DAY 4 – SEPT 5th, 2019

DAILY PROGRAM

09:00-10:30	*Room Plenary*	*Room Exhibition*	*Room Multipurpose*
	TS1 - HBIM II	Time Machine Workshop	TS2 - Restoration, Rehabilitation & Conservation of Heritage
10:30-11:00	COFFEE BREAK		
11:00-12:30	*Room Plenary*	*Room Exhibition*	*Room Multipurpose*
	TS3 - Artificial Intelligence in Heritage II	TS4 - 3D Doc, Preservation & Analysis of Heritage sites in the Middle East	TS5 - Heritage 3D Documentation and Modeling II
12:30-13:30	LUNCH BREAK		
13:30-14:30	DEMO SESSION – Exhibition room		
14:30-16:00	*Room Plenary*	*Room Exhibition*	*Room Multipurpose*
	TS6 – Heritage 3D Documentation in the Mediterranean Area	TS7 - Monitoring and Conservation of Heritage	TS8 - Stability and Structural Analyses of Heritage
16:00-16:45	AWARDS & CLOSING SESSION		
17:00-18:30	EXCURSIONS: Cathedral of Avila		
18:30-20:00	TAPAS TOUR		

INTERVIEW

FULVIO RINAUDO (Politecnico di Torino, Italy)

- HBIM, WHERE ARE WE GOING? -

Q: What HBIM is?

A: In the last years, many research groups tried to understand in which way BIM technology could have a role in the Cultural Heritage (CH) documentation, intervention and management. BIM technology shows that it needs different solutions to offer a complete documentation database for Cultural Heritage assets, therefore the new acronym HBIM is used currently to underline a specific direction for research and applications.

Q: Which are the main goals of HBIM in CH documentation?

A: CH buildings, historical centres, natural and historical landscapes are the main typologies of assets that could be investigated to allow valorisation, restoration and management actions. By considering the international charters of restoration published in the past, they need a strong documentation to drive correctly the above-mentioned interventions. The possibility to offer a complete 3D database to support the experts involved in CH actions is one of the most important goals of the research in HBIM. They will offer the possibility to point out the 3D links between results coming out from different analysis.

Q: Commercial or Opens Source solutions?

A: The different nature of CH drives the researcher to create personalized HBIM platform. Open source platforms are today the only ones that offer the needed instruments to adapt HBIM solutions to different CH asset typologies.

Q: Fulvio, in your opinion, in which direction the research on HBIM has to be directed?

A: In the past GIS was considered as a substitute of the digital maps. In the same erroneous way, someone continues to consider HBIM as an instrument able to show 3D metric surveys. This was not true for GIS and this is not true for HBIM. 3D metric survey needs a level of detail that is difficult and not useful for HBIM purposes. In the future years, the researchers do not have to waste time trying to represent the 3D components of an asset as they really are in shape: they have to direct their attention to the integration of the results of the entire investigations useful to document a CH asset in a complete way. Researchers have to use in a correct way the multiscale management of 3D data in general. Only in that way, it will be possible to show to professionals the advantages of a real 3D database in day-by-day actions. Other interesting field of applications could be: the use of HBIM not only for "buildings", but also to document the 3D correlations between emerged and submerged structures and systems, or the use of HBIM to record the restoration interventions to build up real and effective management systems for Cultural Heritage assets.

INTERVIEW

GEERT VERHOEVEN (LBI, Austria)

- ROBOTICS, AUTOMATION & AI IN CULTURAL HERITAGE -

How are these three fields currently used in cultural heritage? During the past decades, academics and practitioners have been exploring various digital approaches to engage with cultural heritage. Amongst many other techniques, cultural heritage has been increasingly relying on the three related, but dissimilar, fields of artificial intelligence (AI), robotics and automation for both data acquisition and processing. *Anno* 2019, the data acquisition or 'input' stage is found at the borders and intersection of robotics and automation. Examples include quad-mounted geophysical sensors for archaeological prospection, robotic total stations, drones for large-area mapping and humanoid robots for exploring inaccessible or dangerous areas. Despite their merits, these platforms are often hyped without adequately addressing their application limits and the issues associated with such data-driven approaches. Two decades ago, cultural heritage scholars (especially archaeologists) knew that they lacked all the required skills, knowledge and tools to properly assess all the data they were gathering. Multi- and transdisciplinary teams were formed but reaching true symbiosis amongst them proved very hard to achieve. In the end, no matter how good such teams could work together and how cunning their analyses, the heritage specialist still had to combine all pieces of new information to synthesise the gained heritage-specific knowledge. Nowadays, data sets are a multitude bigger, but the theoretical and analytical tools necessary to deal with them did not catch up. This is why new 'output'-specific approaches – found at the AI-automation intersection – were slowly introduced. The increasing implementation of AI in the data analysis, be it deep learning or some other type of machine learning, is nowadays often considered an answer to this data explosion. However, the use and understanding of most AI tools for automating the output stage still must overcome many hurdles before they can be considered valuable. Although algorithms like support vector machines have proven useful for segmenting point clouds, one should be aware that most research is deep learning-centred. What many of these applications fail to recognise, however, is that deep learning methods are not robust and only work for closed-end classification problems with large sets of clean, labelled data. One can imagine that the automated image labelling of Roman black gloss pottery versus African red slip ware bears a resemblance to the cat versus dog classification problem. But can famous heritage places and buried archaeological sites be reliably (but obviously not uniquely) captured by a limited vector of properties? Where are the nation-wide, let alone Europe- or worldwide comprehensive databases of cultural heritage objects and archaeological sites that could be used as training data? Finally, the properties 'learned' by these algorithms are very often incomprehensible, with different machine learning systems yielding unique sets of attributes. How is this alchemic behaviour supposed to aid our data understanding?

The need for automated, standardised and intelligible data acquisition and processing is undeniable, and so is the fact that specific AI algorithms will be useful in the future. But this does not remedy the lacking views on how to establish information-gaining workflows, uniform data management pipelines and durable dissemination strategies. The bad track record of the heritage community in those matters, combined with the daily increasing data volumes and reliance on poorly understood tools, turns this into a huge challenge. From that point of view, the present use of AI, robots, and automation in cultural heritage seems as much of a blessing as it is a curse.

INTERVIEW

LUIS APARICIO (*University of Salamanca, Spain*)

- FINITE ELEMENT ANALYSIS IN HERITAGE -

Q: Luis, nowadays which are the main strategies for simulating the structural stability of historical constructions?

A: Nowadays, engineers have a lot of possibilities for simulating the stability of historical constructions. In case of a masonry we can evaluate the stability of a wall, vault or dome by means of limit analysis theorems, discrete element methods or even analytical equations. Within this articulated panorama the Finite Element Method (FEM) has been placed as one of the most used strategy, due to its capacity of simulating events (e.g. earthquakes) in large and complex structures. This capacity is improved with the recent development of constitutive models (i.e. solutions that allow to evaluate the mechanical behavior of a material), able to simulate a great variety of mechanical phenomena. However, as engineers we do not forget that we a have lot of complementary tools available to evaluate historical constructions. Depending on the situation, we will use one or another.

Q: Luis, what will be the role of the geomatics within the structural analysis of historical constructions?

A: Geomatics plays an important role in the structural analysis of historical constructions. In fact, geomatics is focused on providing the geometrical component of these simulations. We need to pay special attention to the development of portable laser scanners e.g. based on SLAM. These sensors are really amazing, especially in complex inner scenarios typical of historical constructions. They are able to provide cm accuracy which is not enough if we need to monitor the structural movements, but enough to make a numerical model able to capture the general stiffness of the structure. SLAM-based scanning requires much less time than static laser scanning or SfM. Another important topic nowadays is the transition from a point cloud to a CAD model suitable for numerical simulations. Within this field, the reverse engineering procedure, based on parametric surfaces, NURBS and Loft surfaces, seems to be the most promising method. However, these approaches require a lot of manual work, therefore cutting-edge technologies are focused on the development of automatic strategies.

Q: Luis, what is the take-away message?

A: The structural diagnosis of historical construction is a critical part in the conservation of our legacy. Thanks to the PC computational capacity as well as the latest advances in constitutive models, it is possible to simulate a wide variety of risks, attained using a wide variety of tools. Within this context, FEM has become one of the most used strategies due to its capacity of simulating complex and large construction systems with different levels of detail (micro- and macro-modelling). Inside this discipline we could find, among others, the following lines of research: i) strategies to transform point clouds into CAD models, ii) calibration methods and iii) development of new constitutive models.