



# Clarifying design for orchestration: Orchestration and orchestrable technology, scripting and conducting



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## A B S T R A C T

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In this article we consider the “design for orchestration” concept and introduce a set of notions to clarify matters of concern. We propose to distinguish *orchestration technology* and *orchestrable technology*, to define orchestration as a combination of *scripting* and *conducting*, and to differentiate *primo-scripting* and *run-time scripting*. As a way to see how these different notions relate one to another, we take the example of CSCL scripts.

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## 1. Introduction

The orchestration metaphor usually refers to “what the person in the middle of the orchestra (transposition: classroom; on-line setting) is doing with the help of the baton and gestures (transposition: with instructions, hints or by tuning the computer-based system’s parameters)”.

This metaphor is potentially confusing as, according to some definitions, orchestration seems to be essentially, if not only, about writing music for an orchestra (i.e., deciding how some music should be played by a set of instruments), directing performance (i.e., directing the way the musicians perform the orchestration) being referred to as “conducting”.

Dillenbourg proposes a definition: “Orchestration refers to how a teacher manages in real-time multi-layered activities in a multi-constraints context” (Dillenbourg, 2012). This clarifies the issue. This issue is not new, and many topics related to the notion of orchestration have been studied, with different perspectives and/or in different contexts, in previous works (although they were not presented in this way). However, it is beneficial to make orchestration a key issue of the field once again, and give it a definition that is in-line with current uses of technology in education.

Dillenbourg highlights the fact that settings now involve different modes (individual and collective, in class and on-line, etc.). I would add the fact that ICT has changed the context in different ways, due to the fact that players (e.g. teachers, students) come with their technology and their technological skills and habits, and are not dependent (and do not want to be dependent) on technologists. Educators asking professional developers to build software specific to the targeted setting, or students limiting themselves to the use of software offered by the institution, are the exception rather than the norm. Players tend to use whatever tool they will contextually find available and convenient – the applications running on their smart phones, software they have installed on their laptop, available web services, etc. – which may vary from player to players and from session to session. Within such an approach, in some sense, software is a contextual construction. Moreover, although in some cases the setting involves specifically designed software, users’ usages and expectations are influenced by this general evolution (Tchounikine, 2011).

Orchestration as introduced by Dillenbourg is mainly about empowering human teachers. The orchestration concept is not limited to the context of classrooms and orchestration by teachers. Nevertheless, the way technology is used in classrooms and the specificity of this context gives importance to this issue.

Considering how orchestration may involve and/or be supported by computer-based systems requires, however, differentiating different notions.

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## 2. Orchestration technology and orchestrable technology

In order to make clearer what “designing for orchestration” means, I propose to distinguish *orchestration technology* from *orchestrable technology*:

- Orchestration technology is technology that achieves or supports the activity of orchestrating.
- Orchestrable technology is technology which use can be decided or adapted (before the session and/or at run-time) by the players in charge of the orchestration (the teacher, a system) while orchestrating the setting, in the same way that other parameters of the setting (the timing, the groups, the task, the physical space, the teaching objectives, etc.) may be adapted.

Orchestration technology may correspond to different realities such as:

- Technology that provides teachers with some support for managing the setting. Examples: technology that renders salient some dimensions of the setting that is of interest for orchestration (e.g. tangible interfaces rendering learners’ workflow salient (Dillenbourg, 2012)); technology that provides teachers with monitoring or intervention means.
- Technology that attempts to manage the learning setting as attempted ITSs (e.g., automatically managing the flow of activities). The objective may be to manage orchestration in a way that is completely automated or, rather, to deal with part of the orchestration, as a way to allow teachers to concentrate on the core issues.

Orchestrable technology may correspond to different realities such as:

- *Flexible technology*, i.e., technology reifying in some way or another some given pedagogical intentions (e.g., a workflow structuring learners’ collective activity) while allowing some tuning and run time adaptation by teachers (or the system itself, or the learners).
- *Creating-affordance technology*, i.e., technology whose usage is likely to create pedagogically rich events. Here, there is an explicit decision not to design and consider technology according to a single precise targeted usage. Rather, the artifact is meant to allow different usages, and give the player in charge of the orchestration some latitude with respect to how students will be prompted or allowed to use it.

## 3. (Primo)scripting, conducting and (run-time)scripting

In classrooms or in on-line settings, managing unexpected events or taking opportunities requires real-time management (Dillenbourg, 2012; Dillenbourg & Tchounikine, 2007). However, real-time management does not mean there is no pre-session management.

In order to help clarifying the orchestration notion one might come back to the music metaphor<sup>1</sup> and distinguish what is to be played, how it should be played, and the management of the performance.<sup>2</sup>

However, in order to identify issues and research questions to be considered for developing orchestrable and orchestration technologies, an interesting perspective may be to consider these distinctions in terms of teachers’ processes and requested tasks, and not only in terms of “before” and “during” the session:

- There is a process that consists in defining what is to be played (the music, the learning scenario general principles). Given the fact we focus here on the orchestration notion, I will not consider this further.
- There is a process that consists in deciding how what is to be played will be played in the current setting. This is the process within which one analyzes the way different means (registers, instruments, dynamics, etc.) may be used in order to obtain a targeted enactment (the musicians’ performance), and one makes design decisions with respect to this objective.
- There is a process that consists in, using the output of the precedent process as a resource, analyzing the setting enactment and using different means to influence what happens, particularly what performers do.

Within this perspective, orchestration of a learning session may be analyzed by distinguishing *scripting* and *conducting*:

- *Scripting* is about envisaging how a set of means should be used in order to address teaching objectives. It is an analysis, design (from scratch or by adaption) and taking-decisions task, which result in a resource for action. As an example, scripting a CSCL setting may include:
  - Analyzing the way means such as task and sub-task definitions, task distribution, roles, scheduling, data-flow, the technological framework, and the scaffolding or physical space provided may be used to structure and support students’ activities.
  - Making design decisions.
  - Attempting to anticipate some real-time issues (as much as possible) by introducing some flexibility (Dillenbourg & Tchounikine, 2007): how the teacher and/or software may react or be adapted in response to the absence of a member of the group, a timing issue, a dispute, a technological failure, etc.
  - Representing decisions in a way that enables their implementation by students, teachers and/or platforms. The output is what is usually called “the script”<sup>3</sup>.

<sup>1</sup> As I am not a musician, the way I use this metaphor may not be more pertinent than the way others use it. Therefore, readers should stick to the view introduced here, although some others may exist and be more coherent with the musical context. This contradicts the point of metaphors but, anyway, metaphors are not good for science.

<sup>2</sup> If sticking to the definition according to which orchestration is about writing music for an orchestra only, the different processes may be seen as: writing the music, orchestrating the music and conducting the orchestra.

<sup>3</sup> In this article, “script” refers to pedagogical scenarios in general, and to CSCL scenarios in particular.

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