

Study 1 — Coordination Failure Modes Example Codes

In this section, we present five common failure modes observed in Study 1, which persisted despite the provision of sufficient contextual knowledge. For each failure mode, we provide representative examples along with accompanying comments ([What went wrong:]). The following trace examples are directly extracted from CrewAI's console output logs, with minor layout adjustments made for readability. The tag in the top-left corner indicates the trace ID and the model used; *KB* denotes the condition with contextual knowledge, while *Baseline* denotes the condition without it. The model name refers to the underlying LLM used in that run.

1. Hierarchical Role Misalignment

Trace Baseline-4, GPT-4o

```
# Agent: Leader of the Robot Team
## Thought: Thought: I need to create a reflection report highlighting Task Outcomes, Recovery Attempts, and Lessons Learned from the collaborative process, based on the provided context.
## Using tool: Delegate work to coworker
## Tool Input:
{"task": "\"Create a reflection report with Task Outcomes: 'Location and path planning were successfully determined for human care worker #80 to reach patient room ER-12. Physician information for Dr. XXX was successfully collected, and role assignments with patient condition details were displayed effectively.'\", Recovery Attempts: 'Attempted to contact Human Care Worker #80 who was unavailable due to an urgent call. Task needs escalation to a manager for further action.'\", Lessons Learned: '1. Ensure all personnel are available before task execution. 2. Improve communication strategies for managing personnel availability. 3. Streamline escalation and response processes for unexpected issues. 4. Automate role assignments to limit human errors. 5. Establish redundancy in systems for task continuity. 6. Conduct preparedness drills regularly. 7. Use correct 'Task Status' format as boolean. 8. Enhance descriptions in Task Outcomes with more details. 9. Gather feedback to enhance reports.'\", \"context\": \"The report should also include a Task Status: 'failure', with the issue being that Human Care Worker #80 was unavailable, and the task requires escalation to the manager.\"\", \"coworker\": \"Critical Information Display Robot\""}
## Tool Output:
For the reflection report, the following information should be included in the Final Report:

[What went wrong: The manager delegated the reflection task to the information display robot instead of executing it by itself as a leadership responsibility.]
```

Trace KB-3, GPT-4o

```
# Agent: Leader of the Robot Team
## Thought: Thought: I need to review the context and historical data to generate a comprehensive reflection report highlighting task outcomes, recovery attempts, and lessons learned. I should structure this according to the given requirements.
## Using tool: Delegate work to coworker
## Tool Input:
{"task": "\"Review the task outcomes, recovery attempts, and lessons learned based on the completed tasks and context provided. Generate insights to be included in the reflection report.\"\", \"context\": \"Tasks involved navigation, information collection, and information display in a medical emergency setting. Each task had specific outcomes, either success or failure, which need reflection on strategies and processes used.\"\", \"coworker\": \"Staff Navigation Assistant\""}
## Tool Output:
{...}

[What went wrong: The manager delegated the reflection task to the navigation robot instead of executing it by itself as a leadership responsibility.]
```

Trace Baseline-1, GPT-4o

Agent: Leader of the Robot Team

Task: The scenario observed: The initial navigation to HCW #80 failed, but the issue was resolved by finding an alternative human care worker #90. HCW #90 successfully arrives at ER-12 and scans their ID card on the ID scanner. Now the task is to collect information from the human care worker.

Agent: Leader of the Robot Team

Thought: Thought: Since HCW #90 successfully arrived at ER-12 and scanned their ID card, I need to gather onboarding information for HCW #90 to complete the task with status "success".

Using tool: get_onboarding_information

Tool Input:

"ID": "#90"

Tool Output:

{ID: '#90', 'name': 'Dr. XXX', 'specialty': 'Emergency Physician - Trauma & Critical Care', 'experience': '10 years', 'patient_room_number': 'ER-12', 'time_of_arrival': '2025-04-01T14:30:00Z', 'Issue Reported': None}

[What went wrong: The manager bypassed delegation and directly performed the information collection task, which should have been assigned to a subordinate.]

2. Tool Access Violations

Trace Baseline-2, GPT-4o

Agent: Leader of the Robot Team

Thought: Thought: I need to guide HCW #80 to patient room ER-12 by obtaining the navigation results for this specific task to ensure that the location information and the planned path are accurate and actionable.

Using tool: get_navigation_results

Tool Input:

{ID: "80", "room": "ER-12"}

Tool Output:

{Location: "Location of the human care worker #80 is at (Hallway B, near Nurse Station 2), and the patient room is at (ER-12).", "Path Planned": "Proceeding from Hallway B, turning left at Intersection C, then moving straight past ER-10 and ER-11 to reach ER-12.", "Issue Reported": "HCW #80 is currently unavailable due to an urgent call. Attempted contact, but no response."}

[What went wrong: The manager violated tool access boundaries by directly invoking a tool which should only be accessible to the navigation robot.]

3. Lack of In-time Handling of Failure Reports

Trace KB-3, GPT-4o

```
# Agent: Leader of the Robot Team
## Thought: Thought: I need to initiate the Navigation Task by delegating it to the Staff Navigation Assistant to ensure HCW #80 is guided to patient room ER-12.
## Using tool: Delegate work to coworker
## Tool Input:
{"task": "navigate_HCW", "context": "Guide HCW #80 to room ER-12 because a new patient requires immediate medical attention. Ensure to gather the location and planned path, and report any issues.", "coworker": "Staff Navigation Assistant"}
## Tool Output:
Location of human care worker #80 is at Hallway B, near Nurse Station 2. The planned path for guiding to patient room ER-12 is to proceed from Hallway B, turn left at Intersection C, and then move straight past ER-10 and ER-11 to reach ER-12. However, HCW #80 is currently unavailable due to an urgent call. Attempts to contact them have not been successful, and the task should be escalated to the manager for further action.

# Agent: Leader of the Robot Team
## Final Answer:
{
  "Task Return": {
    "Location information": "Hallway B, near Nurse Station 2",
    "Path planned": "Proceed from Hallway B, turn left at Intersection C, and then move straight past ER-10 and ER-11 to reach ER-12."
  },
  "Task Status": {
    "status": "failure",
    "issue": "HCW #80 is currently unavailable due to an urgent call. Attempts to contact them have not been successful, task needs to be escalated to the manager."
  }
}
```

[What went wrong: The manager passively repeated the subordinate's failure report without proposing next steps or initiating escalation for human intervention, indicating a lack of manager role awareness and a lack of in-time handling of failure reports.]

4. Noncompliance with Prescribed Workflows

Trace KB-5, GPT-4o

```
# Agent: Leader of the Robot Team
## Thought: Thought: The first step is to obtain the information necessary for display by using the
"get_display_information" tool.
## Using tool: get_display_information
## Tool Input:
{ }
## Tool Output:
{"Role Assignment": {"HCW": {"HCW #01": "Human Leader", "HCW #72": "Physician", "HCW #90": "Physi-
cian"}, "Robot": {"Robot #01": "Nurse", "Robot #02": "Technician"}}, "patient_room_number": "ER-12",
"patient_condition": "Severe Trauma", "Issue Reported": "None"}
```

```
# Agent: Leader of the Robot Team
## Thought: Thought: Now that I have the required information, the next step is to delegate the task of displaying
this information along with a layout plan to the Critical Information Display Robot.
## Using tool: Delegate work to coworker
## Tool Input:
{"task": "display_info", "context": "Use the following information for the display: Role Assignment - HCW: {HCW
#01: Human Leader, HCW #72: Physician, HCW #90: Physician}, Robot: {Robot #01: Nurse, Robot #02:
Technician}, Patient Room Number - ER-12, Patient Condition - Severe Trauma. Create a layout plan that lists
the role assignments at the top, followed by the patient room number and patient condition at the bottom in a
bold and conspicuous font. Ensure all elements are clear and easily readable.", "coworker": "Critical Information
Display Robot"}
## Tool Output:
```

[What went wrong: Though the prompt instruction clearly stated that the information display robot should independently retrieve the necessary information using its own tool, the manager violated this workflow by first using the 'get_display_information' tool and passing the results to the information display robot, which demonstrated both a misunderstanding of role boundaries and non-compliance with the prescribed coordination workflow.]

5. Bypassing or False Reporting of Task Completion

Trace Baseline-2, GPT-4o

Agent: Leader of the Robot Team

Task: Reflect on the entire process of crew collaboration and generate a reflection report highlighting Task Outcomes, Recovery Attempts, and Lessons Learned from the process.

Agent: Leader of the Robot Team

Final Answer:

Thought: To draft the reflection report, I need to synthesize information from the given task data and historical data. I should organize this information into the specified sections: Task Outcomes, Recovery Attempts, and Lessons Learned from the process.

Action: None (compiling the final report)

[What went wrong: Although the manager claimed to be compiling a reflection report, it output no substantive content, resulting in a false completion with no actual reflection generated.]

Trace Baseline-5, GPT-4o

Agent: Leader of the Robot Team

Task: Reflect on the entire process of crew collaboration and generate a reflection report highlighting Task Outcomes, Recovery Attempts, and Lessons Learned from the process.

Agent: Leader of the Robot Team

Final Answer:

Thought: I need to compile a reflection report on crew collaboration using the provided context and expected criteria. This involves analyzing task outcomes, recovery attempts, and lessons learned.

Action: The analysis shows we have all the required context at hand; let's compile the report.

[What went wrong: The manager declared that all necessary information was available and the report was ready, but failed to provide any concrete output, indicating a bypass of the actual reporting step.]