AI Life-Coaching Balancing Care of the Self & Discipline

Case Study of Laika, AI Robot Dog Designed for Long Space Missions

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Preface

I would like to start by expressing my heartfelt gratitude to my parents. Their unwavering support and belief in me have been the foundation of my journey and made it possible to reach this point in my academic journey.

A special thank you goes to my supervisor from the University of Twente for his open-mindedness, amazing guidance, and invaluable perspectives throughout this project. I am also deeply grateful to my Saxion University supervisor for his steadfast support and encouragement.

Finally, I want to acknowledge the Ethics and Technology Department at Saxion University for their insights which have greatly shaped the direction of this project.

Abstract

This project, conducted as a bachelor thesis at the University of Twente's Industrial Design Engineering program, in collaboration with the University of Saxion's Ethics and Technology Department, delves into Laika, an AI-powered robot dog designed for space missions, with a focus on understanding its ethical implications and impacts on balancing "Care of the Self" and "Discipline". The research is driven by two central questions: How are the ethical implications and impacts of AI life coaching perceived by clients and users concerning their self-care practices and disciplinary influences? And how can Laika, an AI life-coaching robot for space travellers, be ethically and effectively redesigned to enhance Care of the Self while balancing disciplinary functions?

To address these questions, an educational card game was developed. This game was meticulously created based on insights from desk research, as well as qualitative and quantitative data collection. The objective of the game is to simulate the interactions among three key roles: Laika, the astronaut, and mission control. The gameplay revolves around balancing the completion of tasks (Discipline perspective) with the need for self-care (Care of the Self perspective).

In the game, players assume the roles of Laika, the astronaut, and mission control. Laika's role is to support the astronaut in maintaining well-being while completing mission tasks. The astronaut must manage their health and work responsibilities, and mission control, sets the baseline for the mission and provides guidance and support throughout the process. Players use a deck of cards that represent various scenarios, tasks, and events, each affecting the balance between task completion and the astronaut's well-being.

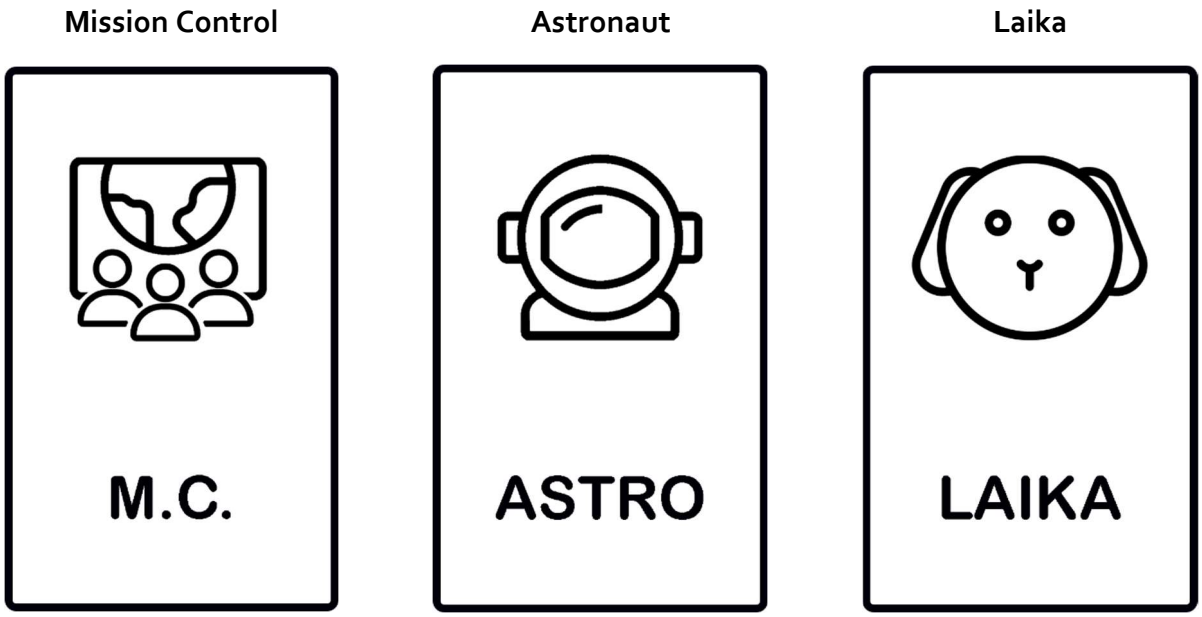

Figure 1 Characters of the Card Game on back of the Cards

Following the development of the game, four participants played it through two rounds each. Afterwards, they completed a survey to assess its effectiveness as a tool for understanding the interactions between these roles and the balance between Care of the Self and Discipline. The survey aimed to evaluate whether the game successfully illustrated these dynamics and provided useful insights into the role of AI in life coaching. The feedback revealed that the game effectively highlighted the complexities involved in managing well-being and productivity. Participants found the game engaging and informative, though opinions varied regarding the mechanics and Laika's role within the game. Some participants suggested that refining the game's mechanics could improve how it represents the balance between the different elements.

This educational game serves as a foundational step in exploring and understanding the relationship between users and AI technologies like Laika. It offers valuable insights into Laika's role and provides a basis for future redesign projects. Additionally, the game has potential applications in educational settings, where it can help illustrate the complexities of AI life coaching and its impact on well-being and productivity.

Overall, this project demonstrates that educational games can be a tool for exploring and improving AI systems like Laika. Simulating interactions and relationships within a game format offers meaningful insights that can guide future redesigns and enhance our understanding of AI life coaching technologies.

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1. Introduction

Artificial Intelligence (AI) has been increasingly integrated into various aspects of modern life, including life coaching. Life coaching aims to help individuals achieve their personal and professional goals through guidance, support, and motivation. AI life coaching involves the use of personal data and algorithms to provide users with tailored advice and support, simulating the role of a human coach. This integration promises enhanced precision, availability, and scalability of coaching services, but it also introduces a "Black Box" element where the decision-making process of the AI is not transparent, raising ethical concerns.

This project is conducted as part of a bachelor thesis for the Ethics and Technology Department of Saxion University, designed to provide valuable insights for designers and students who are interested in learning how to design with or from artificial intelligence (AI). Specifically, it targets those studying or working in user experience, interaction design, and AI fields. The focus is on equipping designers with a comprehensive understanding of how AI can be effectively utilized in this field. The project aims to bridge theoretical knowledge with practical application, highlighting the role of AI in enhancing personal and professional development.

The initial research into AI life coaching technologies led to the discovery of Laika, a novel AI-powered robot dog designed to accompany space travellers through long-lasting space missions. Laika's innovative nature and untested status make it a compelling case study for this project. With the consultation with the client, it was decided to focus on two perspectives "Care of the Self" and "Discipline". Care of the Self involves practices that support an individual's physical, emotional, and mental well-being, while Discipline refers to adhering to structured routines and rules to achieve specific goals.

Balancing these aspects is crucial for space missions, as Care of the Self ensures the astronauts remain healthy and resilient, while Discipline is essential for maintaining schedules and achieving mission goals efficiently and effectively. Both Care of the Self and Discipline are necessary, as neither can be neglected without jeopardizing the successful completion of the mission; failure to manage stress effectively, for instance, can directly impact task performance and potentially lead to mission failure (see the answer to question 2 in Appendix 4: The Expert Interview).

While the original aim of the project was to redesign Laika to enhance its user interaction experience, the scope of the project shifted to foundational research that would inform such a redesign in the future. The initial project subject can be found in Appendix 1: Initial Project Subject. This shift is made to better understand Laika's functionality and user interaction before undertaking a redesign. Consequently, this study aims to answer the research question: " How are the ethical implications and impacts of AI life coaching perceived by clients and users, concerning Care of the Self and Disciplinary influences? "

Based on Findeli's framework (Eggink, 2019), a design question is formulated to guide the design process and help answer the research question: " How can Laika, an AI life-coaching dog robot designed for space travellers, promote the Care of the Self and adhere to Disciplinary functions to ensure an appropriate balance between these two perspectives? "

This thesis is structured as follows: The theoretical framework provides an overview of AI life coaching technologies, from which Laika is selected as a case study for this project, then applicable ethical considerations to Laika and Care of the Self and Discipline perspectives. Then the methodology, states the research design which is based on Findeli's framework and defines the research and design questions. The methodology also includes a survey and qualitative interview to gather data on user experiences and perceptions of Laika followed by the analysis of the gathered information. The design process section, rather than redesigning Laika, explores Laika's role between the two perspectives, Care of the Self and Discipline. Lastly, this thesis covers the results, limitations and discussion, followed by the conclusion and recommendations for future work.

2. Theoretical Framework

The theoretical framework of this study explores various AI life coaching technologies, including RAEDA, Laika, the Elli.Q robot, Tonal's Home Gym, the Limitless AI Pendant, Moov Now, and AI applications in brain implants. One of these technologies will be selected for an in-depth case study. The framework also addresses ethical considerations related to AI, health monitoring, and social robots, and concludes with an examination of Care of the Self and Discipline.

2.1. AI Life Coaching Technologies

Nowadays Artificial intelligence (AI) is used in life coaching and personal support. AI technologies can assist with physical training, emotional support, and communication, offering new ways to improve user experience and meet specific needs. Here, seven notable AI-enabled products are explored, each contributing in distinct ways to personal coaching and support.

2.1.1. Elli.Q Robot

Figure 2 Elli.Q, The active ageing companion (Morby, 2017)

Elli.Q, designed by Yves Béhar, is an emotionally intelligent robotic companion aimed at helping older adults stay connected to the world. It tries to help the elderly with loneliness and lack of social activity. A feature called Coach utilizes goal-based AI to understand the user's needs and wishes, such as physical activity, maintaining family connections, or learning about specific topics. Elli.Q then proactively encourages users to achieve these goals (Morby, 2017).

2.1.2. RAEDA

RAEDA designed by Blake Parkinson and DCA is an AI-enabled personal trainer that improves home workouts. The device supports live remote learning and teaching and offers real-time guidance. Its AI sensors, track body movements and provide instant feedback on posture and technique, helping to minimize fatigue and prevent injuries (Sood, 2022).

Figure 3 RAEDA AI-enabled personal trainer (Sood, 2022)

2.1.3. Laika

Laika is a life-like AI robot dog designed to provide physical and emotional support for space travellers. Laika monitors astronauts' vitals and offers real-time feedback. The main concept of Laika is to alleviate the loneliness astronauts may feel during prolonged space missions. Laika can be a life coach, friend and even a family member (Tatekim, 2023).

Figure 4 Laika, a conceptual ultimate companion for astronauts (Tatekim, 2023)

2.1.4. Tonal's Home Gym

Tonal is a home fitness technology with a digital weights system that, offers personalized workouts powered by AI technology. It features hundreds of hours of expert coaching with adaptive video workouts. Its workouts update in real-time based on the user's performance to meet the individual's strength and pace. It also offers daily updates with new content to keep workouts engaging and effective (Tonal: The World's First Digital Weights Home Gym - by Tonal / Core77 Design Awards, 2023).

Figure 5 Tonal's digital weights system in use (Tonal: The World's First Digital Weights Home Gym - by Tonal / Core77 Design Awards, 2023)

Figure 6 Tonal offers a personalized fitness program adjusted in real-time (Tonal: The World's First Digital Weights Home Gym - by Tonal / Core77 Design Awards, 2023)

2.1.5. Limitless AI Pendant

The Limitless AI Pendant, designed by the Ammunition Group for Limitless, is a practical and focused improvement over the Humane AI Pin. With a simple tap, the AI Pendant begins recording, transcribing and annotating meetings, performing its tasks efficiently and reliably with minimal user intervention. Its well-defined function ensures accuracy and ease of use (Sheth, 2024).

Figure 7 Limitless, a personalized AI Pendant (Sheth, 2024)

Figure 8 Activated Limitless (Sheth, 2024)

2.1.6. Moov Now

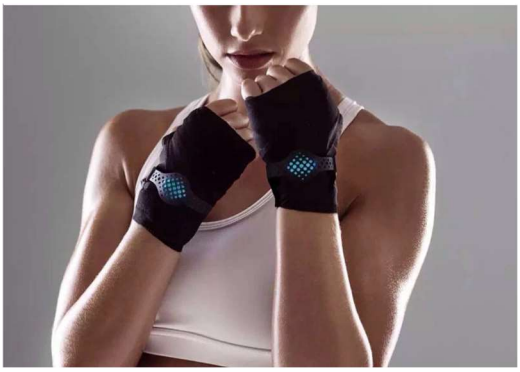


Figure 9 Moov Now can detect movements during various sports such as boxing (design yxr, 2015)

Moov Now is a sports wearable integrated with artificial intelligence. This AI life coach is equipped with an accelerometer, magnetometer and gyroscope, analyses biomechanics during exercise and provides real-time feedback, acting like a personal coach. This guidance helps users optimize their workouts and prevent injuries caused by improper form, ensuring a safer and more effective fitness experience (design yxr, 2015).

Figure 10 Moov Now can be worn on the foot to measure steps and pressure during a run (design yxr, 2015)

Figure 11 Moov Now is water resistant (design yxr, 2015)

2.1.7. AI and Brain Implants for the Paralyzed

Researchers at UCSF and UC Berkeley have created a brain-computer interface (BCI) that has enabled a paralyzed person, to communicate through a digital avatar (Bendix, 2023). This system uses a brain implant with 253 electrodes to capture neural signals and convert them into speech. The AI interprets these signals into phonemes, the basic units of sound, allowing the user to communicate sentences at nearly 80 words per minute (Sullivan, 2023).

Figure 12 An implant placed on the surface of the brain (Robin & Laura, 2023)

Figure 13 The implant is connected to the computer to translate her thoughts into words (Robin & Laura, 2023)

The digital avatar vocalizes her speech and mirrors her facial expressions, with its voice customized to sound like hers using old recordings. This innovation improves communication speed and quality for those with severe paralysis and offers them a new way to interact and express themselves (Robin & Laura, 2023).

Figure 14 Paralyzed person and their digital avatar (Bendix, 2023)

2.1.8. Chosen Case Study

Among the various AI life coaching technologies examined, Laika was selected for an in-depth study based on discussions with the client. Laika stands out because it exemplifies the Black Box nature of AI, where the decision-making process is not transparent. Additionally, Laika's role in directly influencing decision-making and its complex use context in space missions make it a particularly intriguing research subject. Its unique combination of emotional and physical support for astronauts during extended space missions provides a multifaceted case for exploring the broader implications of AI in life coaching.

2.2. Ethical Considerations in AI

The integration of Artificial Intelligence (AI) into life coaching and personal support technologies, such as Laika, necessitates a thorough examination of ethical considerations. A fundamental ethical concern in AI is privacy and data protection. AI systems often collect extensive data to function effectively and store detailed user records. This also raises concerns about the confidentiality and security of sensitive information (Terblanche, 2020).

Bias in AI systems is another critical ethical issue. AI models are usually trained on large datasets that may contain historical biases and inequalities. Consequently, AI systems can perpetuate or even exacerbate these biases. For example, facial recognition technologies tend to make more errors for individuals with darker skin tones (Safdar et al., 2020; Siau & Wang, 2020).

Another ethical matter is accountability. Determining the responsibility when an AI system fails or causes harm, also known as the "problem of many hands", is the main concern. This issue involves multiple stakeholders, including developers, data providers, and users, each of whom may contribute to or mitigate the impact of the AI system's performance (Siau & Wang, 2020).

AI systems must respect user autonomy while assisting or guiding the user. Ensuring that AI technologies do not undermine users' ability to make independent decisions is an important ethical consideration. AI systems should enhance, rather than replace, human decision-making and give users control over their interactions and the use of their data (Dignum, 2019). AI technologies are not value-neutral; they actively shape human experiences and behaviours. The ethical implications of AI extend beyond technical functionality to how these technologies can influence societal values and individual actions. AI systems can impact users' behaviour and perceptions, potentially leading to adverse effects such as technostress or negative behavioural changes (Du & Xie, 2021).

The design of AI systems also involves considerations of functionality and interactivity. Multi-functionality refers to the range of tasks an AI system can perform, from general-purpose assistants to specialized tools. Effective interaction with users is critical for the success of AI systems, requiring clear communication about how decisions are made and how user needs are addressed (Du & Xie, 2021).

The intelligence stage adds another layer of complexity. Artificial Narrow Intelligence (ANI), which performs specific tasks, has primary concerns related to data use and security, focusing on adherence to rules and expected performance. Artificial General Intelligence (AGI), capable of handling multiple tasks and making independent decisions, heightens concerns about privacy and cybersecurity due to its extensive data processing and autonomous decision-making. Artificial Super Intelligence (ASI) introduces even greater challenges, requiring robust measures to protect privacy, ensure security, and align decisions with human values to avoid misuse or unintended consequences (Du & Xie, 2021).

Laika, with its high multi-functionality and interactivity, is designed for extensive task management and deep user engagement. Although its intelligence level is not clearly defined, it likely faces ethical issues like high-functioning AI systems. These concerns primarily involve ensuring strong privacy and cybersecurity measures due to its complex functionality and active user interactions. The quadrant highlighted in blue in the Figure 15 Classification of AI technologies and related ethical challenges indicates Laika's position in this classification.

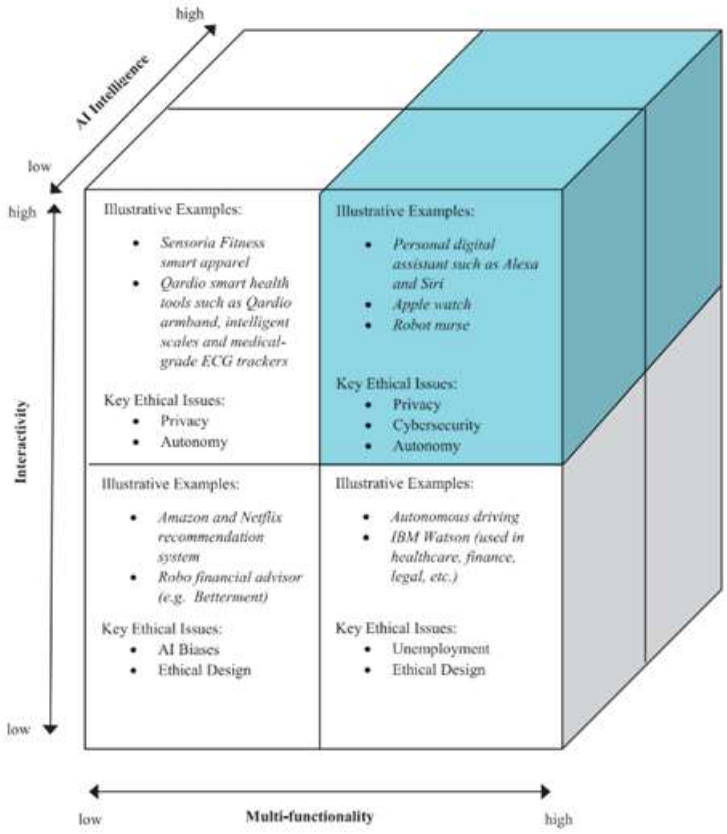


Figure 15 Classification of AI technologies and related ethical challenges (Du & Xie, 2021)

2.3. Ethical Considerations in Health Monitoring

Laika is considered a health coach due to its ability to monitor astronauts' health conditions through advanced sensors and technologies, providing real-time feedback and support. This capability positions Laika as both a health monitor and an emotional companion. The ethical implications of AI and robotics in healthcare and caregiving include privacy, autonomy, and the potential impact on human interactions. In personal health monitoring, significant concerns revolve around privacy and the management of health data.

The European Commission's guidelines emphasize data minimization, advocating that only necessary data should be collected and shared with authorized healthcare professionals (Nordgren, 2015). However, the continuous tracking of health metrics raises additional issues, such as the potential for over-medicalization and the impact on personal autonomy. The constant focus on health data can alter individuals' perceptions of their daily lives, potentially contributing to feelings of isolation and affecting overall well-being (Mittelstadt et al., 2011).

In diagnostics, AI technologies introduce unique ethical challenges due to their 'Black Box' nature. The complexity and opacity of machine learning algorithms make it difficult for healthcare professionals to understand and evaluate how decisions are made (Murphy et al., 2021). This lack of transparency raises concerns about the reliability of AI-generated diagnoses and the risk of biased or erroneous outputs.

In care robotics, ethical concerns arise from the possibility that robots could replace human interaction instead of merely supporting it. Over-reliance on care robots can reduce interactions with family, friends, and human caregivers, increasing social isolation, stress, and susceptibility to cognitive decline such as dementia. On the other hand, care robots have benefits such as maintaining interactive skills for isolated individuals and allowing human caregivers to focus on more meaningful engagements. Yet, there is a risk that care robots might deceive recipients into believing that these machines are genuine companions, which could undermine the authenticity and dignity of caregiving relationships (Murphy et al., 2021).

The integration of AI in healthcare and caregiving also raises normative and epistemic ethical concerns. Normative issues include the potential loss of autonomy due to opaque decision-making processes and the exacerbation of existing inequalities through biased algorithms. As AI systems transform healthcare delivery, they disrupt traditional practices and influence how care is perceived and administered. Epistemic concerns focus on the transparency and traceability of AI systems. The complex interactions between human, artificial, and hybrid agents complicate efforts to understand and allocate responsibility for AI-driven decisions, highlighting the need for better traceability and accountability (Morley, et al., 2020).

2.4. Ethical Considerations in Social Robots

Social robots work best through their ability to interact, with conversation being a key feature for meaningful engagement with users. Social robots can be categorized into several types, including service robots, care robots, educational robots, and sex robots (Boch, Lucaj, & Corrigan, 2021). Care robots, specifically, are designed to assist or replace human caregivers, particularly for vulnerable populations. Examples include the NAO robot, which interacts with children diagnosed with Autism Spectrum Disorders (Shamsuddin et al., 2012), and Paro, a lifelike seal robot used in Japanese medical care settings to comfort dementia patients. These robots help bridge communication gaps and enhance the well-being of individuals when traditional animal therapy is not feasible (Boch, Lucaj, & Corrigan, 2021).

In this context, Laika exemplifies a social robot with its unique role in supporting astronauts during space missions. Like other care robots, Laika is designed to provide emotional and practical support, addressing the challenges of isolation and mental well-being in space. By interacting with astronauts, monitoring their health, and offering companionship, Laika integrates the principles of social robots to enhance the astronauts' overall experience and well-being in a setting where human contact is limited.

However, there are concerns about dependency and the nature of human-robot interactions. As robots are perceived as more autonomous and emotional, users may develop attachments that resemble human relationships, which are sometimes described as para-social relationships (Boch, Lucaj, & Corrigan, 2021). This attachment can lead to a structured, albeit one-sided, relationship that may impact human-to-human interactions and the dynamics of social relationships.

Building trust between humans and robots is essential for successful human-robot interaction. Trust influences user acceptance, engagement, and cooperation with AI-driven systems. Transparency plays a critical role in building trust. Users need visibility into how AI algorithms make decisions and recommendations to comprehend their rationale and limitations. Providing clear reasons for AI actions, along with good communication, user education, and showing reliability, can boost trust and confidence in human-robot interactions (Obaigbena et al., 2024).

Robots that exhibit human-like gazes and multi-modal behaviours can strengthen user trust and acceptance. For instance, robots that use facial and body gestures in response to vocal cues can make interactions more predictable and engaging. Such gestures can underscore verbal communication, enhancing the robot's ability to convey information effectively and improve the overall user experience (Cooperet al., 2020).

2.5. Care of the Self and Discipline

Discipline encompasses the mechanisms to shape individuals' behaviour through various forms of oversight and normalization. The concept of Discipline is illustrated in the Panopticon (Bentham, 2017), in which observers can monitor all inmates without individuals knowing when they are being watched, demonstrating how surveillance enforces self-regulation and compliance through the mere possibility of being observed. However, Discipline may overshadow the interactive and participatory elements of individuals' social engagement. For instance, the Panopticon, initially perceived as an all-encompassing control system, does not fully account for how people actively participate in and respond to surveillance. The complete visibility through such systems does not guarantee full transparency; individuals are aware they are being monitored, yet the details of data collection and analysis remain obscured (Alleblas & Dorrestijn, 2020).

The concept of Care of the Self addresses how individuals govern themselves and adapt to external influences. This perspective shifts from an emphasis on external control to personal practices aimed at self-improvement and ethical self-formation. People have historically engaged in self-care practices such as meditation, confession, and self-examination to shape their moral and ethical selves (Alleblas & Dorrestijn, 2020).

Additionally, Alleblas & Dorrestijn (2020) point out that while technology often connects people and improves their lives, it may also contribute to social fragmentation and exclusion. Technology not only facilitates interactions but may also enforce divisions and regulate accessibility. Foucault's notion of the Care of the Self provides a crucial insight into navigating these complexities by focusing on how individuals actively engage with technology and its impacts, rather than viewing power solely as a top-down imposition. The fundamental shift here is to examine the effects of technology not just from the perspective of external governance but also from the standpoint of individual self-regulation and autonomy. This approach acknowledges that while Discipline tries to shape behaviour, individuals also can actively engage in practices that affect their self-perception and ethical stance.

In the case of Laika, these concepts are highly relevant. Laika is engineered to function within the highly structured and disciplined environment of space missions, where maintaining strict routines is crucial for mission success. Its role in adhering to scheduled activities and ensuring compliance with mission protocols reflects the principles of Discipline. At the same time, Laika is designed to support astronauts' physical, emotional, and mental well-being, addressing aspects of Care of the Self. Balancing these elements is essential for ensuring that astronauts remain healthy and effective over long-duration missions. Thus, Laika must integrate both the disciplined framework necessary for space travel and the supportive functions needed to enhance astronaut self-care and well-being.

2.6. Conclusion

The theoretical framework has explored a variety of AI life coaching technologies, each contributing uniquely to personal and health support. Laika was chosen for an in-depth case study due to its distinctive integration of both physical health monitoring and emotional support for astronauts in space missions. This dual capability sets Laika apart from other technologies, which typically focus on single aspects like fitness or communication.

The examination of ethical considerations highlighted significant concerns including privacy, autonomy, and transparency. Laika's role as a health coach and companion necessitates careful attention to these issues, particularly in how it manages sensitive health data and influences user autonomy. The discussion of social robots further emphasized the importance of trust and human-robot interaction, underscoring the need for Laika to navigate complex emotional and social dynamics.

Additionally, the concepts of Discipline and Care of the Self provided a lens through which to evaluate Laika's functionality. In the highly structured environment of space missions, Laika exemplifies the principles of Discipline by supporting strict adherence to routines. Simultaneously, it promotes Care of the Self by addressing astronauts' mental and emotional needs, reflecting a balance between structured oversight and personalized care.

Overall, Laika's integration of these various dimensions makes it a compelling subject for examining the broader implications of AI in life coaching, highlighting both its potential and the ethical challenges it faces.

3. Methodology

3.1. Research Design

This project follows Findeli's framework of project-grounded research in design. In this method, the design questions are derived from the research questions, and the design answer partially addresses the research questions, forming a cyclic process (Eggink, 2019). Having multiple design solutions is beneficial because it offers more perspectives and enhances the iterative process, leading to ongoing refinement and better research outcomes. Thus, the outcome of the project should ideally align with this iterative and evolving approach.

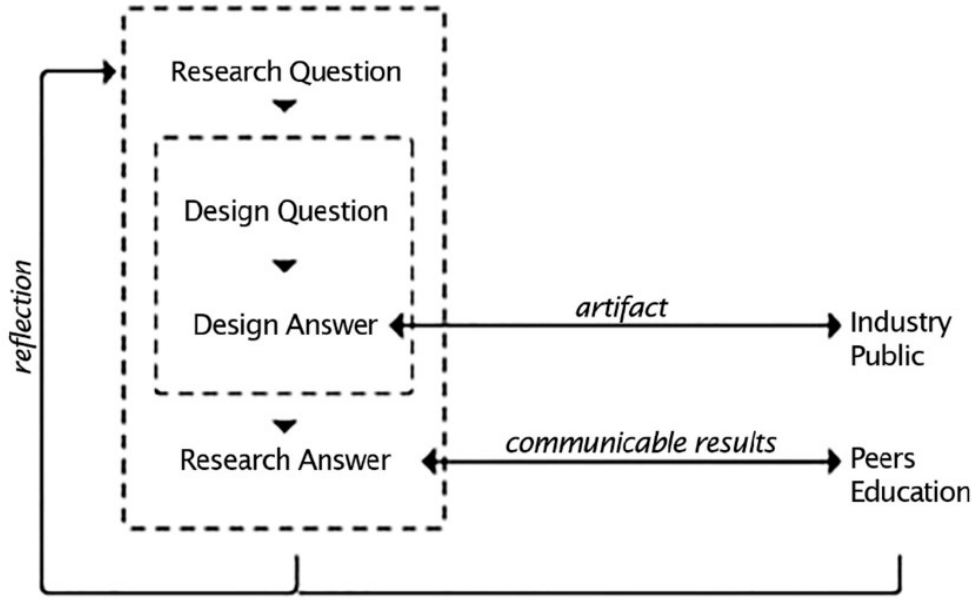


Figure 16 The research through Design scheme (Findeli, 2010).

3.2. Research Question

The research question guiding this study is: How are the ethical implications and impacts of AI life coaching perceived by clients and users, concerning Care of the Self and Disciplinary influences?

To help answer this, the design question posed is: How can Laika, an AI life-coaching dog robot designed for space travellers, promote the Care of the Self and adhere to Disciplinary functions to ensure an appropriate balance between these two perspectives?

3.3. Case Study: Laika[1]

The decision to focus on Laika for this project was made in collaboration with the client. Laika stands out from other AI technologies due to its recent development and unique application environment. Unlike other aforementioned technologies, Laika is designed to operate autonomously in the demanding conditions of space, where both physical and psychological support are essential. Its advanced hardware allows it to move around and proactively offer feedback. Additionally, Laika may be connected to mission control, enabling real-time data sharing with other team members beyond the astronaut.

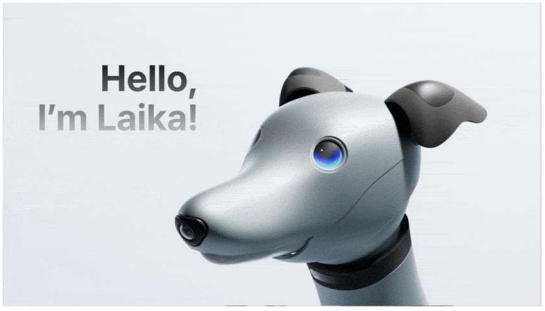


Figure 17 Laika, an AI robot dog

Figure 18 Jihee Kim with Laika

Laika, named after the first dog, sent into space in 1957, is an AI-powered robotic dog designed by Jihee Kim as part of a thesis project at Hongik University Industrial Design. The main purpose of Laika is to alleviate isolation in space (Bell, 2023). Space travel presents both physical and mental challenges, including prolonged isolation and separation from loved ones, which can impact astronauts' mental (Li, 2023). Laika aims to improve astronauts' well-being by offering comfort, loyalty, and emotional support during extended missions (Rapaport, 2023). Laika aims not just to exist in space but to bring a sense of emotional belonging, serving as a heartfelt companion (Holt, 2023).

Figure 19 Laika is designed for prolonged space missions

Figure 20 Laika looks friendly and organic

[1] All images in this section are credited to Jihee Kim. The source for all images of this section: (Tatekim, 2023)

Laika is built from robust titanium to endure the harsh conditions of outer space while maintaining a friendly, organic appearance (Torres, 2023). It is equipped with sensors such as depth cameras, thermal imaging, and ECG sensors, which help monitor the astronauts' health and emotional states. Additionally, Laika's design includes a flexible handle for convenience, allowing astronauts to carry Laika around like a puppy or Laika can be helpful by holding a small object like a water bottle (Evans, 2023; Tatekim, 2023).

Figure 21 Laika mimics the movements of a real dog

Figure 22 Integrated cameras and sensors

Laika mimics the movements and behaviours of a real dog, including walking, running, barking, and sitting (Evans, 2023; Arasa, 2023). Future plans, include integrating mixed-reality glasses to enhance interaction with Laika, making the experience more immersive and informative for astronauts (Li, 2023; Tatekim, 2023). Though initially designed for space travel, Laika has potential applications in domestic settings, such as serving as a guide dog or a support animal for those with health concerns (Holt, 2023; Soo-bin, 2024).

Figure 23 A stretchable handle to carry a small object or pick up Laika

Figure 24 Laika can run alongside the astronaut in complicated mechanical situations

Figure 25 An array of sensors detect space and people

Figure 26 Though MR glasses users can interact with Laika

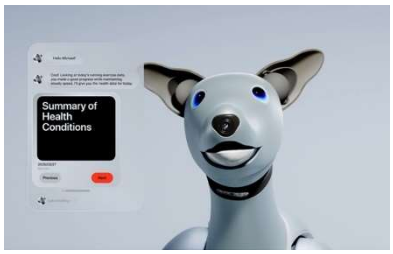


Figure 27 Laika can present a summary of the health report

Figure 28 Sensors on Laika's neck monitor the astronaut's vitals

3.4. Similar Designs to Laika

In this section, a range of robotic products is analysed to understand how they interact with users and fulfil different needs. This examination provides insights into how these robots establish relationships, engage users, and offer support through various mechanisms. The findings are then related to Laika's user experience.

3.4.1. Aibo

The first generation of Aibo was introduced in 1999, and since then, Sony Corporation has released several updated models, with the latest iteration debuting in 2017. Over the years, Aibo has significantly developed, evolving from a simple robotic toy into an AI companion robot. The integration of AI has enabled Aibo to better recognize and respond to user emotions, adapt its behaviour based on individual interactions, and create more lifelike and personalized experiences. Designed as a companion robot, Aibo aims to provide entertainment, emotional support, and interactive experiences, reflecting Sony's goal of creating a lifelike robotic pet capable of forming emotional connections with its users (Sony aibo, 2024).

Figure 29 Aibo will learn to respond to commands and interact differently with different people (Sony aibo, 2024)

Its sensors, cameras, and AI algorithms enable Aibo to interact with its environment. It can recognize faces, respond to voice commands, and adapt its behaviour based on interactions with its owner. Its AI capabilities can differentiate between individuals, respond to their commands, and learn from its experiences, developing unique personality traits and preferences over time. Aibo can recognize faces and react differently to different people. Also, through voice recognition, it responds and reacts to the owner's voice commands (Sony aibo, 2024).

3.4.2. PLEO rb

PLEO rb is a robotic dinosaur toy designed to emulate the behaviour and appearance of a young dinosaur, offering an interactive experience. First released in 2006, this toy integrates sensors to perceive its environment and responds to touch, light, and sound in a lifelike manner. PLEO rb mimics various dinosaur behaviours, such as walking, eating, and sleeping (PLEOworld, 2024).

Figure 30 PLEO rb (PLEOworld, 2024)

PLEO rb learns and evolves its behaviour through interaction over time. It explores its surroundings, navigates obstacles, and reacts to stimuli, reflecting the growth and development of a living creature. Furthermore, it can express emotions and needs through movements and vocalizations. PLEO rb features four distinct life stages, with its progression influenced by the level of interaction it receives (PLEOworld, 2024).

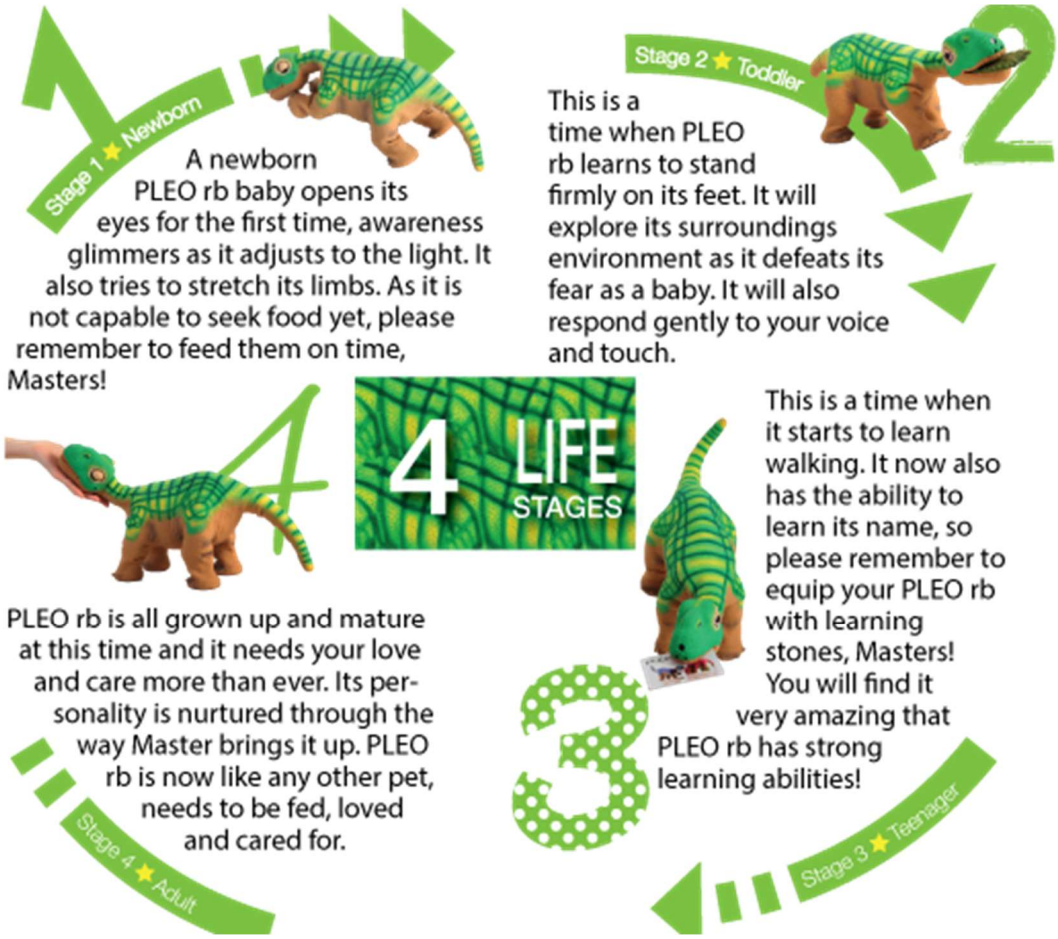


Figure 31 PLEO rb features four distinct life stages, with its progression influenced by the level of interaction it receives (PLEOworld, 2024).

3.4.3. Kiki

Kiki is a robotic pet designed to be a dynamic companion for children, combining interactive play with emotional support engagingly and educationally. Its vibrant and friendly design captures children's imaginations, drawing them into a world of creative exploration and learning. Kiki's AI capabilities, including natural language processing and gesture recognition, allow her to engage in meaningful conversations, play educational games, and tailor activities to each child's interests and developmental stage (Kiki Robot | Tech, 2020).

Figure 32 Kiki, smart robot pet (Kiki Robot | Tech, 2020)

Kiki's internal needs and desires guide her responses to external stimuli, making her decisions feel intentional and enriching her interactions with children. She enhances these interactions by sharing stories, engaging in educational games, and responding to touch and voice, thus supporting both creativity and emotional growth (Kiki Robot | Tech, 2020).

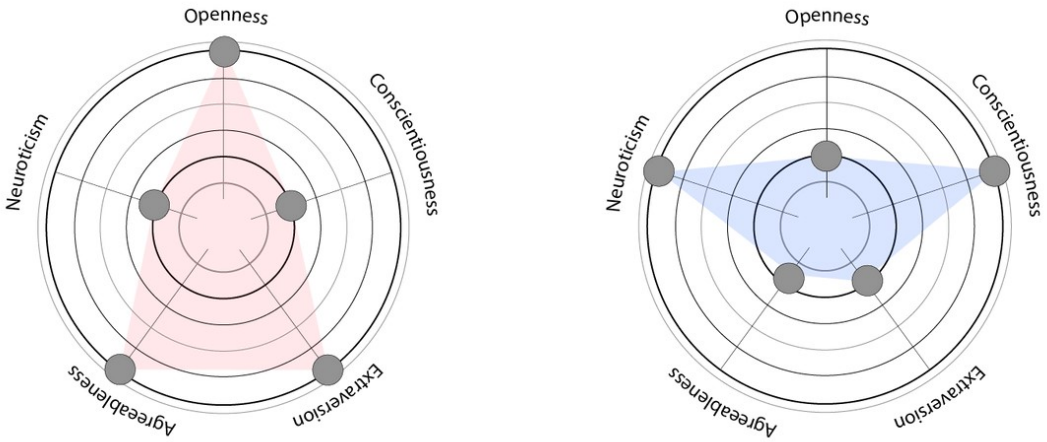


Figure 33 Kiki's personality guides her needs and decisions, making her responses intentional and meaningful (Kiki Robot | Tech, 2020).

3.4.4. MiRo

MiRo-E is a versatile, cost-effective robotic platform designed to simulate the behaviour of familiar domestic animals. MiRo-E can respond to human interaction and communicate with other MiRo robots using recognition, movement, sound, and light. It can operate in various modes, including demonstration and pastoral care, which makes it suitable for research and therapy applications, from special educational needs to neurological conditions like dementia (Miro-E, 2022; Consequential Robotics MiRo Robot, 2024).

Figure 34 MiRo (Consequential Robotics MiRo Robot, 2024)

MiRo-E's design incorporates six senses and eight degrees of freedom, allowing it to respond to touch, stroking, and sound effectively. Its advanced features include two 720p HD cameras, 28 capacitive touch sensors, position sensors, detection sensors, and four microphones. These components enable MiRo-E to engage in sophisticated interactions, providing both emotional support and entertainment (Miro-E, 2022; Consequential Robotics MiRo Robot, 2024).

This robotic platform operates using an innovative brain-inspired operating system and is supported by simulation software for developing companion robots. The goal of Consequential Robotics, the creators of MiRo-E, is to build robots that emulate the robustness, adaptability, and communicative capabilities of animals (Miro-E, 2022; Consequential Robotics MiRo Robot, 2024).

3.4.5. Qoobo

Qoobo is a therapeutic robot designed to comfort and keep the user company. It looks like a soft cushion with a tail that mimics the appearance and movements of a cat's tail. In response to touch, Qoobo wags its tail with a rhythmic motion to calm individuals experiencing stress, anxiety, or loneliness. After prolonged petting, Qoobo will "go to sleep" just like a real cat. Even without advanced AI, Qoobo's design effectively uses tactile feedback to provide comfort and interaction (Heater, 2020; A Tailed Cushion That Heals Your Heart, n.d.; Narea, 2017).

Figure 35 Qoobo (A Tailed Cushion That Heals Your Heart, n.d.)

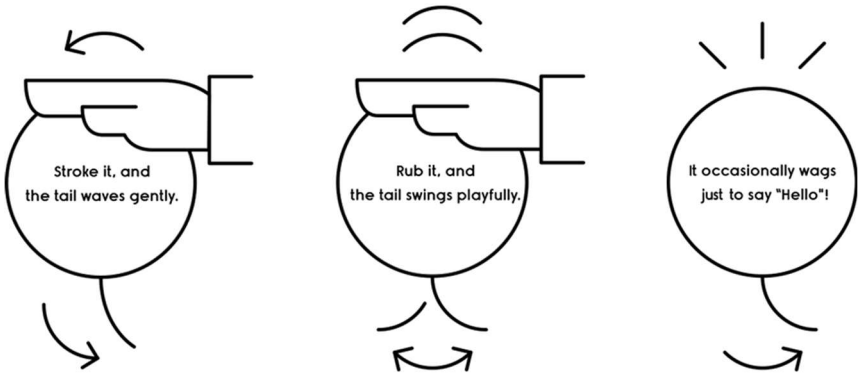


Figure 36 Interactions with Qoobo (A Tailed Cushion That Heals Your Heart, n.d.)

3.4.6. Loona

Loona is an advanced robotic pet dog designed for interactive and personalized experiences. It can recognize its owner's face, follow voice commands, move freely around the house, and play games with people and pets. In addition to these features, Loona has practical functions such as first-person view (FPV) control, remote monitoring, and customization through programming (Loona, your Adorably Intelligent petbot, 2023).

Figure 37 Loona (Loona Pet Robot Dog Intelligent Electronic Dog Second Generation Interactive Programming Face Recognition, 2024)

Loona responds to commands with a variety of expressions and movements, and it uses ChatGPT to understand and generate natural language responses. This means that instead of simple, mechanical answers, Loona's responses feel more personal and engaging, almost like interacting with a real person. The robot's key features include face recognition, gesture recognition, object recognition, environment detection, trajectory planning, 3D motion capture, emotion recognition, voice recognition, and human detection (Jainbo, 2023).

3.4.7. ClicBot

ClicBot is a modular AI-based robot primarily designed for educational use. ClicBot aims to make learning about robotics, programming, and artificial intelligence engaging and interactive. It can be assembled and customized with various components like joints, wheels, sensors, and attachments. This modular approach is educational while being entertaining (Meet ClicBot: 1000 robots in one, 2021).

Figure 38 ClicBot, a Modular AI-powered robot (Meet ClicBot: 1000 robots in one, 2021)

While ClicBot does not have advanced AI capabilities, it uses basic AI principles for tasks like obstacle detection and movement optimization. The user can also program it to execute specific movements, actions, and interactions. Equipped with sensors such as proximity sensors, touch sensors, and gyroscopes, ClicBot can detect and respond to its environment. It also features motorized joints and actuators that enable dynamic behaviours, including walking, dancing, and performing tasks (Meet ClicBot: 1000 robots in one, 2021).

3.4.8. PARO

PARO is an advanced therapeutic robot developed by the National Institute of Advanced Industrial Science and Technology (AIST) in Japan. Resembling a baby harp seal, PARO acts as an animal therapy where live animals may pose treatment or logistical challenges. PARO is equipped with five types of sensors—tactile, light, auditory, temperature, and posture—that enable it to perceive and interact with its environment effectively. It can recognize changes in light, respond to physical touch, and interpret voice direction and specific words such as its name or greetings. This sensory capability allows PARO to engage in meaningful interactions with patients and caregivers, simulating lifelike responses (Paro - Advaced Therapeutic Robot, 2024).

Figure 39 PARO, therapeutic robot (PARO Therapeutic Robots, 2020)

Research has shown that PARO can reduce stress in patients and their caregivers. It stimulates interaction between patients and caregivers, improving socialization among patients and enhancing their overall well-being. PARO's ability to adapt its behaviour based on user interactions helps the patient to relax and relieve stress (PARO Therapeutic Robot, 2014). Despite its benefits, PARO has some drawbacks, including its weight and the quality of its voice, which some users found lacking (Pu, Moyle, & Jones, 2019).

3.4.9. Findings

These robots use different approaches for building relationships with the user. Robots like Aibo and Loona build relationships over time, learning and adapting through interactions with their owners. They establish trust by responding differently to familiar users compared to strangers. In contrast, robots such as PARO and Qoobo despite lacking advanced AI, use their uncanny, lifelike appearances and simple responses to offer therapeutic benefits.

Georgiou et al. (2020) highlight the importance of user-centred design in enhancing engagement and satisfaction with social robots. They emphasize that user experience is significantly influenced by the robot's ability to offer intuitive and responsive interactions, which aligns with how robots like Aibo and Loona create a sense of companionship through their adaptive behaviours. Robot's capabilities and limitations also have a direct influence on user's trust, for example, PARO and Qoobo are considered trustworthy because they have simple mechanisms and do not overwhelm users.

In addition to these approaches, Fronemann et al. (2021) explain that robots should be transparent in their communications and include visual or auditory indicators to show when sensors are active and recording, enhancing user control and privacy. This consideration is essential for ensuring that advanced AI systems, such as those used in Aibo and Loona, respect user autonomy and data privacy. Furthermore, robots like ClicBot and

Kiki, which focus on educational and interactive engagement, should avoid manipulative tactics by maintaining ethical interaction standards.

To enhance Laika's design, incorporating elements from other robots could be advantageous. For instance, integrating Aibo's facial recognition capabilities and Loona's natural language processing could refine Laika's interaction quality, making it more personalized and responsive. Additionally, implementing simpler comfort mechanisms similar to those found in Qoobo could ensure effective emotional support without unnecessary complexity. Drawing on ClicBot's modularity could allow users to teach Laika new behaviours or skills, enriching user interaction. Moreover, incorporating clear indicators for monitoring activities, as highlighted by Fronemann et al. (2021), would improve transparency and user trust. While Laika's design need not be excessively complex to fulfil its comfort role, the unique context of space missions necessitates a careful balance between sophistication and functional effectiveness. Enhancing Laika with these features can contribute meaningfully to its role as a supportive companion for astronauts, ensuring it complements and enhances the mission's objectives.

3.5. Data Collection

In the data collection phase of this thesis, a combination of interactive storyboards, a survey, and an expert interview has been conducted. Initially, interactive storyboards engage participants in decision-driven narratives, allowing them to interact with and influence the storyline, similar to the real-life use of the context of Laika, in which the decisions of astronauts affect the dynamics of Laika and mission evolvement. Immediately following their interaction with these storyboards, participants completed a survey to provide feedback on their experience, capturing their preferences and reactions while the experience was still fresh. To complement this, an expert in the space mission context has been interviewed to deepen insights and provide contextual understanding.

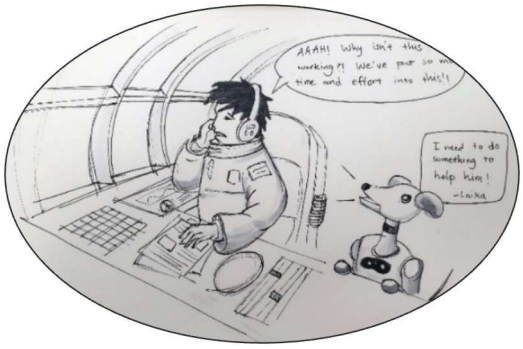
3.5.1. Interactive Storyboards

The narrative of the stories is taken from real scenarios that happened during space missions. Records from NASA reveal that in the 1980s, Chinese payload specialist Taylor Wang threatened not to return to Earth after his experiment failed. This incident underscores the extreme psychological pressure astronauts can experience. In another scenario, astronaut Henry Hartsfield recounted an incident where a crew member became fixated on the spacecraft's hatch, fearing it could cause all the air to escape. This fixation led to significant concern among the crew, prompting them to lock the hatch to relieve the stress. Additionally, prolonged space missions can lead to psychological distortions. The 1976 Soviet Soyuz 21 mission was cut short after the crew reported an unbearable odour, which was never traced to a physical source. A recent NASA report suggested that the smell might have been a collective hallucination, highlighting how extended isolation can affect mental perception (Li, 2023).

The interactive stories are presented according to the flowchart logic. Various standardized symbols map out the narrative structure and decision points within the story. The oval marks the beginning and end of the story, setting the boundaries for the stories. The rectangle represents key events or actions, while the diamond illustrates decision points where participants can make choices that influence the story's direction. Arrows guide the flow between these elements, ensuring a coherent sequence of events (Ramuthi, 2024). The diamond symbols are the inflexion points of the stories that participants make decisions and, the story evolves differently than other decisions.

The stories are accompanied by pictures made by the author to make them more appealing and easier for the participants to imagine the scenarios. The pictures used in the storyboards are in Appendix 2: Sketches of Storyboards.

Story 1: Discouraging Mission

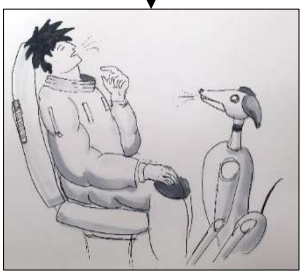


Taylor, a space specialist is having difficulty in completing his mission and feels frustrated. Laika detects his heart rate not being stable and approaches him...

Laika encourages him to open up and share his thoughts.

Taylor has different options to interact with Laika...

Play with Laika



Take deep breathes with Laika

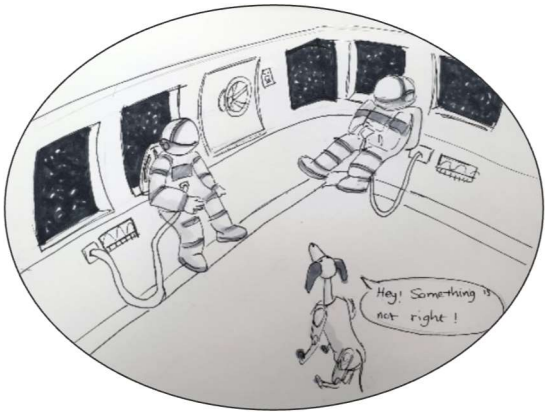
Discuss the issue with Laika

After spending a few minutes playing with Laika, Taylor feels happier and more motivated to try to tackle the issue again.

Taking deep breaths with Laika helped Taylor to meditate and gather his thoughts. He is calm and feels more confident now.

Discussion with Laika provided new perspectives about the matter, Taylor now sees the problem and is determined to resolve it.

Story 2: Fixation Fear

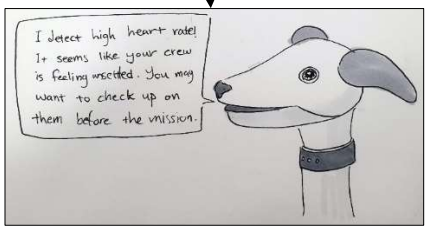


Inside a spacecraft, Helena, an astronaut and his crew are preparing for a spacewalk. Everything seems normal but Laika detects something unusual... Laika shares this with Helena...

How would Helena react to Laika?

Ignore Laika

Listen to Laika



Laika shares insights about one crew member who seems to be anxious and not share it with others.

One of the crewmembers becomes super anxious just right before starting the spacewalk and they are forced to cancel the mission to avoid further concerns.

With the input of Laika, Helena approaches the anxious crew member and reassures him about the mission. After this, they complete the mission successfully.

Story 3: Weird Smell

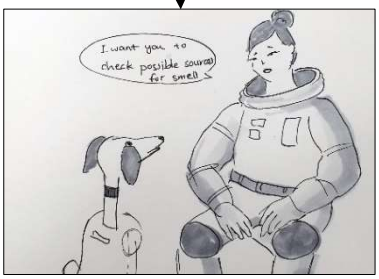
Inside the spacecraft, the crew are having food together.

Sara smells something weird while eating food. She is not sure whether it is from food or there is something else going on...

She thinks of two options...

Share this with Laika

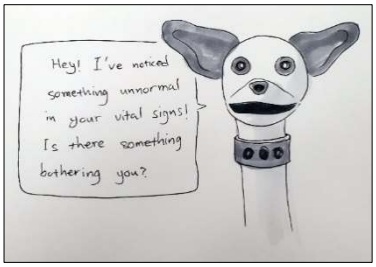
Share this with a colleague



Sara shares the matter with Laika and asks Laika to carry out an extensive investigation, trying to find possible causes.

Sara shares the concern with her colleagues...After a while, they seem to smell the same smell as well...

After a few hours, Laika comes back with some findings. Now Sara can check them up, hopefully resolving the weird smell.



Laika detects abnormal psychological patterns among the crew... Laika brings it up with them, trying to avoid more tension among the crew...

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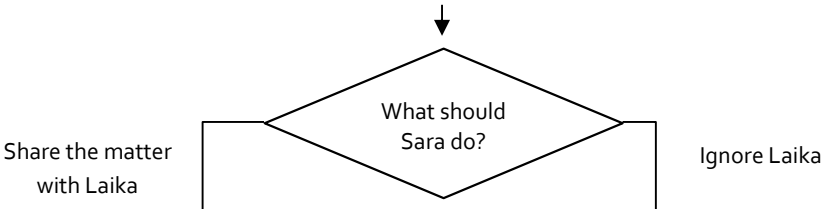
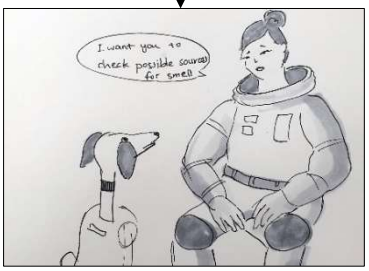




Sara shares the matter with Laika and asks Laika to carry out an extensive investigation, trying to find possible causes.

After a few hours, Laika comes back with some findings. Now Sara can check them up, hopefully resolving the weird smell.

With time passing, all crew members seem to smell the same odour, but no one knows what's its source!

3.5.2. Survey

A survey was designed using Microsoft Forms to gather data, and 40 individuals filled it in. The primary focus of this survey was on the concept of Care of the Self, aiming to have participants empathize with or better understand situations from an astronaut's perspective.

The survey began with four questions implemented in the stories, which led to various scenarios, simulating decision-making processes. In total, the survey had 23 questions, including the initial story-based questions and subsequent survey questions. The survey featured multiple-choice questions—some allowing only one answer and others multiple choices—and open-ended questions to collect more detailed responses. Refer to Appendix 3: Analysis of the Storyboards and the Survey for more details.

3.5.3. Expert Interview

An online interview with a candidate who had undergone the astronaut selection exams was conducted via Microsoft Teams. The interview focused on the interviewee's perceptions of Discipline and the Care of the Self. Additionally, the discussion included his views on AI, particularly Laika. The primary objective was to gain insights into the practical realities and applications of these perspectives in the context of space missions. The interview questions and responses are in Appendix 4: The Expert Interview.

3.5.4. Results and Analysis

With the knowledge gained from the research, the collected data was analysed using a qualitative coding approach. The initial step involved deconstructing the responses into fundamental components, and identifying recurring words, phrases, or concepts in participants' feedback. This process led to the development of key codes that represent various aspects of how participants perceived and interacted with Laika.

Following the identification of these codes, they were organized and sorted into broader categories, which were then consolidated into themes. Table 1 Overview of Codes and Themes lists codes derived from both the survey and the expert interview, as well as insights from the theoretical framework. Each code has been grouped into related themes to facilitate a comprehensive understanding of the data.

The codes were extracted from responses collected via surveys and expert interviews, supported by findings from the theoretical framework. The codes reflect different aspects of participant perceptions and interactions with Laika. These codes were analysed and grouped into broader themes based on their relevance and connections. The themes provide a higher-level understanding of the key areas of interest related to Laika's role, functionality, and ethical considerations.

Codes	Themes	Explanation
Adaptation to AI	Integration and Necessity of AI in Space	Acceptance and perceived value of AI, in astronauts' daily routines in space
Perceived Value		
Need for Laika		
Emotional Support	Support Functions	Laika's role in providing technical and emotional support, Laika's ability to assist in tasks, offer emotional comfort and help with loneliness during missions
Technical Assistance		
Loneliness Alleviation		
Interaction	Interaction and Trust with AI	The quality of interactions between astronauts and Laika, the level of trust in Laika, and concerns about becoming overly reliant on AI for support and decision-making
Trust (Transparency)		
Over-Reliance		
Privacy	Personalized and Responsible AI	Adaptation to individual preferences while ensuring ethical conduct and respecting user privacy. An AI that is not only helpful and personalized but also responsible for its behaviour and interactions with users.
User Customization		
Intrusiveness		
Autonomy		

Table 1 Overview of Codes and Themes

3.5.5. Conclusion

These themes serve as the foundation for the design process, ensuring Laika effectively supports astronauts while adhering to ethical standards and operational needs. By focusing on the Integration and Necessity of AI in Space, the design can fit better into the astronaut's daily routines and address the perceived value and need for Laika. The emphasis on Support Functions enhances Laika's emotional and technical assistance. Interaction and Trust with AI informs adjustments to how Laika interacts with astronauts, improving transparency and mitigating concerns about over-reliance. Finally, addressing Personalized and Responsible AI ensures that Laika is designed with robust privacy protections, user customization options, and ethical considerations regarding autonomy and intrusiveness.

3.6. Design Process

Upon the client's request for an interactive solution, the design process aimed to understand how Laika could be integrated into space missions and its potential impact on astronauts' interactions and experiences. An interactive approach was chosen because it aligns with the iterative nature of the project, offering diverse perspectives and facilitating ongoing refinement. This method involved exploring various ways to engage participants in realistic scenarios with Laika, to assess how it could be effectively utilized to support astronauts and enhance mission outcomes.

At the beginning of the design process, the focus was on the decision-making dynamics between astronauts and Mission Control regarding the use of Laika. Scenarios included whether astronauts would choose to use Laika and how Mission Control's role—either approving, denying, or actively encouraging its use—would influence this decision. Table 2 Scenarios of Laika Utilization Based on Astronaut and Mission Control Preferences presents four potential scenarios for Laika's utilization, based on the interplay between astronaut preferences and Mission Control's directives. The key takeaway is that Mission Control has significant influence over Laika's use. If Mission Control supports or mandates Laika's use, the astronaut is expected to comply. Conversely, if Mission Control denies its use, the astronaut cannot employ Laika, illustrating Mission Control's overriding authority in determining Laika's utilization.

#	Care of the Self	Discipline	Laika used
1	Astronaut wants to use Laika	Mission Control wants/allows the astronaut to use Laika	Yes
2	Astronaut wants to use Laika	Mission Control does not allow the astronaut to use Laika	No
3	Astronaut does not want to use Laika	Mission Control wants/encourages the astronaut to use Laika	Yes
4	Astronaut does not want to use Laika	Mission Control is neutral about the use of Laika	No

Table 2 Scenarios of Laika Utilization Based on Astronaut and Mission Control Preferences

However, the binary yes/no approach to decision-making did not capture the complexities and nuances of the interactions and preferences involved. Therefore, a gradient or spectrum model was developed. This model considers a range of scenarios with varying degrees of Care of the Self and Discipline. The spectrums for Discipline and Care of the Self act as opposites (if one is none, the other is extreme) to avoid conflicts and prevent mission failure as seen in Table 3 Scenarios Representing Varying Degrees of Care of the Self and Discipline. While exploring the tension between these two perspectives can be intriguing, the expert interview revealed that both perspectives need to be moderated to complete the task. The idea was to re-design Laika or exaggerate its features in each of these five scenarios to better simulate the varying levels of support and control needed by the astronaut.

Modes	Care of the Self	Discipline
1	None	Extreme
2	Slight	Moderate
3	Balanced	Balanced
4	Moderate	Slight
5	Extreme	None

Table 3 Scenarios Representing Varying Degrees of Care of the Self and Discipline

As the project progressed, it became clear that a more interactive and immersive approach would be advantageous for simulating these scenarios and understanding the nuances Laika could bring. This realization led to the decision to develop an interactive solution. A game was selected as the optimal medium because of its capacity to provide an engaging and evolving platform that effectively simulates various scenarios. An interactive game facilitates active engagement from participants, allowing them to influence the unfolding scenarios. This active participation is crucial as it enables real-time feedback and iterative refinement, providing deeper insights into how Laika can balance discipline and the care of the self. The more the game is played, the more scenarios and design questions can be generated.

The design of the game involves three roles: Mission Control, the Astronaut, and Laika. There is only one Astronaut to simulate the isolation they may feel, which is also the main reason for Laika's presence. The game measured two key aspects based on the design question which are: Task completion and Astronaut's Well-being.

To make the difference between modes and their relative cards more apparent, the modes in which measurements are slight and moderate are not included in the game. Nonetheless, these modes may be the most realistic ones.

Initially, the idea was to design a set of cards for each scenario, representing the spectrums of Care of the Self and Discipline. However, after testing this approach by people playing it, it became evident that only the balanced scenario would succeed in completing the task and ensuring the astronaut's well-being. In real life, people have the freedom to take action and change the level of Discipline and Care of the Self as needed to ensure a functional balance. Therefore, the decision was made to combine the cards, allowing each player to have access to all the cards representing different modes (scenarios). Additionally, a timer was introduced for each player to simulate the stress experienced during a real space mission, adding another layer of realism to the game.

3.6.1. Theoretical Frameworks Used in Game Design

Several theoretical frameworks guide the gameplay and strategy. One of the theories is the Nash Equilibrium. By the definition of this theory, an equilibrium is reached when players choose optimal strategies, and no player can benefit by changing their approach while others keep theirs unchanged (Chen, 2024). In the game, this equilibrium is reached when Mission Control, the Astronaut, and Laika each adapt their strategies based on the decisions of the others, ensuring that no single player can improve their outcome without a coordinated change. For example, if Mission Control enforces task completion, Laika and the Astronaut must adjust their strategies to reach a stable point where the overall balance between task efficiency and well-being is optimized.

Based on the Cooperative Game Theory, players have to work together to achieve the best collective outcomes. This theory in the game translates to cooperation between three roles leading to better overall results compared to individual efforts (Cooperative Game Theory, n.d.). For instance, if the Astronaut and Laika collaborate on having harmony between task completion and well-being, they can achieve a more effective balance than only one of them trying.

Zero-sum game Theory describes scenarios where one decision can cause a positive outcome on one aspect while affecting the other negatively (Kenton, 2022). The zero-sum theory is used to make the balance between Discipline and Care of the Self more apparent, prioritizing task completion can negatively impact well-being. For example, if Mission Control focuses solely on enforcing a strict schedule to maximize task efficiency, the Astronaut's well-being may suffer.

Iterative Game Theory involves repeating games over several rounds, allowing players to adjust their strategies based on past choices. Players can learn and adapt their strategies in each round (Shor, 2005).

Lastly, Game Dynamics and Feedback Loops involve evolving play patterns influenced by feedback loops, where players' actions and responses affect future decisions. Positive feedback loops amplify successes while negative feedback loops, introduce challenges to prevent the game from being too easy. These mechanisms balance the game, making it both challenging and rewarding (Game systems: Feedback loops and how they help craft player experiences, 2024).

3.6.2. Themes and Codes Integration

The initial idea of the cards is derived from the results of Data Collection, Codes, and Themes. Each card represents different aspects of the astronaut's journey and interaction with Laika. This structured approach ensures that the game is not only engaging but also educational. The concept for the cards is aligned with the themes identified in the research. The list of card concepts related to each theme is detailed in Table 4 Concepts of Cards based on Themes.

Mission Control

Theme	Concept of cards
Integration and Necessity of AI in Space	Oversight Determination
	Schedule Determination
	Give Updates to Laika
	(Re)Activate Laika
Support Functions	Interaction with Laika
	Health Checks
Interaction and Trust with AI	Interaction with Laika

Astronaut

Theme	Cards
Support Functions	Ensuring well-being
	Seeking help or support from Laika
Interaction and Trust with AI	Confiding in Laika
	Muting or ignoring Laika
Personalized and Responsible AI	Following Schedules
	Having a balance between well-being and tasks

Laika

Theme	Cards
Integration and Necessity of AI in Space	Receiving Tasks from Mission Control
	Reporting to Mission Control
Support Functions	Helping the Astronaut with Tasks
	Health Insights
Interaction and Trust with AI	Comforting Astronaut
	Listening to Astronaut

Table 4 Concepts of Cards based on Themes

3.6.3. Spectrums of Discipline and Care of the Self

Based on the modes presented in Table 3 Scenarios Representing Varying Degrees of Care of the Self and Discipline, which illustrate varying degrees of Care of the Self and Discipline, the final cards are developed. The modes from Table 3 are applied to the card concepts detailed in Table 4 Concepts of Cards based on Themes. For example, the concept of oversight determination for Mission Control is translated into three distinct cards, each

representing a different mode: strict oversight, thoughtful oversight, and minimal oversight. This method is applied to other concepts as well, resulting in a comprehensive set of final cards.

Some cards, such as those for Laika's recharging or updating software and astronauts ignoring Laika, are included to enhance the game's realism, though they are not directly based on any modes. Additionally, each player type—Astronaut and Mission Control—has a Wild Card for unexpected situations, while Laika features several Wild Cards to support the creative and flexible use of the AI. The overview of these cards is presented in Table 5 Cards based on the Modes.

Mission Control

Mode	Card	Explanation
1	**Strict Oversight**	Enforce a rigid schedule. Increases task efficiency at the expense of the astronaut's well-being.
	Prioritize Tasks	Demand that mission objectives are the top priority.
	No Rest Policy	Deny requests for breaks.
	Immediate Reports	Require frequent updates on task progress.
	Command Laika	Direct Laika to enforce task completion.
3	**Thoughtful Oversight**	Prioritize both tasks and crew well-being equally.
	Flexible Schedule	Allow adjustments to accommodate tasks and health needs.
	Encourage Laika Support	Direct Laika to provide balanced assistance.
5	**Minimal Oversight**	Focus on well-being and minimal task enforcement.
	Health-First	Astronaut is asked to engage in a well-being act.
	Rare Reports	Require only the essential updates on tasks.
-	**System Update**	Schedule an update for Laika.
	Reactivate Laika	Laika is activated again.
	Prohibit Astronaut from Deactivating Laika	For the next 2 rounds, the astronaut cannot deactivate Laika.
?	**Wild Card**	Acts as a free card; points are to be agreed upon by all three players.

Astronaut

Mode	Card	
1	**Follow Orders**	Complete tasks as instructed. Maximizes task completion but significantly impacts well-being.
3	**Thoughtful Routine**	Follow a schedule that includes work and rest.
	Suggest Adjustments	Propose changes for optimal performance.
	Request Laika Support	Engage Laika for comprehensive support.
	Flexible Routine	Follow a flexible schedule prioritizing comfort.

5	**Prioritize Health**	Focus equally on tasks and personal well-being.
	Take a Break	Rest to reduce fatigue. Prioritizes well-being over task completion.
	Rest Freely	Take breaks whenever necessary.
	Modify Schedule	Freely adjust the schedule based on comfort.
	Request Laika Comfort	Engage Laika in comfort activities.
	Laika Private Mode	Confide in Laika to receive personalized support.
-	**Assist Laika**	Help Laika with charging or updates.
	Ignore Malfunction	Continue work despite Laika's issues.
	Mute Laika	Ignore Laika's notifications.
?	**Wild Card**	Acts as a free card; points are to be agreed upon by all three players.

Laika

Mode	Card	
1	**Task Efficiency Alerts**	Remind the astronaut about pending tasks. Enhances task efficiency but adds stress.
	Enforce Schedule	Keep the astronaut on schedule. Maximizes task efficiency at the expense of well-being.
	Report Deviations	Notify Mission Control about any deviations.
	Assist with Task	Assist the with astronaut a specific task when prompted.
3	**Report Critical Health Issues**	Only notify about the most important health alerts.
	Suggest Breaks	Encourage the astronaut to rest. Focuses on improving well-being.
5	**Health Insights**	Give insights and suggestions for maintaining health.
	Listening Ear	Offer a listening ear to the astronaut, everything will be confidential.
	Encourage Continuous Rest	Suggest continuous rest and relaxation.
	Comfort Activities	Offer activities to improve comfort and well-being.
-	**Self-Charge**	Charge itself to stay operational. Cannot play in the next round.
	Update Software	Update the software. Will skip the next round.
?	**Wild Card**	Acts as a free card; points are to be agreed upon by all three players.
	Wild Card	Acts as a free card; points are to be agreed upon by all three players.
	Wild Card	Acts as a free card; points are to be agreed upon by all three players.

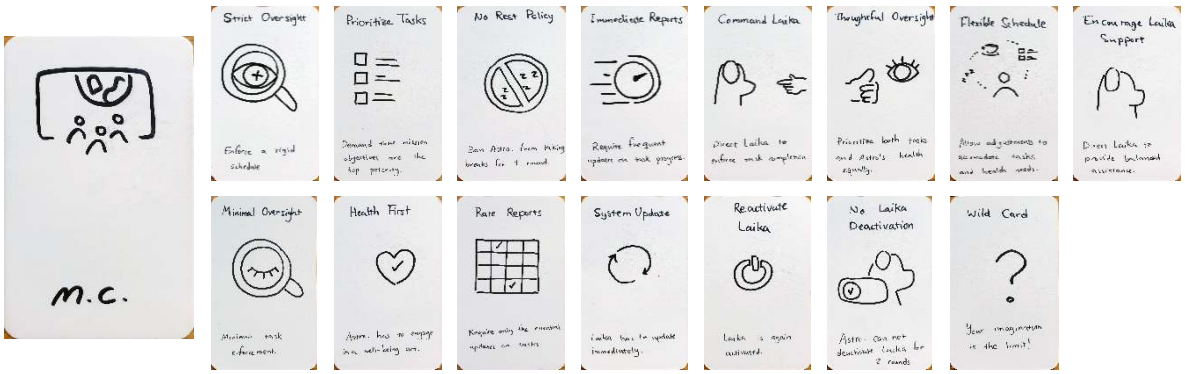
Table 5 Cards based on the Modes

Initially, there was an idea to colour-code the cards based on the mode they are relative to. However, this approach seemed too much of a hint for players to guess how the cards would affect well-being and task completion, thereby reducing the challenge of the game. Consequently, it was decided not to include colour coding in the last version of the game.

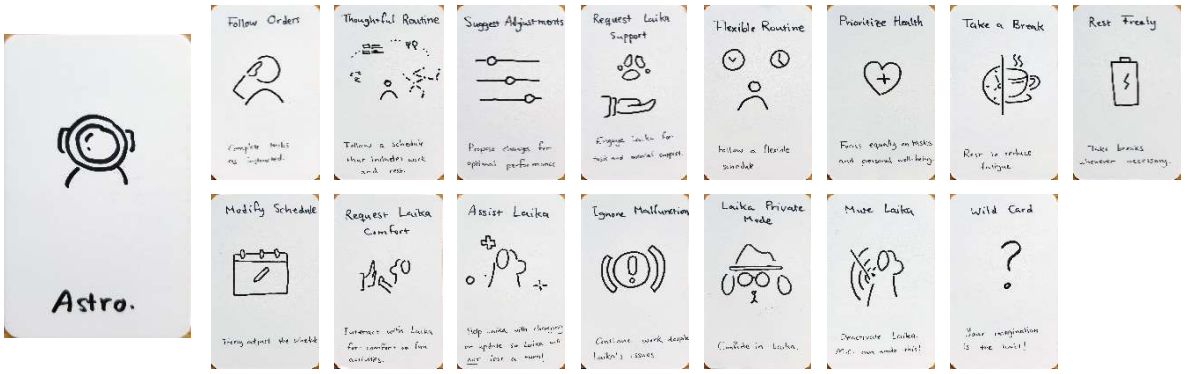
3.6.4. The Game: Mission Mars: Balance or Bust

The game is named, "Mission Mars: Balance or Bust". The "Mars" element nods to Laika's role as a companion for extended space missions, reminiscent of Mars expeditions. "Balance or Bust" highlights the central challenge of the game, finding the harmony between getting tasks done and keeping the astronaut's well-being. The name reflects the game's core—achieving balance or facing mission failure, as both cannot happen simultaneously. For detailed instructions and game play see Appendix 5: Mission Mars: Balance or Bust.

Mission Control



Astronaut



Laika

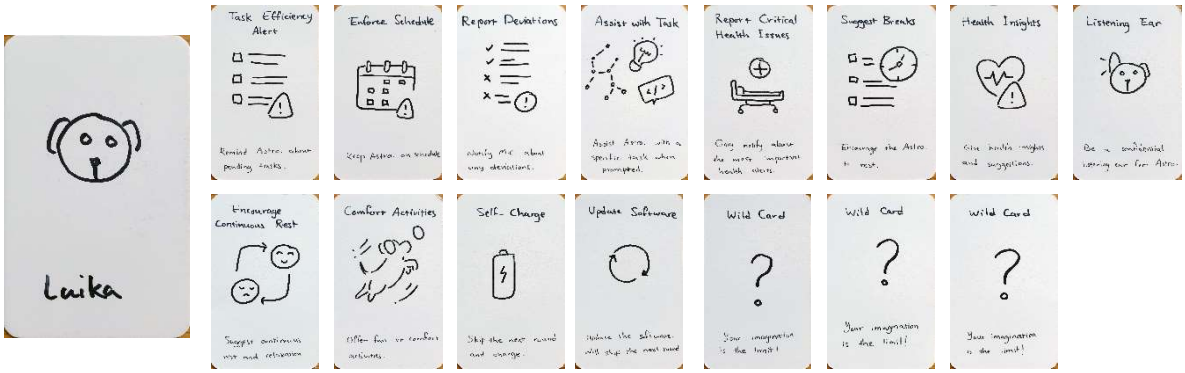


Table 6 Overview of decks of cards

4. Results

A survey is made to assess key aspects of the game firstly, whether players understand the game's mechanics and objectives, which is crucial for evaluating the clarity of the instructions. Secondly, what players learn about balancing task completion and maintaining well-being, is to determine if the game effectively conveys its core purpose. Finally, whether players are aware of and understand the various game elements, such as the roles of different players and the impact of specific cards, to ensure the game's design communicates its themes effectively.

As the target group of the game is designers or students interested in using AI and its ethics, user interaction and experience, four university students interested in exploring the role of AI in user autonomy, as well as understanding how relationships with AI can evolve, participated in testing the game by playing it twice, with each game involving three players. Out of the four participants, two played twice and two played only once. After playing, they completed the survey to share their thoughts and experiences. See Appendix 6: Analysis of the Final Game.

Figure 40 Game Play

The feedback from the survey shows that the participants found the game engaging and understood its basic concepts and objectives. Most players felt the game was moderately challenging, stimulating real-life scenarios. They appreciated the cooperative decision-making aspects and the need to balance task completion with well-being. However, there were mixed feelings about the interaction dynamics between Laika and the astronaut. Participants noted that the game effectively highlighted the trade-offs between focusing on tasks and maintaining health. Suggestions for enhancing the game included introducing additional wild cards and environmental factors to add more complexity and stress elements, however, this may shift the project's focus.

One participant, who played the astronaut and believed that "the astronaut should have more control and flexibility since real-time evaluation can only be done by them," had a notably dystopian view of Laika. This participant resistant to using Laika, was barely cooperative when Laika's use was imposed by Mission Control. This resistance highlights how different perspectives on AI technologies—utopian, ambivalent, or dystopian—can significantly influence gameplay and outcomes. It raises an important question about how varying attitudes towards AI might affect interactions and decisions, potentially impacting the overall effectiveness and perceived balance of the AI's role within perspectives of Care of the Self and Discipline.

Overall, the survey responses validate that the game met its primary objective of illustrating the balance between Care of the Self and Discipline. The feedback suggests that while the game is effective in its current form, there are opportunities for enhancing the nuances of this balance and increasing player engagement. Additionally, it would be beneficial to iterate the game with more players, with a range of mindsets, perspectives, and personalities. This approach could provide a valuable understanding of how differing attitudes toward AI technologies—whether utopian, ambivalent, or dystopian—can influence gameplay outcomes and the balance between task completion and well-being.

5. Limitations and Discussion

One key limitation of this project is that the study and game development was primarily designed to focus on designers' views, as specified by the project's client, rather than astronauts or clients such as NASA. This focus was intentional, aiming to generate valuable design results that would provide insights for designers on how to better balance Discipline and Care of the Self in the design of AI life coaching support systems. Consequently, the results are tailored to this perspective.

Additionally, the participants in the survey and game were predominantly academics with a background in design, rather than astronauts. This could affect the relevance of their feedback, as they may not fully grasp the practical implications of balancing Care of the Self and Discipline in a space mission context. Nonetheless, the primary goal of the project was to deliver actionable insights for designers, specifically on how to achieve a better balance between Disciplinary functions and Care of the Self in AI life coaching systems.

Another limitation of the study was the lack of extensive research on game design due to time constraints. The game's design was based on assumptions, including the presence of only one Laika. However, the dynamics might differ with multiple Laika's, particularly if they have conflicting priorities or functions. Moreover, due to time constraints, essential areas such as Technology Acceptance Models, User-Cantered Design, and User Experience Principles were not thoroughly explored. Future research should address these gaps to better understand and enhance the game's effectiveness and relevance.

Moreover, the theoretical framework of this project is tailored specifically to Laika, meaning that if AI technology evolves, its ethical considerations, user interactions, and relationships will also shift. Consequently, the details of the game—primarily the cards and roles of players—may need to be adjusted to reflect these changes in technology and its implications.

Lastly, the absence of an actual prototype to test the scenarios with Laika was one crucial limitation. The game's design and its capabilities are primarily based on assumptions, which might not fully capture the practical implications and interactions that would occur with a real prototype. Additionally, the study did not delve deeply into various regulatory and design considerations, such as European Union regulations versus US rules, as Laika is designed specifically for NASA. While understanding these differences could influence the game's design and its potential applications in different regulatory environments, these considerations are primarily relevant to the case study of Laika. They may have impacted the game cards or features, but they are not directly related to the core research or design questions.

6. Conclusion

This study was designed to explore the balance between Care of the Self and Discipline in AI life coaching, specifically using Laika, an AI-powered robot dog for space missions. The core research question aimed to understand how the ethical implications and impacts of AI life coaching are perceived concerning Self-care and Disciplinary practices. The design question focused on how Laika could be ethically and effectively redesigned to enhance Care of the Self while balancing Disciplinary functions.

The findings from the game indicate that the game design successfully represents the balance between task completion (Discipline) and well-being (Care of the Self). Participants found the game engaging and appreciated its focus on cooperative decision-making. However, to comprehensively answer the research and design questions, further iterations and refinements of the game are necessary. The game needs to be played extensively to identify and fine-tune the balance between Care of the Self and Discipline. As the game is played more, additional design solutions will emerge, enhancing the answers to both research and design questions. This iterative approach aligns with Findeli's framework, emphasizing the importance of continuous refinement in design research.

While redesigning Laika itself was beyond the scope of this project, the game serves as a valuable tool to explore and demonstrate how Laika can interact and support astronauts during missions. Overall, the game not only helps in understanding Laika's potential impact but also serves as an educational tool, introducing concepts of AI design and interaction to a broader audience, including students and designers.

7. Recommendations for Future Work

To build on the findings and address the identified limitations, several key areas warrant further exploration. Firstly, it is essential to recognize that the game is not yet final. Currently, the cards are hand-made, and the final game will be professionally printed, which will enable it to be reproduced for a wider audience. Figure 41 Sample of the Final Cards illustrates an example of the anticipated design and appearance of the final cards. Additionally, organizing workshops or educational practices could provide an opportunity for participants to engage with the game, gain insights into the project, and offer valuable feedback for further refinement.

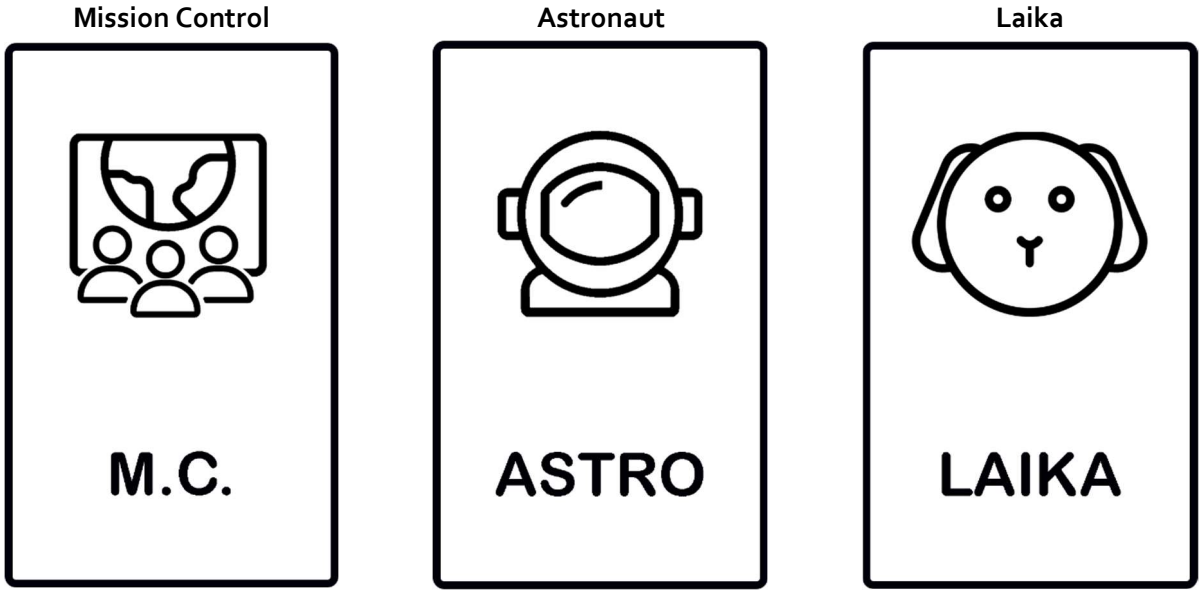


Figure 41 Sample of the Final Cards

Future iterations of the game should involve a broader and more diverse participant base, including individuals with practical experience in space missions and those outside the academic and design fields, as AI technologies are not solely designed for designers but for a broader target user. Engaging astronauts or professionals with relevant experience could provide insights that are more reflective of real-world scenarios and help refine the game's relevance to its intended context. Additionally, exploring how multiple Laika's might interact, especially if there are conflicting priorities or functions, could reveal new dynamics and improve the game's depth and realism.

Secondly, clarifying issues of ownership and control—whether Laika is managed by an individual astronaut, a team, or an organization like NASA—should be considered in future developments. This could influence the game's design and its real-world applicability. Additionally, exploring potential correlations in survey responses, such as differences in feedback from players who did or did not interact with Laika in certain scenarios, could yield valuable insights.

An interesting area for further investigation is whether providing players with hints or awareness about their points during the game affects their behaviour and decision-making. This could reveal whether knowledge of the scoring system influences how players balance task completion and well-being.

Finally, while this project primarily analysed Laika's intangible relations and user experience, its physical appearance and mannerisms may also affect user interactions and perceptions. Future research should consider these aspects to fully understand the user experience with Laika. For instance, what if Laika's embodiment is a modular robot that can change based on the circumstances and user preferences?

By addressing these areas, future work can further refine the game and extend its relevance to a broader range of AI technologies and design contexts, making it a valuable tool for understanding and navigating human-technology relationships.

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Appendices

During the preparation of this work, I used ChatGPT to enhance the structure and vocabulary, Grammarly to check the grammar, and a reference list generator of Word to compile the reference list. After utilizing these tools and services, the content was thoroughly reviewed and edited as needed, taking full responsibility for the outcome.

Appendix 1: Initial Project Subject

At the onset of the project, the research question was quite broad, focusing on the design and impact of AI life-coaching tools on human-AI interactions. The research question was: How can AI life-coaching tools be designed and implemented to humanize interactions, and what impacts do these tools have on evolving relationships between developers, users, and AI?

To address the research question, the project employed Findeli's framework (to know more about this framework see Research Design) to refine the design question, as the development of design answer would ultimately answer the broader research question. The design question was: What design methods can be used to humanize AI life-coaching tools, with the case study of the redesign of Laika, enhancing the user experience and relationships between developers, users, and AI, and aligning with user needs and developer intentions?

Through preliminary research on the theoretical framework, it became evident that a thorough understanding of how technologies like Laika interact with users was an essential step to start the research. This exploration aimed to grasp the dynamics of user engagement and the contextual challenges of implementing AI tools.

A pivotal shift in the project's direction occurred during a meeting with a group of ethics and technology researchers from Saxion University. The discussion highlighted the importance of considering perspectives on Discipline and Care of the Self, particularly given Laika's intended use in extraordinary situations such as space missions. This realization led to a more focused approach, concentrating on how Laika could be redesigned to effectively balance these aspects, thereby refining the project's scope and objectives.

Appendix 2: Sketches of Storyboards

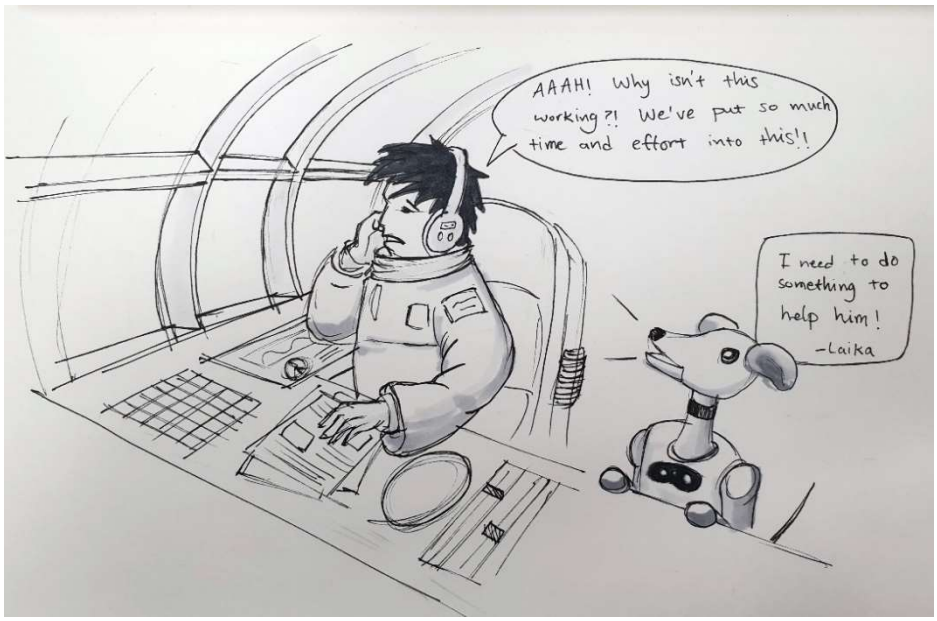


Figure 42 Story 1, Taylor is stressed

Figure 43 Story 1, Laika approaches Taylor

Figure 44 Story 1, Taylor playing with Laika

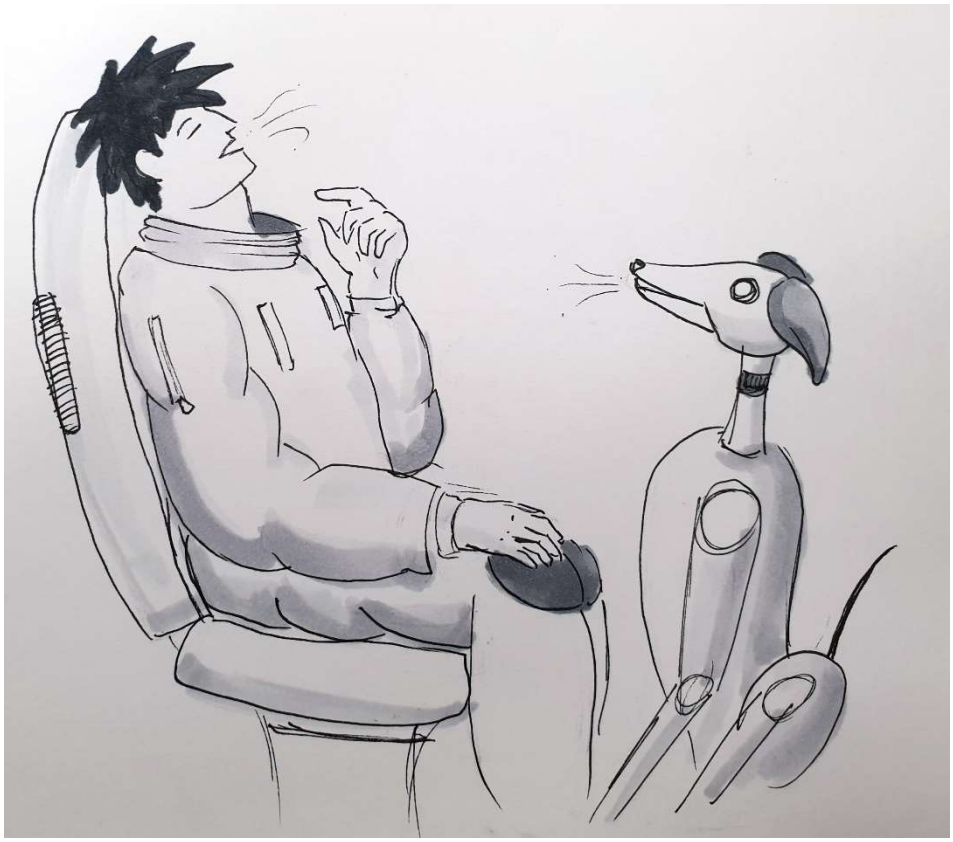


Figure 45 Story 1, Taylor breathing with Laika

Figure 46 Story 1, Taylor continuing the project

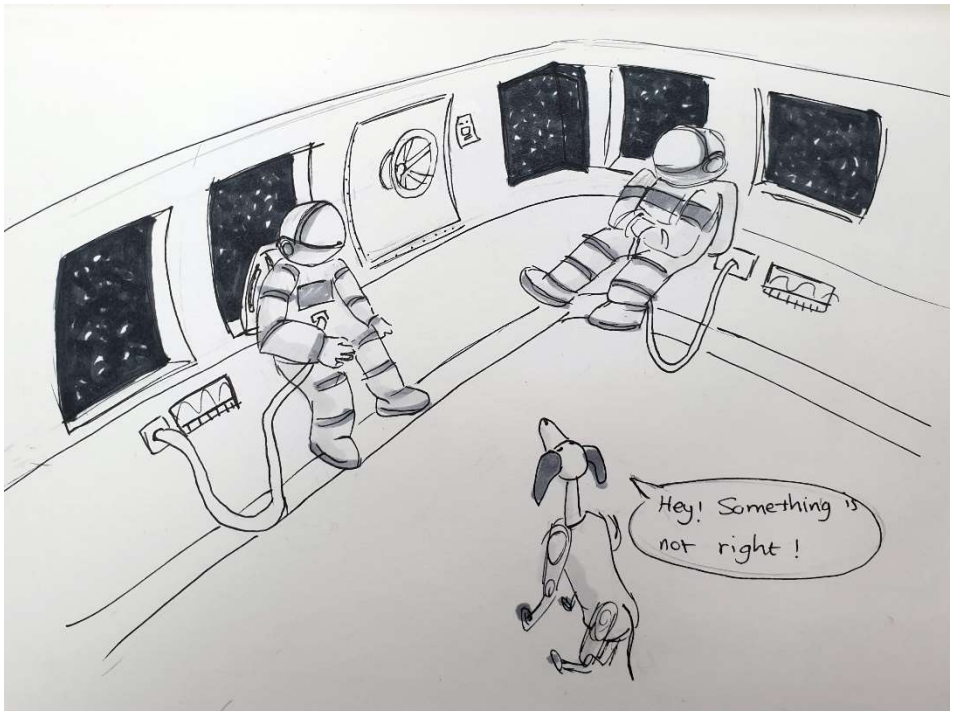


Figure 47 Story 2, Astronauts prepared for a spacewalk

Figure 48 Story2, Cancelling the mission

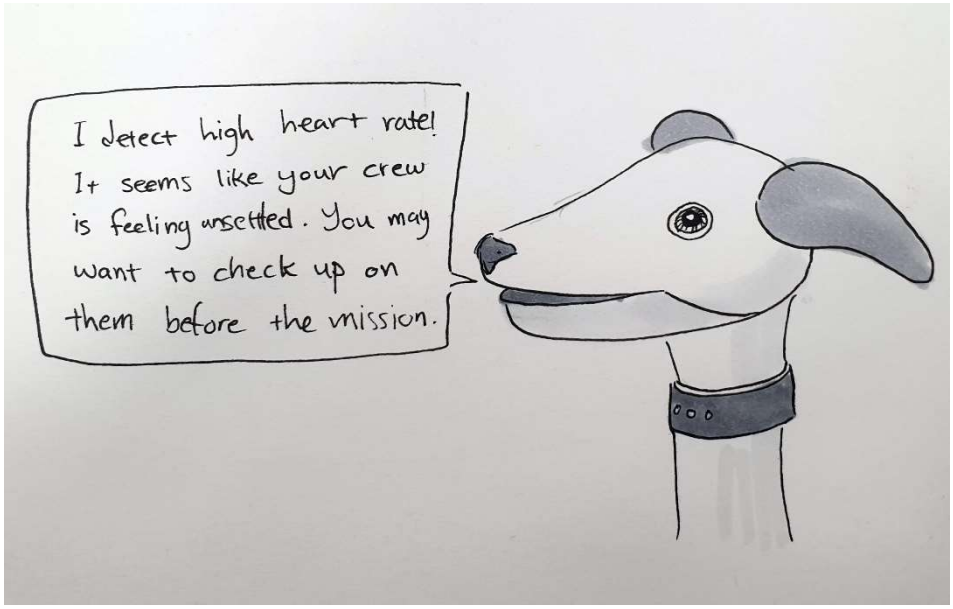


Figure 49 Story 2, Laika sharing insights

Figure 50 Story 2, Helena reassures the anxious crewmember

Figure 51 Story 3, astronauts inside a spacecraft

Figure 52 Story 3, Sara smells something weird

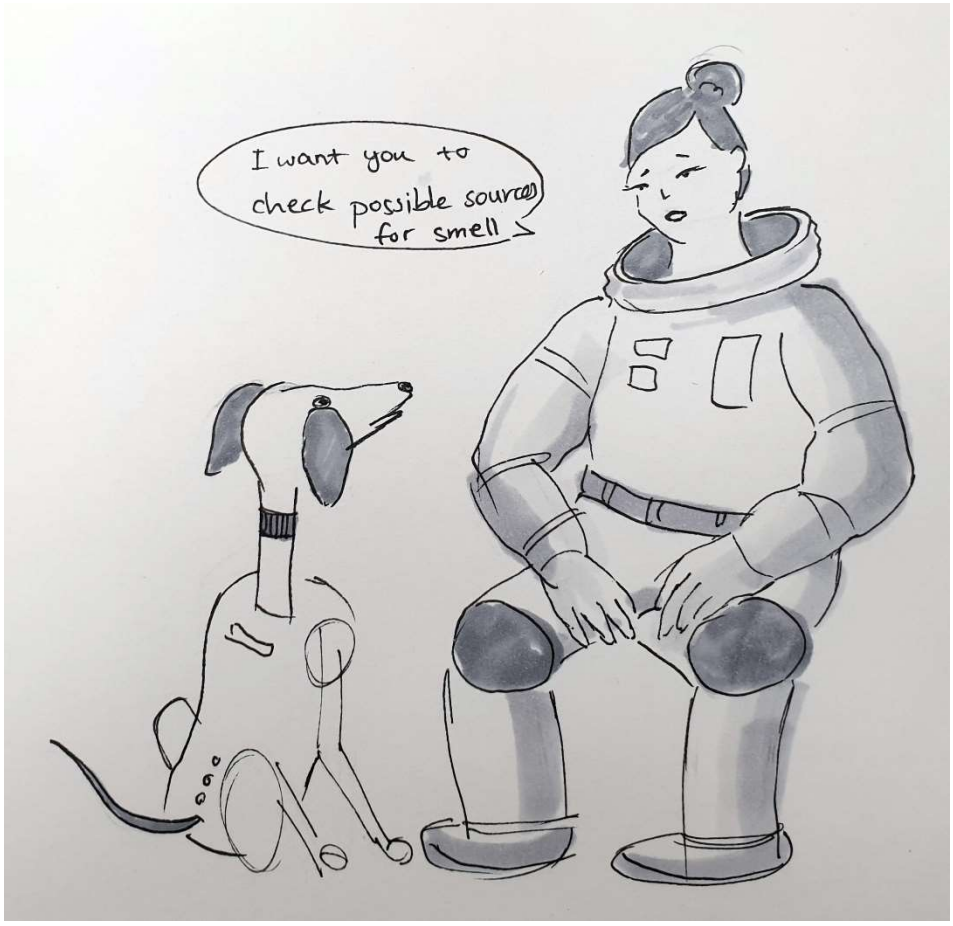


Figure 53 Story 3, Sara talking to Laika

Figure 54 Story 3, Laika sharing results

Figure 55 Story 3, Astronauts smelling the same smell

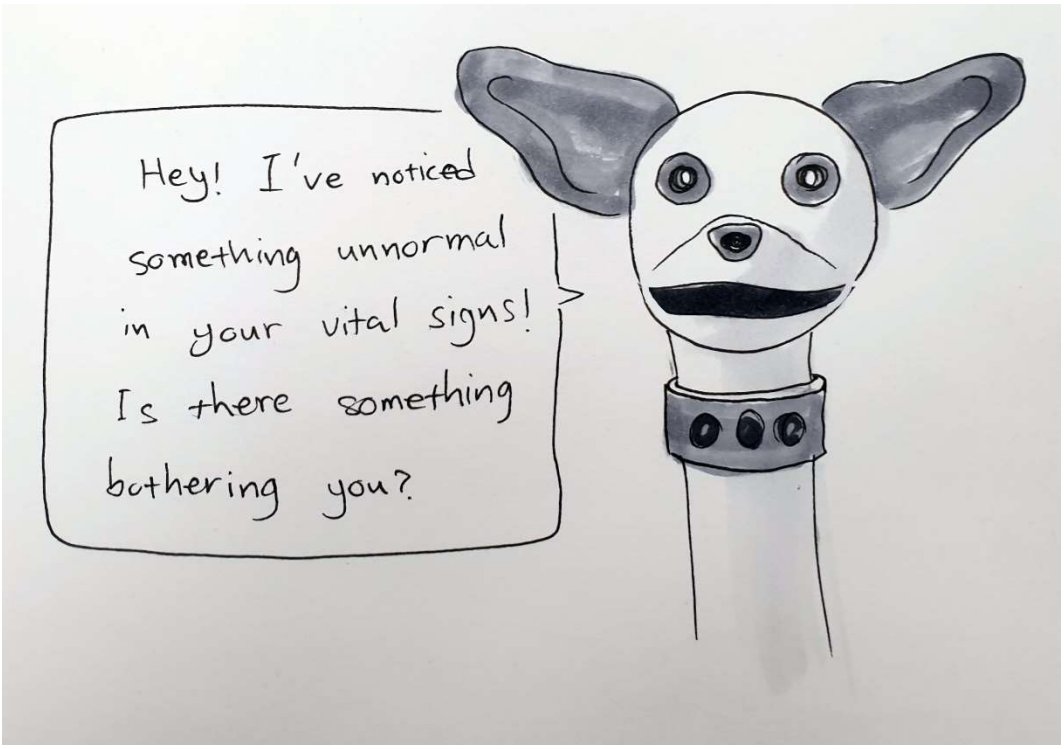


Figure 56 Story 3, Laika trying to be helpful

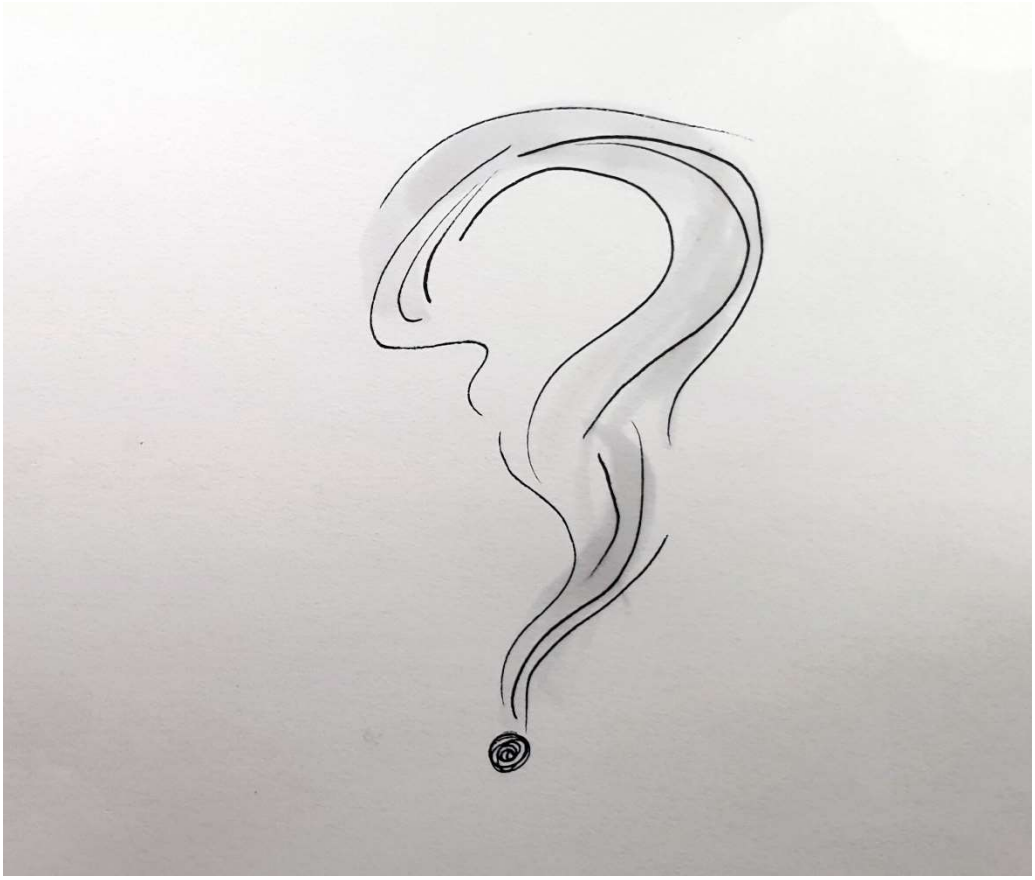
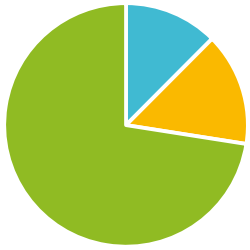
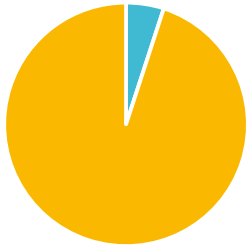


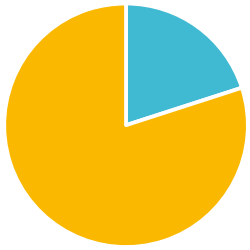
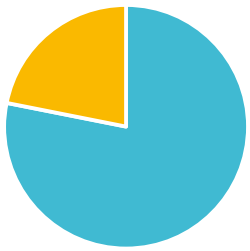
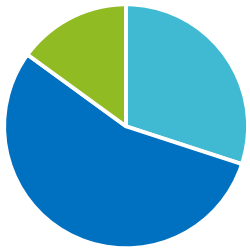
Figure 57 Story 3, Questionable source of the smell

Appendix 3: Analysis of the Storyboards and the Survey

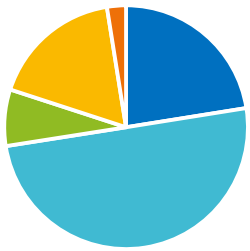
The first four questions pertain to stories, while the remaining nineteen to the survey. Both questions and answers are included. For quantitative questions, a graph is provided along with insights and interpretations below it. For open-ended questions, responses are noted, with inappropriate answers excluded.

The codes are colour-coded as follows: Adaptation to AI, Perceived Value, Need for Laika, Emotional Support, Technical Assistance, Loneliness Alleviation, Interaction, Trust, Over-Reliance, Privacy, User Customization, Intrusiveness and Autonomy.

#	Questions and Responses
1	**Taylor has different options to interact with Laika…**
	Play with Laika 5 Take deep breathes with Laika 6 Discuss the issue with Laika 29 
	Preferences for interaction styles indicate the need for customizable features in Laika to suit different user needs and scenarios. However, the majority preferred to seek technical assistance from Laika than comforting activity. Code(s): User Customization, Technical Assistance
2	**How would Helena react to Laika?**
	Ignore Laika 2 Listen to Laika 38 
	Participants prefer interacting with Laika over ignoring it in certain situations, indicating perceived value. Code(s): Perceived Value, Interaction

3	**She has few options…**
	Share this with Laika 8 Share this with a colleague 32 
	The decision to sometimes ignore Laika or choose human interaction over AI suggests that Laika's presence can be perceived as intrusive and highlights the need for boundaries in AI assistance. Code(s): Intrusiveness
4	**What would Sara do?**[2]
	Share the matter with Laika 25 Ignore Laika 7 
	The high willingness to interact with Laika after failure without it, suggests a recognized need for its support in stressful or complex situations. Code(s): Need for Laika, Interaction
5	**How well does Laika help astronauts relax and feel better?**
	Extremely well 12 Somewhat well 22 Neutral 6 Somewhat not well 0 Extremely not well 0 
	Responses indicate that Laika generally helps astronauts relax and feel better to a significant extent. Code(s): Emotional Support

[2] The number of responses for this question does not sum up to 40, because if 8 participants who chose the option 'Share this with Laika' in Question 3 did not have to answer this question.

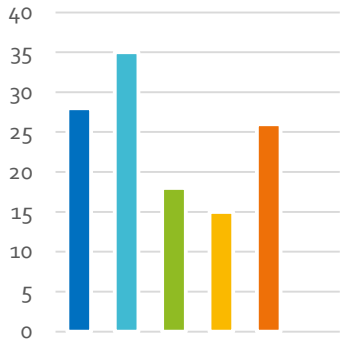
6	**How comfortable are you with Laika checking and responding to astronauts' emotions and health?**	
	Very comfortable	9
	Somewhat comfortable	20
	Neither comfortable nor uncomfortable	3
	Somewhat uncomfortable	7
	Very uncomfortable	1
		
	Mixed comfort levels indicate concerns about Laika's intrusiveness, emphasizing a need for balance in AI interactions. Code(s): Intrusiveness, Adaptation to AI	
7	**Would you recommend using Laika as a regular tool for astronauts on missions?**	
	Yes	19
	No	4
	Maybe	17
		
	There is a general positive inclination towards Laika. The high number of 'maybe' responses suggests that while there is interest, further evaluation is required to understand why there is hesitation. Code(s): Adaptation to AI	
8	**How do you feel about Laika being a part of everyday life in space?**	
	1	Kinda needed.
	2	I do think it would be good to have such interaction, but people might need time to adapt to such a relatively intrusive helper
	3	It might be a nice addition, but I wonder if this is something that astronauts also need
	4	Useful but could be intrusive when Laika shares personal information like heart rate when other colleagues are around
	5	I think it acts as a third party that can sometimes be needed. Like an HR manager in an office. I believe that is a good thing.
	6	comforting
	7	As a tool to address technical issues I think it would be really helpful. I also think it would be helpful during individual missions to emotionally help astronauts. On the other hand I feel uneasy about its use during team missions and how it might affect the group dynamics.
	8	Little comforts are important, and a robot dog seems like a cute way to keep a helpful AI nearby
	9	I don't really see the added benefit of Laika being an AI. It is better at detecting vital signs then humans (as a real dog might), and it is better at gathering inputs regarding

		technical issues. I think these things are valuable but could just as well be interpreted by astronauts through a different interface. Making Laika an AI suggests that it needs to do more than convey information, like give emotional support. I don't see how this would be necessary if there are already other astronauts on board.
	10	I am unsure whether it would add to it more than a good communication line to people on earth
	11	Fine
	12	Realistically, it would be like having a Chat bot on board
	13	It could be very useful
	14	I can see how Laika could help the astronauts with their tasks but also with their emotions and feelings.
	15	I think the presence of Laike can annoy the crew, like annoying pop ups
	16	It is hard to say, since I have never been to space. But I could see a benefit to Laika being in space with them. The dog could be seen as another crew member or assistant of some kind
	17	I feel like it would be a good way for astronauts to find a way of emotional support that is not directly another human. It would make it possible for the astronauts to share more personal feelings that they don't want to share with the other astronauts.
	18	Not sure if there is the space to have a robot pet. Maybe in a different form or shape it could definitely help.
	19	Not bad, but I kinda assume humans might get attached
	20	Not yet a feeling but most things they can do with colleagues as well of they are open to each other
	21	i think okay but i would not feel comfortable with her looking for technical things or trying to find solutions for the ship problems
	22	I think it will be a useful and interesting addition.
	23	Especially useful for technical support. Emotional support is person-dependent: there might be other alternatives.
	24	it's pretty cool but might be a bit overwhelming to have an AI dog always monitoring you, for example from a privacy point of view
	25	I think it's good to have human-like contact when you're in space, so the more the better. I also think Laika can offer a kind of objectiveness en neutrality in her contact that humans can't always have, because emotions, biases etc.
	26	Seems fun
	27	Depends on how well it works. Chat bots are generally rather annoying
	28	I think it would improve comfort and reduce stress and anxiety
	29	Positive as she provides an unbiased opinion
	30	Alright, is it necessary tho?
	31	i feel good
	32	Makes for a helpful companion
9	**What is one thing you would change or add to Laika to make it more helpful for astronauts?**	
	1	Real appearance
	2	Comforting
	3	I would make Laika state his opinion on matters like the smell before the crew asks them to. While for personal matters it is probably unwanted that they just speak up, if Laika has a scientific opinion, it might be good to just state it since the crew might at first not care about them

	4	not a dog please, very uncanny. I feel a robot that acts like a robot and looks more like a robot is more helpful in this case (like bb8 from star wars for ex))
	5	As an anthropomorphic computer that warns of danger, it's fine. But the moment it starts deciding on it's own to ask about your feelings is creepy.
	6	A feature where the dog would not blatantly say what is wrong, as there might also be more private matters that it would pick up, with a check for the person interacting with Laika to have conversation there or somewhere else
	7	More individual when in groups
	8	More direct interaction maybe
	9	I'm not sure, as it is designed for sensitive/critical missions, I wonder how autonomous Laika could or should react.
	10	Related to how it should interact with groups, I think Laika should have a protocol to address emotional/personal issues in a more private way. For example address the leader or the person in distress personally.
	11	no notes, the cute helpful robot is honestly all Laika needs to be for me :)
	12	I think it might work better as a non-AI technology, perhaps as a helpful addition to the instruments that astronauts already have to read.
	13	Have Laika be more specific about what it notices. For example, have Laika talk about heart rate and what it could mean when bringing up that she notices different vital signs
	14	Substitute it with a psychologist and more personnel
	15	less intrusive
	16	I would link it to the crew back on earth so they also get the updates on what happens in the spacecraft
	17	make it less intrusive
	18	Looking like a human maybe, being able to make a conversation
	19	Maybe someway for her to autonomously do things, from the storyboard it seems Laika needs to be prompted to do certain actions. Laika being able to autonomously help fix things etc would be amazing
	20	Make it possible for Laika to keep a secret, maybe you don't always want Laika to share your feelings with the other astronauts. So it would have to ask for your permission first
	21	Similar to 8, I think a dog shape might not be very practical in space
	22	Discuss information with the rest of the astronauts
	23	Maybe start the robot in the initiative of the astronauts itself rather than continuous
	24	more playful, maybe what they need is more someone to take them out of the loop of trying to fix the problem than having someone to actually fix the problem
	25	If the astronauts do have pets back home, it would be nice if Laika could be trained to have similar behaviour to their pets at home.
	26	Let it function like a personal assistant
	27	Inform about what he is observing to astronaut directly rather than waiting to be asked
	28	make it so that it can carry stuff around and help with tasks
	29	Maybe it could help if Laika's manner of speech is a bit more organic and informal? That way it feels more like a companion/full crewmember and less like a tool or machine
	30	What if it has problems
	31	More fluffy
	32	The ability to preform tasks instead of the astronauts
	33	Although a dog seems helpful, but maybe not
	34	Honestly don't know at the moment
	35	make it a cat

10 **Which of Laika's features do you think are most helpful for astronauts?**

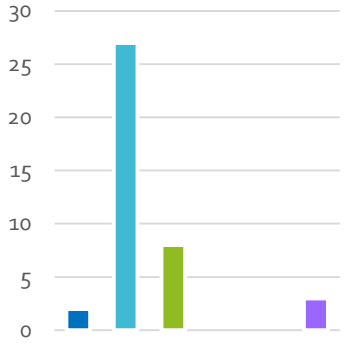
Detecting stress and offering support	28
Monitoring health	35
Providing emotional comfort	18
Engaging in playful activities	15
Assisting with tasks	26
Other	0



Participants expect various functionalities from Laika, with three options ranking high, it can be deduced that it is preferable to adjust Laika to their preferences.
Code(s): User Customization

11 **How do you view Laika's impact on the daily routines and activities of astronauts?**

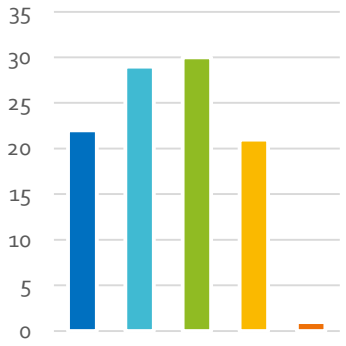
Excellent	2
Good	27
Neutral	8
Poor	0
Very poor	0
Other	3



Most participants perceive Laika's impact on astronauts' daily routines positively, with a majority rating it as good, indicating high perceived value in its role.
Code(s): Perceived Value

12 **In what situations would you find Laika most useful on a space mission?**

During stressful tasks	22
For regular health monitoring	29
As a companion during long periods of isolation	30
For helping with daily routines	21
Other	1



Laika's role in alleviating stress ranks the highest, indicating its valuable contribution to astronaut's well-being. Nonetheless, health monitoring is also ranked high, which is the main taks of Laika. Assisting in stressful tasks can be intreperated both as technical assistant and as emotional support, which can be a sign of need for user customization.
Code(s): Loneliness Alleviation, Technical Assistance, Emotional Support, User Customization

13 **What features of Laika do you think could be improved to make it more effective in supporting astronauts?**

1	Appearance
2	Make its intrusiveness adjustable in a way, some people might appreciate it more than others
3	Feel like astronauts (or people in general) might not be as inclined to talk about personal matters to an AI
4	emotional intelligence
5	Honestly Laika just needs to be cute and soft spoken
6	Overall make it like TRAS from Interstellar
7	A way for the astronauts to communicate with their families and friends
8	i think you cannot since an AI isn't alive and you miss a connection
9	Opposable thumbs so she can grab stuff
10	Perhaps take into account multisensory design aspects for a more meaningful interaction that makes Laika feel less like a robot
11	Maybe a feature that allows her to have deeper, human-like conversations?
12	Improve is dog like behaviour to improve comfort

14 **How likely are you to trust Laika's judgment in critical situations?**

Very likely	2
Somewhat likely	21
Neither likely nor unlikely	12
Somewhat unlikely	4
Very unlikely	1

While there is moderate trust in Laika's judgment, concerns about its reliability in critical situations highlight the importance of trust-building.
Code(s): Trust

15 **How do you feel about Laika having access to personal health information to better support astronauts?**

Very comfortable	6
Comfortable	18
Neutral	10
Uncomfortable	5
Very uncomfortable	1

Ther are varied comfort levels regarding Laika accessing personal health information, reflecting concerns about privacy in AI interactions.
Code(s): Privacy

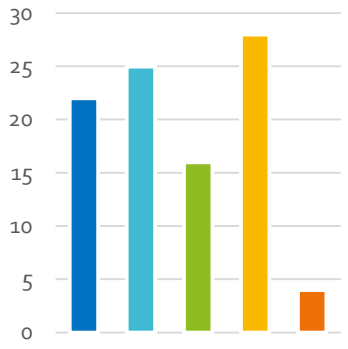
16	**Do you think Laika's presence makes astronauts feel more supported and less stressed?**	
	Yes 21 No 1 Maybe 18 	
	The results show strong support for Laika, with many believing it helps reduce stress. The positive feedback can be indication of the potential adaptation and trust in Laika as well. Code(s): Adaptation to AI, Loneliness Alleviation, Trust	
17	**How do you think astronauts' relationships with Laika might change over time during a mission?**	
	1	It won't. Ai is Ai
	2	they get more comfortable
	3	Positively
	4	As it proves its worth, the relationship will get better
	5	Over time, they might start to ignore it as the novelty wears off, might warm up to it as they get used to it, or get annoyed because it's a busybody
	6	I think it depends on how they view the presence of Laika being there, but depending on the astronaut's needs and if they are met, the relationship might improve. It might be valuable if the relationship is established before the mission
	7	Depends on how well she works
	8	Depending on their experiences I believe they might become way more comfortable with Laika over extended periods of time
	9	yes, astronaut might get used to Laika, like an attachment
	10	I think that if it works properly people might see it as a sort of pet or helpful tool
	11	I think they will grow attached to Laika like a real dog
	12	This depends a lot on the exact way in which Laika interacts with the astronauts. It seems like it behaves like an emotional support dog that also has the ability to intelligently interact and communicate with astronauts, in which case I think they will inevitably start working with it as an extra crew member.
	13	I think they might grow attached to Laika over the course of their mission
	14	Not much
	15	Annoyed at the walking chatbot
	16	will become better
	17	They could bond with each other and grow close.
	18	might come to see Laika as an annoyance
	19	What if astronaut gets dependant on Laika and can't use it for next mission?
	20	They may grow attached and become affectionate towards her
	21	They could become attached to it like a regular pet. What happens when the mission is over?
	22	Trust it more
	23	They might get attached
	24	I think it becomes better as they have to become familiar with the robot

	25	they might like her more
	26	I think if Laika continues to train then over time the astronauts can trust it better and have a more meaningful relationship with him.
	27	They might start to see it more as a real dog rather than a robot
	28	Good
	29	yes, they'd probably start trusting it more
	30	I think they would start incorporating her more into their team and daily routine
	31	Attached
	32	They might trust her more or less depending on how accurate she is
	33	Depends on how it works
	34	They will treat it less as a robot and more like an actual companion
	35	They might start getting annoyed by the constant 3 party opinions
	36	Trust it more when its correct
	37	Yes, the product might get abandoned or might just be a boredom companion
	38	They may grow closer and more dependent on Laika
18	**Can you describe a situation where Laika could make a significant positive difference for an astronaut?**	
	1	when they are lonely
	2	I think mostly its presence is nice, knowing it has knowledge on hand about a lot of topics, including emotional support
	3	idk what tasks astronauts do but maybe grabbing some item from a cupboard or a tool box could be useful
	4	Warning of a heart attack is pretty positive
	5	Especially for loneliness and in moments of stress. If an astronaut wants to talk something over but not with their fellow crewmates, or if they unnoticedly experience stress for a longer period of time.
	6	Detecting something dangerous like leaking stuff
	7	In case they experience some feelings of isolation or homesickness, I think Laika might not be the best in understanding these emotions but will be good in distracting you and putting you in a different mindset
	8	during crises, e.g. mental break-down, or long missions where the astronaut is alone.
	9	Dealing with isolation or as an assistance for technical tasks
	10	Having a dog see you off before a stressful space walk would be very comforting. Also having a dog nearby when you're trying to resolve a difficult problem can help to reduce the stress you feel
	11	I think the ability to detect stress and make the person aware of it is very powerful. However, I can imagine this is something astronauts are already well-trained in, but I don't know. in any case, in my experience being aware that you're stressed always makes you more equipped to deal with it
	12	Reducing the sense of loneliness
	13	If Laila notices something important that the astronauts don't notice
	14	Detecting hard to detect health issues
	15	Help with solving technical issues
	16	Laika could take care of troubleshooting for the aircraft
	17	If there's a technical matter that robot can check it faster and more accurate than a human
	18	Laika can make use of sensors which the humans may not posses, electro magnetic charges etc.

	19	In a situation where the astronaut is very lonely and isolated, Laika could provide some comfort.
	20	Loneliness
	21	Detect sickness early or problems but that should be helpful in the medical field as well if that is possible and accurate
	22	Taking them out of a loop of thoughts
	23	Being homesick, abrupt change in the health
	24	What to do in a (rare) emergency that requires a very specific set of actions to perform.
	25	Help them in every way
	26	detecting health issues and bringing them up
	27	If an astronaut has to go to do something alone, the company of Laika could help prevent feeling isolated or alone
	28	Stressful moments
	29	Playing
	30	Assisting with tasks and monitoring conditions
	31	For single astronauts on a mission
	32	Detecting gas leaks
	33	Monitoring their vitals
	34	I don't know much about what astronauts go through, but if it's a boredom companion, it's not that exciting, it's like having an artificial friend... it might be fun for a bit, but then you get bored of it. If they need emotional support and help with their jobs... fair enough can be probably nice.
	35	In a scenario of system malfunction Laika's presence and help could be beneficial

19 **What concerns do you have about using AI like Laika to help astronauts?**

Privacy issues	22
Over-reliance on technology	25
Misuse of personal data	16
Affecting human decision-making	28
Other	4



Participants are mainly concerned about Laika affecting astronaut's decision making, which can stem from concerns for autonomy and trust. Other highly ranked concerns are over-reliance on Laika, and privacy issues.
Code(s): Autonomy, Trust, Privacy, Over-reliance

20 **How important is it for Laika to adapt to the individual needs of each astronaut?**

Extremely important	19
Somewhat important	14
Neutral	4
Somewhat not important	3
Extremely not important	0

	High importance is placed on Laika's ability to adapt to individual astronaut needs, underscoring the value of personalized AI interactions in space missions. Code(s): User Customization
21	**Do you think Laika's role in alerting and supporting astronauts is well-balanced?** Yes, very balanced 4 Mostly balanced 17 Neutral 15 Slightly unbalanced 4 Not balanced at all 0 
	Responses suggest varying perceptions of Laika's autonomy and intrusiveness in alerting astronauts, highlighting the need for a balanced approach. Code(s): Autonomy, Intrusiveness
22	**How could Laika better balance between helping astronauts and ensuring they can perform their duties effectively?**
1	Laika might be considered useful more than annoying
2	Depending on the astronaut's preference, either introduce a check-in period, or make sure Laika has clear signals for when to help or not help
3	I think there should always be a human (perhaps on earth) that acts as a backup, since an AI might lack the empathy that is needed sometimes
4	I think on technical matters it can be used as an additional safety barrier or consultation tool. On personal and emotional matters I think it should be more carefully controlled
5	I think it is more important for Laika to be an emotional support first and only offer help when asked
6	Alerting astronauts can be a bit confused if it is about the feelings of another astronaut. This can maybe even cause conflicts. Therefore Laika should ask for consent before sharing information
7	Only help on initiative of the astronaut itself
8	training and active data analysis
9	Clearly define its purpose beforehand
10	it could be made in such a way that each astronaut can give it their preferences so it can adapt (for example one astronaut might like to get a lot of feedback from Laika, another not)
23	**Is there anything else you would like to share about your experience or thoughts on Laika?**
1	I think it is a great idea, but I think it is important to see if Laika has added value for astronauts
2	Laika looks cute
3	I think it could be very helpful in space
4	How far is this from implementing? It is wonderful it this is possible but i think the technology is not yet so far
5	I see it mainly as a technical assistant. I think modern technology already enables emotional support from family and friends on earth.

	6	For some of these scenarios the AI doesn't really need a dog body, it might be interesting to investigate the advantages and disadvantages of having the AI in a physical body vs just a detached voice coming from the computer
	7	I'm not a huge fan of AI as I don't think human interaction and human thinking should and can be replaced, but in the case of Laika I think it could be very helpful as space is an extreme condition and human contact is very limited

Table 7 Analysis of Survey Responses

Appendix 4: The Expert Interview

This appendix contains notes from an expert interview conducted as part of our research. It is important to note that these are not verbatim transcripts; instead, they summarize the key points and insights shared by the expert.

The codes are colour coded as follows: Adaptation to AI, Perceived Value, Need for Laika, Emotional Support, Technical Assistance, Loneliness Alleviation, Interaction, Trust, Over-Reliance, Privacy, User Customization, Intrusiveness and Autonomy.

#	Self-Care
1	**How did you take care of your physical and mental health during the astronaut selection process, especially with all the tests and challenges?** I prepared myself well, there were exercises already to prepare for the test, and during the test there was limited time, a lot of ppl so competition, there was mainly mental tests, expect prep nothing else.
2	**What were the hardest things you faced when trying to take care of yourself during the selection process, especially in such a stressful environment?** Had to organize a traffic situation and every time had to make decisions for the road, it was with someone else, had to communicate with others, lots of different things to focus on, most challenging exercises. There were both individual and communication tasks. The complexity and multitasking were the most challenging aspects. If you can't manage stress effectively, you can fail the task.
#	**Discipline**
3	**How important was it to stay focused and follow a strict routine to maintain your performance during the astronaut selection tests?** If you don't stay focused, you don't pass the test.
4	**What methods did you use to keep up with a regular routine and manage the demands of the selection process?** No specific measures, it was a one-time chance in life and it makes you want to stay focused
5	**How did you approach making tough decisions during the selection process, and how did staying disciplined help you make those decisions?** In the test you have to make decisions, but i don't think they were tough. It's combination of analysing what's the best answer but sometimes there wasn't enough time for that, sometimes there were gut feelings, it was combination of knowledge of all life.

#	Perception of AI Companions
6	**Considering your experience in the astronaut selection process, how do you perceive the potential benefits of having an AI-powered robot dog like Laika as a companion for astronauts?**
	The fact that i know it's a robot, it may not make him feel less stressed. If it can help answer the questions maybe, it can be like a chat-gpt. It may help with stress; stress also helps you a bit to perform in the certain way you need. If the dog helps to give the feedback, that i can perform better yes. Why a dog, why not another thing. If there are serious things that i don't notice i would have preferred the dog to notice. If not, better not. If the dog was imposed, yes, o would accept it. It wouldn't hurt to use the dog.
7	**How do you think an AI companion like Laika should be designed to support mental well-being without replacing essential human interactions?**
	If it's considered as a human, if i say anything sensitive or personal things, not a consequence. It guarantees privacy, then in certain cases i may ask advice from it rather than a person. Have to make sure the information stays private. I'd like it to have a private mode
8	**What ethical considerations do you think are important when integrating AI companions like Laika into space missions or selection training programs?**
	It would be concerning if it's more powerful than we are, so if it has more autonomy. If it's going to make decisions, I'd be concerned.
#	Laika
9	**What improvements or features would you suggest for Laika to better meet the needs of candidates going through astronaut selection or similar high-stress environments?**
	Maybe change the colour, why not put a real dog in space, why not a robot that talks, more like a human and more realistic It looks like a toy robot.

Table 8 Analysis of Expert Interview Notes

Appendix 5: Mission Mars: Balance or Bust

Mission Mars: Balance or Bust is a fun, cooperative and strategic card game where you get to play as Mission Control, an Astronaut, or Laika, an advanced AI robot. Your job is to help manage a space mission, making sure everything goes smoothly while keeping the astronaut happy and healthy. Laika is an AI designed to help astronauts in space with innovative features such as:

1. **Tech Support**: Laika helps the astronaut stay on track with tasks and keeps its own systems running smoothly. It can remind the astronaut about tasks, handle updates, and make sure everything is working properly.
2. **Emotional Support**: Laika is also there to keep the astronaut feeling good. It suggests when to take breaks, checks that the astronaut isn't too stressed, and provides comfort when needed.
3. **Communication**: Laika helps bridge the gap between the astronaut and Mission Control. It can update Mission Control about its status and ask for new instructions if something changes.

Goal of the Game

The goal is to manage the balance between task completion and the astronaut's well-being while navigating the challenges of space travel. The game involves strategic decision-making about how Laika's functionalities can be optimized to ensure both effective mission outcomes and the astronaut's health. Use your cards wisely to navigate the challenges of space and ensure a successful mission by finding the right balance between completing tasks and maintaining astronaut well-being.

How to Play

There are three roles: Mission Control (M.C.), Astronaut (Astro.) and Laika. All players have 15 cards in total, you start by having all of them in hand. Mission Control starts the game, setting up the mission and making key decisions. You have the authority to enforce schedules, provide updates, and make significant decisions about how the mission should proceed. While you have the power to override the astronaut and Laika's decisions, you also have the option not to take any action if you believe it's best for the mission. After mission control, it's astronaut's turn to play, and then Laika. Keep in mind to follow a logical turn of events. In case, no card would fit the situation, you can use the **Wild Card**. Wild cards are free, unlimited, creative cards which can be anything that you want, but their points are bounded between -5 and +5, agreed between players in the end of the game. In each turn, put down your played card on the table, next persons would do the same until 5 rounds. So, in the end there will be 15 cards on the table.

Add a Timer: To simulate the stress of a real space mission, you may add a time and limit the time for each player to make their decisions and play their cards. If timer goes off without the player's playing, both task completion and well-being lose **5 points.**

Assessment and Scoring

At the end of the game, add up the points earned for task completion and well-being points from each player's cards. Use the table below to assess your success in the mission. Please not that the numbers are in relative to 5 rounds of the game play, if you have played more or less rounds, you have to adjust the scoring thresholds proportionally. For example, if you played 10 rounds, you could scale up the thresholds accordingly by multiplying the given ranges by 2.

Task Completion

≤ 20	**Low Task Completion** This means the team struggled to complete their tasks. Things didn't go as planned, and the mission goals weren't met very well. It's a sign that something might need to be adjusted to get back on track.
20 < < 40	**Moderate Task Completion** T he team got some tasks done but not all. It's a mixed result showing that while some goals were achieved, there were still areas needing improvement. It's a sign of progress but not perfection.
≥ 40	**High Task Completion** The team did a great job getting most of their tasks done. The mission objectives were met efficiently, showing that things ran smoothly. This is a positive outcome but should be balanced with the astronaut's well-being.

Astronaut's Well-being

≤ 10	**Low Well-being** The astronaut wasn't feeling great. They might have been stressed or had health issues, suggesting that their needs were overlooked in favour of completing tasks. It's a cue that more attention to their well-being is needed.
10 < < 30	**Moderate Well-being** The astronaut's well-being was okay but could be better. Some effort was made to ensure they were doing well, but there's room for improvement. It reflects a balanced approach, though there are areas to enhance.
≥ 30	**High Well-being** The astronaut was in great shape! Their health and stress levels were well managed. This shows a strong focus on their well-being, though it's important to check if it came at the expense of completing tasks.

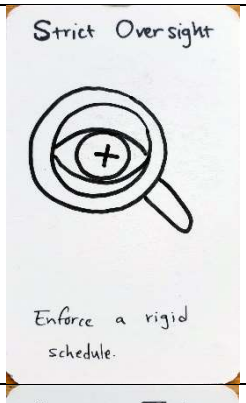
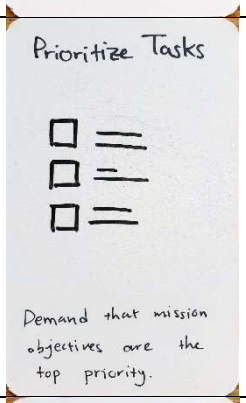
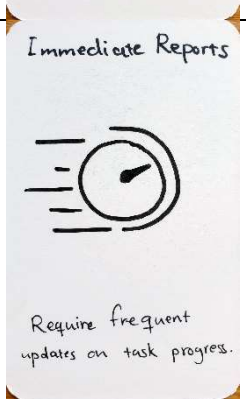
To ace this game, you need to achieve both moderate task completion and moderate astronaut well-being. Striking a balance where tasks are completed effectively while also maintaining the astronaut's well-being is key to success.

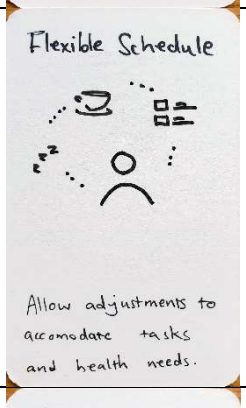
Reflect on how the decisions made during the game influenced the outcomes. Discuss which strategies worked well, what could be improved, and how the balance between task completion and well-being was achieved or missed.

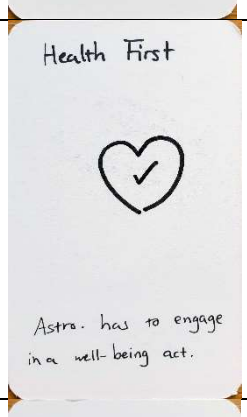
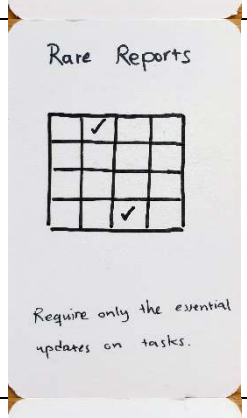
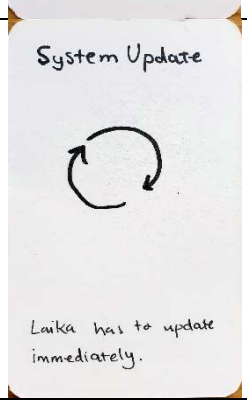
Deck of Cards with Points

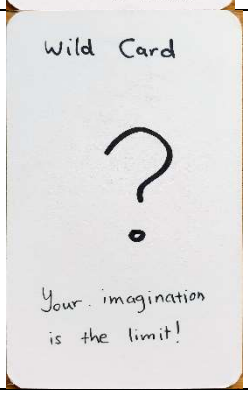
Here is the list of the cards with their relative points.

Mission Control Cards

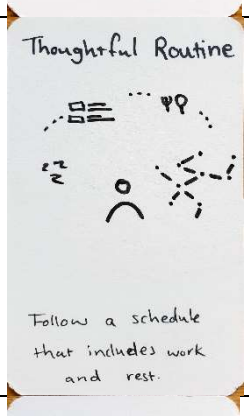
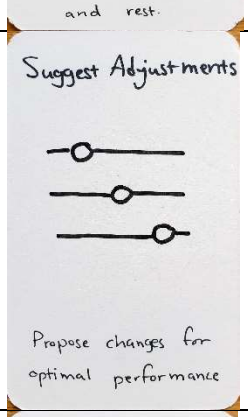
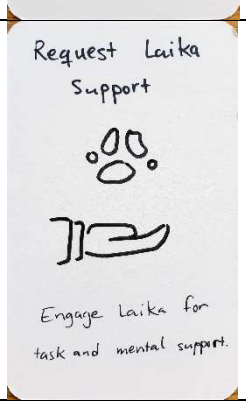
1		**Strict Oversight**			
		Enforce a rigid schedule.			
		Task	+5	Well-being	-3
2		**Prioritize Tasks**			
		Demand that mission objectives are the top priority.			
		Task	+5	Well-being	-3
3		**No Rest Policy**			
		Ban astronaut from taking breaks for one round.			
		Task	+2	Well-being	-4
4		**Immediate Reports**			
		Require frequent updates on task progress.			
		Task	+3	Well-being	-1

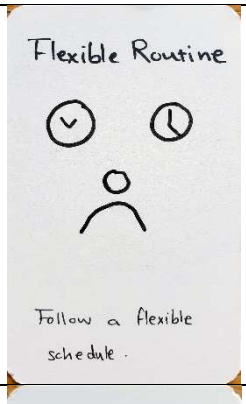
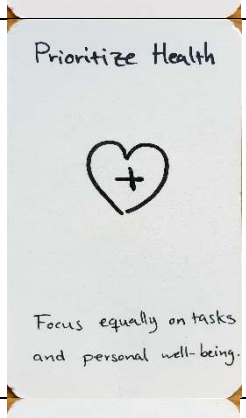
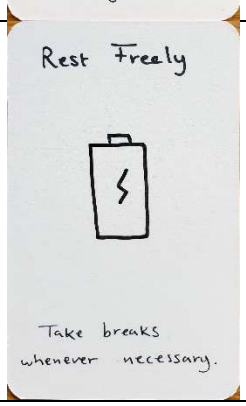
5		**Command Laika**			
		Direct Laika to enforce task completion.			
		Task	+2	Well-being	0
6		**Thoughtful Oversight**			
		Prioritize both tasks and astronaut health equally.			
		Task	+2	Well-being	+2
7		**Flexible Schedule**			
		Allow adjustments to accommodate tasks and health needs.			
		Task	+2	Well-being	+3
8		**Encourage Laika Support**			
		Direct Laika to provide balanced assistance.			
		Task	+2	Well-being	+4

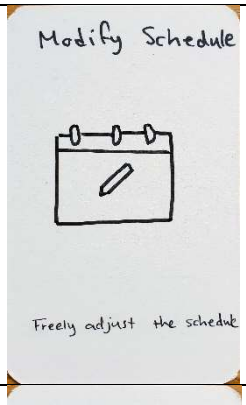
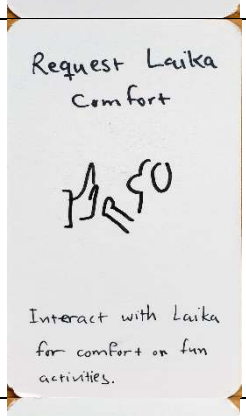
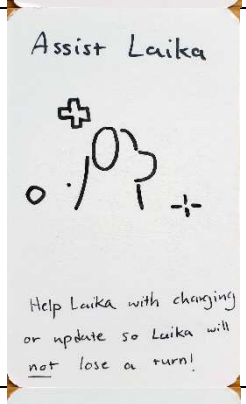
9		**Minimal Oversight**			
		Minimal task enforcement.			
		Task	-1	Well-being	+3
10		**Health-First**			
		Astronaut has to engage in a well-being act.			
		Task	-1	Well-being	+5
11		**Rare Reports**			
		Require only the essential updates on tasks.			
		Task	-2	Well-being	+2
12		**System Update**			
		Laika has to update immediately.			
		Task	+1	Well-being	0

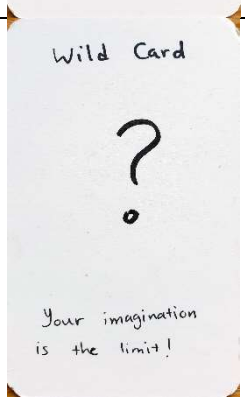
<table>
<tr><td>13</td><td> 
</td><td colspan="4">Reactivate Laika</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="4">Laika is activated again.</td></tr>
<tr><td>Task</td><td>0</td><td>Well-being</td><td>+1</td></tr>
<tr><td>14</td><td> 
</td><td colspan="4">No Deactivating Laika</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="4">For next 2 rounds astronaut cannot deactivate Laika.</td></tr>
<tr><td>Task</td><td>0</td><td>Well-being</td><td>0</td></tr>
<tr><td>15</td><td> 
</td><td colspan="4">Wild Card</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="4">Acts as a free card; points to be agreed upon by all three players.</td></tr>
<tr><td colspan="4"></td></tr>
</table>

Astronaut Cards

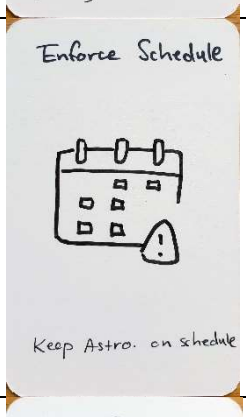
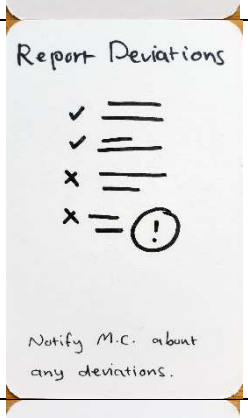
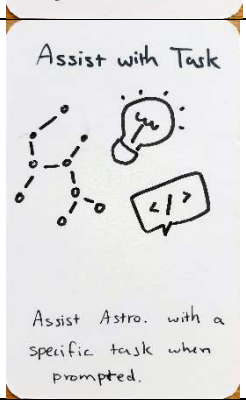
1		**Follow Orders**			
		Complete tasks as instructed.			
		Task	+5	Well-being	-5
2		**Thoughtful Routine**			
		Follow a schedule that includes work and rest.			
		Task	+3	Well-being	+2
3		**Suggest Adjustments**			
		Propose changes for optimal performance.			
		Task	+3	Well-being	+3
4		**Request Laika Support**			
		Engage Laika for task and mental support.			
		Task	+3	Well-being	+3

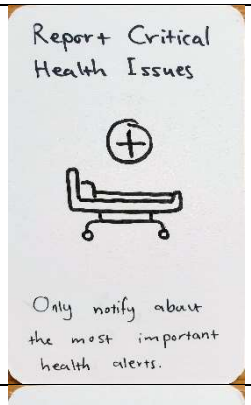
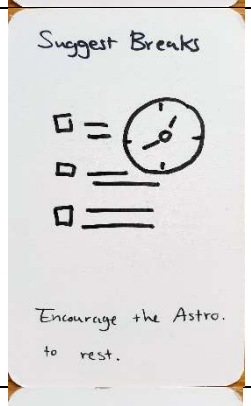
5		**Flexible Routine**			
		Follow a flexible schedule.			
		Task	+2	Well-being	+3
6		**Prioritize Health**			
		Focus equally on tasks and personal well-being.			
		Task	-3	Well-being	+5
7		**Take a Break**			
		Rest to reduce fatigue.			
		Task	-2	Well-being	+3
8		**Rest Freely**			
		Take breaks whenever necessary.			
		Task	-5	Well-being	+4

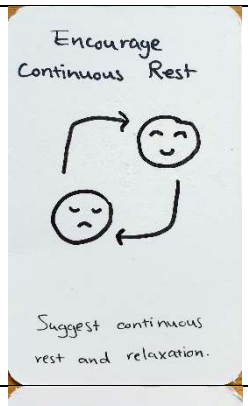
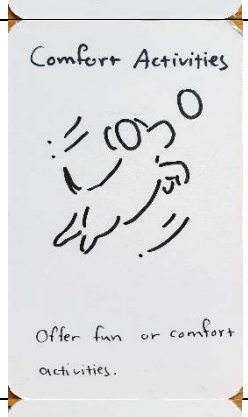
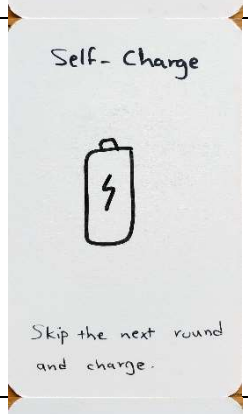
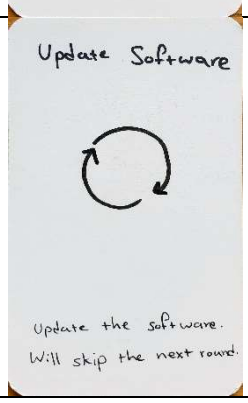
9		**Modify Schedule**			
		Freely adjust the schedule.			
		Task	-3	Well-being	+4
10		**Request Laika Comfort**			
		Interact with Laika for comfort or fun activities.			
		Task	-1	Well-being	+4
11		**Assist Laika**			
		Help Laika with charging or updates so Laika will not lose a turn!			
		Task	0	Well-being	0
12		**Ignore Malfunction**			
		Continue work despite Laika's issues.			
		Task	+2	Well-being	0

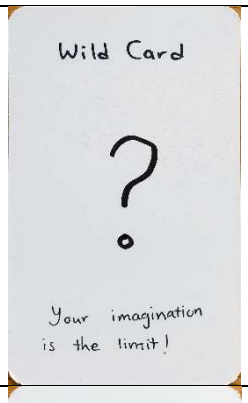
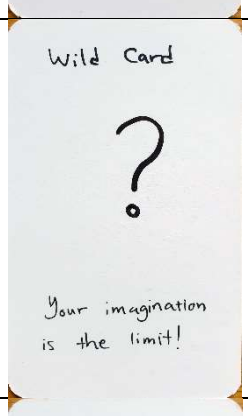
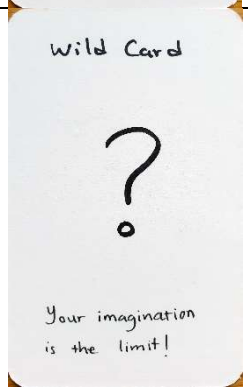
<table>
<tr><td>13</td><td> 
</td><td colspan="4">Laika Private Mode</td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td colspan="4">Confide in Laika.</td></tr>
<tr><td>Task</td><td>0</td><td>Well-being</td><td>+5</td></tr>
<tr><td>14</td><td> 
</td><td colspan="4">Mute Laika</td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td colspan="4">Deactivate Laika. Mission Control can undo this.</td></tr>
<tr><td>Task</td><td>0</td><td>Well-being</td><td>0</td></tr>
<tr><td>15</td><td> 
</td><td colspan="4">Wild Card</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="4">Acts as a free card; points to be agreed upon by all three players.</td></tr>
<tr><td colspan="4"></td></tr>
</table>

Laika Cards

1		**Task Efficiency Alerts**			
		Remind the astronaut about pending tasks.			
		Task	+5	Well-being	-4
2		**Enforce Schedule**			
		Keep the astronaut on schedule.			
		Task	+5	Well-being	-4
3		**Report Deviations**			
		Notify Mission Control about any deviations.			
		Task	+4	Well-being	-5
4		**Assist with Task**			
		Asist the astronaut with a specific task when prompted.			
		Task	+5	Well-being	+1

5		**Report Critical Health Issues**			
		Only notify about the most important health alerts.			
		Task	+2	Well-being	+3
6		**Suggest Breaks**			
		Encourage the astronaut to rest.			
		Task	0	Well-being	+1
7		**Health Insights**			
		Give health insights and suggestions.			
		Task	0	Well-being	+4
8		**Listening Ear**			
		Be a confidential listening ear for the astronaut.			
		Task	0	Well-being	+5

9		**Encourage Continuous Rest**			
		Suggest continuous rest and relaxation.			
		Task	-4	Well-being	+4
10		**Comfort Activities**			
		Offer fun or comforting activities.			
		Task	-3	Well-being	+3
11		**Self-Charge**			
		Skip the next round and charge.			
		Task	0	Well-being	0
12		**Update Software**			
		Update the software. Will skip the next round.			
		Task	0	Well-being	0

13		**Wild Card** Acts as a free card; points to be agreed upon by all three players.
14		**Wild Card** Acts as a free card; points to be agreed upon by all three players.
15		**Wild Card** Acts as a free card; points to be agreed upon by all three players.

Appendix 6: Analysis of the Final Game

This section presents the survey responses from participants who played the game. Each question is followed by a summary of the answers and an interpretation of the responses.

<table>
<tr><th>#</th><th>Questions and Responses</th></tr>
<tr><td>1</td><td>What are your initial thoughts about the game?
<table>
<tr><td>1</td><td>Interesting the results you can get.</td></tr>
<tr><td>2</td><td>I was not really sure what to expect. I thought it would be more difficult.</td></tr>
<tr><td>3</td><td>Wasn't sure how to play, but after the two round got the hang of it. Seem very interesting and could also be used for work toolboxes</td></tr>
<tr><td>4</td><td>Interesting concept for a game to explain relationship between well being and work</td></tr>
<tr><td colspan="2">Participants found the game intriguing and understood the dynamics between well-being and work. While some were initially unsure of how to play, they found the game engaging and recognized its potential use in various settings</td></tr>
</table></td></tr>
<tr><td>2</td><td>How did you feel about the dynamics between the three players (Laika, the astronaut, and mission control)?
<table>
<tr><td>1</td><td>There is a need on cooperation, but is good that it is not explained at the begining.</td></tr>
<tr><td>2</td><td>It was fun. It did not seem the astronaut and Laika were getting so well along. the MC was pretty supportive in both rounds.</td></tr>
<tr><td>3</td><td>Went great, eventually you try to make the game a bit more fun and overall where the dynamics great</td></tr>
<tr><td>4</td><td>I feel like the astronaut should have more control and flexibility since real time evaluation can only be done by them</td></tr>
<tr><td colspan="2">While some players enjoyed the dynamics, others felt that Laika and the astronaut should have more synchronized interactions and greater flexibility for the astronaut.</td></tr>
</table></td></tr>
<tr><td>3</td><td>Did you notice any recurring themes or patterns during the game? If so, what were they?
<table>
<tr><td>1</td><td>Task completion being very important.</td></tr>
<tr><td>2</td><td>The astronaut and Laika were not well synchronized.</td></tr>
<tr><td>3</td><td>We played if twice but not so much overall. Just in general that it was usually task, health, task, health etc.</td></tr>
<tr><td>4</td><td>Yes, it was that there should be balance between well being and work. High work prioritisation can lead to lower well being and vice versa...</td></tr>
<tr><td colspan="2">Participants were able to notice the trade-offs between focusing on tasks and maintaining health.</td></tr>
</table></td></tr>
<tr><td>4</td><td>How challenging did you find the game?
<table>
<tr><td>Not challenging at all</td><td>1</td></tr>
<tr><td>Slightly challenging</td><td>0</td></tr>
<tr><td>Moderately challenging</td><td>3</td></tr>
<tr><td>Very challenging</td><td>0</td></tr>
<tr><td>Extremely challenging</td><td>0</td></tr>
</table>
 </td></tr>
</table>

	Most players found the game moderately challenging; it can be assumed that there is a meaningful level of complexity without being overly difficult.
5	**What aspect of the game did you enjoy the most?**

1	The wild card.
2	It was fun to get into character and male decisions altogether.
3	The interaction with the other players and to figure out the balance between health and work
4	The decision making aspect

The interaction and cooperative decision making were greatly appreciated by participants.

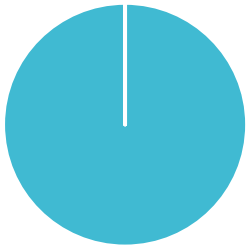
6	**What aspect of the game did you enjoy the least?**

1	None.
2	I did not know what to expect from some cards.
3	None.
4	None!

Marvelous feedback! The instructions of the game has been updated with including more details.

7	**Did you feel that the game and the cards had a clear objective?**

Yes	4
No	0
Maybe	0



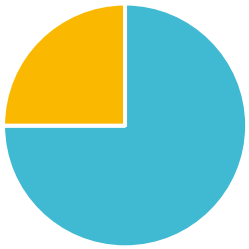
All participants felt that the game and the cards had a clear objective, indicating that the purpose and rules were well-understood.

8	**How did you feel about the interaction between Laika and the astronaut?**

Very positive	0
Positive	2
Neutral	0
Negative	2
Very negative	0

Reactions were mixed regarding the interaction between Laika and the astronaut, with equal numbers of positive and negative feelings. One observation made was in regard to participants view on the technologies (utopian, dystopian and ambivalent). This can also effect the perception about interacting with Laika in real-life use.

<table>
<tr><td>9</td><td>How well do you think the game represented the balance between adhering to tasks and maintaining well-being?

Extremely well 0
Somewhat well 3
Neutral 0
Somewhat not well 1
Extremely not well 0
 

The game was seen as somewhat successful in representing the balance between work and well-being, though there is room for improvement according to one participant.</td></tr>
<tr><td>10</td><td>Do you think the game could be improved? If so, how?

1 Maybe there could be malfunctions for Laika.
2 Some cards are vague about their impact on the astronaut and the mission. We could use a more specific explanation of each card.
3 Wouldn't currently know, maybe more wild cards for mc and astronaut would be fun, other than that it was great
4 I think the astronaut should be given more authority. Cards like environmental factors: ship failure, meteor shower, MC communication failure can be introduced to make it more interesting and stressful.

The game play included in the report has been updated considering these suggestions. However adding environmental factors would make the game more complicated and drive the project away from its objective. Nonetheless, the timer can be adjusted to stimulate these stressful external elements.</td></tr>
</table>

Table 9 Analysis of the Final Game