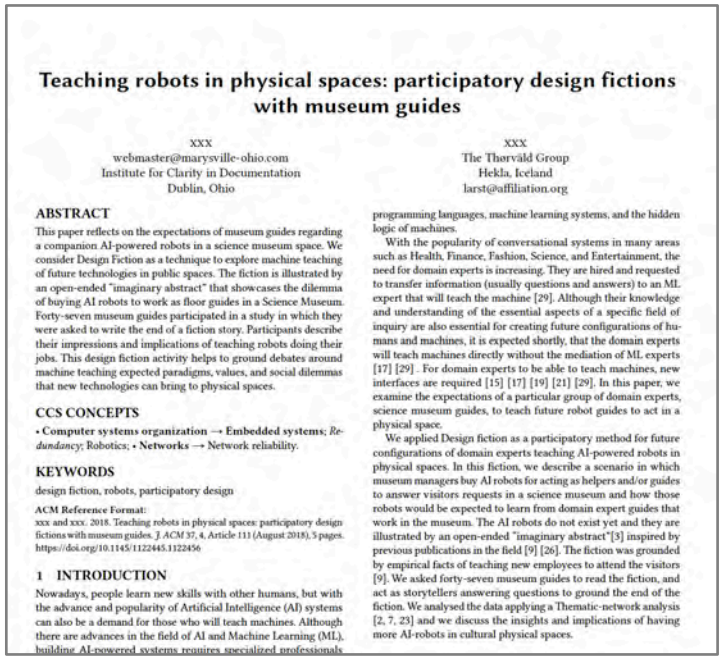
H. Candello, C. Pinhanez, M. Pichiliani, P. Cavalin. Teaching Machines to Show Science: a Study with Museum Guides. In: HCI4ML wksp at CHI'19.



Teaching robots in physical spaces: participatory design fictions with museum guides

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ABSTRACT

This paper reflects on the expectations of museum guides regarding a companion AI-powered robots in a science museum space. We consider Design Fiction as a technique to explore machine teaching of future technologies in public spaces. The fiction is illustrated by an open-ended "imaginary abstract" that showcases the dilemma of buying AI robots to work as floor guides in a Science Museum. Forty-seven museum guides participated in a study in which they were asked to write the end of a fiction story. Participants describe their impressions and implications of teaching robots doing their jobs. This design fiction activity helps to ground debates around machine teaching expected paradigms, values, and social dilemmas that new technologies can bring to physical spaces.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

KEYWORDS

design fiction, robots, participatory design

ACM Reference Format:
xxx and xxx. 2018. Teaching robots in physical spaces: participatory design fictions with museum guides. *J. ACM* 37, 4, Article 111 (August 2018), 5 pages. https://doi.org/10.1145/1122445.1122456

1 INTRODUCTION

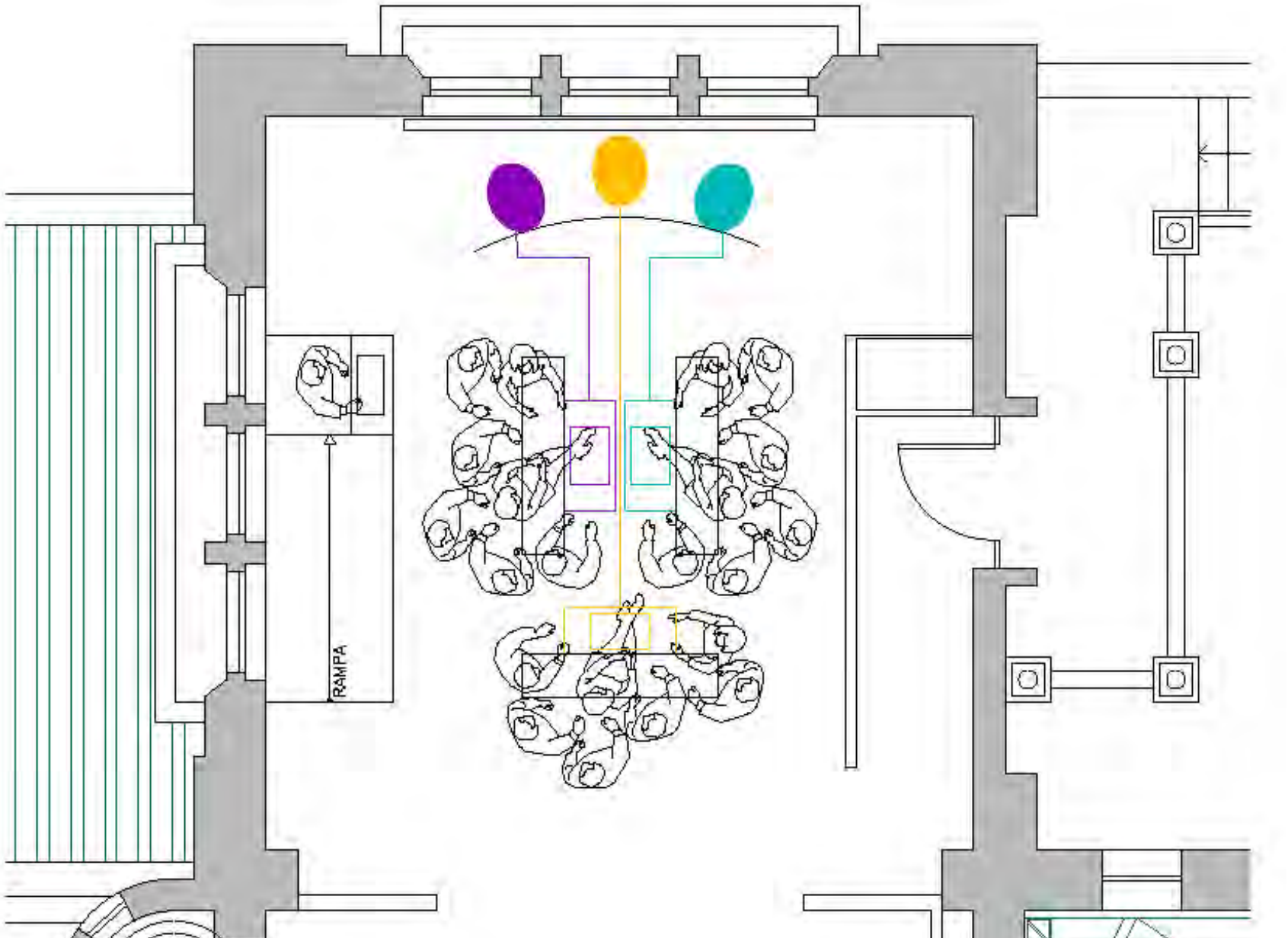
Nowadays, people learn new skills with other humans, but with the advance and popularity of Artificial Intelligence (AI) systems can also be a demand for those who will teach machines. Although there are advances in the field of AI and Machine Learning (ML), building AI-powered systems requires specialized professionals programming languages, machine learning systems, and the hidden logic of machines.

With the popularity of conversational systems in many areas such as Health, Finance, Fashion, Science, and Entertainment, the need for domain experts is increasing. They are hired and requested to transfer information (usually questions and answers) to an ML expert that will teach the machine [29]. Although their knowledge and understanding of the essential aspects of a specific field of inquiry are also essential for creating future configurations of humans and machines, it is expected shortly, that the domain experts will teach machines directly without the mediation of ML experts [17] [29] . For domain experts to be able to teach machines, new interfaces are required [15] [17] [19] [21] [29]. In this paper, we examine the expectations of a particular group of domain experts, science museum guides, to teach future robot guides to act in a physical space.

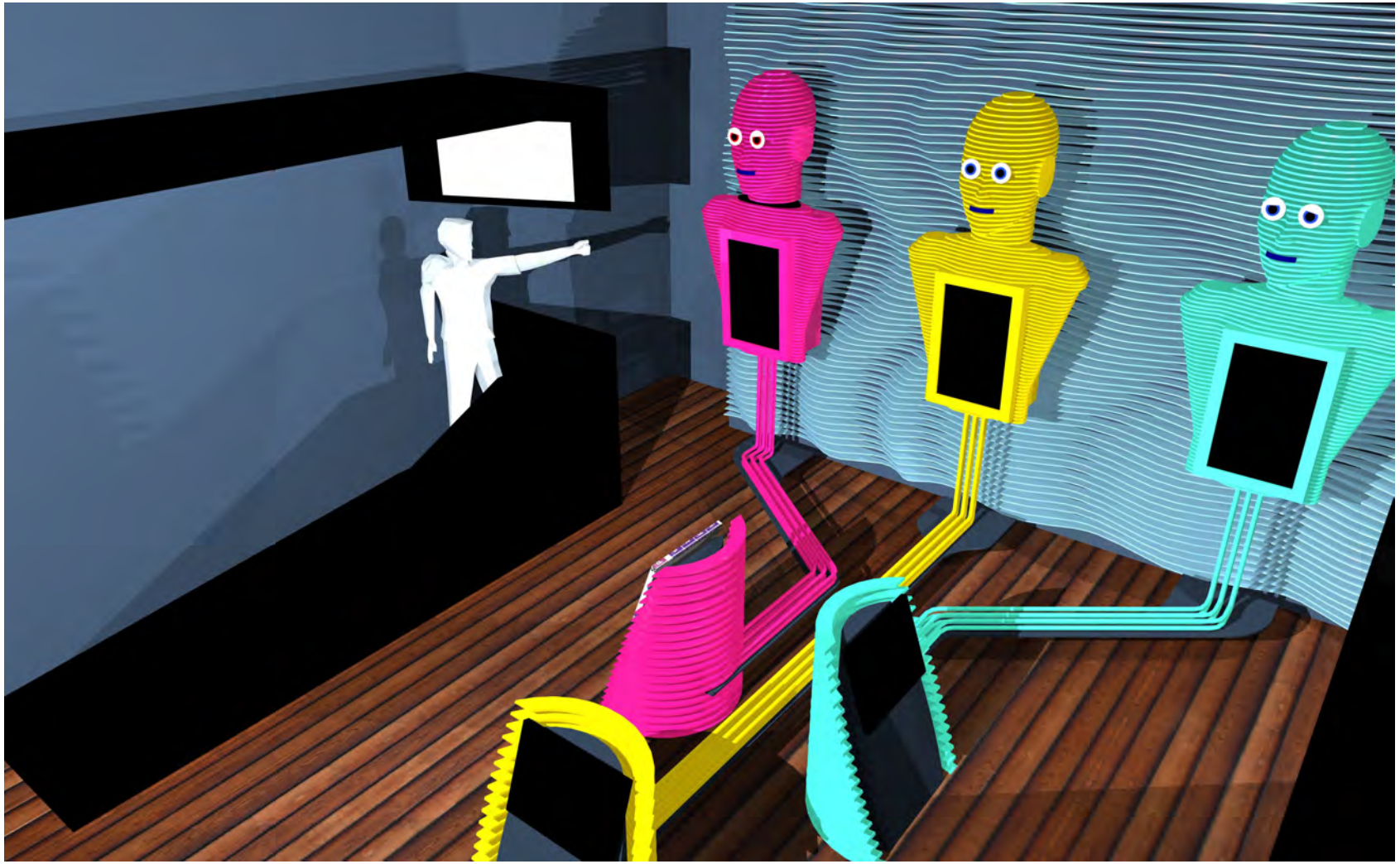
We applied Design fiction as a participatory method for future configurations of domain experts teaching AI-powered robots in physical spaces. In this fiction, we describe a scenario in which museum managers buy AI robots for acting as helpers and/or guides to answer visitors requests in a science museum and how those robots would be expected to learn from domain expert guides that work in the museum. The AI robots do not exist yet and they are illustrated by an open-ended "imaginary abstract"[3] inspired by previous publications in the field [9] [26]. The fiction was grounded by empirical facts of teaching new employees to attend the visitors [9]. We asked forty-seven museum guides to read the fiction, and act as storytellers answering questions to ground the end of the fiction. We analysed the data applying a Thematic-network analysis [2, 7, 23] and we discuss the insights and implications of having more AI-robots in cultural physical spaces.

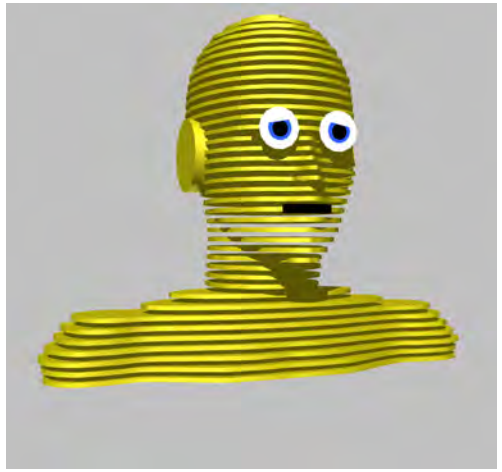
H. Candello, M. Pichiliani, Mairieli Wessel , C. Pinhanez, Michael Muller. ACCEPTED TO The **Halfway to the Future**

Proposed design of the physical space

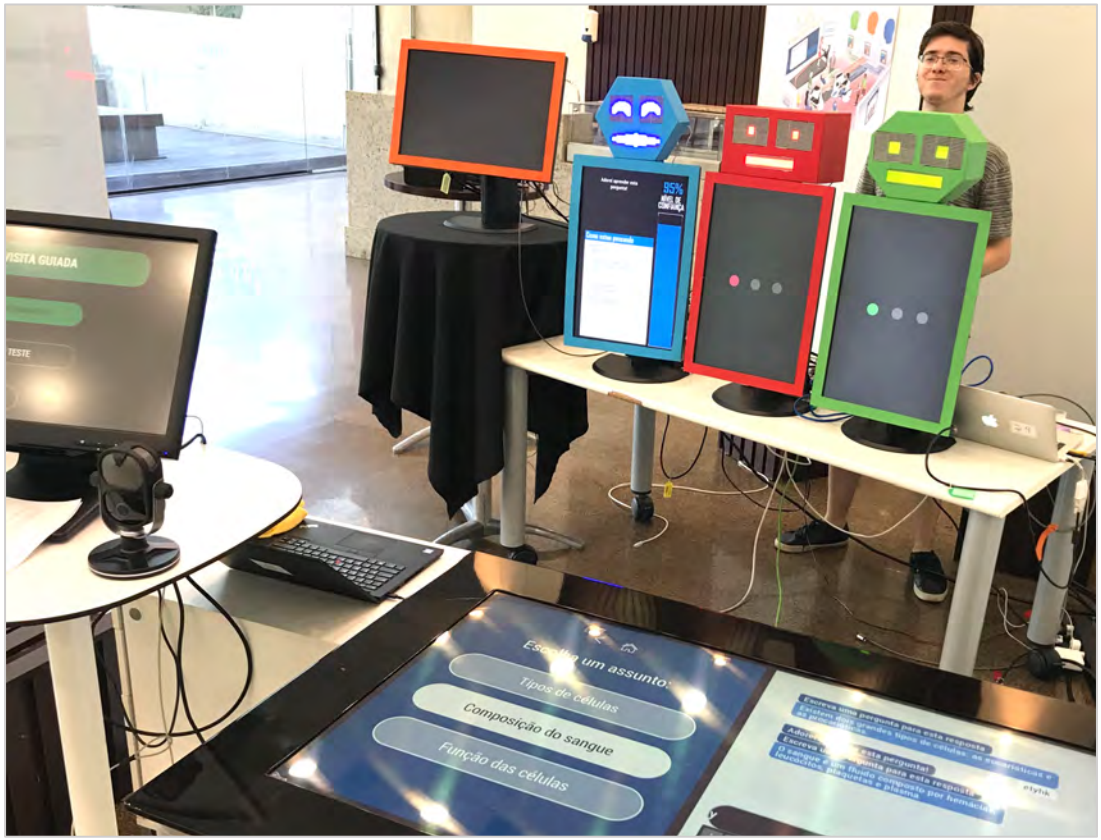


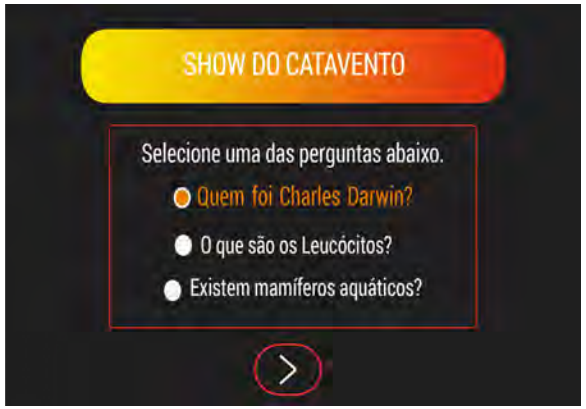
Cenographic concepts (studies)





Lab prototype





Experience demo and field studies

Roadmap of the exhibit

- testing, redesigning, testing, redesigning ...
- opening in March of 2020
- starting development of companion material for teachers
- working with IBM Corporate Citizenship to create an outreach program for schools

What kids should learn in 30 minutes about AI?

“Children shall leave the exhibit having a sense that an AI system is not a perfect, magic black box which solves problems better than people, but in fact that AI mimics the imperfection of human beings and of our society, and therefore should be questioned and controlled by its citizens.”

Thanks!

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Digital architecture

Watson Developer Cloud

- Watson Assistant
- Speech to Text
- Text to Speech
- SDK for Node.js
- Compose for Elasticsearch

Others:

- Processing
- Raspberry Pi
- Android SDK