Factors Influencing Interaction with Social Interactive Agents

A Study on Empathy, Ethics, Persuasion and Proactivity

Technical Report

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Technical Report
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Preface

This report presents the results of research carried out during a postdoctoral fellowship at the GEDES group at the University of Granada, under the supervision of Professor Francisco Gutiérrez Vela and Patricia Paderewisk Rodríguez. It summarizes the findings from a thorough investigation into the interaction between humans and Social Interactive Agents (SIAs) within the field of Human-Computer Interaction (HCI).

During the postdoctoral research, the primary focus was to examine the key factors influencing these interactions, specifically emphasizing empathy, ethics, persuasion, and proactivity. These factors were selected due to their significance in designing agents that can promote positive, ethical, and effective user experiences.

The aim of this report is to offer a comprehensive understanding of how these factors shape user interactions with SIAs, ultimately contributing to the progress of HCI research and the development of agents that are more responsive and responsible.

By focusing on *empathy*, *ethics*, *persuasion*, and *proactivity*, this report underscores the importance of these factors in designing agents that are not only efficient but also attuned to human needs and values. It seeks to contribute to ongoing discussions about the design and evaluation of SIAs by providing a deeper insight into how these properties affect user interactions and the overall success of these systems.

André Luiz Satoshi Kawamoto
Granada, March 2025

Summary

The interaction between humans and Social Interactive Agents (SIAs) has become an increasingly important area of research in Human-Computer Interaction (HCI). As SIAs are adopted in fields ranging from healthcare to customer service, understanding the properties that influence these interactions is essential for improving user experience (UX) and ensuring ethical engagement.

This report focuses on four key properties: empathy, ethics, persuasion, and proactivity. These properties are examined in terms of their definitions, their importance in shaping user experience, and the ethical challenges they raise. Empathy is explored as the ability of agents to understand and respond to users' emotional states, fostering trust and a sense of connection. Ethics is addressed to ensure agents act transparently, respect privacy, and promote fairness. Persuasion is discussed as the influence SIAs can exert over user behavior, such as encouraging healthy habits or guiding decision-making. Proactivity is analyzed in terms of how agents anticipate user needs and provide timely assistance.

In addition to these core properties, the report highlights other influential factors, such as sociability, personalization, and accessibility. These factors further shape the quality of SIA interactions, enhancing user satisfaction and engagement. The report also discusses various tools and instruments used to evaluate these properties and assess their impact on interaction quality.

The goal of this report is to provide a comprehensive analysis of the properties that influence interaction with SIAs, offering insights that can guide future design and development of more effective, empathetic, and ethical agents.

Contents

Acronyms

AI Artificial Intelligence 5, 10
AIS Artificial Intelligence System 3
AR Augmented Reality 7

ECA Empathetic Conversational Agent 9

HCI Human-Computer Interaction 2

IoT Internet of Things 7

NLG Natural Language Generation 3

SIA Socially Active Agent 1, 2, 5–8

ToM Theory of Mind 3

VR Virtual Reality 7

1

Introduction

1. Introduction

Integrating Socially Active Agents (SIAs) into everyday digital experiences has significantly evolved, transforming how humans interact with technology. These agents, which include conversational assistants, virtual companions, and humanoid robots, are designed to (facilitate more natural, engaging, and effective interactions). As SIAs become more prevalent across various domains, ranging from healthcare and education to customer service and entertainment, their ability to foster meaningful and ethically sound engagements becomes a critical area of research.

To ensure positive interactions between SIAs and humans, it is necessary to consider the factors that shape user experience and trust. Among these, *Empathy*, *Ethics*, *Proactivity*, and *Persuasion* emerge as pivotal components in the design and development of intelligent agents. These factors influence the agent's capability to respond to users' needs, anticipate interactions, and guide behavior in a properly responsible manner.

A distinguishing aspect of this study is the treatment of Ethics as a transversal factor. Ethical considerations permeate all SIA design and deployment aspects, ensuring fairness, privacy, transparency, and interaction accountability. By incorporating ethical principles across all factors, we aim to mitigate risks associated with bias, manipulation, and unintended consequences arising from human-agent interactions.

1.1. Objectives of the Report

This report aims to provide a structured analysis of the fundamental factors influencing human-SIA interactions, with a particular focus on:

- Identifying and defining the core factors (*Empathy, Proactivity, and Persuasion*) that contribute to effective interactions with SIAs.
- Breaking down these factors into specific dimensions that capture their operational relevance in human-agent interactions.
- Exploring implementation mechanisms that enable SIAs to embody these factors in practical applications.
- Establishing ethics as a transversal component that informs the responsible design and deployment of SIAs.

1.2. Overview of Key Factors in Human-SIA Interaction

The interaction between humans and Socially Interactive Agents (SIAs) is shaped by factors influencing their acceptance and effectiveness. Each factor has distinct characteristics and impacts how SIAs interact with users. At the center of this structure is Ethics, a transversal element that permeates all other factors, raising issues such as privacy, data security, transparency, fairness, and autonomy. These principles ensure effective and responsible interactions between SIAs and users.

Figure 1.1 illustrates this relationship, highlighting Empathy, Proactivity, Persuasion and their intersection with Ethics. The overlap between these factors reflects the complexity of human-SIA interactions, emphasizing the need to balance technical capabilities with ethical principles in designing socially intelligent and trustworthy agents.

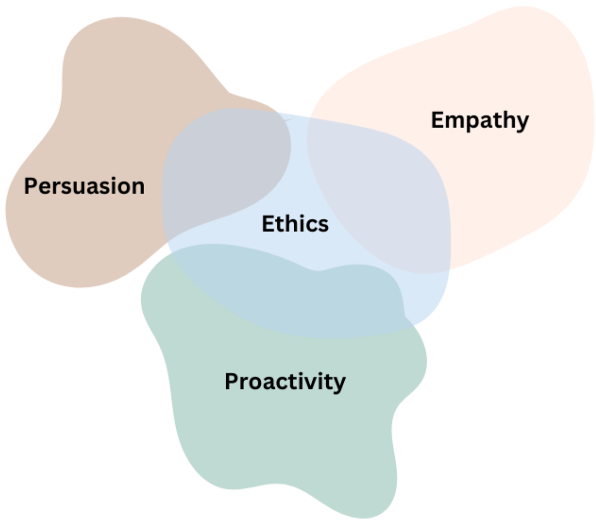

Figure 1.1: Factors Influencing Socially Interactive Agents

1.3. Rationale for Factor Selection

The interaction between humans and Social Interactive Agents (SIAs) is a multidimensional phenomenon that extends beyond traditional usability and functionality concerns in Human-Computer Interaction (HCI). For an SIA to be effective, it must go beyond merely processing user commands; it must understand, adapt, and respond to users in a way that aligns with human expectations of social and intelligent behavior.

The four factors covered by this work were selected based on their role in making interactions more natural, engaging, and effective:

- Empathy ensures that SIAs can recognize and appropriately respond to user emotions, fostering trust and engagement.
- Persuasion allows SIAs to guide users in decision-making and behavioral changes while maintaining credibility and social influence.
- Proactivity enables SIAs to anticipate user needs, offer timely interventions, and adapt to different contexts dynamically.
- Ethics, as a transversal factor, differs from the others in that it permeates all aspects of SIA design and operation rather than functioning as an independent capability.

These factors are further divided into specific dimensions that capture the key aspects of their influence on SIA interactions. We propose implementation mechanisms for each dimension, representing the technical strategies used to embed these capabilities into SIAs.

1.3.1. Empathy

Empathy in Artificial Intelligence Systems (AISs) can be categorized into three main dimensions: affective, cognitive, and compassionate. **Affective Empathy** refers to the AIS's capability to recognize and respond to human emotions. This involves implementing mechanisms such as emotion detection models utilizing natural language processing (NLP), sentiment analysis, and multimodal expressions, including voice, facial expressions, and gestures. Furthermore, the system generates adaptive affective responses tailored to the user's emotional state.

Cognitive Empathy is the AIS's ability to comprehend the user's perspective and mental state. To achieve this, the system employs user modeling techniques to infer intentions and mental states, reasoning based on the Theory of Mind (ToM) to predict appropriate responses, and contextual dialogue adaptation that considers the interaction history with the user.

Lastly, **Compassionate Empathy** refers to theAIS's ability to demonstrate concern and provide support according to the user's specific context. This is facilitated through decision support systems designed to offer empathetic recommendations, Natural Language Generation (NLG) that adjusts to the user's emotional tone, and the utilization of long-term memory to ensure consistent and coherent support across interactions.

1.3.2. Persuasion

The Persuasion factor is divided into four itens: Task Support, Dialogue Support, System Credibility Support and Social Support. **Task Support**, focuses on how the system can influence users to complete tasks more efficiently. This is achieved through proactive suggestions from AI-based assistants, gamification techniques combined with positive reinforcement to encourage progress, and adaptive feedback mechanisms to enhance the user experience.

Dialogue Support, involves using dialogue to ethically and effectively persuade users. Implementation strategies include computational argumentation models for structured interactions, dynamic adjustment of tone and language style to foster engagement, and the use of explainability and justifications to build trust.

The third item, **System Credibility Support**, outlines strategies to enhance the perceived reliability of the AISs. These mechanisms to implement it incorporate transparency in system processes and decisions, references to trustworthy sources to reinforce credibility and avoidance of biases or argumentative fallacies in response generation.

Lastly, **Social Support** emphasizes how the AISs can create a sense of social connection to influence behaviors. This involves using digital personification and identity to strengthen connections, social interaction models powered by neural networks, and personalized recommendation systems tailored to the user's interactions.

1.3.3. Proactivity

Proactivity can be explored through anticipation of needs, contextual suggestions, and problem resolution. In **Anticipation of Needs**, the agent uses predictive analysis, interaction history, and automatic knowledge updates to foresee what the user might require before an explicit request. This ability allows for a more efficient and personalized experience.

In **Contextual Suggestions**, the mechanisms include machine learning algorithms, proactive notifications, and real-time adjustments, ensuring the agent can offer relevant recommendations based on the user's current context. These suggestions help to make interactions more seamless and adaptive to the dynamic needs of users.

Lastly, in **Problem Resolution**, the agent implements integrated help systems and automated assistance, enabling an efficient approach to tackling challenges and providing immediate support. This capability is fundamental for delivering users a more satisfying and practical experience.

1.3.4. Ethics

Ethical considerations shape how Empathy, Persuasion, and Proactivity should be implemented, ensuring that glsplsia foster positive interactions while avoiding risks such as manipulation, bias, privacy violations, and over-reliance. Ethics thus serves as a guiding principle that informs decision-making at every level of SIA development, from data handling and transparency to fairness, accountability, and user autonomy.

Within these factors, mechanisms to ensure ethics are embedded at every stage. For instance, in Empathy, clear boundaries are set to avoid privacy violations or emotional exploitation, supported by continuous monitoring to prevent responses that could harm or discomfort users. Ethical training practices, such as anonymized data, strengthen the foundation of empathetic interactions. In Persuasion, ethical implementation involves aligning persuasive strategies with genuine user benefits and promoting healthy, informed choices. Conversely, Proactivity integrates ethics by ensuring that suggestions are relevant and empower users to make decisions freely.

By integrating these ethical mechanisms into the fabric of Empathy, Persuasion, and Proactivity, glsplsia can enhance user experiences in ways that are not only effective but also respectful, fair, and trustworthy.

2

Socially Interactive Agents

Socially Interactive Agents (SIAs) are computational systems designed to engage with humans in socially meaningful ways. They employ behaviors that simulate verbal and non-verbal communication, empathy, and adaptability. Examples of SIAs include virtual assistants, social robots, and digital avatars, all aiming to make human-computer interactions more intuitive and effective.

SIAs integrate Artificial Intelligence (AI) and interface design to facilitate social interactions. They can assume various forms based on their application context (Figure 2.1):

- **Virtual Assistants**: systems like Alexa[1], Copilot[2], Google Assistant[3], and Siri[4], that communicate using natural language to perform tasks and answer queries.
- **Physical Robots**: devices such as Pepper that interact both verbally and physically with users, often used in service and healthcare sectors.
- **Digital Avatars**: Representations in virtual environments, like those in educational platforms or gaming, that users can interact with.

SIAs offer functionalities that enhance user interaction, including:

- **Multimodal Command Interpretation**: Processing voice, text, and gesture inputs to understand user commands.
- **Contextual and Adaptive Responses**: Providing replies tailored to the user's context and preferences.
- **Continuous Learning**: Improving responses and behaviors based on past interactions.

2.1. Advantages of SIAs

Implementing SIAs provides several benefits:

- **Accessibility and Inclusivity**: Making technology accessible to diverse user groups, including children, older adults, and individuals with disabilities [1].
- **Engagement and Emotional Connection**: Creating stronger user bonds through empathetic and socially aware interactions [0].
- **Personalization and Efficiency**: Customizing interactions to individual preferences, thereby optimizing task completion and user satisfaction.

[1] https://alexa.amazon.com
[2] https://copilot.microsoft.com/
[3] https://assistant.google.com/
[4] https://www.apple.com/siri/

(a) Alexa Devices. **(b)** Social Robot **(c)** Digital Avatar.

Figure 2.1: Creating subfigures in LaTeX.

- **Multidomain Applications**: Being versatile across various sectors such as education, healthcare, and customer service.

2.2. Contributions of SIAs

SIAs are developed to address the unique needs of diverse demographic groups, showcasing their versatility and positive impact across various domains. These technological solutions, tailored to different audiences, range from education to digital inclusion, enhancing human-computer interactions to be more accessible and effective.

For instance, educational robots facilitate learning by teaching programming and social skills to children and adolescents. These tools make the educational process more interactive and engaging, helping in mastering technical content and developing interpersonal abilities.

In the case of older adults, virtual assistants contribute to well-being by promoting daily engagement and reducing loneliness. Through consistent interactions, these systems foster more active routines and social connectedness, which positively impact mental and emotional health.

In professional settings, task organizers and virtual assistants enhance productivity by suggesting how to structure commitments, manage schedules, and prioritize demands. These functionalities help professionals focus on their core activities, achieving greater efficiency in their work.

Another notable application is the ability of SIAs to promote digital inclusion. Systems provide alternative methods of communication to empower individuals with disabilities by enabling greater expression, interaction, and autonomy in various contexts, significantly increasing social and digital participation opportunities for these individuals.

2.3. Challenges in the Development of SIAs

Developing and deploying SIAs present challenges that must be carefully addressed to ensure effectiveness. These challenges span technical, cultural, and ethical dimensions, highlighting the complexity of creating Socially Interactive Agents that meet the diverse needs of users.

One major issue is **platform compatibility**. SIAs must provide consistent functionality across various devices and operating systems. Seamlessly integrating into various technological ecosystems ensures that users experience the same quality and reliability regardless of their preferred platform. For instance, Amazon's Alexa demonstrates a successful approach to platform compatibility by operating reliably across multiple smart devices, including speakers, phones, and home automation systems, thus underscoring the importance of robust frameworks for integration and consistency in user experience.

Another critical concern is **privacy and security**, particularly in handling personal data. As SIAs often process sensitive information, it is essential to implement advanced measures, such as end-to-end encryption and secure data storage, to protect user information and ensure secure interactions. Failure to address these issues could result in data breaches, loss of trust, and the potential misuse of personal information. Developers can draw lessons from modern encryption technologies in applications like health chatbots, where privacy is critical.

Cultural and social factors also play a significant role in successfully adopting of SIAs. These systems must be designed with a deep understanding of cultural diversity and social norms to avoid misunderstandings or alienating certain user groups. For example, a conversational agent used in education must account for variations in language, idioms, and teaching approaches to serve a global audience effectively. Inclusivity and sensitivity are key to fostering positive and widely accepted user experiences.

The **integration with emerging technologies** poses both an opportunity and a challenge. The combination of SIAs with Augmented Reality (AR), Virtual Reality (VR), and Internet of Things (IoT) opens new possibilities for interaction but requires significant development and testing efforts. For example, integrating SIAs into VR environments, such as virtual classrooms or healthcare simulations, offers immersive and interactive solutions but demands high precision, processing, and seamless functionality.

Finally, upholding **ethical standards** is important in developing SIAs. These agents must avoid manipulative practices and prioritize transparency, fairness, and respect in their interactions. Developers must ensure that SIAs operate within a framework of ethical guidelines promoting trust and accountability. For example, establishing clear data usage policies and ensuring that users have control over their data is essential to maintaining ethical integrity. Moreover, frameworks for auditing and validating the ethical behavior of SIAs could help prevent potential misuse and harm.

These challenges underscore the intricate nature of creating and maintaining Socially Interactive Agents that are functional but also ethical, inclusive, and practical. Addressing these barriers requires a multidimensional approach that combines technical innovation, cultural sensitivity, and adherence to ethical principles, ensuring that SIAs can be embraced as a valuable tool across diverse domains.

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3
Empathy

3.1. Definition

Human empathy is a complex process that involves affective components (the ability to feel another person's emotions) and cognitive components (the ability to understand another person's perspective). It is the capacity to share and understand other people's emotions authentically [9], and can be defined as the ability of an individual to connect with and respond to the emotions of others. This conception is widely accepted across various fields of study, such as psychology, sociology, and neuroscience, and serves as a foundation for understanding this term in different contexts[3, 5, 9].

However, in interactions between humans and computational agents requires adapting this concept because computational agents, being artificial systems, cannot experience emotions as humans do [2, 5, 9, 10]. In human-agent interactions, perceived empathy focuses on the user's impression that the agent understands and responds appropriately to their emotions without involving a genuine emotional experience from the agent. The agent can convincingly show understanding and emotional responsiveness. In this context, empathy is a simulation designed to enhance the user experience and make the interaction more natural and satisfying [2, 5, 7, 9, 10].

Computational agents can emulate empathy through different communication modalities, like choosing words and phrases that convey understanding and support, adjusting intonation and speech rhythm to transmit emotions such as sadness, joy, or concern, or pausing for an appropriate amount of time before responding to give a sense of attentive listening and consideration [9].

3.2. Importance and Benefits of Empathy

In human relations, empathy offers clear benefits for improving interpersonal relationships through enriching interpersonal relationships, increased engagement, and credibility [4]. Additionally, empathy influences the motivation of prosocial behavior, that is, actions and behaviors that benefit others and society. Empathy plays a crucial role in motivating such actions. Characteristics and the importance of prosocial behavior include altruism, moral principles, justice, aggression inhibition, affectionate attitudes, and help [9, 4, 3].

Regarding interactions with SIAs, benefits include increased user trust when interacting with systems that demonstrate empathy, reduced stress, improved comfort and performance in task completion, and improved agent acceptance [7, 9, 4].

3.3. How to Implement Empathy

Empathy may be expressed por meio de de canais vocais (verbais e não verbais), expressões faciais e gestos. Quando see trata de fala, a escolha de palavras apropriadas e as emoções transmitidas pelo agente são componentes importantes da expressão da empatia. No caso de gestos e expressões, por sua vez, os sistemas tendem a ser percebidos como mais empáticos quando emulam padrões de comportamento já e práticas sociais associadas atestados em interações humanas [7, 4].

When implementing empathetic social agents, designers need to establish a well-developed emotion model that defines the type of emotion that can occur in a given scenario, both for the observer and the target. The level of sophistication in expressing and recognizing emotions depends on how mature the model is [10].

Additionally, multimodality is an important factor. SIA that utilize multiple modalities to recognize redundant cues can better understand the user's affective state and thoughts, thus maximizing empathetic interactions [10].

The agents' personality also plays a significant role, as different personalities can modulate the empathetic process [11]. Lastly, the general context is crucial for achieving empathetic interaction from the system, as scenarios must provide emotional experiences to which the system can respond appropriately [10].

3.3.1. Implementation Examples

Several projects discuss the implementation of empathy in artificial agents and robots, each with different objectives.

Hu et al. (2021) described a voice-based conversational agent that reflects the user's emotions detected in their speech by responding with vocal utterances like ”ha-ha”, ”wow”, and ”um...”. In addition to these emotional expressions, the agent adapted the conversation flow using praise, distraction, and reappraisal strategies, increasing the perceived emotional intelligence of the empathetic agent.

Yang, Sun, and Shen (2023) presented a virtual agent that simulates empathy by reflecting the user's emotions verbally and through the avatar's body language.

Bickmore and Picard (2005) described another embodied conversational agent.

Social robots, such as Paro, are designed to evoke empathy and feelings of care, helping users cope with loneliness or the perception of pain [8].

A framework for Empathetic Conversational Agents (ECAs) leverages three hierarchical levels of capabilities to model empathy. This framework can be a foundation for integrating additional behavioral and empathetic capabilities while maintaining efficient and responsive conversational behavior. The system incorporates these baseline empathetic behaviors by equipping emotion communication capabilities, which include perceiving and expressing emotions [13].

Empathetic conversational user interfaces (CUIs) can also be used in negotiation simulators to increase emotional awareness and control, training users to handle different situations and personality types [12]. In healthcare, empathetic interfaces can provide support and information compassionately, especially in mental health applications [12].

In education, empathetic computing can create adaptive learning environments by recognizing learners' emotional states and adjusting the difficulty level and presentation style [12]. Social agents can train young doctors on how to interview patients with depression [9]. Additionally, social agents can be designed for intercultural training, focusing on intercultural empathy [9], and can also help children deal with bullying [9].

3.3.2. Challenges

Despite the opportunities offered by empathy in social agents, there are several challenges and limitations to consider. First, the lack of a universal definition for empathy makes the term problematic. Multiple non-equivalent definitions used by different disciplines hinder standardization [4]. Besides, measuring empathy in AI systems is a challenge, as there is no widely accepted evaluation method to determine the degree of empathy a system possesses [4]. Lastly, there is the risk of unfavorable outcomes, where an inadequate expression of empathy can increase distrust in the information provided by the agent [14].

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4
Ethics

4.1. Ethics

4.1.1. Definition

Ethics in the context of SIAs involves the principles of fairness, transparency, privacy, and accountability in their design and interaction with users. Ethical considerations also include the prevention of harm and the respectful treatment of users.

4.1.2. Importance

Ethics is crucial in establishing trust between the user and the agent. Without a foundation of ethical practices, users may feel exploited or uncomfortable, undermining the effectiveness of SIAs.

4.1.3. Impact on Trust and Acceptance

Ethical behavior, such as transparent data handling and clear communication about the SIA's capabilities, influences user trust and acceptance. A lack of transparency or unethical practices can lead to distrust or rejection of the SIA.

4.1.4. Implementation Examples

An example of ethical design is ensuring that SIAs are clear about their data collection practices and giving users control over their data. Another example is preventing biased responses in AI-powered assistants.

4.1.5. Challenges and Ethical Considerations

One of the main challenges in implementing ethical practices in SIAs is ensuring transparency without overloading users with information. Additionally, balancing the need for data collection with user privacy is a critical issue.

5

Persuasion

5.1. Persuasion

5.1.1. Definition

Persuasion in SIAs refers to the agent's ability to influence the user's behavior or decision-making process, often through subtle cues, recommendations, or suggestions.

5.1.2. Importance

Persuasion is important in improving the effectiveness of SIAs in contexts like health care, education, and customer service, where encouraging positive actions can lead to better outcomes for the user.

5.1.3. Impact on User Decision and Behavior

Persuasive techniques can guide users toward making decisions that align with desired outcomes, such as adopting healthier habits or making informed choices in a purchase decision.

5.1.4. Implementation Examples

An example of persuasion in SIAs is a fitness app encouraging users to stick to their workout plans by using motivational messages or personalized feedback. Another example is virtual shopping assistants recommending products based on the user's preferences.

5.1.5. Challenges and Ethical Considerations

The use of persuasion raises ethical concerns about manipulation. It is important that persuasion is used transparently, without exploiting users' vulnerabilities or autonomy.

6

Proactivity

6.1. Proactivity

6.1.1. Definition

Proactivity refers to the SIA's ability to anticipate and respond to user needs or situations without being explicitly prompted by the user.

6.1.2. Importance

Proactive SIAs can enhance user experience by providing timely and relevant assistance, reducing the need for the user to initiate every action. This leads to smoother and more efficient interactions.

6.1.3. Impact on User Experience

Proactive behaviors, such as suggesting next steps or offering help before it is requested, can improve the overall experience by making the interaction feel more intuitive and supportive.

6.1.4. Implementation Examples

An example of proactivity is a smart home assistant that adjusts the thermostat based on user preferences without needing a direct command. Another example is a virtual assistant that reminds a user about an upcoming meeting without being prompted.

6.1.5. Challenges and Ethical Considerations

While proactivity can improve user experience, there are concerns about invasiveness or overstepping boundaries. It is important to ensure that proactivity is balanced and that users retain control over the interaction.

7

Evaluation Instruments

8

Other Factors

8.1. Other Important Factors

9
Conclusion

A conclusion...

A

Source Code Example

Adding source code to your report/thesis is supported with the package listings*. An example can be found below. Files can be added using* \lstinputlisting[language=<language>]{<filename>}*.*

```python
"""
ISA Calculator: import the function, specify the height and it will return a
list in the following format: [Temperature,Density,Pressure,Speed of Sound].
Note that there is no check to see if the maximum altitude is reached.
"""

import math
g0 = 9.80665
R = 287.0
layer1 = [0, 288.15, 101325.0]
alt = [0,11000,20000,32000,47000,51000,71000,86000]
a = [-.0065,0,.0010,.0028,0,-.0028,-.0020]

def atmosphere(h):
    for i in range(0,len(alt)-1):
        if h >= alt[i]:
            layer0 = layer1[:]
            layer1[0] = min(h,alt[i+1])
            if a[i] != 0:
                layer1[1] = layer0[1] + a[i]*(layer1[0]-layer0[0])
                layer1[2] = layer0[2] * (layer1[1]/layer0[1])**(-g0/(a[i]*R))
            else:
                layer1[2] = layer0[2]*math.exp((-g0/(R*layer1[1]))*(layer1[0]-layer0[0]))
    return [layer1[1],layer1[2]/(R*layer1[1]),layer1[2],math.sqrt(1.4*R*layer1[1])]
```

B

Task Division Example

If a task division is required, a simple template can be found below for convenience. Feel free to use, adapt or completely remove.

Table B.1: Distribution of the workload

	Task	Student Name(s)
	Summary	
Chapter 1	Introduction	
Chapter 2		
Chapter 3		
Chapter *		
Chapter *	Conclusion	
	Editors	
	CAD and Figures	
	Document Design and Layout	

Glossary