



Object-oriented programming: Some history, and challenges for the next fifty years



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ABSTRACT

Object-oriented programming is inextricably linked to the pioneering work of Ole-Johan Dahl and Kristen Nygaard on the design of the SIMULA language, which started at the Norwegian Computing Centre in the Spring of 1961. However, object-orientation, as we think of it today—fifty years later—is the result of a complex interplay of ideas, constraints and people. Dahl and Nygaard would certainly recognise it as their progeny, but might also be amazed at how much it has grown up.

This article is based on a lecture given on 22nd August 2011, on the occasion of the scientific opening of the Ole-Johan Dahl hus at the University of Oslo. It looks at the foundational ideas from SIMULA that stand behind object-orientation, how those ideas have evolved to become the dominant programming paradigm, and what they have to offer as we approach the challenges of the next fifty years of informatics.

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1. Introduction

On 22nd August 2011, a public event was scheduled to open both the 18th International Symposium on Fundamentals of Computation Theory and the Ole-Johan Dahl hus [1], the new building that is home to the University of Oslo's Department of Informatics, and which is shown in Fig. 1. The morning session opened with an Introduction by Morten Dæhlen, followed by two invited talks, one by myself, Andrew Black, and one by Jose Meseguer. These talks were followed by a panel discussion on the future of object-orientation and programming languages, chaired by Arne Maus, and comprising Andrew Black, Yuri Gurevich, Eric Jul, Jose Meseguer, and Olaf Owe.

As it happened, none of these events took place in the Dahl hus, because the beautiful lecture room that had been scheduled for the conference was put out of commission, less than half an hour before the start of the session, by an electrical fault: the scientific opening of the Dahl hus was actually conducted in the neighbouring Kristen Nygaard building. Thus, nine years after their deaths, Dahl and Nygaard were still able to form a symbolic partnership to solve a pressing problem.

This article is based on the invited talk that I delivered at this event. It is not a transcript; I have taken the opportunity to elaborate on some themes and to précis others, to add references, and to tidy up some arguments that seemed, in hindsight, a bit too ragged to set down in print.

2. The birth of SIMULA

In American usage, the word “drafted” has many related meanings. It can mean that you have been conscripted into military service, and it can mean that you have been given a job that is necessary, but that no one else wants to take on.

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Fig. 1. The Ole-Johan Dahl hus. (Photograph © the author.)

In 1948, Kristen Nygaard was drafted, in both of these senses. He started his conscript service at the Norwegian Defence Research Establishment, where his assignment was to carry out calculations related to the construction of Norway's first nuclear reactor [2]. Years later, Nygaard recalled that he had no wish to be responsible for the first nuclear accident on the continent of Europe.¹

After extensive work on a traditional numerical approach, Nygaard turned to Monte Carlo simulation methods. He was made head of the "computing office" at the Defence Establishment, and in 1952 turned full-time to operational research. He earned a Master of Science degree from the University of Oslo in 1956, with a thesis on probability theory entitled "Theoretical Aspects of Monte Carlo Methods" [3]. In 1960, Nygaard moved to the Norwegian Computing Centre (NCC), a semi-governmental research institute that had been established in 1958. His brief was to expand the NCC's research capabilities in computer science and operational research. He wrote "Many of the civilian tasks turned out to present the same kind of methodological problems [as his earlier military work]: the necessity of using simulation, the need of concepts and a language for system description, lack of tools for generating simulation programs" [2]. In 1961, he started designing a simulation language as a way of attacking those problems.

In January 1962, Nygaard wrote what has become a famous letter. It was addressed to the French operational research specialist Charles Salzmann. Nygaard wrote: "The status of the Simulation Language (Monte Carlo Compiler) is that I have rather clear ideas on how to describe queueing systems, and have developed concepts which I feel allow a reasonably easy description of large classes of situations. I believe that these results have some interest even isolated from the compiler, since the presently used ways of describing such systems are not very satisfactory. ... The work on the compiler could not start before the language was fairly well developed, but this stage seems now to have been reached. The expert programmer who is interested in this part of the job will meet me tomorrow. He has been rather optimistic during our previous meetings."

The "expert programmer" was of course Ole-Johan Dahl, shown in Fig. 2, and now widely recognised as Norway's foremost computer scientist. Along with Nygaard, Dahl produced the initial ideas for object-oriented programming, which is now the dominant style of programming for commercial and industrial applications. Dahl was made Commander of the Order of Saint Olav by the King of Norway in 2000, and in 2001 Dahl and Nygaard received the ACM Turing Award "for ideas fundamental to the emergence of object-oriented programming, through their design of the programming languages SIMULA I and SIMULA 67." In 2002, Dahl and Nygaard were awarded the IEEE von Neumann medal. Dahl died on 29th June 2002.

There has been some confusion about the naming of the various SIMULA languages. The first version of SIMULA, whose preliminary design was presented in May 1963 and whose compiler was completed in January 1965, was a process description and simulation language, and was at the time named just SIMULA. This language had neither classes nor inheritance. In their paper presented at the first History of Programming Languages Conference [2], Nygaard and Dahl refer to this language as SIMULA I, and I shall do the same here. Combining their experience with this language with some important new ideas, Dahl and Nygaard went on to design a general purpose language, which was finished in 1967. This language was at the time named SIMULA 67, although there is now a Simula '87 standard, and this language is now usually referred to simply as Simula; it was SIMULA 67 that explored the ideas that were to become "fundamental to the emergence of object-oriented programming." I will use the name SIMULA when referring to the common thread of ideas that pervade both languages, and the forms with post-scripted numerals when referring to a specific language.

¹ David Ungar, private communication.

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