Bachelor Thesis Review

Faculty of Mathematics and Physics, Charles University

Thesis author	Hyungbin Joo
Thesis title	Life-like simple particle motion
Year submitted	2021
Study program	Computer Science
Study branch	General Computer Science

Review author	Univ. Prof. Dr. Mag. Thomas Schmickl	Advisor
Department	Karl-Franzens University of Graz, Austria Institute of Biology, Department of Zoology Supervisor of the Artificial Life Lab Graz, Chair of the Field of Excellence „COLIBRI" (Complexity of Life in Basic Research and Innovation)	

Overall

	good	OK	poor	insufficient
Assignment difficulty	X			
Assignment fulfilled	X			
Total size *... text and code, overall workload*	X			

I review here the thesis of Hyungbin Joo on the „Primordial Particle System". I am the original inventor of this system and the main author of the paper in Scientific Reports that the candidate used as a reference to compare the C++ implementation to in the analysis presented here, thus I know the PPS system and the original study quite well. As such, I have to state that the candidate made an excellent job in the thesis under review:

The thesis is precisely describing the benchmarked system, describing the methodology to reimplement the PPS in C++, which is surely not a trivial task, and letting it perform so well that the high number of analyses, which all require many repetition of runs with many particles (systematic parameter sweeps) could have been performed in sufficient details. The candidate used then this software to compare the results of the own implementation to the results published in Scientific Reports in the original publication made on the PPS (based on a NetLogo model). The results are drawn qualitatively and quantitatively and clearly stated in the thesis.

The thesis is well written and also linguistically very well done.

The quality of the results seems excellent and I would encourage the candidate to:

- share the C++ code in the public repository on gitlab that collects all different implementations of the PPS system. If this review is not accessible to the candidate, please pass on this information to the candidate.
- try to publish this study in a relevant outlet in the form of a paper, or at least on ArXiV, so that is ist publicly easily available. I think several conferences in the realm of Artificial Life research or Complexity Research can be suitable for this.
- publish a youtube (or similar) video on the software, explaining the usage (a tutorial) and demonstrating some of the things shown here in this thesis.

Thesis Text

	good	OK	poor	insufficient
Form *... language, typography, references*	X			
Structure *... context, goals, analysis, design, evaluation, level of detail*	X			
Problem analysis	X			
Developer documentation	X			
User Documentation	X			

The thesis is written ver well concerning linguistics, style and formulation. I found it very well structured and clearly to understand what is where and why it is placed there in the thesis. There is a clear logic narrative through the text and the text is also precisely pointing towards the conclusion drawn from the benchmark results presented here. This leads to a well achieved problem analysis of whether or not the observed emergence can be found also in the novel C++ implementation produced by the candidate.

The user documentation is done in a good way and I think the basic concept and design of the software is also well described for future co-developers or developers of derivative software streams.

Thesis Code

	good	OK	poor	insufficient
Design *... architecture, algorithms, data structures, used technologies*	X			
Implementation *... naming conventions, formatting, comments, testing*	X			
Stability	X			

I cannot really assess the *quality* of the code, as I am a biologist by training. I code (also C++) throughout my academic career (and before that), but I feel not to be an expert enough to review pure C++ coding quality in a Computer Science context. However, I can still assess the quality aspects of the software based on the description I find in the thesis itself, and this is excellent: When I review here only the PDF of the thesis, thus I can only indirectly assume that the implementation is clean and stable, again from the high number of analysis that obviously ran well through up to the end and from the code parts that are visible across the thesis.

The thesis contains many details on the OpenGL implementation, many schematics and pseudocode description that explain the software design and structure, thus I am personally convinced that the design and the implementation are done very well. However, I think it has to be well coded otherwise it would not run so well to allow these sophisticated parameter sweeps.

Overall grade **EXCELLENT (or whatever is the best grade in your country)**

Award level thesis **Yes, in my university I would see it as such an award candidate**

Date 9th of June 2021

Signature