

Proposal of Gaze Analysis to Visualize Tacit Knowledge of Nursing Expert Skills

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Abstract. This study was conducted to develop nursing skills learning support system, particularly addressing a “blood drawing technique,” among other nursing skills. It analyzes tacit knowledge associated with skilled nurses’ (hereinafter “experts”) movements when executing a blood drawing technique, devoting attention to their gaze. Overall, positive correlation was found between the ladder level and the success rate.

Keywords. Nursing Skill, AR, Gaze Analysis, Expert, Tacit Knowledge

1. Introduction

Movements necessary for inserting a needle into a blood vessel, which require particularly delicate manipulation, among other nursing skills, depend greatly on the nurse’s experience because the stream of blood vessels, the depth from the skin surface, and the flexibility of blood vessels differ from person to person. These movements are difficult to verbalize and to master by novices.

The purpose of this study is to examine methods for analyzing tacit knowledge in the movements of skilled nurses when performing blood sampling procedures. Assuming that tacit knowledge is involved, we specifically investigate the relationship between gaze trajectory and tacit knowledge.

2. Methods

2.1. *Methods (Experiment) overview*

This experiment measured gaze trajectory in the “blood drawing technique.” Using 5 types of interchangeable blood vessel models on the arm model, selected 4 types of blood vessel models out of 5 types. Blood was collected 5 times each, for a total of 20 times. (Figure 1). To give a sense of presence to the blood collection, we assigned simulated patients in front of the arm models, thereby creating an environment in which the nurse can perform blood collection while having a conversation with a patient. finger pressure.

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2.2. *Participants, experiment period and Gaze measuring device and analyzer*

The participants were 19 current nurses working at a general hospital who agreed to participate in this study. The experiment was conducted during four days. The study was implemented after obtaining approval from the ethical committee of our university.

For gaze measurement, we used a wearable eye tracking system (“Tobii”, Tobii Pro Glasses 2, G2.100; Tobii Technology) and using analysis software: Tobii Pro Lab

2.3. *Gaze data analysis*

For gaze analysis, we examined 1) the correlation between the time ratio of blood vessel selection and puncture and the success rate, particularly addressing “blood vessel selection” and “puncture.” Subsequently, we extracted 2) the skilled nurses’ gaze behavior for each blood vessel model.

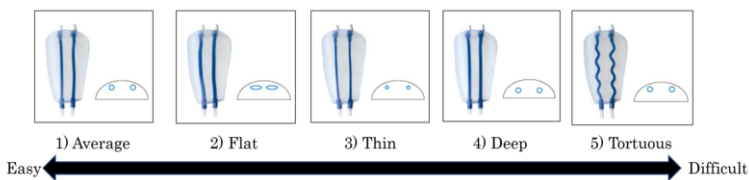


Figure 1. Blood vessel models.

3. Results

In this paper, we describe the gaze behavior of the “3) thin” blood vessel model. Table 1 shows the classification results using K-means. This shows that there is an overall positive relationship between nurses’ level of experience (ladder level) and success rate.

Table 1. Evaluation model cross-validation results: “3) Thin” blood vessel model

Percentage of validation dataset	0.1	0.2	0.3	0.4
Average accuracy	1	1	1	0.5

4. Conclusions

1. Gaze data analyzed for "thin," "deep," and "tortuous" blood vessels included 10 nurses, nine nurses, and 17 nurses, respectively. In this experiment, we could suggest the correlation between the time ratio of vessel selection to puncture and video success rates after visual confirmation.

2. From gaze characteristics of nurses, we could suggest the correlation between high success rates and ladder levels of 1 to 5. The ladder level is a competency evaluation system defined by the Japanese Nursing Association.

5. References

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