European Commission, Horizon 2020

FACTSHEET

Didactical Guidelines for VR Training

SHOTPROS

based on the D3.3 - European Framework for Training and Assessment (using VR) of DMA-SR Behaviour of Professionals

TARGET GROUP: police trainer & instructor

WHAT TO EXPECT: Didactical concepts and guidelines for VR training sessions

SOURCES: based on empirical and experiential findings of the research studies and feedback meetings of the SHOTPROS project

Note: There are separate factsheets outlining policy considerations (important areas to consider in the decision to implement VR training) and implementation considerations for VR training (guiding questions for implementation of VR training).

The didactical guidelines in the training framework are based on seven criteria that have been shown to compose good training and enhance learning and transfer[1]. In the appendix a checklist containing the criteria is provided. LEAs can use this checklist[2] to systematically evaluate training sessions.

[1] For reasons of readability; references to the literature that we based ourselves on are omitted in this factsheet. Please for references to the evidence-base underpinning this factsheet see D3.3 European Framework for Training and Assessment (using VR) of DMA-SR Behaviour of Professionals.

[2] The checklist was developed by VUA prior to SHOTPROS[2], is applicable to both VR training and "normal" training of DMA-SR, and was used (among other uses) in the site visits of training within SHOTPROS

Criterion 1: Is there a clear assignment?

The training assignment communicates the purpose and relevance of the learning objective to the trainees. Providing clear assignments motivates trainees to engage with the training and provides clarity on the learning goals and enhances the training effects.

Didactical guidelines:

- Plan the way the assignment will be communicated in the training beforehand and ensure that it aligns with the training schedule and learning needs of the trainees
- Decide whether the learning objective of the training session requires the use or support of VR: Is VR the best tool for the training assignment you want to practice? (For example, should physical contact, handcuffing, communication training using micro expressions be trained? A different training mode would probably support this better. Is the goal to bring together and apply different learnings in one scenario and to learn tactical behaviour? VR might be the ideal training mode)
- Keep the training assignment brief. This enhances opportunities for execution, variation, and repetition in the VR training.
- Align the training assignment and learning objective with the VR environment and scenario selection:
    - Take advantage of the flexibility of the virtual environments and adjust the scenario infrastructure to the training assignment
    - Make use of the risk assessment tool to create a VR scenario that aligns with the assignment
- Provide limited autonomy in the assignment for VR training as trainees may initially struggle with the newness of the tool itself and thus may get disengaged.

Takeaway Message: Clear Assignment

- A clear assignment is important for VR training because practical consideration for the learning objective, training set-up and scenario selection influence the user experience of VR as a training tool
- VR training allows trainers to adjust the environment and infrastructure of a training scenario to the training assignment, whereas in real-life training, trainers have to adjust the assignment to the environment of the scenario depending on what the training location facilitates.

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Criterion 2: Is there high-quality instruction?

Good training instruction provides trainees with a task goal and sets the tone for the training. Through concise instruction, the trainees obtain information about the nature of the training and the relevant points they need to focus on. Good training instruction has been shown to facilitate skill acquisition.

Didactical guidelines:

- Provide VR-specific instruction:
  - Provide a clear overview of what students can expect from a VR training, possibly in a short session before the actual VR training starts (include what to expect from a VR environment, how to move within a virtual environment, what tools are available in the VR environment etc.)
  - Provide step-like, protocolized instructions on how to put the VR gear on to reduce the time spent on VR preparations and provide a clear step by step calibration and tutorial scenario guided by a trainer. These measures can become redundant when trainees gain experience with VR.
- Provide practice-specific instruction:
  - Provide closed training instructions that let trainees know what scenario they have to complete and what level of difficulty they can expect
  - Keep the number of focus points for trainees very limited as they have to invest a large amount of their mental capacity to navigate the virtual environment.
- Provide task-relevant instruction during the VR training:
  - In contrast to real-life training, in VR trainers can be invisible in the training environment. They have the freedom to directly coach role-player behaviours without trainees seeing or hearing it. Adjusting role-player behaviour on the fly can be done through wireless headset/microphone communication between trainer and role-player or by physically moving or guiding the role-player to the intended position.

Takeaway Message: Training Instruction

- Providing concise and relevant instruction is immensely important in VR as the newness of the training tool requires special attention
- Compared to real-life training, VR training provides additional opportunities for instruction, particularly as the trainer can be invisible in the virtual training environment

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Criterion 3: Is the practice situation designed well?

A well-designed scenario is defined by the level of realism it offers to the trainee and enhances the transfer of knowledge and performance under pressure. The situation should therefore provoke realistic stress, present a realistic problem, and provide room for realistic solutions.

Didactical guidelines:

- Trainers can use a stress level selection to create a realistic training context. VR training has shown to elicit adequate levels of experienced stress.
- The VR scenario should provide realistic problems trainees could encounter on duty.
- Be aware that the virtual environment is not equal to the physical environment (e.g., a room in VR is not a physically confined, and officers cannot "leave" the VR premise).
- Haptic feedback from the physical environment is often missing and movement can be altered; ensure that the solutions to solve the situation are achievable in VR.
- Consider whether realism pitfalls of VR can be prevented (e.g.: stairs are very immersion-depriving – so if they are not necessary, don't use them in the scenario)
- Ensure options for experiencing success. When the trainee performs well, the role-player or NPC should reward the performance of the trainee. (NPC = non-playing character, a pre-programmed or automated character in the VR environment)
- Change environmental constraints through
    - adjusting the scenario and environment
    - adding or removing constraints in the virtual environment on the fly (e.g., have the operator place a NPC out of the field of view of the trainees or by making communication between officers harder by adding noise to the environment)
    - the Trainer Dashboard (see D4.5) to adjust stress cues.
- Change task constraints through providing different instructions and tasks from repetition to repetition (e.g., instructing the role-player to act with weapon in one scenario and without a weapon in the next repetition)
- Change the trainees' constraints through influencing their level of stress, mental effort, and attentional capacities.

Takeaway Message: Well-designed Practice Situation

- Trainers should design the VR environment before and adjust it during training, to enhance realistic context and create realistic problems.
- The scenario can be actively managed by the trainer or operator in the Trainer Dashboard and allows various options for the trainee to gain self-efficacy.

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Criterion 4: Is model learning used?

Model learning is using a demonstration as instruction. The learner observes the model to learn the modelled skill. Model learning has been shown to facilitate skill acquisition, retention and motor learning.

Didactical guidelines:

- Make use of trainees as peer models, instead of relying on expert models. Trainees can observe colleagues execute a scenario on the spectator station depicting the VR world. Familiarise trainees with the use of the different viewing perspectives and performance indicators (e.g., line of fire, movement paths, field of view, performance statics), and the controllers of the VR in the spectator view.
- Alternatively, use VR "Ghost Mode". As "ghosts" a trainee can be in the virtual environment and observe colleagues' performance without being visible to them.
- Give trainees a clear viewing assignment that relates to the learning objective (e.g., instruct them to pay attention to decisive DMA moments or a certain tactical skill)
- Use after-actions review (AAR) as video feedback to allow the trainee to learn from their own performance
- **Note**: If the trainer would like to demonstrate certain skills or behaviours themselves, the trainer has to be wearing a VR suit. Otherwise, either the trainer is visible but the environment is not (VR vizors off) or the environment is visible but the trainer is not.

Takeaway Message: Model Learning

- VR provides a large variety of opportunities for model learning to enhance skill acquisition and retention even without actively executing a scenario
- Trainers should particularly take advantage of peer modeling through the **IAM** and the trainees' own actions as models of themselves through the **AAR**

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Criterion 5: Is there variation and differentiation?

Variation and differentiation in training allow the learner to explore various solutions for achieving a goal and to tailor practice to the learning need of the trainee. Variation and differentiation enhance exploration, skill acquisition and transfer of learning.

Didactical guidelines:

- A pre-defined selection database of VR environments aids quick and easy variation and differentiation (e.g., a minimum of three different virtual environments, and different levels of complexity in scenario building blocks)
- Change the context of the scenario for each repetition to avoid familiarisation:
  - Environmental: night vs. daylight, additional objects, more/less visibility, etc.
  - Different starting points for trainees/role-players in the same environment
- To achieve differentiation, ensure a mix of various threat levels ranging from non-lethal to lethal threat differing per repetition:
  - NPC: change NPC level of aggression, change their appearance (strong and fit or old and frail, for example)
  - Role-players: change role-player behaviour instruction, change their appearance (i.e. change of VR skin) and handing them different tools/weapons
  - Manipulating objects: change presence/appearance of weapons ("hidden" under clothes, behind the back of a NPC, unusual weapons like a hammer etc.)
- Monitor the trainee's success. Aim for maximum challenge and minimum errors ("error-free learning") by differentiating according to competence and success
  - If the training seems too simple for the trainee, up-scale the level of complexity by activating additional stress cues or changing the context (e.g., night-time, level of threat, presence of weapons).
  - If the trainee starts to make mistakes, down-scale the level of complexity (e.g., daytime, low to medium level of threat).
- During training, adjust the scenario complexity on the fly, using the VR operator or options you have as a trainer

Takeaway Message: Variation and Differentiation

- Location variation is the most distinguishable feature of VR and **must** be implemented in VR training sessions
- VR training offers In-Action Monitoring (trainee performance) → complexity of scenarios can and **should** be adjusted on the fly to enhance learning

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Criterion 6: Is there a possibility for self-management of the learning process?

In a self-managed learning environment (active skill acquisition) the learner can regulate when and how to receive feedback. It facilitates learning, engagement, transfer, and motivation.

Didactical guidelines:

- Trainees should have practical knowledge of the skills they need to apply in the VR training (students who did not have prior practical knowledge engaged less with VR)
- Let trainees themselves handle and position the gear on the gear belt
- Give trainees control over feedback in the AAR (let trainees select parts or perspectives they would like to review or hand them the controller for a walkthrough in AAR)
- Let trainees choose to have their line of fire on or off during execution and review

Takeaway Message: Self-Management of the Learning Process

- VR offers a variety of options for trainees to self-manage their learning process (e.g.: review perspectives in the AAR)
- VR training requires trainees to have previous practical knowledge to fully take advantage of the virtual training environment

Criterion 7: Is there constructive, motivating feedback?

Feedback informs trainees on their performance and supports in evaluating and adjusting performance behaviour in the future. Providing constructive and motivating feedback has shown an increase in motivation, self-confidence, self-efficacy, and benefits learning.

Didactical guidelines:

- During the AAR, make use of the bird's eye view and suspect perspective (as this has been shown to enhance quality of learning)
- To enhance the quality of learning add a pain stimulus to provide instant feedback.
- Let trainees review performance feedback (e.g., statistics) presented in the AAR such as number of shots fired and targets hit, bystanders flagged, etc.

Takeaway Message: Feedback

- The quality of learning of trainees is most strongly associated with the perceived quality of feedback and should be an important pillar in VR training
- VR offers a variety of feedback tools (i.e., features of the AAR) that should be used in correspondence with the expertise of the trainer

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In closing…

The didactical guidelines illustrate the plethora of opportunities and features of VR training. There are various tools to support trainers to select and use features for VR training. Listed below are tools trainers should familiarise themselves with before conducting VR training:

- Risk Assessment Tool to select proper stress-level for trainees (see D4.7)
- SHOTPROS VR solution to decide on scenario and environment and execute the training (WP5)
- Real-time VR Trainer Dashboard for live performance assessment (see D4.5 & D5.4)
- VR Stress Cue Control Panel within the solution to adapt the scenario according to performance and stress-level (see D4.5)
- After-Action Review (see D4.6)

To ensure that training scenarios remain realistic and support the learning experience of the trainees, the operator and trainer must cooperate and communicate well during the steering of the scenario. It is essential that the operator understands the language (including specific jargon) of trainees to react to their commands in VR faster and provide more realistic reactions of NPCs and the environment itself. Hence, operators and trainers need to be familiar with the process of the live-editing of a VR scenario (see D4.5). Recommendations to further enhance the cooperation between operator and trainer are: Prior to the training session:

- ... trainers should communicate the training aim and learning objective with the operator to ensure that the scenarios and NPC reactions are in agreement with the aim and objective of the training
- ... operators should communicate the possibilities the VR live-editor offers trainers in changing and steering the context of the scenario so that trainers know what they can and cannot control during the course of a scenario by themselves.
- ... select short cue words that help in steering the scenario (e.g., “360” to send in an unexpected NPC from behind when the officers do not check their backs).

As a final note of caution we want to emphasise that the many options and functions available in VR do not necessarily mean that they have to be used all the time. Just as with regular training, learning objectives and the learning climate should be stage and centre of training.

Code of conduct

Establishing and reinforcing a code of conduct is also essential in VR training. In VR there is an increased risk of so called gamification. Gamification may increase the chance for compromised ethical/moral behaviour of trainees and could potentially reduce the focus on the learning objective in VR training. Thus, trainers need to pay particular attention during the VR training instruction to avoid gamification and monitor the behaviour of trainees during the use of VR to eliminate gamification behaviour as soon as it arises.

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Appendix: A checklist to systematically evaluate training sessions

1. Is there a clear assignment?
1.1 Is the purpose of the assignment clear?
1.2 Has the relevance of the assignment been named?
1.3 Is autonomy offered in the assignment?

2. Is there high-quality instruction?
2.1 Is the effect of the action emphasized? (External attention)
2.2 Limited number of points for attention?
2.3 Relevant points of attention?
2.4 Use of metaphors?
2.5 Explicit instruction when needed/useful

3. Is there a well-designed practice situation?
3.1 Is practiced with realistic problems?
3.2 Is practiced on realistic solutions?
3.3 Is practiced under realistic stress?
3.4 Is practiced with realistic context?
3.5 Options for gaining self-efficacy?
3.6 Does the practice situation require externally focused attention?
3.7 Is constraint-led approach used?

4. Is model learning used?
4.1 With teacher as an example
4.2 With peers as an example
4.3 With experts as an example
4.4 With own implementation as a model (video feedback)
4.5 Is a viewing assignment given?
4.6 Is the model repeated?
4.7 Is the model visible to everyone?
4.8 Is it a good quality model?
4.9 Does the model fit the learner's development phase?

5. Is there variation and differentiation?
5.1 Does the practice situation offer variety?
5.2 Is the skill practiced randomly? (Instead of blocked/serial)
5.3 Is there differentiation between participants?
5.4 Is there differentiation within participants?
5.5 Is 'error-free learning' used?

6. Is there a possibility for self-management of the learning process?
6.1 Can participants vary the number of practice attempts?
6.2 Can participants vary difficulty in practice attempts?
6.3 Can participants choose which tools they use?
6.4 Can participants choose when they receive feedback?
6.5 Can participants choose where to receive feedback?
6.6 Can participants choose how they will receive feedback?
6.7 Is the trainee encouraged to think about possibilities for improvement?
6.8 Is "implicit feedback" provided?

7. Is there constructive, motivating feedback?
7.1 Is feedback given after successful attempts?
7.2 Is feedback based on careful observation and analysis of implementation?
7.3 Does the feedback ensure understanding of the purpose of implementation?
7.4 Does the feedback provide an understanding of the current level of implementation
7.5 Does the feedback provide an understanding of the possibilities for improvement of implementation?
7.6 Is there time for reflection by the participant?
7.7 Are good results named?
7.8 Are improvements named?
7.9 Is effort named?
7.10 Does the feedback invite externally focused attention?