An Approach for the Visualization of Crafts and Machine Usage in Virtual Environments

Evropi Stefanidi, Nikolaos Partarakis, Xenophon Zabulis & George Papagiannakis

ICS-FORTH, Greece
evropi@ics.forth.gr

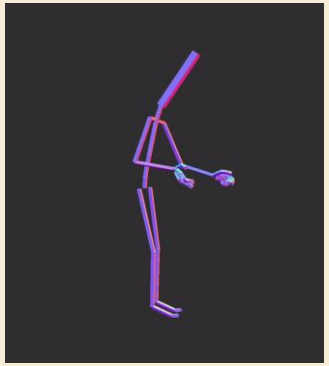
Evropi Stefanidi

Short resume:

- ***Currently***: **PhD** Candidate – Research Assistant at **HCI Group – University of Bremen**
- Bachelor & Master's at **Computer Science** Department, **University of Crete**, Greece
- Research Assistant in **Institute of Computer Science, FORTH**, Greece
- Master's Thesis **Internship** in the University of Geneva, Switzerland
- This work:
  - Conducted in the context of my **Master's Thesis**
  - **Mingei** Project (EC H2020 Innovation Action)

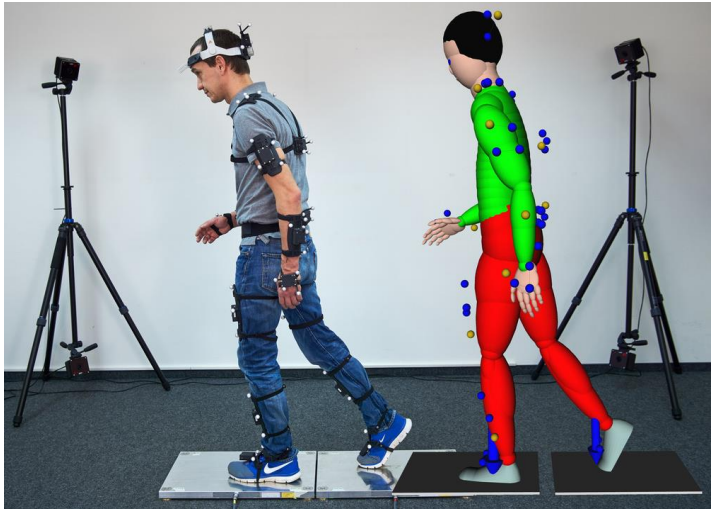
Cultural Heritage (CH) & Heritage Crafts (HCs)

- **HCs** of great significance to **CH**
- Cultural, historical, economical and societal significance and value
- CH includes both **Tangible** (e.g. tools, artifacts, documents) and **Intangible** (e.g. know-how, skills) dimensions



BVH viewer for visualization of MoCap files

- **Digitization** of both imperative for presentation, representation, dissemination, preservation and conservation **[WTO]**
- **Human motion**: key component of many forms of ICH (e.g. dances, crafts, and rituals)
- **Recordings** of human motion used to **document** and **capture** performances or practices → Motion Capture



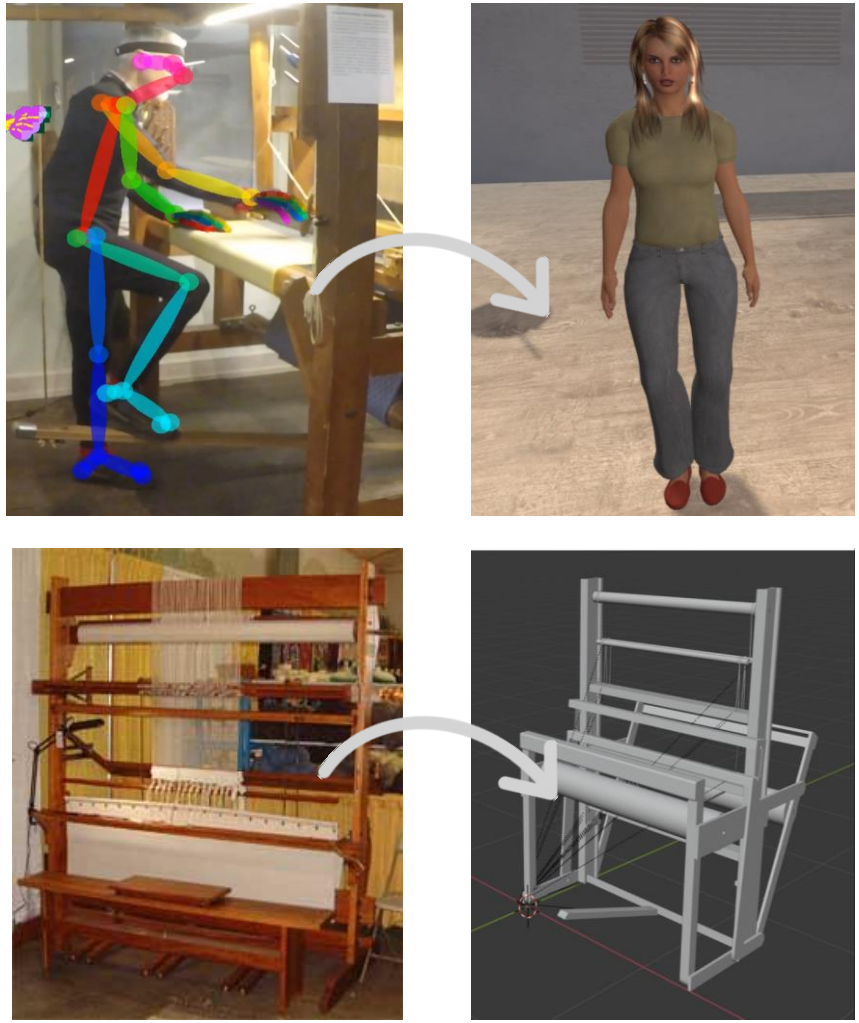
Gap

- Several **crafts** threatened with **extinction**
- **Digitization** can help
  - But: **static**, **scattered** (geographically & thematically), only focusing on **capturing visual appearance**
- Need for a **comprehensive picture** of the studied assets
  - including both **visual/structural** information, & **stories/experiences** with their **cultural**, **historical** and **social context**, and their **evolution** over time

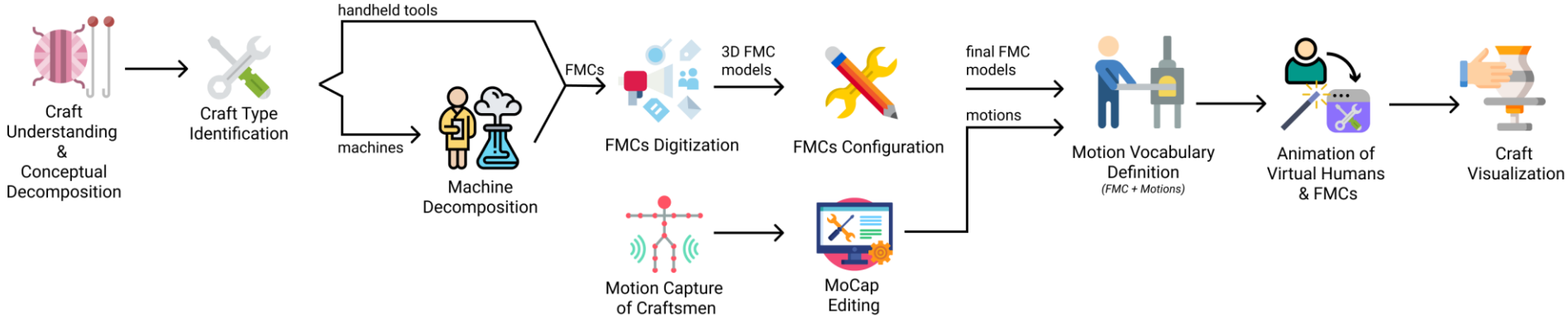
Comprehensive methodology for the **representation** of both **tangible** and **intangible** aspects of **Craft as Cultural Heritage**

Proposed Methodology

- **Novel methodology** for the **visualization of HCs** in **Virtual Environments** (VEs)
- **Practitioner** represented by a **Virtual Human** (VH) and **objects** through their **3D reconstructions**
- Practitioner actions are reproduced by **animating** the VH based on **MoCap** recordings
- **Decomposition** of **machines** to their basic functional parts, allowing for **generalization**



Proposed Methodology for Craft Reenactment in VEs



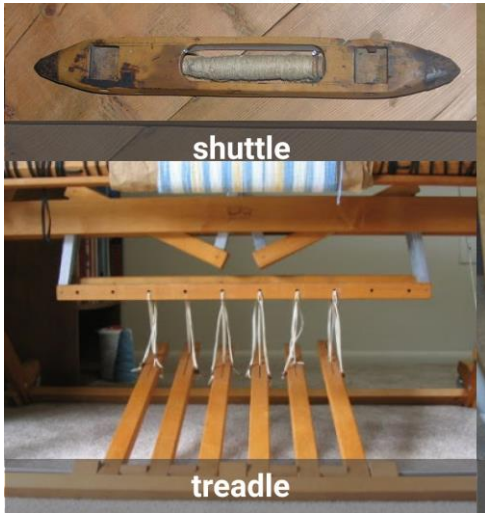
The HC of Loom Weaving

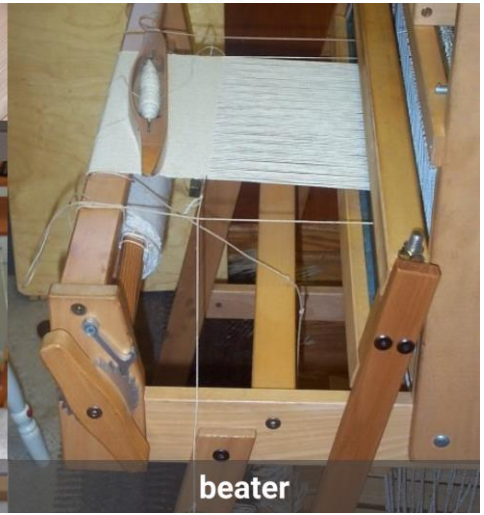
The HC of Loom Weaving: MVIs & FMCs

Conceptual Decomposition

- 3 basic motions (MVIs):
  - **shedding**
  - **picking**
  - **battening**

- 3 Fundamental Machine Components (FMCs):
  - **treadle**
  - **shuttle**
  - **beater**

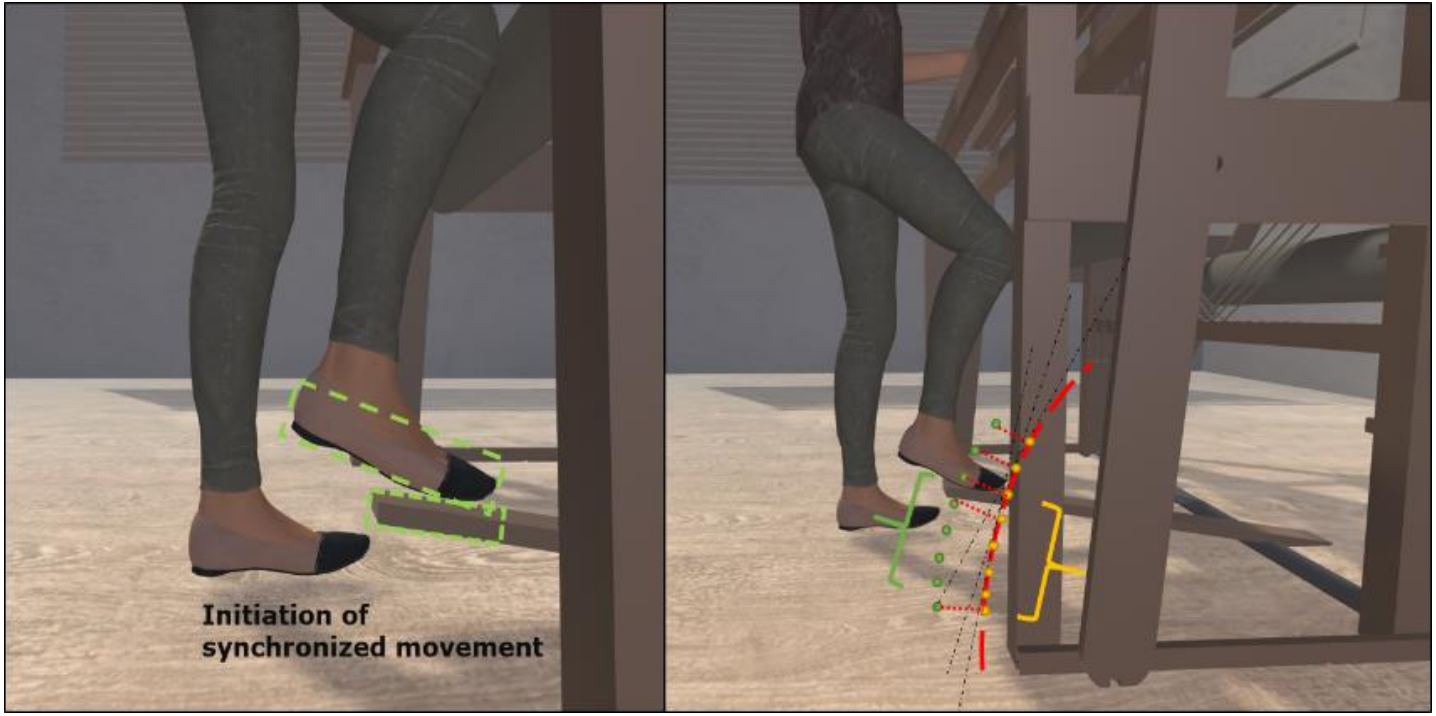




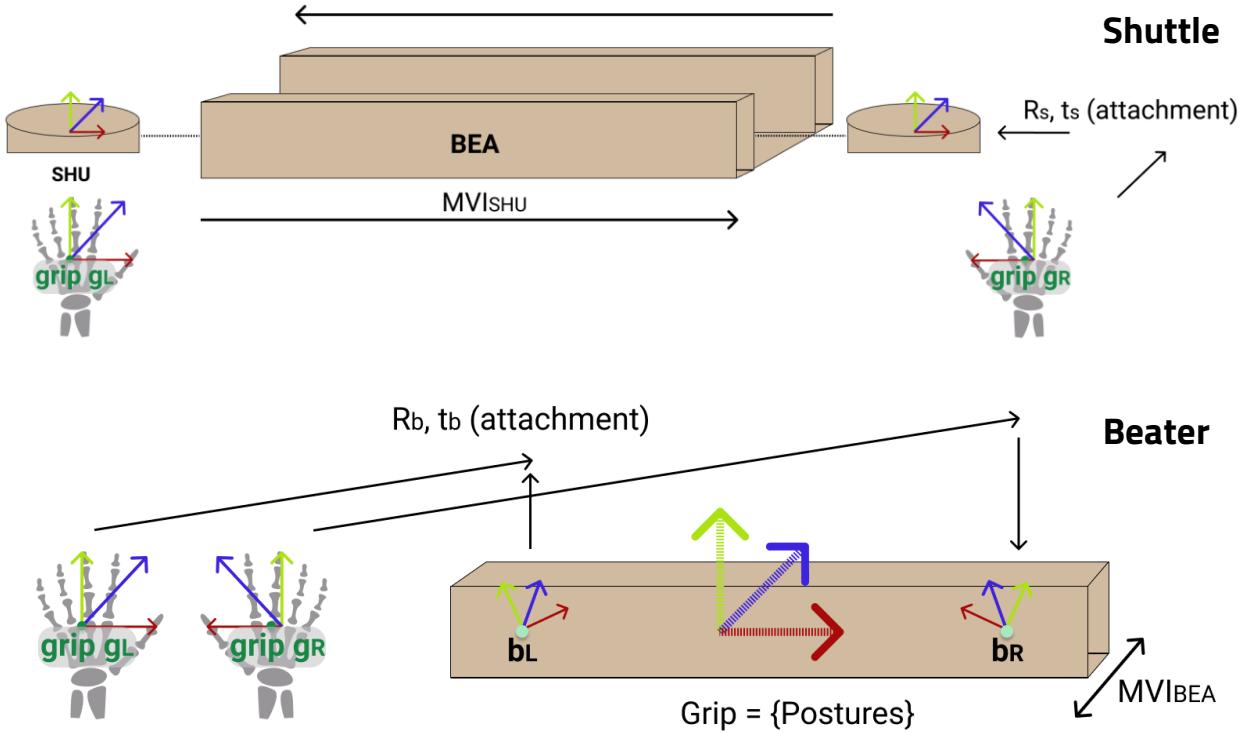
Inducing Machine Motion From Human Motion: Foundation & Modeling

- Application of **Translation**, **Rotation** and **Scaling** transformations to VH & FMC
- **Synchronization** of the FMC's motion with that of the VH for each MVI, based on the feasible induced motion trajectory of the FMC
- **Animation function AN(A/FMC**, Posture) which animates either the **A** or FMC according to an MVI

MVIs modeling: Treadle, Beater and Shuttle



MVIs modeling: Treadle, Beater and Shuttle



Example MVI implementation: Treadle

- 3D model of FMC **translated/rotated around the correct joint** by a constantly re-calculated **angle**, depending on the movement of the VH's right leg

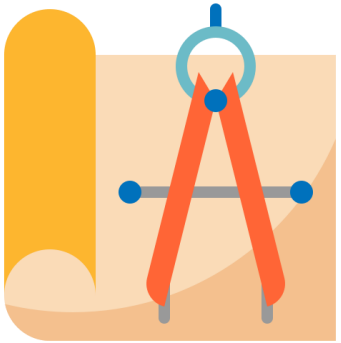
Conclusions

This work delivered:

- A **novel generic methodology** for presenting crafts in Virtual Environments, by employing **Virtual Humans** as practitioners who can use both **handheld tools** and **machines**

which could help in the efforts of presenting, representing and preserving Heritage Crafts

Future Work



Already completed (**not** part of this paper):

- Development of an **Authoring platform** for Crafts
- **Training** in **VR**
- **User-based evaluation** of Authoring platform

Current Future Work:

- **Addressing** issues discovered in **user-based evaluation**
- Addition of **Narrator Avatar** for storytelling
- New **user-based evaluation experiment** to assess usability and user-experience
  - Inclusion of other **Heritage Craft stakeholders** such as curators and practitioners

Acknowledgments

- This work has been supported by the EU Horizon 2020 Innovation Action under grant agreement No. 822336 (Mingei); the authors are grateful to project partner ARMINES for the acquisition of MoCap data and the practitioner community of the Association of Friends of Haus der Seidenkultur (HdS), Krefeld, Germany for their collaboration and support on understanding the craft of loom weaving.

Thank you!

For questions, please contact me at ***evropi@ics.forth.gr***

FORTH
FOUNDATION FOR RESEARCH AND TECHNOLOGY - HELLAS

Mingei