Ontology-Mediated Cultural Contact Detection Through Motion and Style in Southern Chinese Martial Arts[*]

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1   Introduction

Intangible cultural heritage (ICH) is the discipline that encompasses methods to encode for preservation, publish and transmit objects of cultural significance that have no correspondence in material culture like artworks and buildings do. The boundaries of what should be captured as intangible cultural objects are blurred, due to their immaterial nature. However, concepts such as style, experience, tradition and, as a generalisation of the latter, cultural contact, have all been subjects of study in ICH research. Even though a great deal of the body of ICH is intrinsically endangered by being conveyed through oral history, occasionally available material evidence may serve as a vehicle through which intangible elements are captured [2]. Every so often, focused efforts respond to this challenge through several means, notably by capturing performances of culturally significant activities in multimedia or multimodal capacities [9].

One of the channels where intangible culture is expressed is *kinesthesia*: whereas purely kinetic dimensions such as pose, gesture and movement, are themselves information carriers, it is through their perception that they acquire significance in studying their role in the transmission of culture. This has been primarily carried out in the context of dance, arguably the best-known performative discipline that values motion, perception and interpretation, however, this also holds true in martial arts. As in dance, many forms and styles are expressed through allegorical devices, such as the crane or the drunkard, which either reveal the source of inspiration for a given technique, or provide a means to facilitate its transmission. Another example is the osmosis between military and civilian martial arts - the latter employing makeshift weapons or simulating

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them with hand techniques due to the prohibition to bear arms - to counter the phenomenon of piracy in China. Such influence materialises into cultural traits.

This paper introduces an ongoing study aimed at understanding how such a complex, immaterial and kinesthetic art form as martial arts can be formally modelled so that its cultural traits can be singled out, with a view of detecting phenomena of contact such as influence, assimilation or domination. The study will contribute: (1) a flexible, standards-compliant formal ontology that models martial arts through kinesthetic, stylistic and social lenses; (2) an instantiation of the ontology in the context of the Hong Kong Martial Arts Living Archive; (3) a method for detecting ICH traits through an existing cultural contact ontology.

2   Background

2.1   The movement in martial arts as ICH

Unlike tangible monuments, where cultural identities are manifested through physical objects, intangible heritage is defined through its reliance on tacit and embodied practices. These are, in turn, subject to a dynamic process of human interactions, as well as a constant transformation linked to social change and exchange. Taking up Wulf's statement, the intangible culture practices are usually bodily, performative, expressive, symbolic, rule-based, and non-instrumental. Therefore, to transmit them, we need a social and interactive process where the human body functions as the medium to acquire practical knowledge [12].

The oeuvres of ICH comprise the practices from diverse nations and cultures. Among those, martial arts - being an experience that "resonates with everything it touches, changing how you think and act, perceive and feel" [1] - incorporate a global diffusion of ideas, images and consumer goods, as well as present the transnational crossing of social-cultural boundaries [6]. For this reason, the general domain of martial and combative arts has attracted numerous scholarly enquiries to understand social and personal transformations, as well as to reveal the circular impact of body and culture upon each other [3].

2.2   HKMALA: The Hong Kong Martial Arts Living Archive

Through the sustained creation and re-creation of diverse ethnic groups, Chinese martial arts nowadays are practised in countless groups at various organisational levels, ranging from "families" to "schools" and "sects", each with its own set of philosophies, concepts, techniques, and training systems [11]. With these groups as the hives of cultural transformation, Hong Kong has acted as a vibrant center for Southern Chinese martial arts throughout the 20th century due to its role first as a major port and trading center, then as a safe haven for refugees across China [4]. However, these treasured cultural practices, made famous globally by the movie industry, are being endangered by rapid urban development, population growth, cultural transformation, and the aging of the masters.

In response, the *Hong Kong Martial Arts Living Archive* (HKMALA) originated as a heritage project in 2012, to archive Hong Kong's rich and diverse kung

fu styles with traditions [4]. The HKMALA project is a longitudinal research collaboration between the International Guoshu Association, City University of Hong Kong, and the Laboratory for Experimental Museology (eM$^+$) at EPFL. It encompasses a comprehensive analysis of digital strategy including motion capture, motion-over-time analytics, 3D reconstruction, high speed and panoramic video, and a comprehensive photographic archive of all kung fu masters involved. Its datasets represent the world's largest motion archive for intangible cultural heritage, spanning over 130 sets of empty-hand and weapon sequences, or *taolu*, representing 19 styles and performed by 33 elite Hong Kong practitioners. The archive is accompanied by extensive contextual documentation such as ritual descriptions and multimodal entities comprising texts, audios, interviews, and digital records of physical objects such as weapons and training tools.

The current logical organisation of resources in HKMALA reflects the use case of assembling them for exhibitions around a designated theme.[4] To organise them into an open-access learning resource requires a knowledge organisation system that has both the flexibility to accommodate content in the diverse South Chinese martial arts spectrum, and awareness that said content is a carrier of ICH elements like tradition, style and influence. Providing such ontological grounding, as described in what follows, is part of our mission. Once this is carried out and HKMALA is published accordingly, it will play an active role in the preservation, re-activation and revitalisation of traditional martial arts [11], as well as the basis for future educational programs [8].

3   Ontologies for cultural studies on martial arts

Our first effort in the knowledge organisation of HKMALA is to construct a formal ontology. This has the dual aim of: (1) using it for modelling HKMALA metadata into a knowledge graph, and the latter for reorganising multimedia/modal content and enabling ontology-based access to it; (2) enabling cultural studies by identifying the potential for entities in the ontology to constitute cultural traits, so that a rule system for detecting contact can be built upon them.

Any modelling effort with a focus on cultural heritage must provide a scholar with the tools to single out and highlight the entities with a potential to contribute as traits of a culture, or to be transmitted through a form of contact. Martial arts are no exception, less so because their manifestations are only seldom captured as cultural objects, and any encoding effort comes at a loss. Whilst in our use case kinetic and kinesthetic elements hold our primary interest, it cannot be denied that dimensions pertaining to, e.g. how the discipline is taught or the symbology of preset choreographies, are equally culturally significant.

Based on these design considerations, the ontology network is being developed to satisfy these requirements:

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[4] Some themed exhibitions were: *Lingnan Hung Kuen Across the Century: Kung Fu Narratives in Cinema and Community* (2017), and *Safeguarding the Community: an Intangible Cultural Heritage New Media Exhibition* (2018).

1. *Modular.* As the dimensions along which cultural contact is traced vary profoundly, each is best captured in its own ontology module.
2. *General.* Use cases aside, the model should be general enough to be adapted to most martial arts or to non-combative kinesthetic performing arts.
3. *Inferenceable.* Cultural traits are not made explicit: as many entities have a potential to act as manifestations of a culture, they only materialise as such when an inference is made, or in data built upon the ontology.
4. *Grounded.* Build the model up to the level where the entities specialise those of a designated upper ontology, and use the latter as a reference.

Developments of our martial arts ontology system are being made openly available on GitHub.[5] We have structured our network along three possible dimensions through which lenses can be built to highlight a cultural phenomenon (req. #1). These are the *kinesthetic*, *stylistic*, and *social* dimensions.
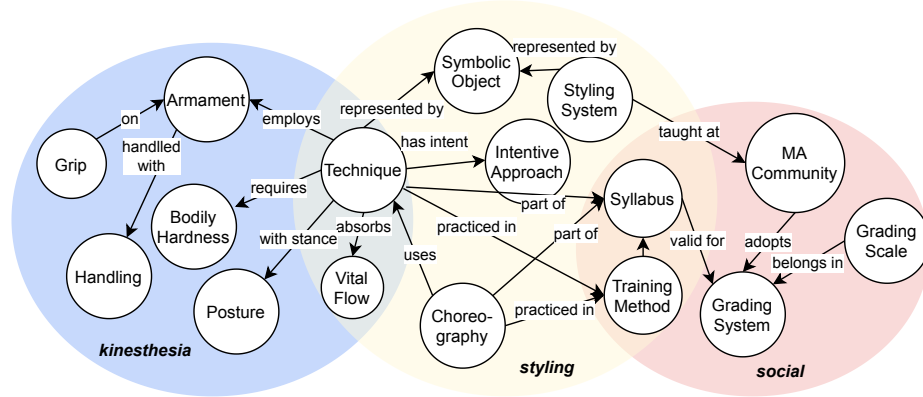
Fig. 1. Key concepts of our martial arts ontology network, structured according to three principal cultural dimensions: kinesthesia, styling and social.

The starting documentation for this modelling effort is the corpus of panel texts and media captions for the exhibitions that were established for HKMALA through the years, as well as multimedia subtitles of interviews to masters and their technique explanations. The base terminology was lifted from the corpus by project members and engineered as classes and properties. The resulting key concepts are synthetically shown in Figure 1, with nodes for classes and edges for properties relating them through either domain and range, or class restrictions. The figure reflects the organisation into modules denoting the principal cultural dimensions, with classes serving as contact points between them.

Kinesthetic dimension. The features that describe the articulation of the human body or weaponry during a stance or attack belong in this module. These

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[5] CROSSINGS ontologies, https://github.com/CROSSINGS/ontologies.

include posture, grip, movement and the parts of the anatomy they affect. This kinetic model is complemented with kinesthetic concepts, such as body hardness and flow of vital energy (e.g. the *qi* in kung fu), that are not quantifiable in themselves, but are manifested and perceptible through kinetic means.

Stylistic dimension. How combinations of kinesthetic features culminate in what may be defined as a technique, choreography (or form, e.g. *kata* or *taolu*), style or as an entire martial art, is the remit of this module. Along with the kinesthesia of styles, the symbolism that inspires them or aids their transmission (e.g. the observation of a drunkard's erratic moves or of a crane's stance) is of unquestionably crucial cultural value and is encoded as a Symbolic Object.

Social dimension. This is the system that describes how martial disciplines are taught, learnt, assessed and disseminated. Here, a Martial Arts Community represents collective social agents where this takes place, e.g. a school, clan, sect or sports federation. These are also distinguished through their training methods, and the norms in place to assess the technical mastery of a practitioner. The relevance of capturing this aspect as a potential cultural trait is warranted by the fact that, even within the same discipline and style, different pedagogical frameworks may be employed by assimilation or opposition.

Note that no specific commitment is made to the HKMALA context: any notions specific to Southern Chinese martial arts will require the ontologies to be specialised or instantiated (req. #2). Also, to ensure enough flexibility to develop rule systems upon the ontologies, we aim at an implementation within the OWL 2 RL profile (req. #3). Such rule system will be necessary to be able to classify e.g. an experienced practitioner as a Master – a status recognised in the social dimension – or a piece of Armament or other object as a training tool. Lastly, we are experimenting with the adoption of DOLCE UltraLite [7] as the top-level ontology that provides fundamental notions such as agents, qualities, norms and methods, as its highest level closely reflects our expectation for a core set of candidate entities for cultural traits (req. #4). The decision to extend a top-level ontology, rather than a cultural heritage model such as CIDOC CRM [5], is motivated by the fact that this is primarily a domain ontology, therefore its cultural heritage standing is to be indirectly detected (see below).

4   Outlook

Our martial arts ontologies are being developed to serve a variety of use cases.
The main ongoing effort is the knowledge-based re-organisation of the HK-MALA itself. To that end, an RDF dataset based on the ontology discussed earlier is being generated through re-engineering the structured metadata of HK-MALA media files. Once augmented with alignments to datasets like Wikidata, the dataset will be used for the annotation of individual segments of motion capture and video resources, thus enabling fine-grained querying of the entire archive through the resulting knowledge graph. Both tasks are currently underway.

Another goal is to formalise the detection of cultural contact: the documentation that accompanies HKMALA exhibitions references many contexts where a form of influence took place, e.g. Japan to China or military to civilian, and the traits where it is manifested, such as weaponry or the symbolism behind a technique or style. Granados-García previously conducted a similar study, if on the Ancient World and over tangible cultural heritage, developing a CIDOC-based cultural contact model[6] and inference rules written as OWL property chains and SPARQL constructs [10]. We are investigating the application of this approach to semi-automatically detect cultural influence on the HKMALA dataset, by creating new inference rules that use ICH elements as cultural traits.

References

1. Allen, B.: Striking beauty: A philosophical look at the Asian martial arts. Columbia University Press (2015)
2. Carboni, N., Luca, L.D.: Towards a conceptual foundation for documenting tangible and intangible elements of a cultural object. Digit. Appl. Archaeol. Cult. Heritage **3**(4), 108–116 (2016). https://doi.org/10.1016/j.daach.2016.11.001
3. Channon, A., Jennings, G.: Exploring embodiment through martial arts and combat sports: A review of empirical research. Sport in Society **17**(6), 773–789 (2014)
4. Chao, H., Delbridge, M., Kenderdine, S., Nicholson, L., Shaw, J.: Kapturing Kung Fu: Future proofing the Hong Kong martial arts living archive. In: Digital Echoes, pp. 249–264. Springer (2018)
5. Doerr, M., Ore, C., Stead, S.: The CIDOC conceptual reference model - A new standard for knowledge sharing. In: Grundy, J.C., Hartmann, S., Laender, A.H.F., Maciaszek, L.A., Roddick, J.F. (eds.) Challenges in Conceptual Modelling. Tutorials, posters, panels and industrial contributions at the 26th International Conference on Conceptual Modeling - ER 2007. Auckland, New Zealand, November 5-9, 2007. Proceedings. CRPIT, vol. 83, pp. 51–56. Australian Computer Society (2007), http://crpit.scem.westernsydney.edu.au/abstracts/CRPITV83Doerr.html
6. Farrer, D.S., Whalen-Bridge, J.: Martial arts as embodied knowledge: Asian traditions in a transnational world. Suny Press (2011)
7. Gangemi, A., Guarino, N., Masolo, C., Oltramari, A.: Sweetening WORDNET with DOLCE. AI Mag. **24**(3), 13–24 (2003). https://doi.org/10.1609/aimag.v24i3.1715
8. Kenderdine, S.: Embodied museography. About the Culture Academy Singapore **23**, 37–41 (2012)
9. Kenderdine, S., Shaw, J.: Archives in motion: Motion as meaning. Museum and Archive on the Move: Changing Cultural Institutions in the Digital Era, edited by Oliver Grau Wendy Coones and Viola Rühse pp. 211–233 (2017)
10. Loreto Granados-García, P.: Cultural Contact in Early Roman Spain through Linked Open Data. Ph.D. thesis, The Open University (October 2020), http://oro.open.ac.uk/73887/
11. Patrick, L.: Preserving Local Documentary Heritage: Conversations with Special Library Managers and Archivists in Hong Kong. City University of HK Press (2015)
12. Wulf, C.: Performativity and dynamics of intangible cultural heritage. In: Ritual, Heritage and Identity, pp. 76–94. Routledge India (2020)

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[6] The Cultural Contact Ontology, https://github.com/paulagranados/CuCoO.