

1 ----- Review 1 -----

2

3 Overall Recommendation: 5 (5 – marginal – only just acceptable)

4 Evaluation Confidence: 2 (2 – Rather unconfident, but I know a bit)

5

6 Summary: This paper describes a system that supports artists in creating space-filling and/or curve-following ornamentation. Among the highlighted features are: mechanisms that allow the designer to manually place prominent elements that are then symmetrically replicated; guides to assist the manual placement of elements; local editing tools that automatically "clean up" after the designer deletes a prominent element; and provisions to allow the synthesis of patterns along flow lines. The authors report a user study with eight designers (6 students) who provided favorable ratings after using the system.

7

8 With respect to what I see as the **main contributions** of this paper to computer graphics, I have to say that it's hard for me to see how the described system significantly advances the state of the art, apart from its attempt to allow more interactive control than prior works.

9

10

11 Clarity of Exposition: The writing was good overall. I found it a bit difficult in **section 2** to readily appreciate exactly what the current work enabled that was not possible before. **A clearer statement of the existing problem that the current work set out to solve would be beneficial.** By this I don't mean the general problem of relieving the tedium of ornamentation, which was already addressed by the related work, but **more specifically what artists might want to accomplish that they cannot satisfactorily accomplish using previously developed ornamentation-support systems.**

12

13 Figures should be numbered in the order in which they are mentioned in the text. This means that figure 4 should appear sooner, if it is going to be referenced before figure 2.

14

15

16 Technical Soundness: Mostly. The main weakness I see is that the system seems **too rigid in its handling of element layout.** Once an element is placed, either by the artist or by the algorithm, **it is permanently fixed.** It seems to me that more aesthetic and robust results could be obtained through a more sophisticated approach in which elements' positions are allowed to adjust somewhat as the design evolves to end up with a more aesthetically pleasing result. In addition, the lack of any **automated ability to moderately scale individual elements** also seems like a weakness. With the present approach, it seems too easy to potentially end up in a sub-optimal state (due to prior choices) relative to a more optimal state (if some adjustment were allowed to happen).

17

18 With respect to the user study, I have two concerns. First, it seems inappropriate to **compare the current system to Illustrator, rather than to one or more of the similar previously-developed ornamentation-support systems.** Of course it is easier to develop ornamentation with a support system than without one. The main question is: **how does the present system compare to similar existing systems in terms of its usability, results, etc.** I think it would have been more robust to let the users **work directly with the Wong system** rather than to simply present them with three images created using it. Second, I worry a bit about the demand characteristics of the experiment. If most of the subjects are students, and are aware that they are being asked to "rate" a system developed by a **respected colleague,** they may be reluctant to offer anything other than positive feedback. Also, a robust experiment would first of all ensure that **participants do not know which system produced any of the heart-shaped figures,** and then might ask them to rank the figures in order of aesthetic appearance, or to rate each of them on a 7-point scale, which would allow for a better comparison.

19

20

21 Quality of References: Much prior work is mentioned. I was only surprised by the omission of Lu 2014: DecoBrush: Drawing Structured Decorative Patterns by Example, which seemed to be very similar in its aims to the present work, in

particular with respect to allowing the user more control to guide the ornamentation design process.

Reproducibility: Probably.

Explanation of Recommendation: Overall, I don't think this is a particularly strong contribution. The results seem a bit "stiff" and the described method seems to lack sophistication in comparison to prior work. It's hard to see major contributions in this submission that are destined to be adopted and cited by others. Nevertheless, the effort is well-intended, and the presented system clearly represents a significant effort on the part of its developers.

----- Review 2 -----

Overall Recommendation: 5 (5 - marginal - only just acceptable)

Evaluation Confidence: 4 (4 - Pretty confident, I know this area well)

Summary: This paper presents a combined framework mixing interaction and optimization to create ornaments.

Clarity of Exposition: The exposition is clear for the most part. However, the paper does not really explain its technical contribution well.

Technical Soundness: good

Quality of References: good

Reproducibility: good

Explanation of Recommendation: On the positive side, the video illustrates the implementation of a nice system. The examples are of reasonable visual quality and the system seems to work as described in the paper.

On the negative side, the paper describes a longer list of minor changes to an existing algorithm. It's not only the similarity to [WZS98]. In general, the system described in the paper reuses a lot of established concepts and the combination of these concepts does not seem to lead to fundamental new insights or significant technical challenges.

In addition, the design of ornaments is a bit random, because there do not seem to be very clear guidelines on how to create ornaments. The ornaments created in the paper have a specific style and they are generally not that similar to the ornaments shown in Figure 1. That means that overall there seems to be a very large class of ornaments that cannot be handled by the paper. That is fine, but it's just that I would not consider the paper a major practical break-through as well.

In summary, I would argue against accepting this paper.

----- Review 3 -----

Overall Recommendation: 6 (6 - acceptable)

Evaluation Confidence: 3 (3 - Moderately confident, I know as much as most)

Summary: The authors present a method to synthesize ornaments in a given region. Individual elements of the ornament are greedily placed at the minimum of a 2D objective function over the canvas (the 'placement' function) that is updated after each element placement. The shape and appearance of elements and their

connections to other elements are synthesized using a procedural model adapted from existing work [WZS98]. The objective incorporates minimum distance constraints, global design principles like placement symmetry or alignment along a vector field, and optionally manual guidance, for example placing elements along a given path or inside a custom shape. Improvements to the efficiency of [WZS98] allow for manual editing of individual elements at any time during the synthesis process, but existing element placements (apart from the element being modified) are not updated.

I would consider the combination of general (non-procedural) placement optimization that may include arbitrary global terms, and procedural element synthesis to be the main contribution of this paper. This combination was already present in a very rudimentary form in [WZS98], but has been developed further by the authors of the present paper. I would consider the improved high-level control, as well as the ability to control elements during synthesis, a consequence of this combination. Local edits of the finished model, as shown in the video, seem to be useful in practice, but may be less interesting from a technical perspective, since, as far as I understand, only the procedural part described in [WZS98] needs to be re-run for the affected elements.

Clarity of Exposition: This is my main concern. While the paper is well written and understandable in general, some details that are important to get a good understanding of how the results were generated are missing. First, it is unclear how the connections between elements and the actual appearance of elements and their connections are generated, and second, which placement functions and procedural rules were used for most of the results. See the explanation of recommendation for more details.

Technical Soundness: Seems to be fine.

Quality of References: Methods that edit existing element arrangements could be added (since the paper focuses on interactivity):

- "Global Beautification of Layouts with Interactive Ambiguity Resolution", Xu et al. 2014
- "PATEX: Exploring Pattern Variations", Guerrero et al. 2016

and to a lesser extent, furniture placement shares the goal of placement optimization with the current paper:

- "Interactive furniture layout using interior design guidelines", Merell et al. 2011
- "Edit Propagation using Geometric Relationship Functions", Guerrero et al. 2014, which uses similar placement functions

Reproducibility: This is tied to the clarity of exposition. Since some details of the method are not very clear and it is not clear which procedures and placement functions were used to generate the results, the reproducibility could be better.

Explanation of Recommendation: Adding more direct control to procedural synthesis is an important research topic. The presented method explores this topic on the example of ornament synthesis, but the general idea of mixing global optimization for object placement, and procedural modeling for synthesizing details may be applicable to a wider area. While some elements of this research were already present in previous work like [WZS98, BSMM11, RTHG16], I think that the approach of using a relatively general objective function to place elements and a procedural model for element connections and appearance is sufficiently different from previous work. I would therefore recommend accepting the paper with some minor revisions to improve the clarity of exposition, as described below.

93 The paper is generally well written and understandable, but there is a lack of detail in some parts of the exposition.

94 First, it is not clear to me from reading the paper how elements are connected and how to actual appearance of elements and their connections is chosen or synthesized and placed into the placement circles. I understand that [WZS98] provides more details and that this is not the main focus of the paper, but since these points are necessary to understand how the results were created, they should at least be mentioned somewhere with a reference to [WZS98] and a short summary of how these parts of the method are handled.

95 Second, it is not clear which procedural scripts and placement functions were used to create the results. At least for one or two of the results, the procedures and placement functions should be given so that these results could be reproduced.

96

97 The comparison to [WZS98] could be better, maybe by adding more examples or preferably, by letting the users interact with both methods and decide based on that which one they like better.

98

99 Finally, there could be a few more results; why not include some of the results shown in the video (which look really nice)? There still seems to be enough space left in the paper.

100

101 Details:

102 - In the supplementary material, at the end of Section 1.1, E(g) should probably be E(1-g)?

103 - In the supplementary material, I_s and g are mentioned in Section 1.1 but only defined in Section 1.2

104 - In the supplementary material, Section 1.4: "In the axis reflection results shown ..." -> shown where?

105

106

107

108 ----- Review 4 -----

109

110 Overall Recommendation: 7 (7 - good)

111 Evaluation Confidence: 4 (4 - Pretty confident, I know this area well)

112

113 Summary: The paper proposes a system for creating 2D ornamental designs that respect global aesthetic constraints while also allowing for local user interaction/control. Global constraints, including a balanced filling of space, symmetry, and optionally respecting a user-providing image, are enforced via placement scoring functions. User input is taken in account in the form of user-drawn stencils indicating where the design must/cannot be, user-drawn vector fields, or direct manipulation of the design after it has been generated. The authors show visual results demonstrating the effects of each system component and compare to prior work which inspired this paper. They also conduct an informal, small-scale user study in which participants liked using the system and generally preferred it to Illustrator but would like to see some additional features.

114

115

116 Clarity of Exposition: Generally yes, but there are a few areas that could use improvement:

117

118 Section 2, typo: "the pioneer work" -> "the pioneering work"

119

120 Section 2: "since the execution process is inherently hierarchical, L-systems are not suitable for artistic control mechanisms ranging from global to local scale." This is too strong/contentious a claim to make without further justification. Perhaps tone down "not suitable" to "do not easily support."

121

122 Section 4: "We allow artists to define a global order for placing elements, treating the definition of the placement strategy as a creative configuration step." I did not follow this. "A global order" sounds like specifying up-front the sequence of which elements will be placed when, which I'm pretty sure you don't mean. What is this referring to? The artist choosing what placement functions are active? The artist choosing what model to use?

123

124
125 Technical Soundness: Yes. I appreciate the formal description of the placement
functions in the supplemental material.
126
127
128
129 Quality of References: Yes.
130
131
132 Reproducibility: Mostly yes, but there are a few areas where I thought the
description was lacking/underspecified:
133
134 What do the 'models' used by your system (e.g. "the Strawberry model") look like?
They seem to be composed of "elements" and "connections," but what does it take
to author one? You mention "growth rules" at one point—are they composed of L-
system / grammar components? It would be helpful to know the interface that these
models must implement (i.e. for interacting with placement functions / the rest
of the system).
135
136 When multiple placement functions are active at the same time (e.g. p_dist,
p_sym, p_raster), how are these combined? How are relative weights determined?
137
138 It was never 100% clear to me whether the fact that larger elements are placed
first is (a) explicitly specified in the algorithm or (b) an emergent property.
The definition of p_dist in the supplemental makes it sound like (b), but
elsewhere in the paper it sounds like (a).
139
140 You describe placing each element by a greedy search for the best placement
location given the current placement functions. Do you also have to greedily
search over all possible elements that could be placed? Does the model determine
which elements can be placed where/when, and if so, how? This is not clearly
described anywhere.
141
142 Section 6: The description of the graph here is underspecified. For example, "the
graph structure and weights are updated"—what weights?
143
144
145 Explanation of Recommendation: This is a solid paper which takes ideas proposed
in influential prior work (the pattern design framework of Wong et al.) and
improves upon them in flexibility and interactivity. The proposed system is well-
thought-out and has many useful features. I would like to see this work
published, and I would encourage the authors to release the system described, if
they are not already planning to do so.
146
147 A few other questions I have:
148
149 Figures 7, 8, 10: What symmetries are being enforced here? The text mentions in
at least one place (Section 5.1) that symmetry constraints are active. It would
be easier to judge these results if this was specified.
150
151 Figure 7 middle: If I understand correctly, the symmetry constraints are only
enforced on the level of element point locations (and not element types,
geometries, or colors). This means that the fact that the red/blue flowers in
this design are symmetric is coincidental, right? If so, it would be good to be
clear and up-front about this.
152
153 Limitations: does the greedy, largest-first placement strategy ever bite you? Are
there situations where a more global optimization/search strategy e.g. Markov
Chain Monte Carlo could produce better results?