Creating instructions for the use of a Photron FASTCAM NOVA S6 high-speed camera in recording advanced manufacturing processes at Fraunhofer Innovation Platform at the University of Twente.

Huub Oude Vrielink, Industrial Design Engineering, University of Twente, The Netherlands.

The thesis focuses on developing comprehensive instructional materials to facilitate the use of a Photron FASTCAM NOVA S6 high-speed camera system, for recording various manufacturing processes at the Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente (FIP-AM@UT). Given that only one research engineer is proficient with the camera, there is a growing need to make this tool more accessible for other engineering staff, enabling them to utilise the camera in more research projects. By creating user-friendly guidelines, the aim was to reduce the knowledge barrier and allow users with limited experience to effectively operate the camera, thus enabling more autonomous research on the manufacturing floor.

The core research question driving the thesis was formulated as: “How can instructional materials for the Photron FASTCAM NOVA S6 be optimised to enhance accessibility and ease of use for recording advanced manufacturing systems at FIP?” This question was supported by several sub-questions, which investigate the foundational photographic knowledge necessary for operating high-speed cameras, the specific operational requirements of the Photron FASTCAM NOVA S6, the contexts in which this camera will be employed at FIP-AM@UT, and how visual design and layout can improve the effectiveness of instructions.

The research methodology employed included a detailed review of relevant literature on high-speed imaging, photography, and instructional design, alongside practical case studies. This combined approach resulted in the creation of a structure for the instructions and guidelines. The literature review explored essential topics like planning and presentation, and topics on how to improve clarity of the instructions, as well as research into cognitive ergonomics with the goal of improving the way information is presented and improve user attention and retention.

In addition to the literature review, practical use cases were conducted to refine the instructional materials. These use cases involved real-world applications of the camera, such as recording a laser powder bed fusion process in an additive manufacturing setting. These exercises provided valuable insights into the challenges of high-speed recording in different industrial contexts and highlighted the importance of factors such as camera placement, lighting, and lens selection. The knowledge gained from these experiments was directly applied to the contents of the instructional materials, ensuring that the guidelines are not only theoretically sound but also practical and tailored to the specific needs of FIP-AM@UT.

The created structure divided the instructions into four chapters: Camera setup, Recording setup, Operation, and Software and image processing. The camera setup section guides users through the physical setup of the camera and its connections, while the recording setup advises on positioning the camera, optimising lighting, and ensuring the correct focus. The operation section covers the essential controls and settings required for recording, and the software and

image processing section explains how to use the Photron FASTCAM Viewer 4 (PFV4) software to analyse and edit captured footage.

During the design process the research findings were converted into visual and textual concepts for the instructions. Through a process of ideating, conceptualising and testing a final design was made for the second chapter and several other important pages, which functions as a basis for the design for other chapters.

While it was succeeded to develop a comprehensive instructional framework and one fully developed chapter, time constraints prevented the full testing and creation of the final design. Future work should focus on completing the remaining chapters of the manual and test the complete document, as well as exploring additional areas such as colour theory in instructional design and the use of lens filters to broaden the range of recordable processes. Additionally, it is suggested that formal training sessions could be beneficial for introducing staff to high-speed imaging and familiarising them with the camera system.

In summary, a detailed framework for designing instructional materials for the use of the Photron FASTCAM NOVA S6 for advanced manufacturing processes were provided. By leveraging a combination of theoretical research and practical use cases, the thesis delivers a user-centred approach that balances technical precision with multiple cognitive theories, ultimately aiming to facilitate more autonomous research and innovation at FIP-AM@UT.