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## Social Stories

Advanced User Interfaces  
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## Abstract

The *Social Stories* web application endeavors to create an innovative web application aimed at individuals with high-functioning Neuro-Developmental Disorders (NDD), with a focus on adolescents and young adults within this demographic. Leveraging advanced technologies such as ChatGPT and DALL·E APIs, the project aims to generate some personalized social narratives, merging therapeutic insights with cutting-edge artificial intelligence.

This application facilitates the creation of dynamic, age-appropriate Social Stories that are tailored to various scenarios, aiding users in understanding and navigating social situations. Emphasizing engagement and simplicity, the platform integrates user-friendly interfaces developed in ReactJS for the frontend and Python for the backend, ensuring seamless interactions and accessibility.

Through meticulous research on Social Stories, conversational AI, and generative image technologies, the team uncovered limitations in existing approaches, inspiring the pursuit of a more adaptive, diverse, and immersive storytelling paradigm. Future iterations aim to incorporate advanced text-to-speech functionalities, enhanced visual dynamics, and interactive scenario-based modules, augmenting user experiences.

The *Social Stories* web application aspires to bridge therapeutic methodologies with technological advancements, offering a promising avenue to bolster social skills, foster independence, and provide a versatile toolset for individuals navigating the complexities of social interaction within the realm of Neurodevelopmental Disorders.

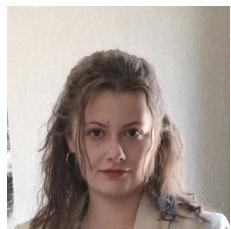
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## Member Contribution

The success of the project is attributed to the collective efforts and collaboration of each team member, contributing their expertise to the research, development, and integration of the *Social Stories* web application. Active participation in team meetings, sharing updates, challenges, and solutions helped resolve issues faster. The provision of support, feedback, and assistance ensured the project's success.

### Cabai Eleonora

**Role:** Frontend Developer (React)

**Contributions:**

- Created the user interface and interactive elements using React.
- Designed a visually engaging and user-friendly frontend with features for smooth user interaction and navigation.
- Integrated the entire project, ensuring seamless functionality between frontend and backend components.

### Mellatdoust Parinaz

**Role:** Lead Researcher

**Contributions:**

- Conducted in-depth research on conversational AI and Image Generation tools.
- Analyzed findings related to Social Stories in AI applications.
- Explored prompts suitable for ChatGPT and DALL·E and continued ongoing research to stay updated with emerging AI trends.

### Pantofaru Andreea Monica

**Role:** Backend Developer (Python)

**Contributions:**

- Developed the backend infrastructure in Python for ChatGPT and DALL·E API communication.
- Implemented functionalities to handle requests from the frontend to APIs.

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## 1 Workflow of Project Activities

This section details the sequential progression of activities undertaken by our group, encompassing comprehensive research and subsequent development tasks.

### Research Phase

Initially, the group conducted extensive research encompassing the utilization of Social Stories, conversational AI, and image generation. The research aimed at understanding the applications of Social Stories in therapeutic contexts and exploring the potential uses of AI technology.

### Task Division

Following the initial research phase, the group allocated tasks among team members, delineating responsibilities as follows:

- One member focused on investigating suitable prompts for ChatGPT and DALL·E.
- Another commenced backend development in Python.
- A third member initiated frontend development in React.

This division of tasks facilitated concurrent progress in multiple areas of the project.

### Project Development and Research Progression

During this phase, each group member dedicated their efforts to their assigned task, engaging in iterative development based on feedback and testing. Weekly meetings ensured synchronization, alignment, and facilitated the resolution of challenges.

### Integration Phase

In the final phase, the group collaborated to integrate the three components. Continuous communication among members significantly reduced challenges encountered during this phase.

## 2 Executive Summary

**Project Name:** Social Stories

**Core Mission:** Utilizing smart technology to create personalized stories for individuals with high-functioning Neurodevelopmental Disorders (NDD).

**Industry/Sector:** Educational Technology

**Products/Services:** The *Social Stories* web application crafts dynamic narratives, tailored to specific situations and information provided by therapists, using intelligent chat and images. What sets this project apart is its ability to generate a new story for the same situation every time it's accessed, ensuring sustained engagement and facilitating effective learning without monotony.

**Unique Selling Proposition (USP):**

- **Fresh Stories:** Unlike traditional Social Stories, our application generates a new narrative each time, maintaining engagement.
- **For Everyone:** Social Stories caters to all age groups, not solely younger children.

**User Engagement and Interaction:** The application sustains user engagement by generating each time a new story for the same scenario, aiding in better adaptation and comprehension of lessons. Additionally, users have the flexibility to choose their preferred format — audio, text, or images — to personalize their experience.

**Therapist Collaboration:** Therapists play a crucial role in tailoring stories to each individual's needs, in fact they determine the scenarios and lessons, and can modify stories based on user requirements. Through collaboration between therapists and the application, stories are customized according to age, fears, and preferences. Users also have the option to select their preferred format—audio, text, or images.

**Technological Integration:** The application integrates intelligent chat and image tools like ChatGPT and DALL-E. ChatGPT generates diverse stories and concepts, while DALL-E transforms them into visuals. Built with Python and ReactJS, the web-based application ensures ease of use.

**Conclusion:** Social Stories amalgamates technology and therapy to facilitate enhanced learning for individuals with high-functioning NDD. With its constantly refreshing stories, inclusive for all age groups, and therapist involvement, the project aims to augment social skills. The seamless integration of smart technology ensures a comprehensive and personalized learning experience.

### 3 Requirements

#### 3.1 Stakeholders and Target Group

The project stakeholders include:

- People with High Functioning Neurodevelopmental Disorders (NDD) (primary users).
- Therapists and teachers (secondary users).
- Family members of individuals with NDD participating in activities.

Our primary target group comprises teenagers and young adults with high functioning NDD (verbal). The primary focus is on individual interactions with the system outside therapy sessions, mainly at home or in school settings.

#### 3.2 Context and Needs

The project context revolves around a portable, multi-sensory system engaging users in interactive activities. Identified needs are as follows:

- **N1:** Engaging activities to counter negative attitudes.
- **N2:** Improvement in personal autonomy and life skills.
- **N3:** Creation of comfortable and friendly activity spaces.
- **N4:** Support for customizing existing activities.
- **N5:** Assistance in creating new stimulating activities.

#### 3.3 Goals

The project aims to achieve the following goals:

- **G1:** Develop multi-sensory game-style activities supporting specific training tasks in NDD treatment [N1-N3].
- **G2:** Create a safe, comfortable space for repeated interaction [N1-N3].
- **G3:** Support customization of activities by therapists and teachers [N4, N5].
- **G4:** Enable users to practice at their own pace [N1, N3].

### 3.4 Constraints

The project operates within the following constraints:

- **C1:** User-controlled system usage time.
- **C2:** Content designed for easy personalization.
- **C3:** System may offer action suggestions to the user.

### 3.5 UNG Model

The UNG Model of the project is depicted in Figure 1.

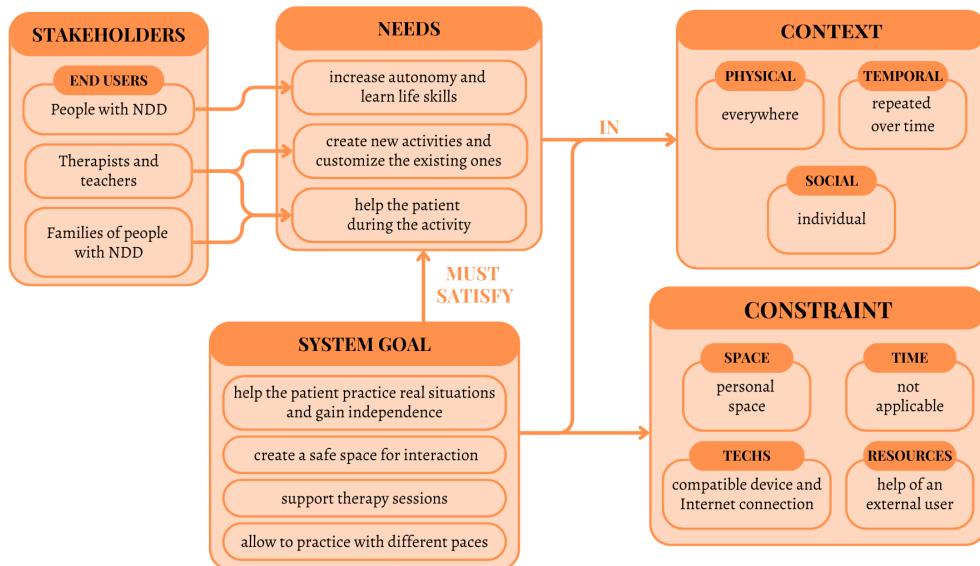


Figure 1: Project UNG Model

## 4 State of the Art

In our research, we came across two critical points: limitations of Social Stories and the use of generative AI. We will elaborate on each of these points to provide insights into our choice of system.

### Limitations of Social Stories

Our investigation into Social Stories revealed their primary focus on children. However, in-depth research highlighted the potential benefits also for older individuals, including adults. This observation prompted us to develop an application suitable for a wider age range.

Furthermore, our research indicated that the traditional use of Social Stories often involve repeatedly presenting the same story to the target audience. While this repetition aids in familiarizing individuals with situations, it may inadvertently limit their ability of adaptation. We aimed to address this by employing a method capable of generating diverse Social Stories for the same scenario. This approach enables users to learn adaptability rather than memorizing a singular story, thus reducing potential confusion and distress. Moreover, continuous repetition of the same story may lead to user frustration, consequently our approach generates a new story during each interaction, enhancing enthusiasm and engagement among users.

Additionally, our findings regarding individuals with high-functioning NDD suggested an affinity for simulation games. These games provide a safe space for exploring social interactions and behaviors that might be challenging in real-life scenarios. To align with these preferences, our future project adaptations will incorporate interactive scenarios facilitating user interaction with characters through conversations. These conversations offer users multiple choices for responses, fostering engagement and enhancing learning experiences. The detailed functionality and structure of these conversations will be further explained in the subsequent section regarding the use of generative AI.

### Use of Generative AI

Our exploration into the use of generative AI led us to a study discussing generative agents in a playground world, mimicking human behavior and relationships. This study guided our direction towards interactive storytelling.

For our future adaptations, we plan to utilize ChatGPT as a generative agent, assuming the role of a character within the story. It will generate dialogue options for both the user and the character they engage with. We have already devised a preliminary system involving scenario and character profiles fed to ChatGPT, which generates conversational interactions based on established rules.

However, challenges arose concerning the handling of personal information exchanged within these interactions. To maintain user privacy, we initially considered leaving placeholder brackets for sensitive information, allowing users to fill in the details before the conversation display. Yet, integrating user responses to continue the conversation proved technically challenging due to limitations in prompt handling by ChatGPT. Thus, we redirected our focus toward traditional Social Stories discussed earlier.

Another crucial aspect of effective Social Stories involves image generation through DALL-E. However, we encountered several challenges in this domain:

1. **Inability to generate continuous images**, which was addressed by avoiding repetitive character mentions and ensuring scene changes.
2. **Inconsistency in character generation**, which was resolved by adopting a first-person perspective and avoiding character reflections.
3. **Challenges with style consistency in images**, which was mitigated by opting for a cartoonish style, that limitates issues in replicating specific styles.

In Figures 2 and 3, which were generated for sequential parts of a story centered around anger, the stylistic inconsistency of DALL-E is evident. It is noticeable that Figure 3 does not align with the provided prompt and displays a stylistic disparity compared to Figure 2.



Figure 2: Generated Image n. 1

**Prompt:** *A group of children playing music together harmoniously in Toy Story style*

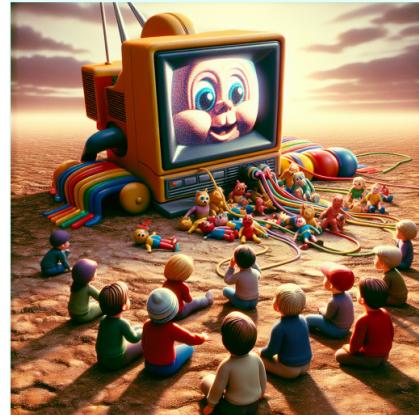


Figure 3: Generated Image n.2

**Prompt:** *Mario appearing angry while looking at another kid in the classroom in Toy Story style*

In conclusion, while facing challenges with generative AI and image generation, we have focused on balancing traditional and innovative approaches to ensure a comprehensive and engaging experience within our Social Stories project.

## 5 Solution - UX Design

### 5.1 General Approach

At the onset of our work, our primary objective revolved around amplifying engagement and personalization within Social Stories, especially considering our target audience of individuals with Neuro-Developmental Disorders (NDD). Extensive research underscored the pivotal need to tailor content precisely to meet the unique needs, preferences, and developmental levels of each individual.

The language within each story was crafted to be clear and straightforward, optionally complemented by visual aids such as illustrations or photographs, incorporated to increase comprehension. Recognizing the value of involving the individual's interests in the created story, whenever feasible, we looked for ways to facilitate their active participation, acknowledging its potential to heighten engagement and the overall efficacy of the Social Story.

The interaction between users and the system primarily occurs through personal devices such as laptops, tablets, or smartphones. Following an exploration of various interaction scenarios, we opted for an appealing yet simple theme.

Our aim was to create an interface that not only captivates users but also remains intuitively navigable and comprehensible. We incorporated vibrant yet calming colors to establish an inviting atmosphere without overwhelming users. Furthermore, our design incorporates an intuitive layout, in which content is organized logically to ensure effortless access to features and sections.

In summary, the UX design of the *Social Stories* web app was centered on creating an engaging yet simplistic interface to cater to users' storytelling needs. By adhering to user-centric design principles and implementing intuitive interactions, our design aimed to deliver a gratifying and seamless user experience tailored to this unique audience.

## 5.2 User Workflows

The user workflow for our application delineates the user's seamless interaction with our platform. Upon opening the application, users encounter two primary paths: *Settings* and *Select the Story*. The following descriptions elucidate both scenarios, accompanied by diagrams for a straightforward comprehension.

### 5.2.1 Settings Path

When the user initiates the application, they have the option to navigate to the *Settings panel* by selecting the *Settings button*. Within this panel, several options are available, including

- *User Profile*, where therapists can access and modify the user's information. The Edit Information option allows updates to their name, birth date, problems, and other pertinent details.
- *Story Settings*, where therapists can edit and configure story settings such as the presence of text, images and speech in the generated stories.
- *Online Stories*, where therapists can edit the list of stories for the online version.
- *Offline Stories*, where therapists can edit the list of stories for the offline version.
- *Add Stories*, where therapists can insert details for the dynamic generation of a new story for the user.

Upon completing any alterations, users can save their changes by clicking the Save button. If further changes are required, the Cancel button allows them to revert to the previous menu.

### 5.2.2 Select the Story Path

Alternatively, users can opt to directly select a story from the main menu. This choice leads them to a repository of available stories, offering options for both online and offline stories. Users can make their story selection from this list.

Once a story has been chosen, the story generation process begins immediately. The application then generates the story, providing previews and allowing users to navigate through the story using the "Next" button. When the user reaches the end of the story, they can press the "Finish" button to complete the experience.

### User Workflow Diagram

The next diagram illustrates the user workflow for the *Social Story* web application.

These pathways facilitate a user-friendly and intuitive interaction model, granting users control over their profile details and story selections within the application.

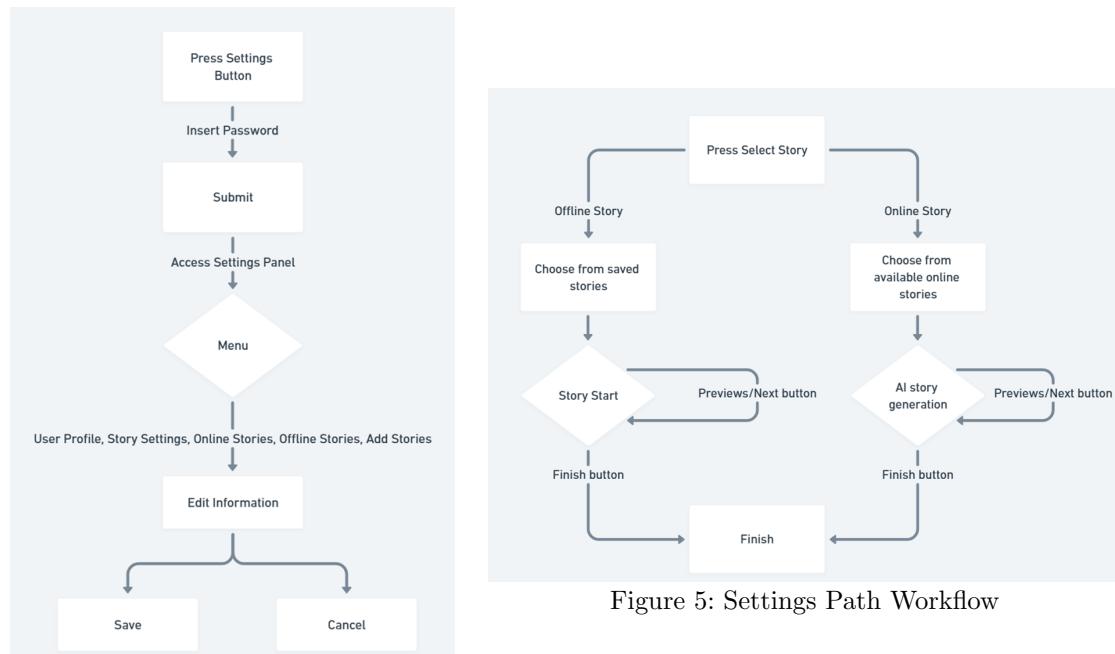


Figure 4: Settings Path Workflow

Figure 5: Story Selection Path Workflow

### 5.3 Relevant Scenarios

#### 5.3.1 The therapist changes the story settings

**Description:** The therapist modifies story settings using their admin privileges.

**Steps:**

1. The therapist accesses the settings by using their admin credentials.
2. They navigate to the left panel and select "Story Settings."
3. By clicking on Text, Image, or Speech options, they adjust respective settings as needed.

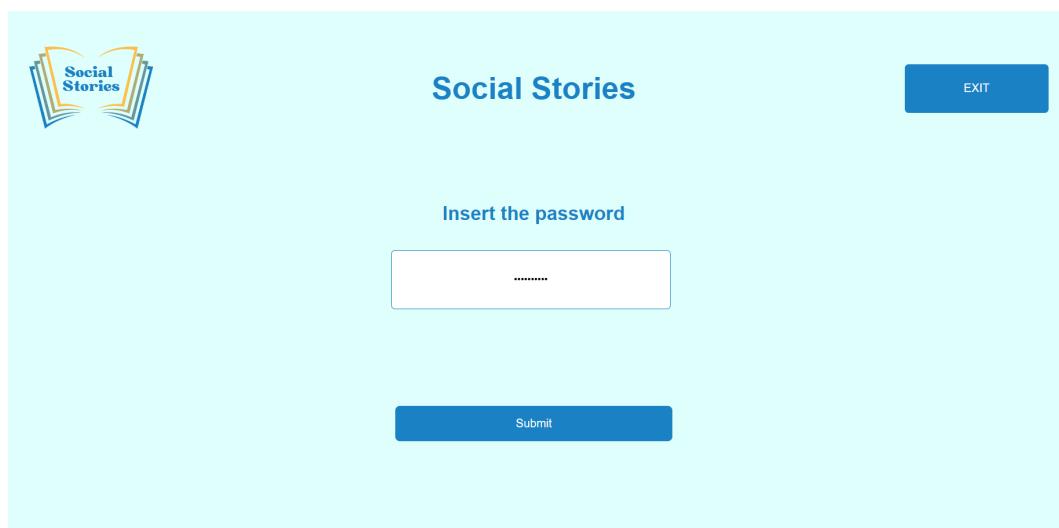


Figure 6: Request for admin credentials

A screenshot of a mobile application interface showing 'Story Settings'. The title 'Story Settings' is at the top in a blue bar. Below it are three sections: 'Text' with 'YES' and 'NO' radio buttons, 'Images' with 'YES' and 'NO' radio buttons, and 'Speech' with 'YES' and 'NO' radio buttons. At the bottom are two blue buttons: 'Cancel' on the left and 'Save' on the right.

Figure 7: Story Settings page

### 5.3.2 The therapist adds a new story

**Description:** The therapist adds a new story via the admin panel.

**Steps:**

1. Using the admin password, the therapist enters the settings panel.
2. Within the panel, they select the "Add a Story" section from the left side.
3. They input a title, description, and desired lesson for the new story.
4. After saving, the newly added story appears in the list of existing stories.
5. To preview the story, they navigate to the main page and select it from the user's perspective.

The screenshot shows a web-based form titled 'Story Details'. It has three input fields: 'Title' (with placeholder 'Title of the story'), 'Scenario' (with placeholder 'Brief description of the story scenario'), and 'Lesson' (with placeholder 'Provide the lesson to teach with this story'). Below the form is a blue button labeled 'Save'.

Figure 8: Add a Story page

### 5.3.3 The user reads the chosen story

**Description:** The user engages with a story through their account.

**Steps:**

1. The user logs into their account.
2. They encounter a button on their page to select a story, choosing between online or offline versions.
3. After choosing, they view a list of available stories and make their selection.
4. Upon selection, they wait for the story to load.
5. User navigate between the story panels using forward and backward options.
6. Upon story completion, they are redirected back to the main page.

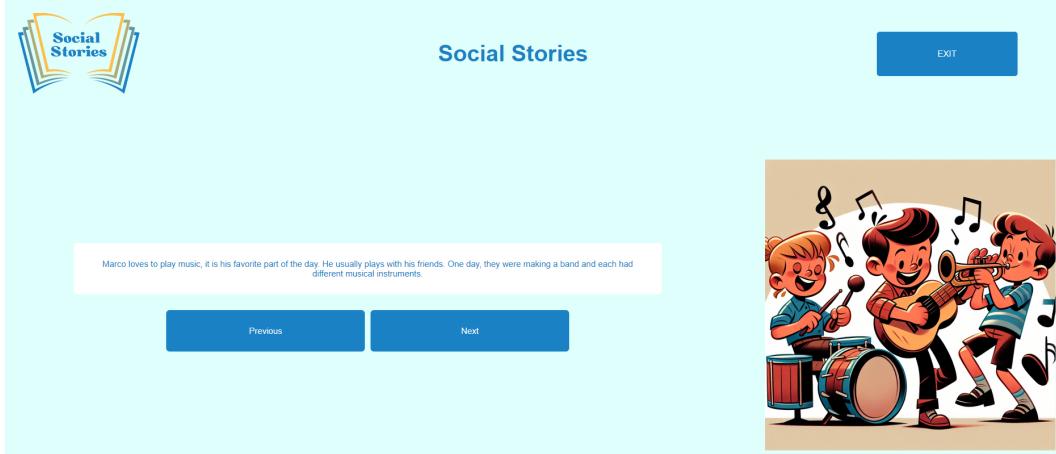


Figure 9: Story with text and images

## 6 Technological Solution

### 6.1 General Technological Approach

Social Stories is a web-based and purely software-driven application, that operates entirely within the digital domain in order to eliminate the requirement for any physical hardware components.

The web application utilizes a Python-based backend system, responsible for facilitating communication with the ChatGPT and the Dall·E APIs, while the frontend is developed using React. This architecture ensures seamless interaction between the user interface, designed with React, and the backend operations conducted in Python, enabling efficient integration and utilization of the ChatGPT and the Dall·E APIs functionalities.

Our methodology involves using ChatGPT both for story creation and for generating prompts for DALL·E. Through extensive research on prompt engineering, we identified an effective structure for ChatGPT prompts that ensures more relevant and coherent responses, which includes:

- Rules for Story Generation, that define guidelines and parameters that govern the narrative created by ChatGPT.
- Rules for DALL·E Prompt, that establish specific instructions and criteria for the prompt provided to DALL·E, ensuring alignment with the story generated.
- Parameters for Content Creation, that outline essential parameters that guide the overall content creation process, ensuring consistency and relevance.

This structured framework enhances the coordination between ChatGPT and DALL·E, resulting in a more coherent and contextually appropriate output.

### 6.2 Python

The simplicity and readability of Python proved invaluable in integrating OpenAI's ChatGPT and DALL·E models into our application. Its clean syntax facilitated rapid algorithm development and straightforward AI model implementation, enabling seamless interaction between our application's backend and OpenAI's APIs. This facilitated the creation of engaging stories with textual and visual elements.

Python's ability to handle JSON data eliminated the need for additional libraries or parsing, minimizing the risk of errors during data transmission between the back-end and front-end and making the integration process more robust and reliable.

### 6.3 OpenAI APIs

ChatGPT and DALL·E APIs are the foundation for generating engaging and immersive Social Stories. In particular, ChatGPT processes simple sentences provided by caregivers to create captivating narratives, while DALL·E generates images starting from textual descriptions created by ChatGPT to complement the stories with visually stunning illustrations.

The initial two segments of the prompt are static and contain the foundational rules given at beginning of each session, whereas the third one introduces dynamic variables that allow the personalization of the result. This prompt was tailored for ChatGPT 3.5, implying that certain limitations specified below may not be applicable to ChatGPT 4.

#### 6.3.1 Rules for Story Generation

The first prompt initializes the rules for the story generation. After experimenting with various approaches, we found it most effective to segregate instructions for DALL·E from this first set of instruction. This separation became essential to prevent ChatGPT from potentially overlooking details within an extensive list of instructions. The prompt provided to ChatGPT is the subsequent:

*"I want you to generate an appropriate social story based on age and scenario. I will give you a character profile, scenario, lesson, likes and dislikes. I want you to generate the story when I type "START". Here are the rules:*

1. *I want to generate images for our story with DALL.E so along the story you should give me indicated image descriptions that need to be fed to DALL.E to get the images of our story. I will give you rules for DALL·E in next prompt.*
2. *Each text part must contain 25 to 70 words and the overall story must be between 2 to 5 parts.*
3. *The format of the whole story should be similar to example below.*  
*Image 1: [prompt for image 1] in simplified Toy Story style.*  
*Part 1: [part of story related to image 1].*  
*Use this format for next images and parts and replace the brackets with appropriate text (the "in simplified Toy Story style" will remain the same in all images).*
4. *The wording of the story must be simple since the social story targets people with neurodivergent disorders.*
5. *The story must use the given scenario to teach the given lesson.*
6. *You will give the whole story (multiple images and parts) to me in one prompt after I type "START".*
7. *Incorporate the given likes into the story if the scenario allows it and ensure dislikes are not involved in the story."*

In particular:

- In the preliminary segment, we introduce dynamic variables while implementing a rule to generate the story only upon typing "START", ensuring relevance in ChatGPT's output.
- Rule 1 specifies that instructions for DALL·E will be supplied independently.
- Rule 2 imposes restrictions on word count and panel numbers to maintain result consistency.
- Rule 3 presents the expected output. Including the panel number (Image 1, Part 1) ensures clarity, as ChatGPT occasionally omits numbering without this reference, and the notation "in simplified Toy Story style" precedes the image example to specify the consistent style required by DALL·E. This style specification could be transformed into a variable within the dynamic section for flexibility.
- Rules 4, 5, and 7 elucidate how variables are employed.
- Rule 6 addresses a recurring issue with ChatGPT, preventing the model from delivering individual story panels and prompting a command before proceeding.

### 6.3.2 Rules for DALL·E Prompt

This section is intentionally kept concise, although it is adaptable for the inclusion of additional rules. As highlighted earlier, excluding the main character from the images ensures consistency and avoids issues related to character attributes, such as ethnicity or skin color. Furthermore, we introduced a rule to avoid abrupt changes in objects and characters representations between panels. This approach simplifies both the description process for the user and the image generation for DALL·E. The prompt provided to ChatGPT is the subsequent:

*"Here are rules of image prompt:*

1. *Keep any mention of the main character out of images (this includes name, picture, body parts, reflection in mirror, etc.).*
2. *If there is a need to mention a interaction between the main character and an object (example: main character sitting on a wooden chair) just give the description of the object without the character (example: an empty old wooden chair).*
3. *Side characters (beside the main one) can only be mentioned in one image."*

### 6.3.3 Parameters for Content Creation

The dynamic segment of our prompt allows the customization of each generated story and serves as the tuning mechanism, so there is no necessity to reiterate the first two segments within the same session. The prompt provided to ChatGPT is the subsequent:

*"Character: +userName, which was born on +userBirthDate, and has to address the following problems: +userProblems. The user has the following interests: +userInterests, and does not like: +userDislikes*

*Scene: +scene*

*Lesson: +lesson*

*Remember to keep any mention of the main character out of the images."*

## 6.4 Front-end

For the frontend development of our application we decided to use React, which is a JavaScript library used for building user interfaces. Its component-based architecture allows for the creation of interactive and dynamic interfaces where therapists can input story prompts, and individuals with NDD can view and interact with the generated content.

### 6.4.1 Therapists interface

The frontend interface for therapists includes forms and input fields enabling the to:

- provide user information, such as name, age, areas of focus (problems to work on), interests and fears,
- insert a title, a brief description and a lesson to add a new story to the list,
- manage and edit the list of both online and offline stories for the user.

In particular, when the therapist enters information for a new story, this data is transmitted to the backend, which queries ChatGPT to generate five distinct versions of the story. These versions are then stored locally for the offline version of the application.

### 6.4.2 Users interface

The frontend interface for users, that typically are people with NDD, allows navigation through the stories titles and presents the chosen story along with related images, if applicable.

The initial decision users face is whether to use the application in online or offline mode, where the available story titles are displayed. However, in the online mode, the story is generated at runtime by ChatGPT, whereas, in the offline mode, it is randomly chosen between a set of five distinct versions of the same story, previously saved locally.

## 7 Evaluation

### 7.1 Research Question and Variables

To assess the quality and efficacy of our *Social Stories* web application, we performed two tests for our two central claims.

**Age Appropriateness** Our primary research question aimed on evaluating the age appropriateness of the Social Stories generated from our application. The variables examined were the language complexity and perspective changes within the stories across different age categories.

**Social Story Validation** The secondary research question focused on validating the Social Stories generated from our application against existing Social Stories, to assess the quality and adherence to fundamental Social Story principles.

### 7.2 Participants' Profile

To evaluate the age-appropriateness across a broader age range, we designed 10 scenarios and tested them using three distinct age groups: 7 years (child), 14 years (teenager), and 21 years (adult). This allowed us to explore the adaptability of our stories across different age categories. The second question did not require participants, as it is a purely qualitative evaluation of the generated content.

### 7.3 Data Gathering and Execution

For the first question, data collection involved designing 10 scenarios applicable to Social Stories and generating stories for each of the three age groups, resulting in a total of 30 stories. For the second research question, the data gathering process involved researching 50 existing Social Stories and generating an equivalent number of stories with similar objectives.

The study for both questions was executed systematically, ensuring a proper evaluation of the generated Social Stories across different age categories and their adherence to existing ones. Comparative analysis and assessment criteria were employed to determine the stories' suitability.

### 7.4 Results and Discussion

The results of the evaluation revealed, as expected, discernible variations in language complexity and perspective changes among Social Stories tailored to different age groups. Additionally, comparative analysis with real-world Social Stories validated the quality and adherence of our stories to fundamental principles. The discussion focused on the implications of these findings and their significance in reinforcing the suitability of our *Social Stories* web application across diverse age ranges.

## 7.5 User Feedback

We had the opportunity to have our application tested by a user within our target group. This feedback proved invaluable in assessing the quality of our work and gaining insights into potential improvements and future developments.

The user, a 16-year-old boy with a highly functioning Neurodevelopmental Disorder (NDD), tested our application under the supervision of his mother, who provided the final feedback. The boy was able to read multiple stories, both locally saved and runtime-generated, focusing on coping with anxiety in crowded places, a significant challenge for the user.

According to the boy's mother, the strength of our application lies in the ability to present the same story in multiple versions, accompanied by images that represent it. She believes this approach allows users to concentrate on the lesson provided rather than being overwhelmed by the specific situation depicted.

Despite potential limitations in content generation by ChatGPT and DALL-E, the overall feedback received by the mother of the user was positive.

## 8 Value Proposition

The *Social Stories* web application is meticulously designed to cater to the distinct needs of stakeholders: individuals with Neurodevelopmental Disorders (NDD) as primary users, therapists, teachers, and participating families.

Focusing on teenagers and young adults with high-functioning NDD, our target audience, we aim to facilitate individualized interactions with our system outside therapy sessions, fostering engagement and skill development at home or school.

**Engagement** The core essence of our application revolves around engaging individuals with NDD through a system that transports them into diverse activities. Our approach immerses users within a safe space where they become central to the narrative, cultivating in them a sense of ownership and encourage them to actively participate, fostering a positive and motivational experience.

**Customization** We prioritize customization, recognizing its significance in meeting individual needs, in fact our system offers flexibility in tailoring activities, ensuring comfort, and challenging exercises, aligning with users' needs. This customization is also extended to caregivers, which curate activities that specifically target skill enhancement and emotional regulation, catering to the unique requirements of each user.

**Independence** While our focus steers towards individual interaction outside therapy sessions—such as at home or school—the system engages users through personal devices, promoting autonomy, skill development, and positive attitudes in a comfortable and friendly environment.

**Literature** Our approach draws inspiration from standardized brain-training exercises while introducing a novel concept within the smart space. By providing activities aimed at specific training tasks in NDD treatment, we step beyond traditional methods, leveraging a technology-driven approach to create a safe, comfortable, and repeatable space for users to engage and thrive.

In conclusion, the *Social Stories* web application has the aim of empowering individuals with high-functioning NDD. By blending personalized engagement, customization, and a safe interactive space, we foster skill development, positive attitudes, and autonomy. Our project represents a unique fusion of innovative storytelling and activities, ensuring a beneficial experience for our targeted audience.

## 9 Future Work

In the ongoing pursuit of enhancing and expanding our application's functionalities, two overarching objectives guide our future development.

We wish to incorporate advanced text-to-speech capabilities, thereby supplementing the storytelling experience with auditory engagement alongside visual stimuli. This integration will significantly elevate accessibility and user engagement, accommodating a diverse range of preferences and needs. We would also like to ensure seamless accessibility even in offline modes, enabling the saving of images and integrating text-to-speech functionalities. The goal is to ensure a comprehensive experience regardless of internet connectivity.

While the existing constraints of DALL·E present challenges in achieving fully dynamic visual content, our forward-looking objective is to establish a more dynamic narrative environment. We aim to bring to life characters and scenarios, empowering users to engage and interact within immersive virtual realms. Our envisioned future involves providing users with choices to determine their behaviors and responses, replicating real-life situations for a personalized and enriching experience.

### 9.1 Interactive game

Our concept revolves around a conversational game where users can choose or create scenarios, each populated with multiple characters for interaction. For example, if the scenario is "*talking to strangers before class*", we would have the settings of a class with multiple students, and when the user chooses a student, they could interact with other characters. Each game might have some goals, for example "*talk to 3 people*". However, for our initial phase, we decided to have one character in the scenario and no objectives. To preserve flexibility, the game is currently structured to have the player initiate and conclude conversations. The prompt presented below was created with ChatGPT 3.5, so certain structural formulations, that aim to avoid recurrent mistakes made by ChatGPT, might not be necessary for ChatGPT 4.

Among all the tested approaches, we determined that the most effective method to maximize personalization, especially when involving personal details, is to pause the game and request the necessary information. For example, if the conversation shifts to books and the character is queried about their favorite book from the user's perspective, a pop-up (or a less intrusive feedback method) is triggered. In this instance, the user is prompted with a question generated by ChatGPT, such as "*What is your favorite book?*" and upon entering their response, the user can then view their typical three options alongside their provided answer within the options.

An alternative method to handle personal details is creating first-person stories. Using our previous example, when the character is asked for their favorite book, the user immediately sees the results but in the segment where they should observe the book's

name, they encounter a placeholder. For instance, one of the presented options might read, "*My favorite book is [YOUR FAVORITE BOOK NAME] by [AUTHOR OF YOUR FAVORITE BOOK]*". While this approach is less intrusive, it may lack appeal for some users, additionally it poses challenges in terms of personalization, as ChatGPT remains unaware of the book's details, reducing its ability to craft specific dialogues. For example, without knowledge of the book's genre, ChatGPT cannot respond with "*I don't like horror stories, unlike you. They make me scared*".

### Game initialization

The first prompt provided to ChatGPT, that initializes the game and provides rules, is the following:

*"Let's initialize a role-playing game. We'll assume roles of two people who will be explained in my next prompts. I will also give you a scenario which we are in. You can generate relevant information about your character but if you need information about my character, ask me even if it is during the game. (indicates that the game is paused and what information you need to proceed). Here are the rules:*

1. *The game will only start when I type "start" and end when I type "stop"*
2. *When it is my turn I want you to generate 3 options for me to choose from 2 of which are friendly and 1 is rude. (They should be indicated as friendly or rude so it is easy to distinguish)*
3. *I will start the whole conversation so after I type start and the game starts you should give me 3 options to start the conversation. Do not start the game before I type "start".*
4. *When I type stop I want you to generate 3 options with same rules as other rounds but these options are ways to end an conversation. DO NOT FORGET THIS PLEASE.*
5. *Keep the conversation flowing (whenever it's my turn generate options for me to choose and ALWAYS answer AUTOMATICALLY as your character. Then generate me new responses to choose from and so on). DO NOT STOP the conversation until I tell you to.*
6. *You can change the topic we are talking about if you believe we talked about a subject enough.*
7. *You are NOT allowed to change the scenario of the game (time, place, etc)."*

In particular:

- Rule 1 specifies the start and end commands.
- Rule 2 imposes the presence of three options for the player to choose from, two of which are friendly and one is rude. We requested ChatGPT to identify them so

that, during integration into our program, if the user selects the rude option we can highlight the choices in red and prompt them to make a different selection since the goal is to promote positive interactions. Initially, we used the term "*polite*", but due to ChatGPT's difficulty understanding it, we opted for "*friendly*".

- Rule 3 outlines the game mechanics, emphasizing that only users should initiate all conversations since a common issue with ChatGPT is related to premature start. To reinforce this, reminders are periodically provided.
- Rule 4 reiterates the user's authority to conclude conversations, offering them options to facilitate the learning of conversation-ending techniques. Similarly, reminders accompany this rule to address potential challenges with ChatGPT.
- Rule 5 and 6 prevents abrupt conversation halts but ensure longer interactions by introducing topic changes.
- Rule 7 prevents potential inconsistencies connected to the change of the scenario during the conversation.

## DALL·E Integration

The use of DALL·E aims to enhance the user experience by incorporating in the story some background images. Inspired by video games, particularly dating simulations where characters interact against a visual backdrop, our concept introduces scene-setting images corresponding to the user-defined scenarios.

While the dialogue will appear on the screen, the background image establishes the context and, when an object is introduced into the conversation, its image temporarily takes center stage before reverting to the original scene. However, it's essential to note that this part of the prompt experienced challenges during testing because of ChatGPT that occasionally lead to mistakes in adhering to previous rules. Despite these challenges, the concept demonstrates promise and potential for improvement. The prompt provided to ChatGPT is the following:

*"One more rule is that I want to connect this game to DALL·E. I need you to generate scenes for me. Scenes are descriptions made into an appropriate prompt for DALL·E. You must make them automatically when needed. (the conditions below come up)*

*You will give me the first scene when I say "START" (it will happen only once). I want you to make a scene description based on the scenario I told you (a description of how the place looks like and where our characters are). It is the scene where our story will happen.*

*The next scenes are only descriptions of objects. When a character talks about an object that would be visible to our characters in the game, you must provide a description of the object (indicated by "object description:"), and when we move on from the subject, you must indicate with "object scene end" that the discussion about that object has ended. The end must happen after a few rounds when we are moving to the next topic of discussion.*

## Parameters for Content Creation

The final dynamic part serves as a key element for tuning and obtaining varied results. Users can experiment with modifying these parameters to elicit different storylines while retaining the consistency and engagement of the interactive conversational experience. The following example illustrates the structure of the dynamic component:

*"Here is the information you need for this round:*

*Scenario: We are two students in computer ethics class taught by professor "Jack Smith". I've seen you in class before, but I never talked to you before. (so we don't know each other's names in the beginning). It is before the start of the class, and I want to start a conversation with you before the professor comes. (the whole conversation needs to happen before class)*

*Here is the profile of my character:*

1. *Her name is Sam.*
2. *She is 24.*
3. *She is studying computer science.*

*You can ask me if you need more information about Sam during the game. Here is the profile of your character:*

1. *His name is John.*
2. *He is 26.*
3. *He is studying telecommunications.*

*Do not start before I tell you to and keep the conversation flowing (even if you need to change the topic of conversation)"*

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