



## **Casanova: a language for game development**

### **PhD Thesis Review**

The thesis introduces a novel functional language, Casanova, for game development. At first, it examines the current state of the art and overviews the limitations of existing frameworks; then, it presents Casanova using the usual progression, design principles, syntax, semantics, implementation, and evaluation with examples of some simple games.

The thesis is overall a solid piece of scientific research on an important topic and stands at the frontier of the research in game development. The introduction of the new programming language is strongly motivated using the typical arguments of programming language research (flexibility, readability, correctness, efficiency, etc.). The description of the language is precise and explained in depth so that all the important aspects of the language are discussed, including the several available extensions overviewed in the appendixes. Thus, I strongly believe that the work meets the standard requirements of a PhD thesis and the PhD title should be awarded to the candidate.

### **Detailed Discussion**

In the same chapter, the problem statement is very general and not strictly related to the research question. In fact, in the game industry projects not necessarily fail to complete because of the development tools and (if this was the case) the thesis does not connect the introduction of this new language to an increase of productivity (it would be impossible to make such a connection in such a short time frame as a PhD entails). In addition, the candidate states that the use of a game-tailored language (with powerful domain-specific abstractions) can reduce the difficulty and risk of development. The candidate also argues that the language should be simple, general-purpose across several game genres, and modular. However, failures in game development have been rarely connected to issues or limitations of the development framework. Thus, the motivation link between Casanova and productivity in this respect is weak. In addition, development in general, and game development specifically, make heavy use of prototyping a topic which should have been discussed more at length. In fact, visual frameworks (Unity, UDK, etc.) but also XNA provide easy ways to design and test simple game prototypes right from the start. Casanova might indeed provide a way to do it with an adequate framework but the abstractions presented along the thesis appear to be at a very high-level and thus it is not clear how much can it take to go from such a high-level to the bare metal. In this respect, it would have been better to present Casanova through its IDE even if it would probably have distract the reader from the actual topic of the work, the language.

Another interesting issue is code optimization, a big part of game development especially for mobile platforms. Casanova is implemented as an F# library so to create a powerful abstraction hides some of the underlying implementation. At the same time, it is not completely clear whether this makes code optimization more difficult to access for experienced developers.

The adoption of a specific design pattern (RSD) as the fundamental brick for the language is very interesting. It would have been nice to have an in-depth discussion about existing design patterns in game development, there are just few books about this but it would have been worth mention them (e.g., Patterns in Game Design by Staffan Bjork and Jussi Holopainen).

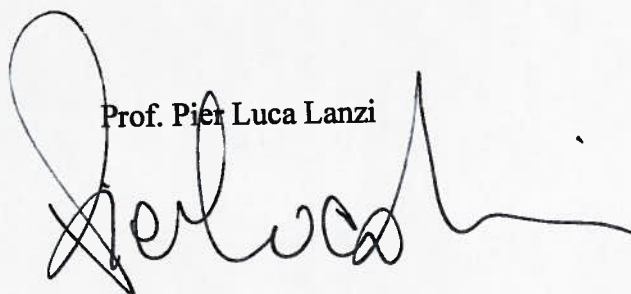
In the discussion of existing frameworks, I was surprised that UDK and its script language were not included since it is a direct competitor (probably, in a strict sense the only competitor) of Casanova. It is in fact a language specifically designed for game development and has a quite powerful IDE used also for AAA games. However, Quake and Unreal are briefly cited but the development framework not considered at length and it would probably deserve.

The evaluation of the language is limited and quite weak: the language is used to implement simple games but its *expressiveness* is not compared to other available solutions (while coroutine comparison is too specific); the evaluation in education is informal (in high school) and involving too few subjects for the game design master. It would have been more useful to have a "traditional" approach and extensively compare the expressiveness of Casanova with existing languages/frameworks. For instance, by comparing the language power and expressiveness over a set of games genres: a comparison between Casanova, Unity, UDK and/or others (Cocos/CoronaSDK/Flash) on a simple platform, an FPS, and an RTS.

Finally, the list of publications connected to this research is quite brief (four conference papers, one workshop and an Italian conference) and this is quite surprising given the huge amount of work. In addition, the final document should be checked for few English problems I noted. In the introduction, the candidate uses "board-games" and "video-games" but to my knowledge since these are nouns and board/video are adjectives, the dash should be dropped and "board games"/"video games" should be used instead. I also found at least two paragraphs starting with a lowercase (3.2.2 and "it is possible" on page 32). I would also change "Bug finding" on page 34 with "Testing".

Milan, January 28, 2013

Prof. Pier Luca Lanzi

A handwritten signature in black ink, appearing to read 'Pier Luca Lanzi', written over the printed name.