Interpretable Multimodal Temporal Patterns of Trainee Behavior During Patient State Transitions in VR Simulation

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1. VR TRAINING EXPERIMENTS

Four different roles including:

These stage labels are scenario-script "phases" in the VR cardiac-arrest case. They mainly encode (1) the patient rhythm / condition and (2) the algorithm branch the team should follow (shockable vs non-shockable), plus sometimes a specific treatment focus.

9 unique stage labels:

- **V-Tach 2D**: Ventricular tachycardia (shockable rhythm) in phase 2, branch D of the scenario state machine; typically represents an alternate protocol path (e.g., instability or non-ideal sequencing) requiring rapid rhythm recognition and shock/CPR coordination.
- **V-Tach 2A.1**: Ventricular tachycardia in phase 2, branch A, step 1; often used to denote the canonical/ideal early shockable-rhythm pathway with prompt defibrillation/cardioversion (depending on pulse) and high-quality CPR.
- **V-Tach 2B.1**: Ventricular tachycardia in phase 2, branch B, step 1; an alternative pathway that may encode delayed or suboptimal decision-making/coordination relative to the canonical branch.
- **Asystole 1D No.1**: Asystole (non-shockable rhythm) in phase 1, branch D; first occurrence of this state in the scenario; expected actions include immediate CPR, epinephrine, and avoidance of defibrillation.
- **V-Fib 4C.1 – AMIO**: Ventricular fibrillation (shockable rhythm) in phase 4, branch C, step 1; a refractory-arrest state where *amiodarone* is indicated in addition to repeated defibrillation and CPR.
- **ROSC 5B – STEMI**: Return of spontaneous circulation (post-arrest care) in phase 5, branch B; STEMI identified, prompting post-ROSC stabilization, 12-lead ECG interpretation, and escalation (e.g., cath lab activation).

2. THEME ANALYSIS UI

The total six dragrams for these six groups

3. RESULT 1

4. RESULT 2

5. RESULT 3

6. REFERENCES

Table 1: Original action and speech event codes extracted from the VR simulation logs and used in this study. Event labels are preserved exactly as recorded in the dataset.

Modality	Original Event Code	Semantic Name	Description
Action	`administered_epinephrine`	Epinephrine administration	Administering epinephrine medication to the patient.
Action	`ascultate_lungs`	Lung auscultation	Auscultating lung sounds to assess airway and ventilation status.
Action	`cpr`	Chest compressions (CPR)	Performing chest compressions during resuscitation.
Action	`perform_bag_mask_pump`	Bag-mask ventilation	Providing manual ventilation using a bag-mask device.
Action	`pulse_check`	Pulse check	Checking the patient's pulse to assess cardiac activity.
Speech	`c_dta`	Task allocation	Assigning specific tasks or actions to team members.
Speech	`c_gta`	Role assignment	Assigning or confirming team roles and responsibilities.
Speech	`clc_dcb`	Directive check-back	Closed-loop confirmation of a directive or instruction (receiver confirms receipt/completion).
Speech	`clc_gcb`	General check-back	Closed-loop confirmation of general information or status updates.
Speech	`jip_ei_q`	Information elicitation (questioning)	Requesting information from teammates (e.g., vitals, timing, observations).
Speech	`jip_esi`	Information evaluation	Interpreting, assessing, or critiquing information shared by teammates.
Speech	`jip_si`	Information sharing	Providing factual or synthesized information relevant to the situation.
Speech	`m_sh`	Hypothesis statement	Stating a diagnostic or explanatory hypothesis about the patient's condition.
Speech	`sle_scu`	Expressing uncertainty	Expressing doubt, concern, or uncertainty about the diagnosis or next steps.