# Connecting the Links: Narratives, Simulations and Serious Games in Prehospital Training

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**Abstract.** Due to rapid and substantial changes in the health sector, collaboration and supporting technologies get more into focus. Changes in education and training are also required. Simulations and serious games (SSG) are often advocated as promising technologies supporting training of many and in the same manner, or increasing the skills necessary to deal with new, dangerous, complex or unexpected situations. The aim of this paper is to illustrate and discuss resources needed for planning and performing collaborative contextual training scenarios. Based on a practical study involving prehospital nurses and different simulator technologies the often-recurring activity chains in prehospital training were trained. This paper exemplifies the benefit of using narratives and SSGs for contextual training contributing to higher user experiences. The benefits of using simulation technologies aligned by processes can be easier defined by narratives from practitioners. While processes help to define more efficient and effective training, narratives and SSGs are beneficial to design scenarios with clues for higher user experiences. By discussing illustrative examples, the paper contributes to better understanding of how to plan simulation-technology rich training scenarios.

**Keywords.** Prehospital training, simulation, serious games, user-experiences collaboration, narratives, design

## 1. Introduction

Today's healthcare cannot bear its cost, is not robust, does not satisfy a large number of patient needs and current development paths have to be changed [1]. Subsequently, education and training for the involved professionals need to be changed. These changes should provide a better understanding of the flows of knowledge, technologies, and financing in a larger context [2].

This paper illustrates planning and design of a large practical study providing contextual understanding and high user experiences for training prehospital work. Contextual understanding was planned based on narratives distilled with different, often collaborating professionals. Interviews and observations contributed to define

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basic activity chains for their everyday practices. High user experiences were supported with using simulations chosen for the corresponding activities such as car simulators for driving, manikins or patient simulators for realistic patients' environment, and scenario simulators for simulating realistic environments for patient care [3]. To set up technologies and to provide engaging context through these activity chains, methods and solutions from serious games were used.

The aim of this paper is to illustrate resources needed, in terms of technologies, expertise and time for planning and performing simulation based training scenarios supporting contextual understanding and collaboration needed between different experts. The motivation behind this work is to contribute to more adequate preparedness, and to illustrate possibilities for collecting and providing evidences for contextual understanding needed for debriefing and assessments for healthcare professionals. The focus is on prehospital training and using simulations and serious games (SSGs). Some parts of this study can be found in earlier papers (see Section 3).

Such a qualitative study has several limitations. The exact amount of resources needed for realizing contextual training depends on several factors: e.g. the actual context, policies, capabilities, problem definitions, cognitive workloads, goals and technologies that always can be improved. Many of these factors varies from settings to settings and individual factors always can be improved. However, improving one factor does not necessarily mean improvement for the whole. Planned new training situations and designing new training environments have to deal with all factors influencing the whole chain from getting the alarm to driving the patients to the hospital and reporting the case. For prehospital work one may win important minutes in handling an alarm quickly and driving to the patients, but these minutes can be lost meeting difficulties in necessary activities when handling the patient or when driving him or her to the hospital.

## 2. Background

Organizations are providing their best to set up modern training and education environments. However, defining new settings for collaboration [4, 5], understanding interoperability [6], and finding technical acceptance for supporting technologies [7] is complex and requires an overall understanding of human-technology collaboration in the context, which this paper aims to contribute to. To develop better training methods for EMS personnel, as compared to previous methods, include training a safe and effective work flow since the whole activity chain is trained. Prehospital care is such a complex healthcare activity, where training traditionally has focused on particular details rather than the entire work flow.

Several papers argue for using lean [8, 9] and lean simulation [10] for healthcare education. Recognizing the benefits of lean especially for handling continuous flows and waste is important; however, implementing them in particular contexts can be difficult [11]. Examples from practice [9] or guidance for implementations [12, 13] are often missing. Lean is often associated with defining processes important to focus on strategies, progress, owners and patient goals [10, 14]. Lean and processes are not enough, though, to define necessary technologies [3], and scenarios [15] to begin with, or to know how to begin to implement SSGs [5]. Even though it is recognized that processes can support understanding of complex healthcare activities [16], in many process descriptions (e.g. [17]), the prehospital care is often treated as a single step in

the systematic care taking process. Sometimes the flow in training can be more important than training separately individual activities [3, 10, 18].

Earlier studies argue that considering narratives described by the practitioners can help [19]. Thus, defining a logical path guided by a process description, necessary and compulsory activities can be considered, then these activities can be enhanced and or supported by simulation technologies for naturalistic user experiences [5].

## 3. Towards Planning Contextual Studies by using SSGs

Emergency management stakeholders from one[2] of the twenty regions/county councils in Sweden, decided to promote the use of simulation technologies for training everyday activity chains[3] for professionals from the ambulance services. Motivated by the requirements from the practitioners the researchers behind this paper observed and recorded more than one hundred actual training situations where pairs or groups of three ambulance nurses trained in everyday settings. Other simulator centers were visited and different simulation based training possibilities with the use of SSGs were analyzed. A prehospital activity chain demonstration was used as background material for discussing possible technologies, scenarios, choices and consequences for training.

Based on lessons from the demonstration[4] and wishes from the practitioners a pilot study for training 24 nurses (12 pairs) was designed and performed. Each pair performed a simulation rich scenario with eight simulators and an everyday scenario, only with a patient simulator. The simulation rich scenario lasted approximately one hour and the everyday scenario 30 minutes, including the scenarios as such and follow-up activities such as interviews and questionnaires. The pilot study lasted 3 working days involving 23 researchers. The involved studies are described in Table 1.

**Table 1.** Overview of involved studies with main activities and main results.

|  | **2012**<br>**Pre-Study** | **2012-2013**<br>**Demonstration** | **2014-2015**<br>**Pilot Study** |
|---|---|---|---|
| Data obtained | Observations from real life (> 100 training situations). Interviews with instructors. | Observations from a single demonstration (2 nurses). Video recordings. Interviews with instructors and practitioners. | Observing 24 (12 pairs) nurses in a 3-day study by using a simulation rich setting compared with an everyday setting. Video recordings. Interviews with practitioners. |
| Main results | Lessons from actual training situations [20]. Understanding the gap between practical needs and technical possibilities. | Defining and showing how to set up technologies demonstrating activity flows needed to train [3]. Defining a technology supporting debriefing. | Defining a scoring instrument [21] and investigating the benefits of using immersive technologies and simulators [15]. |

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[3] These chains usually begin with a call from the dispatch center and driving to the patient. After arriving at the scene, initial patient assessment is performed, and if needed, the patient is transported by ambulance to the hospital. Ongoing treatment is made en route and finally, the patient is handed over at the hospital [20]. Ideally, the training ends with a debriefing.

[4] https://www.youtube.com/watch?v=WGCgEzNwXDU (Retrieved 2/22/2017)

According to our present knowledge, the whole activity chain with several realistic simulations is not trained in current education. For example, none of the simulator centers visited, or earlier research studies described prehospital training using patient simulators in an ambulance car simulator driving through a familiar city.


## 4.  Connecting the Links: SSGs and Narratives to Train Activity Chains

The prehospital chain includes complex activities, not usually trained activities, e.g. finding/recognizing places from where the alarm was sent, handling the patients' environment, neighbors, pets, driving and care of the patients during the way to the hospital, using actual communication channels and technologies, discussing what way to drive, etc. A nurse taking care of the patient in the ambulance car sometimes has to practice five different duties in parallel [3]. Some of these activities are only discussed during classroom situations, and not trained at all.

To train whole activity chains requires many resources [9]. Planning new training needs coordination and collaboration from many different parties [2, 11], here: from different research areas, experts in technology development and use, instructors involved in educating healthcare professionals, responsible managers from the region, physicians and other healthcare professionals. Simulating rich settings, as live simulations is expensive. This can explain why whole activity chains are rarely trained. On desktop computers, however, SSGs promises benefits for contextual training or training decision making e.g. for incident commanders [5].

The demonstration with using simulators at the hand, convinced the practitioners to invest in the pilot study systematically examining the added value of a simulation-rich, high-end contextualized scenario compared with a traditional basic scenario. For this, all technologies were adjusted based on the process description for training and the high end simulation was enriched with the narratives described by the practitioners from the pre-study and demonstration. The practitioners appreciated the high-end settings, with the experiences gained. These contributed to a discussion of problems not previously trained in realistic settings, e.g. handling aggressive pets.

The pre-study and the demonstration also illustrated that practitioners need better evidences for debriefing. Therefore, a logging instrument was constructed, with tags connecting certain video images to the main activities. Certain predefined tags, such as the video sequence for entering a house was connected to checking securing activities in an instrument developed to support debriefing. By adding this feature, the instructor can, in the simulation-rich scenario, directly jump to a certain video during the debriefing to see if the ambulance nurses did necessary preparations for entering the patient's home. Such preparations are necessary for their own safety. Using this instrument, the nurses and the instructor(s) could follow the debriefing with recorded and ordered evidences grouped around main activities and time.

Representing all activities that the nurses perform on a daily basis was experienced to make the scenarios more trustworthy in contrast with traditional simulation training, where focus is on separate activities such as patient care or driving. The main benefit of process-based training approach was: choosing suitable simulators and necessary activities. In order to obtain increased experiences, the necessary activities can be completed with unexpected – but realistic situations. These situations are not necessarily known by designers, but can be defined from interviewing experienced practitioners. These situations and items, not necessarily connected to the patient's

medical condition, contribute to variation and makes the training for a medical condition different, less boring, and may also increase the willingness to train more regularly.

While this work exemplifies the benefit of varying situations, it also pinpoints the need for defining additional methodologies to understand the role of a basic, minimalistic scenario and how this can be supported or extended by technologies in systematic evaluations. A first step here is not only to provide seamless use of technologies, but also to support their seamless integration into education. Defining process description for training requires a good understanding of the context with focus on necessary actors, technologies, and activity flows. Practitioners do not necessarily know about the existence of many technologies, or how to choose and use them on an everyday basis.

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