From MHCI to M-ITI: Lessons in Interdisciplinary Research and Education under the CMU Portugal Partnership

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ABSTRACT
This position paper describes the main challenges and lessons learned setting up and running a dual-degree Master Program in Human-Computer Interaction (MHCI) under the auspices of the Carnegie Mellon Portugal International Partnership. The MHCI program was one of the most successful outcomes of the partnership leading to the creation of M-ITI an innovation institute in Madeira Island – Portugal. The institute emerged from the interdisciplinary research faculty hired to teach to the program. During 10 years, the program trained more than 100 students, most of them are currently working in top high-tech companies or pursued international research careers. In this paper, the authors (co-founders of M-ITI) share their experience and lessons learned to set up a transatlantic program in professional interdisciplinary HCI education.

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INTRODUCTION
The Carnegie Mellon Portugal International partnership (http://www.cmuportugal.org) is a platform for education, research and innovation that brings together Portuguese universities, research institutions and companies, and Carnegie Mellon University (CMU). The partnership was launched by the Portuguese government in 2006. Its mission was to place Portugal at the forefront of innovation in Information and Communication Technologies (ICT), by promoting cutting-edge research, world-class graduate education and a close collaboration with the Portuguese industry. Its activities are funded by the Fundação para a Ciência e a Tecnologia (FCT), supported by the Council of Rectors of the Portuguese Universities (CRUP), and co-financed by industry partners and by CMU.

The partnership was mainly focused on research but the engagement of industry partners required special attention to more short-term professional oriented educational programs. Apart from several dual-degree PhD programs the program involved four professional master programs. hosted at different academic institutions and cities in Portugal: Lisbon, Coimbra, Aveiro and Madeira.

The University of Madeira (UMa) is the smallest and youngest public University in Portugal. With less than 4000 students it hosted a research group focusing in HCI. This group applies to team with the prestigious HCI Institute at CMU which is considered one of the top research departments in the world. What was an unlikely combination becoming one of the most promising partnerships of the CMU Portugal program. The funding provided by FCT to setup the program was used to attract a group of six young international faculty many coming from top institutions such as Media Lab Europe and CMU. This level of critical mass enabled the creation of a unique interdisciplinary research context in Madeira Island, one of the outermost regions in Europe and the Portuguese region with the lower innovation performance and R&D intensity.

The Professional Master in HCI
The professional master in HCI was established based on the MHCI program at CMU. Considered one of the oldest HCI Masters Programs in the world the MHCI (https://hcii.cmu.edu/academics/mhci) is a three-semester program completed over the course of a full calendar year. For the dual-degree program students spend one semester at Carnegie Mellon and two semesters in Madeira. The MHCI is a professional (terminal) degree that prepares students for industry and a career related to user experience, human-computer interaction and beyond. Cohorts are made up of richly diverse student groups with varying degrees of industry experience and backgrounds in design, social science, business and computer science among others.

During the first semester, students learn core HCI methods and techniques in the required classes, while customizing their academic experience with the immense selection of electives across disciplines. While completing the second and third semesters, students continue their diverse electives and complete a substantial industry capstone project with an external client. The capstone project is made up of two courses taken in consecutive semesters and is

structured to cover the end-to-end design process of a product development lifecycle. MHCI students work in teams of 4-6 students with companies ranging from nimble startups to globally recognized brands. Working with faculty mentors and their industry sponsors, teams produce user research, product designs and interactive prototypes to improve or design new applications to a partner's existing technology. The project culminates with a presentation of the teams' final prototypes at the end of the summer.

Institutionalizing Interdisciplinary HCI Research

Because of the dual-MHCI program the University of Madeira (UMa) created the first and only innovation institute as a private non-for profit association of UMa, the regional government of Madeira and Carnegie Mellon University (as honorary associate). Innovation institutes are "horizontal structures focused on innovation and teaching, identified with strategic scientific challenges of potential interests". M-ITI was established in December 2009 and throughout the last 8 years it managed to attract more than 15M€ in external competitive funding. The creation of M-ITI was a landmark for Madeira in terms of R&D, currently the institute and its associated entities depending in the Regional Government are responsible for 50% of the R&D spending in Madeira. Currently M-ITI is affiliated with 44 faculty and post-docs from 14 different nationalities. The research staff (including PhD and other graduate students) exceed 100 people.

M-ITI is currently integrated in LARSYS (www.larsys.pt) the national Laboratory of Robotics and Engineering System which received the international classification of "Excellent" from FCT. Through LARSYS the focus of HCI research from CMU initiated to have an impact in more traditional engineering areas. During the last year, M-ITI also received one of the first ERAChair Grants from the EU Horizon 2020 pilot program. The ERAChair holder selected from an international competition was previously leading the MIT Media Lab groups in Civic Media and Computing Culture.

LESSONS LEARNED

Despite the regional, national and international success and visibility of M-ITI many issues and barriers were identified through the process of setting up an interdisciplinary research center in one of the outposts of Europe. Here we summarized some of the main lessons learned from this.

M-ITI was the first and only innovation institute created at UMa after the new law for public universities from 2007. The original charter of using innovation institutes to open the University to the outside became an exception and not a rule. The faculties, in their majority composed of teaching oriented faculty, lost the control of the educational programs and reacted with tensions and conflicts that hampered the new matrix structure of the University. This was particularly harmful for M-ITI since the competence centers approve hirings, distribution of services, promotions and new academic programs.

M-ITI works in an interdisciplinary domain which again justifies the need for an horizontal structure that could span art, humanities, social sciences, exact and engineering sciences. M-ITI should recruit faculty from the different faculties and become the natural hosts for more innovative graduate programs recruiting students from different fields and providing them with a relevant professional career path. However, with few executions, the core faculty of M-ITI all come from the area of engineering informatics and digital media hosted at the faculty of exact and engineering sciences. Existing faculty from art and humanities but also from social sciences were given opportunities but failed to effectively join M-ITI. Conversely several high-quality researchers hired by M-ITI as post-doc and lecturing pro-bono to other programs at UMa were not hired by the respective faculty despite recommendations from the national accreditation agencies.

UMa is essentially a teaching University and the lack of research culture generates a wrong perception of the value and impact of research at all levels. The creation of a new faculty regulation with different profiles (teaching, mixed and research) instead of being used to give different faculty a more comfortable career path increased the tensions which inevitably fall in favor of most teaching faculty and the accounting of teaching time as opposed to research income and output.

M-ITI was created as an independent not-for-profit organization which enabled the agility and flexibility in terms of management of research funds, but at the same time generated resentment and mistrust about the activities of M-ITI and its benefits to UMa. The necessary involvement of the Regional Government was also perceived as a threat to the University.

Visioning M-ITI: Scenario Planning

In order to envision the future of M-ITI in times of uncertainty we promoted a future Scenario workshop, where M-ITI faculty and researchers investigated how to "extend" the present of the institution, embracing an awareness of emerging futures.

In this two-day workshop the participants asked themselves what possible futures for an academic institution such as M-ITI might be and what their "raison d'être" would be in the years to come. At present, research institutions are stretched between fierce competition, bureaucratic inertia, job (in)security and a strong desire to create a culture of sharing and innovation - a culture from which transformative experiences can emerge, enabling people to live the best possible lives in harmony with their environments.

During the initial phases of the workshop we identified what we find most satisfying at M-ITI, which can be summarized in the 3 main points below:

1. Diversity: the mix of national and international members; different perspectives and cultures; the extension of the members networks outside the island; critical mass,

mobility, the multi and interdisciplinary nature of the work that goes on at M-ITI (HCI focus, Interaction and Service Design, Arts and Technology, Social sciences and Human Factors);

2. "Can do!" culture: freedom and capacity to realise things; flexibility and open mindedness among different disciplines of researchers; embracing and sharing ideas, collaboration among faculty and researchers, respect, independence of hierarchy, open leadership, empowering environment through cohesiveness, practical and financial support, focus on sustainability.

3. Quality of Life: the Island of Madeira, living lab, the people at the institute, the space, the light, the quality of the environment and nature.

Starting from this and looking at the potential future of M-ITI we have identified our shared vision, which can be worded as: *M-ITI exists to research, enable, design and create transformative experiences that empower people to lead the best possible lives in harmony with their environment.* After finalizing this vision, we progressed by projecting M-ITI into the near future in the year 2020 and promoted an exercise of identifying critical factors, changes, and drivers that would likely affect our institute in the future. In this way four different future scenarios were sketched. The scenarios were sketched within a two-dimensional problem space, whose axes were defined:

Figure 1. Visioning Four Scenarios for M-ITI as an Excellence Research Centre.

The four scenarios were imagined as a group exercise where each M-ITI member would try to imagine such a future and elicit its characteristics, which were captured by the facilitators and written on the pertaining scenario quadrant. Each scenario was eventually given a representative image and a title. The following, is a brief description of each scenario:

"Zombie Swamp" - might have been a place of excellence, but the evidence is buried in the mud. Regardless, people working there still bask in their past (unsubstantiated) glories and feel entitled to the benefits of a stable job without too many challenges. They have done their bit for research, but now it's time for society to take care of them. In the past they made strategic connections with high-ranking politicians and bureaucrats, with whom they still share convoluted handshakes in basements of one or the other secret fraternity. Because of these relationships, the institute's name is still well regarded and there is interest in working and studying there. However, the institute has a high turnover of people who are attracted by their rhetoric, but leave as soon as they realize that in reality the place is just an empty shell. The research they do seems relevant in the short term, but their results have low academic impact and no social impact whatsoever. The leadership is self-absorbed, and everyone's primary goal is self-preservation. This results in a climate of conflict, backstabbing and continuous bickering, disempowering anyone wanting to stand out and challenge the status quo. Even though it is an unpleasant, stagnant place to work, it manages to survive through many economic and cultural crises. It remains, if nothing else, as a monument to what it once was, or could have been.

"Particle Accelerator" - a way station that spins academic careers into orbit. The place is teeming with students and staff eager to assist the researchers in their work, providing cheap (or even free) labor on massive research projects. Motivated young people work at all hours under ruthless principal investigators, advancing the PIs' research and publication results. Bibliometric scores are sky-high, turning the institute into a veritable (research) paper factory. The fields of inquiry are as numerous as the researchers themselves, making the institute's focus unclear, unstable and prone to passing fads. Academic competition inside and outside of the organization is fierce - and encouraged. Working at the Accelerator guarantees individual professional advancement, if researchers do not let themselves get distracted by life. Many of the researchers suffer from a Postdoc Syndrome and various levels of short-termism, individualism and self-centeredness. However, the high speed and high profile environment they work in doesn't allow any of these issues to incidentally slip into their awareness. Financial and academic opportunities abound and there is no time (and no point) to stop and reflect on the bigger picture. Even though people are extremely keen to work at the Accelerator and attach their names to its brand, they know it will be just for a brief period. They do not waste their time in attending social gatherings, research seminars and other team building activities that the staff and the management organise to increase commitment to the institute and the local community and culture. Over time, Accelerator's research becomes less and less involved with the world outside of academia. It increases academic excellence, but

without daring to question the academic, social, political or environmental status quo.

"Beer Club" - an insular community of researchers working on long-term studies that may never be relevant to anyone except them. The principal hiring criteria are that candidates are "nice", have good social skills, and have a strong liver. The institute has its own daily rhythm, going back to tea times of the British Empire. They begin with breakfast together, morning tea, lunch, afternoon tea, tea, supper, nightcap… Lunch alone takes over two hours each day, and working hours are 10-17h. In between they attempt to engage in their work: but they invariably encounter a problem, which provides an excuse to explain why they haven't achieved their goals yet. The resources are limited and the institute is plagued by the effects of financial downturns. No incentives are provided for hard workers, and the contracts make it very hard to fire workers who underperform. So why bother? "Next time" is one of the most common themes in the Beer Club, as in: "We could have done that, but… oh well, maybe next time." The collaborators are all good friends and the relationships are somewhat incestuous. All of them are nice people who make token gestures of placid friendliness to people outside of their Club, but they would prefer that the world leave them in peace, perhaps on a small island that provides for all of their needs.

In **"Further"** everyone contributes to a community culture. From researchers to administration, logistics to strategy, every person offers their best abilities to create a place where knowledge, resources and results are shared. The sharing goes beyond the walls of the institute: their work is embedded in their local community and international networks that appreciate their world class, socially relevant research. The work they focus on is high risk and long term, likely to achieve high impact in the world. They are aware of the importance of failure in research and embrace curiosity and exploration as key to innovation. The work is challenging as well as rewarding, recognised inside and outside of the institute. Clear communication about the core principles and values of the institute help to reach communities of non-academic researchers. Institute members are eager to be involved with the outside world, contributing and testing hypotheses directly with people who might be impacted by the research. The institute exists in an ecology of partnerships, from renowned universities to trend-setting SMEs and creative collectives. Inside the institute, the "let's go" mentality prevails, a sense of possibility and support. Anyone can propose ideas within the institute's many avenues for sharing: from the informal cafe and collaborative online platforms, to more formal mutual paper reviews and research seminars. All the activities are open to constructive criticism and there is healthy competition between people, encouraging personal, professional and community development. There is a diversity of skills and interests, with sufficient overlap and complementarity. Many successful collaborative projects start over a cup of tea or a glass of wine in the Further Cafe - the research happens wherever and whenever it wants to. "Further" is a rich intellectual environment whose long-term vision is co-created by all, then coordinated by transparent and lean management and professional, motivated staff. The curiosity of the people in the institute spills over its walls and into the communities who benefit from their work. Serendipity allows mutual interests to flow from the institute to the communities and back again. Over time, the institute becomes an essential thread in the fabric of society, not only through its research, but also through its social dimension and the overall quality of life it inspires.

CONCLUSION

Research at M-ITI is driven bottom-up via the efforts of individual researchers. Leveraging existing links with Carnegie Mellon has allowed us to develop a culture focused on interdisciplinary work with the potential for real world impact. Taking advantage of the rigidity and lack of critical mass in Portuguese academia we have been successful in creating a true international and interdisciplinary institute in HCI. M-ITI was successful in embracing new areas where our base expertise in technology and infrastructure is used to tackle important problems. Many of the accomplished achievements were conducted in a very short period of time due to the Carnegie Mellon - Portugal International Partnership.

However, our main challenges are to create a stable and supporting structure that could leverage M-ITI as an international excellence center to enable it to compete with the top research initiatives in Europe and worldwide. Interdisciplinary education and research is becoming premium for industry but still struggles in traditional academic contexts. One of the main challenges is to develop careers paths for high-quality interdisciplinary faculty, e.g., "hybrids" that combine backgrounds in Art, Design, Mulimedia, Digital Media and Computer Science and Engineering. Interdisciplinary education emerges from the combination of backgrounds and perspectives that students are exposed to. The main challenge is then to provide that context in which different faculty from different backgrounds can teach and conduct research in a well-balanced and mutually respectful environment.

From our experience the main challenges in the educational context are also closely related to a healthy interdisciplinary research context. Attracting and selecting students from different disciplines requires reaching out to many different communities and providing examples of role models and successful achievements in industry and academia. Developing interdisciplinary skill in grad students is also quite challenging usually requiring in class activities with professors from different backgrounds. The Madeira MHCI program and M-ITI are outstanding examples of these challenges which are major challenge for the years to come as technology and interdisciplinary skills become even more required by industry and the knowledge economy.