

//makeMeaning

Designing Objects with a Data Materialization Workflow

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ABSTRACT

This hands-on course will guide participants through an innovative creative workflow referred to as data materialization. The workflow begins by collecting meaningful data and culminates in the production of a designed data object. Participants will be introduced to computational design fundamentals and the foundational elements and principles of art and design. A suite of software tools will be used to realize this workflow including Processing, Inkscape, Rhino 3D and Autodesk Fusion 360.

KEYWORDS

data materialization, data sculpture, design, 3D design, aesthetics, hybrid craft, digital craft, conceptual design, digital fabrication, human computer interaction

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1 CONTEXT: BACKGROUND AND OVERVIEW

Data materialization is a new workflow introduced by the course organizers [Starrett et al. 2018]. The intent of this workflow is to create physical 3D objects built on data that supports the concept of the design. Data informs the generation of a drawing [Starrett et al. 2018] and the generated drawing is the basis for the development of a form. The forms are further developed through modeling, digital fabrication, and finished using more traditional craft techniques, such as casting or sheet metal fabrication, just to name a few. An example is shown in Figure 1.

Many terms currently exist to describe visual works that derive from data. **Data materialization** exists within the domain of data physicalization, differing from data visualization as the main goal is not to accurately represent data in an understandable way [Dragicevic et al. 2019]. **Data materialization** is also distinct from data sculpture. Data sculptures, as defined by Lorne Madsen, are 3D works that have been almost completely defined by information

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[Dragicevic et al. 2019]. **Data materialization** uses data as a design material to ultimately produce a tangible artifact with some means of physical craftsmanship while incorporating generative art processes [Dragicevic et al. 2019].

2 HANDS-ON COURSE LEARNING OBJECTIVES

Upon completion of this workshop participants will be able to:

- (1) Create original art object utilizing data as a material
- (2) Describe principles and elements of 3D design
- (3) Apply a conceptual design practice
- (4) Generate vector drawings from data sources
- (5) Analyze appropriate output options for art objects
- (6) Evaluate the relationships between aesthetics, data and concept and analyze the success of art objects in terms of aesthetics and meaning (subjectively and objectively)

These learning outcomes will be realized using three main themes the application of the **Workflow**, the consideration of the **Meaningful Object**, and the **Critique** of the produced artifact.



Figure 1: Modern Dowry, 2017. A teapot designed utilizing the Data Materialization process. Sintered Nylon, copper plate, silver plate.

2.1 The Workflow

Our novel workflow uses abstract data. Abstract data lacks a “natural notion of position in space” as opposed to data with an existing spatial layout such as weather models or medical imagery, which is often referred to as physical data [Moere 2005]. After the concept

of the work is decided, the data is collected and curated. The data is imported into a customizable Processing sketch which generates a 2D drawing representative of the data. A section of the vector generation of workflow is illustrated in Figure 2. The vectors are imported into a 3D modeling software application to be used as the basis for a 3D form. Finished 3D forms can be output or fabricated using any available digital fabrication technologies: laser cutting, 3D printing, or CNC machining.

3 MAKING MEANING THROUGH OBJECTS

3.1 Concept/Idea

The beginning of the data materialization process begins more closely aligned to a fine art process, than a client directed design process, while the resulting forms may more closely resemble a product design or craft object than a fine art object. The data materialization artifact may fit within this definition, but also exceeds it with the application of the prescribed workflow. The data materialization artifact can also be closely associated with a speculative or conceptual designed object.

3.2 Data as Raw Material

The term “data object” has been defined as “useable, functional, and meaningful artefact whose form and function encode data.” [4] The data materialization process can result in “data objects.” The definition of data objects alludes to the utilitarian applications of the objects, the data materialization process can also result in designs that are not considered utilitarian. Consideration of this criteria are evaluated in our critique process described in section 4.

3.3 The Language of Design: Elements and Principles

The design challenge becomes how to represent a conceptual and meaningful object which includes actual data as a material in the process. Design principles for data objects [Sosa et al. 2018] provide guidance throughout the design process. In combination with the classic elements and principles of 3D design [Stewart 2015] they lend a foundational scaffolding to this new creative endeavor.

4 CRITIQUE

This workflow deliberately allows for rapid iteration of form/pattern possibilities. The produced artifacts should be evaluated and discussed both objectively and subjectively. The elements and principles of design are referenced in an evaluation of the formal (objective) aspects of the object while it is useful to consider the three levels of emotional processing laid out by Donald Norman in his book *Emotional Design* (2004) while evaluating the more subjective qualities of the work [Norman 2004].

5 SUMMARY

This hands-on workshop will walk participants through a data materialization workflow using data as a raw material in the creation of meaningful physical objects. Through the process foundational principles of art and design in combination with the principles of data object design are applied to the creation of an art object with conceptual and aesthetic consideration. Upon completion of this

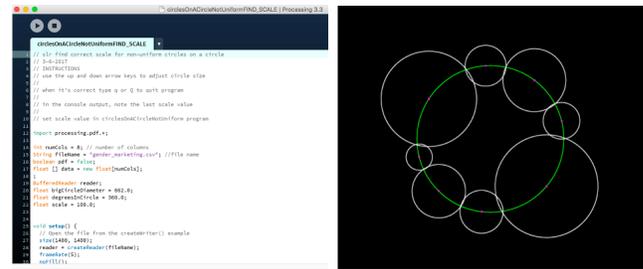


Figure 2: A Processing script generating a drawing based on an imported data set.

workshop, participants will have produced works with both an aesthetic allure and an intellectual intrigue.

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Figure 3: Fabricated outcomes from the data materialization workflow cast in concrete from molds of 3D printed models.

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