From X-ray scatter maps to a mobile app: future of radiation protection training?

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Purpose or Learning Objective:

Conventional projection radiography remains the most common X-ray-based imaging modality, but for example interventional radiology examinations have increased considerably over the last fifteen years. [1] During imaging, healthcare professionals can be exposed to scattered radiation. To minimize occupational exposure, healthcare radiation workers in the EU receive continuous radiation protection training based on Directive 2013/59/Euratom. [2] Various methods can be used in the training to visualize scattered radiation.

In this study, we measured X-ray scatter using several imaging protocols. [3] Based on the measurements, we designed and created X-ray scatter maps and, subsequently, a mobile application for radiation protection training purposes. A user experience study of the application is ongoing.

Methods or Background:

An ATOM dosimetry verification phantom 701/C (Sun Nuclear) was used as a scattering object, and an active dosimeter system (Raysafe i2, Unfors Raysafe AB) was used to measure the dose rate of the scattered X-ray radiation at various locations around the scattering object.

A Matlab (Mathworks, Matlab R2022b) program was used to generate scattered radiation maps, Blender (Blender Foundation, Blender 3.4) was used to transfer maps into 3D models, and Unity (Unity Technologies, Unity 2021.3.12f) was used to create an X-ray scatter simulator mobile application that presents these 3D maps in augmented reality. The application includes scatter maps for the following X-ray imaging protocols:

- Posterior-anterior (PA) chest X-ray (standing)
- Anterior-posterior (AP) mobile chest X-ray (supine)
- Urological procedure utilizing fluoroscopy

Radiography students and healthcare radiation workers were given the opportunity to use the app and participate in a user experience study.

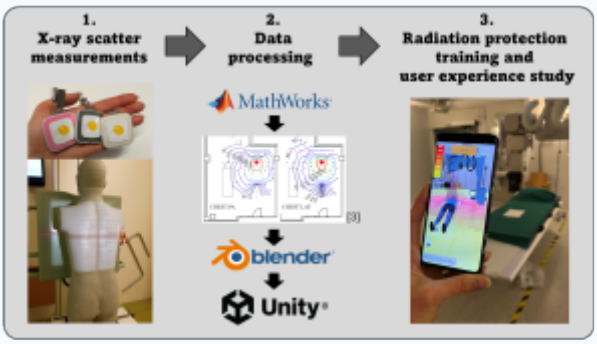

Fig 1: Research process.

Results or Findings:

The user experience study is ongoing, with radiography students composing three-quarters of the total participants (=59) so far. Based on our initial observations, the user experience of the simulator varies. In addition to the actual app design and personal preferences, possible reasons for the variation could include differences in software, camera, and the physical operating environment of the device the app is used on. However, the majority of participants reported that the app enhanced their understanding of X-ray scatter behavior in different imaging protocols, and is a valuable addition to traditional radiation protection training. Furthermore, we note that completing small tasks by users, such as calculating potential exposure levels in different imaging protocols and locations within the imaging room, can maximize the app's potential and further improve understanding of exposure differences in various imaging situations.

Fig 2: X-ray scatter app in use.

Conclusion:

Using an X-ray scatter simulator app in radiation protection training can help better understand the behavior and amount of X-ray scatter in different imaging situations.

Fig 3: QR-codes to the app's download pages in the Play Store and the App Store.

References:

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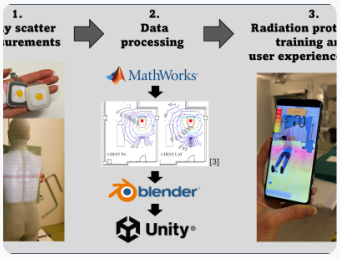
3. Ylimaula, L. Räsänen, M. Hurskainen, A. Peuna, P. Julkunen, M. T. Nieminen, M. Hanni, "X-ray Scatter in Projection Radiography", Radiation Protection Dosimetry, vol. 200, no. 2, pp.120-129, February 2024



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