Project Proposal

Computational analysis of ornament in Iznik ceramics

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MRes Computational Method for Ecology and Evolution

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Introduction

As Darwin noted in the *The Descent of Man and Sexual Selection* (1871), animals and humans are often extravagantly ornamented. The human body is rather dull, but our extended phenotypes — the artifacts we produce — are not (Jones 1856; Gombrich 1994; Trilling 2001). Ornamental motifs — e.g., the plumage of the the Argus pheasant and the tattoos of New Zealand Maori that Darwin discussed — are, however, very complicated and hence hard to describe quantitatively (but see Tehrani and Collard 2009 on Iranian carpets).

This project applies various machine learning tools in order automatically identify and classify ornamental motifs, with the ultimate aim of studying their evolution. It will focus on ceramics produced in the Turkish city of Iznik between roughly 1425 and 1625 (Atasoy and Raby 1994). These ceramics, which have very distinctive patterns, include the hundreds of thousands of tiles that still cover Ottoman public buildings in Istanbul. They are one of the triumphs of Islamic art.

The basis of the project is 465 images of Iznik ceramics culled from museum websites and monographs. These ceramics display various stereotyped motifs: tulips, carnations, "saz" leaves and so on (e.g., Figure

Figure 1: A collection of tulips —part of the vocabulary of Iznik ornament.

1). The project has four aims: First, to develop an ornamental "vocabulary" — a classification of motifs; second, to identify ornamental "styles" — a classification of the various ways in which the words of the vocabulary are combined; third, to develop a method for automatically identifying motifs in ceramics; fourth to develop vizualizations of the results.

Proposed Methods

The 465 images have already been manually segmented for three classes of motifs: carnations ($N = 463$), tulips ($N = 2067$) and saz leaves ($N = 5030$). Unsupervised machine learning (ML) methods will be used to classify these motifs into an ornamental "vocabulary" — sub-types based on their size, shape and colours. Topic analysis will then be used to discover the styles of the artefacts (e.g., a tile or plate). These analyses are based on (laboriously) manually segmented motifs, but we would like to be able to extract them automatically, so I will develop supervised ML methods do so. Finally, I will develop visualization tools for the results. The project is ambitious, builds on much preliminary work; Table 1 gives some details.

Table 1: Proposed methods

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Discover the vocabulary	Clustering (HCA, GMM, kmeans) based on the colour, shape, and size of motifs
Discover the grammar	Latent Dirichlet Allocation (LDA) topic analysis on artefacts
Image segmentation	Mask-RCNN development for automated motif recognition tasks
Visualisation	Use D3, Processing and web languages to build a interactive platform for the results

Anticipated outcomes

The anticipated outcomes of the project are as follows:

1. An orthogonal classification of ornamental motifs into sub-classes based on colour, size and shape.

2. An inital classification of artefacts into styles based on their motifs.

3. A RCNN model capable of accurately segmenting tulips, carnations and saz leaves from Iznik ceramics.

4. An interactive platform to showcase the results.

The methods that I will develop here have several possible uses. Most obviously, they can be used to document the evolution of Iznik ornament over the course of the 150 years or so that it flourished. The sample of artefacts used here is too small to do this directly, however, the RCNN model will permit the automatic segmentation, and hence study, of the hundreds of thousands of tiles in Istanbul. Extending these method to other, related, decorative traditions will allow us to quantitatively study the origin and spread of ornamental motifs. Some of these originate in Ming China; others come from Persia or even ancient Egypt, and they continue to influence ornamental art to this day (Jones 1856; Riegl 1893/1992; Brolio 2016). More generally, the methods that I will develop should be applicable to the study of ornament whereever it is found. For example, they may be useful for large-scale studies of the evolution of bird plumage.

Feasibility
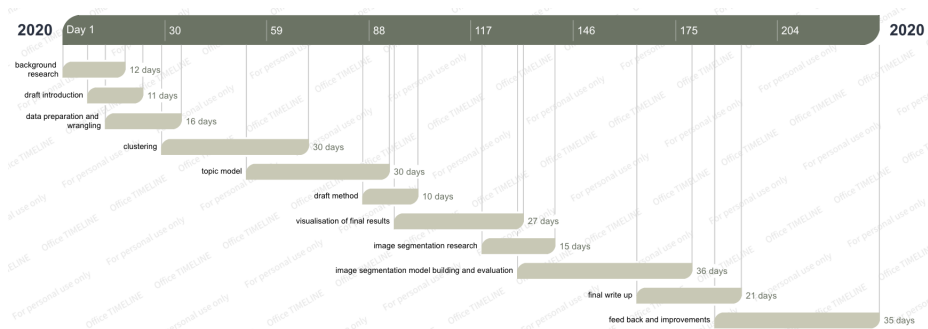
Budget

Approximate budget listed below:

£150 - Monthly visit to South Kensington Campus, one return rail fare and two tube fares per visit

£200 - Potential computing power and hardware buying for image segmentation task

£150 - Potential visit to conferences and seminars

References

Atasoy, Nurhan and Julian Raby (1994). *Iznik: pottery of Ottoman Turkey*. Laurence King.

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Gombrich, E. H. (1994). *The sense of order: a study in the psychology of decorative art*. Phaidon.

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Tehrani, Jamshid J. and Mark Collard (2009). "On the relationship between interindividual cultural transmission and population-level cultural diversity: a case study of weaving in Iranian tribal populations". In: *Evolution and Human Behavior* 30.4, 286 –300.e2.

Trilling, James (2001). *The language of ornament*. Thames & Hudson.