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

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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

- **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** $\text{AN}(\text{A/FMC, Posture})$ which animates either the A or FMC according to an MVI
MVIs modeling: Treadle, Beater and Shuttle
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**Shuttle**

**Beater**

Grip = \{Postures\}

**MVI_{SHU}**

**MVI_{BEA}**

**R_b, t_b (attachment)**

**R_s, t_s (attachment)**
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
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Thank you!

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