Pneunocchio: A playful nose augmentation for facilitating embodied representation

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Figure 1: Players engaged in a "Two Truths and a Lie" game with the Pneunocchio nose augmentation

ABSTRACT

Prior research has offered a plethora of wearables centred around sensing bodily actions ranging from more explicit data, such as movement and physiological response, to implicit information, such as ocular and brain activity. Bodily augmentations that physically extend the user's body along with altering body schema and image have been proposed recently as well, owing to factors such as accessibility and improving communication. However, these attempts have usually consisted of uncomfortable interfaces that either restrict the user's movement or are intrusive in nature. In this work, we present Pneunocchio, a playful nose augmentation based on the lore of Pinocchio. Pneunocchio consists of a pneumatic-based inflatable that a user wears on their nose to play a game of two truths and a lie. With our work, we aim to explore expressive bodily augmentations that respond to a player's physiological state that can alter the perception of their body while serving as an expressive match for a current part of the body.

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CCS CONCEPTS

• **Human-centered computing** → **Interaction devices**; *HCI theory, concepts and models*; **Interaction paradigms**.

KEYWORDS

embodied interaction, pneumatics, bodily augmentation, playful experience

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1 INTRODUCTION

Bodily augmentations have been explored in HCI for a wide array of applications (e.g.,[15, 16, 20, 23]). This effort has been majorly led by research around wearables along with novel sensing and actuating technologies [4, 17, 19, 24, 25]. These bodily augmentations have been used to offer input spaces in and around the human body [2, 3, 5, 6]. Researchers have proposed interfaces that also aim to provide expressive feedback across different body parts of their users [1, 12, 18]. Further, advancements that physically extend the human body have been explored in HCI and have been labelled as bodily extensions by Buruk et al. [7]. These bodily extensions have been utilized in a variety of contexts, such as accessibility [27], promoting movement [17, 23], or proposing a new input space [6, 14].

Meanwhile, prior research has highlighted the importance of embodied interaction as it aids in several aspects of cognition [10, 13], such as navigation [22], speech production [8], and perception of time [9]. As a result, researchers have created tangible interfaces to promote embodied experience owing to their benefits [26]. However, support for embodiment is not restricted to tangibles, as Buruk et al. also proposed the benefits of having bodily augmentations that help a user reflect on their body image and schema [7]. For example,"Wiggle ear" [21] and "Monarch" [11] combined physiological input from a user's body to offer movement and mood representation, respectively, to aid social communication. These attempts have offered an embodied representation by proposing a body augmentation that leverages the emotions (and the physiological response at large) to inform onlookers about the user's feelings. However, prior attempts have either consisted of bulky and uncomfortable mechanical actuators or are designed in a shape that is different to imagine as a part of the body for the user.

In this paper, we propose Pneunocchio, a playful experience around a pneumatic nose augmentation centred around a popular party game, *Two Truths and a Lie* and inspired by the Pinocchio lore[1]. Through Pneunocchio, we aim to explore the effect of a nose-based body augmentation facilitated by physiological response when involved in a playful experience of lying, i.e., the nose grows in size when the player lies. In a preliminary user study, we found out that Pneunocchio was able to provoke thought among the players and prompted responses associated with identifying themes across the three statements and understanding what a lie was in actuality and how it was perceived by the system. The players also reported that Pneunocchio served as a conversation starter.

[1]https://www.britannica.com/topic/The-Adventures-of-Pinocchio

2 DESIGN AND IMPLEMENTATION

Pneunocchio is designed to be a two-player game played along with a system. The game begins with a player wearing the nose augmentation, saying three personal statements about themselves, out of which two are true and the other is a lie. The second player then selects the statement that they think is a lie. Then, both of the players proceed to check with the system to identify the lie across the three statements sequentially. The system, based on the physiological signals it received from the player with augmentation, inflates the nose when checking one of the three statements. Each player takes two turns to wear the augmentation and play the game. Since there are multiple eventual possibilities, including that of both the system and the guesser making the wrong choice, the system is designed to provoke conversations about what a lie is and how it is perceived by the players' physiological system, in addition to altering their bodily perception when the nose is inflated.

In implementing Pneunocchio, we first identified the material for fabricating an augmentation that would serve as the best expressive match for the nose extension with respect to the Pinocchio lore. We used a 0.8mm PE sheet to create an inflatable. Furthermore, we added a spring mechanism for the augmentation to fold when not in use. For sensing the physiological signals from the player's body, we used Emotibit[2]. Through Emotibit, we leveraged Electrodermal activity (EDA) along with Photoplethysmography (PPG) data streams to estimate when the player told a lie. We leveraged variability in heart rate through PPG and an increase in skin conductance through EDA as an identifier for a lie being told. Furthermore, we created an algorithm to compare the trends of these signals across the three statements to identify which statement out of the three could be the most probable lie. The Emotibit communicates with a pneumatic controller, Programmable Air[3], to inflate the augmentation.

3 LIMITATIONS AND FUTURE WORK

The current limitations majorly stem from the microcontrollers that are tethered to a Windows PC for communication. The Emotibit communicates data over Wifi to the system, which is then relayed serially to the pneumatic controller. In future iterations, we will work towards making the whole system wireless to improve the user experience, as well as conducting a field study to identify the associated user experience of Pneunocchio. Further, the algorithm to detect a lie can also be supplemented with machine learning to improve the accuracy of the algorithm. However, the inaccuracies in the current system did provide for a great player experience in exploring the possibilities of guessing which statement was a lie. In the preliminary testing of our system, we identified that it has some limitations. The current limitations majorly stem from the microcontrollers that are tethered to a Windows PC for communication. The Emotibit communicates data over Wi-Fi to the system,

[2]https://www.emotibit.com/

[3]https://www.programmableair.com/

which is then relayed serially to the programmable air. In future iterations, we would be working towards making the whole system wireless to improve the user experience, as well as conducting a pragmatic field study to identify the associated user experience of Pneunocchio. Further, the algorithm to detect a lie can also be supplemented with machine learning to improve the accuracy.

4 CONCLUSION

In this paper, we presented Pneunocchio, a playful nose augmentation. Pneunocchio is an inflatable augmentation that leverages the physiological signals of a player in the game of "Two Truths and a Lie". We articulated the design and implementation of the bodily extension. In the future, we aim to conduct a field study to identify the user experience associated with lying and reflecting on the same through a nose augmentation to offer design guidelines and strategies for creating bodily extensions that promote embodied representation.

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