# **Extending the Philosophy of Computational Criticism**

**Jesse Roberts** 

Electrical Engineering and Computer Science Vanderbilt University Nashville, TN 37235 USA Jesse.Roberts@Vanderbilt.edu

#### Abstract

We consider two works in computational criticism, a little studied but important area for computational creativity (Stiny and Gips 1978) & (Fisher and Shin 2019). The analysis results in the development of a more general, novel, extended model of computational criticism. Along with the more general model, we also provide the first formal attempt to discuss and distinguish *meaning-ful* computational criticism. This theoretical synthesis should be useful to the study and development of computational critics and help to spark further dialogue in this area.

#### Introduction

What makes a person a critic? The United Nations Universal Declaration of Human Rights, Article 19 states "Everyone has the right to freedom of opinion and expression". This is criticism at the most fundamental, possessing and expressing an opinion. Quite literally, everyone's a critic; however, this does not mean that all opinions, or the critics which hold them, are to be considered equal.

In (Mendelsohn 2012), Daniel Mendelsohn, himself a world renowned critic, gives a simple formula for what makes a criticism **meaningful**, *Knowledge* + *Taste* = *Meaningful Judgement*. This makes intuitive sense. A child with no knowledge of painting or impressionism voicing their distaste for Monet should not carry the authority of a qualified art historian. The value assigned to the child's criticism is less than that of the art historian because the child lacks knowledge. Therefore, while everyone is a critic not every criticism is meaningful.

With the above discussion in mind, this paper builds on two key works to attempt to formally distinguish **meaningful** criticism from the trivial. The focus herein may seem narrow with much of the ideas stemming from two papers. However, it is important to note that this paper is only the second paper in the history of ICCC to cite *Algorithmic Aesthetics* (Stiny and Gips 1978). The first was (Fisher and Shin 2019) which is the other paper we will cite heavily. We believe that these two papers make up the substantive literature on theoretical computational criticism, particularly within the larger literature on computational creativity.

• (Stiny and Gips 1978) established disambiguating formalism for the philosophy of computational critique. Their

# **Douglas H. Fisher**

Electrical Engineering and Computer Science Vanderbilt University Nashville, TN 37235 USA Douglas.H.Fisher@Vanderbilt.edu

work sought to allow for the discussion of every possible critic with no prescription regarding the content of the criticism. So, in the existing model, every computational agent in the ecosystem is a critic with no consideration of the critic's meaningfulness.

• (Fisher and Shin 2019) presented a detailed discussion of the desiderata for a computational critic. These desiderata are used as a basis to examine characteristics requisite in a meaningful critic. In (Fisher and Shin 2019) the authors recognize the need for and recommend further comparison with (Stiny and Gips 1978).

We extend Stiny and Gips' philosophical formalism by interpreting and incorporating Fisher and Shin's desired attributes for a computational critic. The result is a more general model which we believe allows for the discussion of all possible **computational critics** and novelly attempts to divide the critical space in Figure 1 into those which are **meaningful** and those which are **trivial**. We additionally rely on studies from the cognitive sciences as a general model of computational criticism must also account for human-like critics given the assumption that the mind is fundamentally mechanical.

Based on the ICCC call for short papers, this is in part a "Debate Sparks" paper as we believe that overt treatment of computational criticism "deserves more attention from the community". Issues of computational "criticism" are implicit in generative systems (Fisher and Shin 2019), but overt, explicit treatment of computational criticism has remained nearly unaddressed. This paper is additionally a "Nuggets and Gems" paper, because Stiny and Gips (1978) is a gem, which has been cited and discussed early on in computing and design venues, but has been largely untouched by the ICCC community.

## **Importance of Formalism**

In (Stiny and Gips 1978) the authors cite three reasons for the development of their algorithmic formalism. First, it provides a common framework in which to study criticism and design. Second, the very act of solidifying thoughts into an algorithmic formalism exposes the assumptions and details that may have otherwise been unclear. Their final justification is that an algorithm makes the theoretical become testable by implementing and executing the algorithm.

#### **Plot of the Critical Space**



Figure 1: Critical Space

In our work on computational criticism, we want to study the class of critics which provide meaningful criticism for a given artifact. Therefore, our development of the present formalism is similarly motivated by the need for a **common framework**, awareness of the **assumptions and details**, and **testability**.

## **The Existing Formalism**

The authors of (Stiny and Gips 1978) appeal to the general model of the process of thought introduced in (Craik 1952). In that model, thought is seen as made of three constituent processes; translation, reasoning, and re-translation which correspond to the receptor, analysis algorithm, and effector respectively in Figure 2. The receptor, R(), takes in an artwork,  $\alpha$ , along with contextual information,  $C_i$ , and produces a description,  $\delta$ . The aesthetic system contains any and all contextual information stored in memory,  $C_m$ , used to inform the analysis algorithm. The analysis algorithm, A(), uses this information to produce an interpretation and evaluation,  $\iota$  and  $\epsilon$ , based on  $\delta$ . Finally, the criticism,  $\chi$ , is generated by the effector, E(). The model introduced by Stiny and Gips is here referred to as the S&G model.

From a theoretical standpoint, R() and A() are mathematical/algorithmic transforms which produce outputs in grammars suitable for the description, interpretation, and evaluation of  $\alpha$ . The description, interpretation, and evaluation of  $\alpha$ . The description, interpretation, and evaluare represented by  $\delta$ ,  $\iota$ , and  $\epsilon$  respectively. Importantly,  $\delta$ ,  $\iota$ , and  $\epsilon$  are latent and not directly represented in the final criticism. E() is a transform which takes these latent representations and produces the final, expressed criticism,  $\chi$ . We refer generally to R(), A(), and E() as critical processes.

Stiny and Gips place no constraint on the description,  $\delta$ , and interpretation,  $\iota$ , or on the grammar to be used to express them. However, the evaluation,  $\epsilon$ , is expected to take the form of a numeric aesthetic value.

#### **Critiquing the Stiny and Gips Model**

The S&G model is believed to be suitable for the description of all possible critics. As discussed in the introduction, Figure 1 shows that only a subset of human-like and not human-like critics are meaningful. We turn now to discuss the desiderata given by (Fisher and Shin 2019) and how the constraints placed by the desiderata on the S&G model result in a more rigorous idea of computational criticism and begin to give form to the idea of "meaningful".

**Understanding the Medium** It is desired that a critic understand the structural medium for a given artwork and a subset of it's formal characteristics. Therefore, a meaningful description, must be an encoding of the artwork which preserves a subset of the medium specific formal characteristics. As an example, if  $\alpha$  is assigned to be a novel and the  $\delta$  resulting from  $R(\alpha|C_i)$  is a block of text in ascii format with no paragraph or chapter structure, then those medium specific formal characteristics (paragraphs and chapters) are lost.

Consider a critic with receptor, R(), which produces a description,  $\delta$ , for a given artwork,  $\alpha$ , with formal and informal characteristics encoded. If  $\delta$  is insensitive to all formal characteristics for a given  $\alpha$ , the critic is not meaningful. For a more complete discussion of model sensitivity analysis see (Kucherenko and Iooss 2014). For simplicity, a function, f, can be said to be insensitive to input  $\theta_i$  if  $\forall \theta_i$ ,  $\partial f(\theta_i)/\partial \theta_i = 0$ .

Just as a receptor which produces a description without encoding any formal characteristics would not be meaningful, a receptor which was unable to exclude any irrelevant information would also not be meaningful. An easy way to check this is to compare the length of a binary string required to encode the artwork and context,  $L(\alpha|C_i)$ , information against the length of the binary string required to represent the description,  $\delta$ . Therefore, a critic with receptor, R(), which produces a description with binary string length,  $L(\delta) \geq L(\alpha|C_i)$  is not meaningful.

Hypothesize about the authorial intent & Attempt to socio-historically situate the artwork A critic should be aware of a creator for the artwork and produce a hypothesis regarding the creator's intent. A critic should also attempt to produce an interpretation which is informed by the sociohistoric context of the artwork and its creator. These two desiderata have been grouped because they both impose sensitivity requirements on the critical processes. Both require that A(), when presented with context information regarding the author and socio-historical setting, allow the context information to affect the output. To exemplify, consider a human critic presented with two identical renderings of the Mona Lisa one of which she is told was painted by Leonardo da Vinci in the 16<sup>th</sup> and the other a forgery made today. The paintings are identical in every visual fashion. Therefore,  $\alpha_{daVinci} = \alpha_{forgery}$ . However, the critique she delivers for each of the paintings will differ due to the contextual information.

To formalize this idea, context information is either encoded in  $C_m$  or provided to the receptor as  $C_i$ . Therefore, a critic with receptor, R(), and analysis algorithm, A(), which produces interpretation,  $\iota$ , which is not sensitive to  $C_i$  and  $C_m$  is not meaningful. It can be said even more generally that any critic with a critical process (R(), A(), E()) which is wholly insensitive to any of the available inputs is not meaningful.

# Stiny & Gips' Model of Computational Criticism



Figure 2: Diagram of Stiny and Gips' description of a computational critic (Stiny and Gips 1978) which takes da Vinci's *Mona Lisa* as input and gives Georgio Vasari's analysis (Vasari 2007) as output.

**Predict the public response** A computational critic should produce a prediction regarding the public's response for a given artwork. The S&G model likewise requires a critic to produce an aesthetic evaluation,  $\epsilon$ . Therefore, we place no constraints on  $\epsilon$  beyond requiring it to exist.

Historically, the prediction of public response started as mathematical aesthetic evaluation with the major works surveyed briefly in (Greenfield 2005). It began with the work of (Birkhoff 1933) who introduced the formulation M = O/C where O is the perceived order and C is the complexity. Shannon's information entropy became a common measure of complexity and was eventually incorporated into (Stiny and Gips 1978) which referred to the ratio M as unity. Stiny and Gips considered the ratio of length of interpretation to description,  $L(\iota)/L(\delta)$ , to be a useful approximation of M.

This field came to be known as computational aesthetics and stems from the first EG Workshop on Computational Aesthetics in Graphics was convened to address the need for computational aesthetic metrics in computer aided design. They defined computational aesthetics as, "the research of computational methods that can make applicable aesthetic decisions in a similar fashion as humans can" (Hoenig 2005). This definition is very similar to Fisher and Shin's idea of public response prediction, reinforcing the equivalence of evaluation and the prediction of public response.

**Reason about the criticism** The highest bar set by Fisher and Shin is that a computational critic should attempt to justify the criticism. One possible formulation,  $\gamma \in \iota$ , would



# **Extended Model of Computational Criticism**

Figure 3: Diagram of the novel extended description of a computational critic which takes Monet's *Houses of Parliament* as input and gives Arsène Alexandre's analysis (Alexandre 1921) as output.

consider the justification,  $\gamma$ , to be a component of the interpretation. However, this makes the assumption that  $\gamma$  is calculable based solely on  $\delta$  and  $C_m$ . This assumption precludes the possibility that the critic may attempt to explain the interpretation without consideration of the process, A().

Disconnecting the explanatory process from the originating process is not a new concept in the world of explainable artificial intelligence (Wick and Thompson 1992). The motivation for the separation lies in a psychological methodology for dealing with introspective evaluation. In (Ericsson and Simon 1980), the authors discuss a human tendency to provide an introspective narrative to account for behaviour and analysis which is entirely disconnected from the originating process. Based on this psychological observation, a general critic must allow for explanation which is distinct from the originating process to allow for modeling humanlike criticism.

A more general formulation considers  $\gamma$  to be a novel component to the general critic model and takes the form  $[\iota, \epsilon, \gamma] = A(\delta | C_m)$ . In this way, the justification,  $\gamma$ , may arise solely as a consequence of  $\delta$  and  $C_m$  and/or it may arise out of a transform applied to  $\iota$  and/or  $\epsilon$ . This adjustment to the S&P model is shown in the extended model diagram in Figure 3.

#### Aesthetic System or Knowledge Base

In the S&G model, the aesthetic system contains the information necessary to choose an interpretive and evaluative method. (Fisher and Shin 2019) also suppose a similar structure which they refer to as the knowledge base. However, in their view the knowledge base is accessible to both the receptive and effective processes as well as the analytic process. This should be the case in general as background knowledge has been shown to affect how humans perceive and respond (van Meeuwen et al. 2014). Therefore, in Figure 3  $C_m$  is accessible to all critical processes.

Table 1: Constraints for Meaningful Computational Critics

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# Constraint
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- 1 A critic with receptor, R(), which produces a description,  $\delta$ , which is insensitive to all formal characteristics for a given artwork,  $\alpha$ , is not meaningful.
- 2 A critic with receptor, R(), which is unable to exclude any irrelevant information from the description,  $\delta$ , for a given artwork,  $\alpha$ , is not meaningful.
- 3 A critic with any critical process (R(), A(), and E()) which is wholly insensitive to any of the available inputs is not meaningful.

## Conclusion

The desiderata from (Fisher and Shin 2019) have been applied to the model from (Stiny and Gips 1978) resulting in a more general extended model and a set of constraints useful for distinguishing meaningful computational critics from the trivial. The adjustments and extensions to the model

are shown in Figure 3. The constraints to distinguish meaningful computational critics from those which are trivial are shown in Table 1.

Even though some critics may not be considered meaningful based on the criteria here, a subset of the critical processes may be meaningful. An example would be a critic which did not possess a meaningful description, but did possess a meaningful evaluation. Systems of this nature are numerous in the literature.

The constraints in Table 1 are only a subset of the constraints which would be necessary to fully define a meaningful critic. However, this represents the first effort to rigorously discuss and distinguish meaningful computational criticism and will hopefully prove useful in their future development.

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