

Telex in Motion, by RAY LC

o Project description (maximum of 1500 words) Please describe the project proposal you intend to undertake during the residency at CERN. The scope of this proposal should include a research period of two months at CERN and a development phase in the form of a remote residency to define and produce a new artwork.

CERN robots are specialists who undertake thankless operations from retrieval to safety to vehicular transport. While their work is done with repetitive precision on a daily manner, we forget that they are also in need of diversion and inspiration, to quench their own thirst for adventure and expression. Telex in Motion is a remote-operated robotic performance involving a robot arm that delivers objects to their destinations of interest in the exhibition stage. Objects on one side of the radiation divide is delivered to the other side for audiences to inspect using robot motions that reveal the object's contents. For example a plant is carefully handled from one side to the other by Telex, and placed on the side of a window on the side of the audience. Meanwhile a dish of sulfur is handled with authority by the robot and put on the proper storage inside a vat. A set of six such items are handed behind a curtain by the robot arm and moved to the audience's home-like environment, where the robot acts out the roles of a care-taker, worker, scientist, performer, emotional-wreck, and socially rejecting transport agent in turn, using the gesture designs of the robot to tell the audience what its personality is. At particular times during the exhibit, a performer is connected to robot arm through remote screen communication, and they perform nonverbal movements interactively through detection of gestures of the performer remotely by a Microsoft Kinect. The outcome is an exhibition performance exploring how a robot arm can transport and facilitate items not only for safety but also for the enjoyment of human audiences. The emotional gestures used by the robot betrays the secret life of a robot with its own agenda and humanity.

The two month research begins with examining the plans and works undertaken by the CERN robots. I will interview the CERN scientists in charge of robotics to understand the tasks and interactions robots have with their human operators. I will also create motion gestures that approximate the types of movements used by CERN robots. As such I will implement these gestures using the uFactory robot arm system available for rental and purchase in my home are in Hong Kong (<https://www.ufactory.cc/>). The robot can also be programmed remotely from CERN such as in the previous projects Presentation of Self in Machine Life (<https://recfro.github.io/presentation-of-self/>) and In/Active (<https://inactive2022.wordpress.com/>). I will undertake the task of caring and programming with the CERN staff to see how human-robotic operation occurs at CERN. I will also examine the way robots operate in their own "secret lives" in chambers that humans cannot reach due to the radiation and dangers of the work. Using this information, I'll create motion designs with our own robot at Hong Kong remotely and also through software emulation to show how Telex can be instantiated in artistic form in the uArm robots from uFactory. The detailed schedule consists of the following milestones:

(one week) meeting and acclimation to the CERN facilities and community; (two weeks) technical support and understanding of robot actions and work flow of CERN scientists and managers; (two weeks) set up experimental tool to model remote control of the uArm robot arm in Hong Kong from CERN and program necessary tools for the remote interaction; (two weeks) in-depth interview of CERN scientists to create video of design and documentary process for the artwork preparation; (one week) wrap up of necessary instruments for transport and creation of documentation for future implementation.

The one month implementation phase will begin remotely back in Hong Kong at the City University of Hong Kong. We will present the work at the Osage Gallery, with whom we have worked previously on the exhibition "I'm Always Here," <https://recfro.github.io/threeminds/osage/>. We have also previously shown work there using two robots playing chess against each other called "Power Chess:" <https://recfro.github.io/power-chess/>. The samples and data collected at CERN will form the backbone of the artwork creation process. The documentation video will be used to introduce audiences to the exhibit. The fieldnote and scrapbook of the process of visits and technical drawings of the robots such as Telex will be shown on a pedestal at the beginning of the exhibit. The main section consists of a robot arm (uArm 6) that takes objects from behind a curtain and brings it to the visitor using a gripper. The movement of the robot depends on the object handled. For example, chemicals are handled carefully with a hint of hesitation and unsteadiness in the handling. The pot of plant is quickly delivered, but the robot also stops in the middle to "smell" the plant in route. The audience will congregate in an exhibition floor with a digital window on the wall representing a room of one's own. The robot thus moves materials from its own "secret life" to the audience.

The objects delivered will form different parts of the “room” such as the plant, a container for trash, and a crystal ball for decorative purpose. The window and room layout will be constructed by Osage staff, while the objects will be inspired by the artist’s previous two month visit to CERN to gather appropriate objects that relate to the real Telemax’s workflow. The actions of the robot and audience reactions will be recorded on video and shared with CERN staff and if possible, the videos of the interaction and narrative flow will be shown at CERN at an appropriate date after the exhibition at Osage. Additional devices like holders, grippers, and projection for the window will be obtained by the artist from the City University of Hong Kong. The musical and sound interactions will be programmed by the artist at Hong Kong with notes and experiments done previously at CERN. Finally the work will be submitted for future dissemination at Ars Electronica and Transmediale.

The performative aspect of the exhibition consists of the dancer Mizuho Kappa (New York City, Japan) and her interactions with the Telemax at Osage. We will enact a dance performance related to the previous Presentation of Self in Machine Life (<https://recfro.github.io/presentation-of-self/>), but with movements updated with those of the CERN Telemax. The robot movements will be updated on python using the uArm API, with new movements created specifically for this performance. The theme of the performance involves the exploration of an unknown region by the dancer with the help of the telepresent robot. As the dancer performs an exploration of the remote space with music by the artist, the robot follows along using a Kinect connected online to the performer’s studio. The outcome is a performance at the exhibition space by the robot, which follows what the dancer movements are in person in New York (see <https://inactive2022.wordpress.com/>). The robot movements will be programmed by the research assistant working with RAY LC at the City University of Hong Kong, using notes collected and videos taken of the Telemax and other robots at CERN. The programme for the performance will also use photography of the CERN robot. Finally, a full video of the performance and documentation of the exhibition at Osage will be shown at CERN and interested venues and also archived online for future dissemination.

o Project summary (maximum of 300 words)

CERN robots are specialists who undertake thankless operations from retrieval to safety to vehicular transport. While their work is done with repetitive precision on a daily manner, we forget that they are also in need of diversion and inspiration, to quench their own thirst for adventure and expression. Telemax in Motion is a remote-operated robotic performance involving a robot arm that delivers objects to their destinations of interest in the exhibition stage. Objects on one side of the radiation divide is delivered to the other side for audiences to inspect using robot motions that reveal the object’s contents. For example a plant is carefully handled from one side to the other by Telemax, and placed on the side of a window on the side of the audience. Meanwhile a dish of sulfur is handled with authority by the robot and put on the proper storage inside a vat. A set of six such items are handed behind a curtain by the robot arm and moved to the audience’s home-like environment, where the robot acts out the roles of a care-taker, worker, scientist, performer, emotional-wreck, and socially rejecting transport agent in turn, using the gesture designs of the robot to tell the audience what its personality is. At particular times during the exhibit, a performer is connected to robot arm through remote screen communication, and they perform nonverbal movements interactively through detection of gestures of the performer remotely by a Microsoft Kinect. The outcome is an exhibition performance exploring how a robot arm can transport and facilitate items not only for safety but also for the enjoyment of human audiences. The emotional gestures used by the robot betrays the secret life of a robot with its own agenda and humanity.

o Project motivation (maximum of 1500 words) Please describe your motivation to apply for this residency and your interest in the CERN community and context in relation to your practice.

Artists and designers want to see beyond the surface, to probe the lingering pain that lies beneath the smiles, to envision the future that we cannot comprehend from the technologies we do not yet have. To truly look into places that harbor the unknown, the futures that we cannot predict, we have to look inside ourselves, to know what we desire and fear. We have to know ourselves.

CERN provides the opportunity to learn about ourselves through the instruments to examine what makes up the universe, and makes up of us. My background of science and engineering in the undergrad days, and neuroscience in the PhD days, has led to a continuing deep interest in the scientific process. I pioneered the design of human-machine interaction from empathic viewpoints, combining science, art, and narratives. In "Secret Lives of Machines," I built lamps, chatbots, cameras that project human emotions (<http://www.raylc.org/machines/machines.html>). In "Look at Me, Think of Me," I constructed a two-way mirror installation activated by voice and EEG brain wave attention signals, illustrating narcissistic nature of modern communication relations using brain data (<https://recfreq.wordpress.com/portfolio/look-at-me-think-of-me/>). Along with artist Jeff Crouse, I installed an immersive projection connected to physical TVs using interactive analog controllers that narrates the evolution of digital data devices as a process of mapping ourselves onto devices (<https://recfreq.wordpress.com/portfolio/flora-network-intelligence/>). I exhibited a projection installation at NYSCI centering around a moving security camera from the 60s that track human faces after gaining the abilities of computer vision. In "Machine Gaze" (<http://www.raylc.org/machinegaze/>), I created a large-scale human face sculpture on which is projected detected audience faces in comparison with a machine learning database of faces as audiences visualized what computer vision data consists of. We developed a workshop that lets audiences put on disguises to think critically about how to empathize with what the machine sees. Machine understanding is a bridge to an ethical future that's subject of the Technology and Social Good side of my work, part of an exhibition I created at Columbia University (<http://www.raylc.org/exhibits/techgood/>). I was awarded a Davis Peace Prize to work with Rohingya refugees in Bangladesh, creating empathic immersive experiences with technology such as VR, biometrics, and documentary film so that we can *be* with them and their stories, not simply observe (<http://www.raylc.org/rohingya/rohingya.html>). I worked on improving water scarcity in Ahmedabad India, 3D fabricating a hand-operated washing machine that uses 80% less water than rural village practices (<http://www.raylc.org/beadit/beadit.html>). I worked with elderly patients from the Riverside Rehab Center who have neglect of one side of the body due to stroke, designing a dress that can be put on using one-handed wrapping over the shoulder twice in succession, so that mobility-challenged elderly can dress by themselves (<https://raylc.net/portfolio/midi-rox-one-handed-dressing-for-disability/>). This concern with humanity is a fit for the art program at CERN, where the humanity behind the technology is celebrated.

Through my work as Designer-in-Residence at New York Hall of Science (<https://nysci.org/home/programs/designers-in-residence/>), I've been educating Explainers (museum part-time students) and giving public workshops (<http://www.raylc.org/machinegaze/>). At CERN, I'll work with programs in the same empowering model of learning to teach machine learning without code, wearable technology for newbies, and storytelling with technology (<http://www.raylc.org/teaching/teaching.html>), utilizing skills as an award-winning educator at Northeastern University College of Art Media and Design and City University of Hong Kong. I'll give talks to the public like (<https://www.youtube.com/watch?v=LatR8ur0Hog>; <https://www.youtube.com/watch?v=kDWSYnL1F8Q>) and let audiences in to see the data and process of prototyping much like our designer workshops at NYSCI. I also want to share my knowledge as research fellow at Cornell Tech building chair robots for remapping human spaces (http://www.raylc.org/chairbots/Ray_VRChair02.pdf).

The fundamental benefit from being a part of the CERN Community is finding a home where truly interdisciplinary work across multiple experts of deep areas of research and art can work together. My own career has been modeled on going deep into an area of neuroscience in creativity and PTSD with papers in *Nature* and *Journal of Neuroscience*, etc, then deep into an area of art in human-machine interaction, with exhibits at NYSCI, City University of Hong Kong, Columbia University, BankArt Studios.

CERN boasts of the experts that I crave to be with, from particle physics and quantum arts residents studying mechanisms of the universe, to biosensor artists with computer science degrees, to inventors of programming languages, to technologists looking at socio-political questions. To an artist, the facilities and technologies are important, and CERN have these work space and shops available, but ultimately it's the people you are with that defines you. For me, I come in with expert knowledge as a world leader in the PTSD field and the discovery of dopamine involvement in learning of extinction responses, (<https://www.nature.com/articles/s41467-018-04784-7>), but I too walked a familiar path, choosing to perturb people with art that questions how we perceive each other and machines we create. I've come to this from a directed walk about a common theme of human understanding, but here's the community that can truly belong to.

I undertake both art practice and research practice, analogous to the diversity and inclusion of diverse practices at CERN. I have taken the idea of interdisciplinary to heart in my life and practice: it is not enough to collaborate with other fields or experts; interdisciplinary scholarship in its most engaging form is working in the new field with fresh eyes, doing the day-to-day activities that come with that practice.

For the artist who imagines science to be a logical and technically advanced, she joins a lab to see how stories are told in publishing, how compromises are reached between technologies that are feasible and studies that are not possible. For the scientist who believes art to be whims of illogical emotionality and results of get-famous schemes, she apprentices herself to the master who forges her own path through constant failures and experiments with audience reactions, to experience how an artwork is constructed from insights from psychology.

While grad student of neuroscience at UCLA, I wrestled with these questions, before a chance encounter with choreographer David Roussève changed my life. I was interviewing him about his new show *Saudade* for the Daily Bruin newspaper. When the topic of how to get classically trained ballet and contemporary dancers to configure their movements to West African and Indonesian motifs, he told me the big secret: he got the dancers to forget their past training by immersing in the new environment fully before allowing them to use their previous language at all. And thus it is with my own interdisciplinary work: forget one's own neuroscience practice and immerse oneself in artistic practice before gaining the internalized insight to communicate and experience in both fields of work, discussing with equal facility outcomes and limitations with a scientist, and designs and themes with an artist. This in-depth journey has led me to the commonality amongst fields, that they all tell stories to activate human engagement. No matter scientist or artist, we are all in our core storytellers.

With these insights in mind, I established an experientially interdisciplinary studio to investigate the way modifications of physical and virtual spaces affect human perception and behavior, in the context of the way people frame interactions with machines in narrative form. Two recent exhibition/performance/research projects illustrate our interdisciplinary approach that uses HCI perspectives in art-design contexts to study human-machine interactions in a narrative exhibition context. *Presentation of Self in Machine Life* is a robot-human performance funded by Hong Kong Arts Development Council (ADC) and New York Foundation for the Arts, at NYSCI and IEEE VISAP, that attempts to bridge the spatial-temporal gap between New York and Hong Kong with a story of a human dancer teaching a robot arm to perform. The distanced-performance shows the robot making gestures of sadness, achievement, recognition, and ultimately show of independence, as the dancer attempts to control the robot technology more and more as the relationship evolves. It investigates the dance-specific dynamic movements for robot choreography from both a storytelling and machine-collaboration research perspective. By addressing human-robot collaboration, robot-audience interaction, and robot-movement choreography, our works in performance-exhibition for human-robot systems begin to probe the way social robots fit into human communal environments. In particular we explored the movement parameters that led to performer and audience interpretation of machine behaviors and created interaction strategies for meaningful collaboration between human and machine.

At CERN however, the humble robot takes its place as amongst the most important research partner in the institution. By working at high radiation levels with dangerous and precise tasks, Telex has been a device of admiration. The time is now to celebrate the emotions and gestures associated with the robot's "secret life," to celebrate the human side of the robots of CERN.