Rehabilitation chair

The rehabilitation chair is a racing-style chair developed for stroke patients. RevSim and Referox aim to build this system by integrating VR elements, therapeutic games, and simulations of daily activities. The goal is to support patients in practicing controlled movements in a motivating and engaging way.

In its early phase, the chair is intended for use inside rehabilitation centres. It is designed to increase patient independence, reduce the need for continuous supervision, and make the rehabilitation process more enjoyable so that patients feel encouraged to continue their therapy.

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Context of use: Education
Level of education: Master

Impact on society

What impact is expected from your technology?

This category has not been filled yet.

Hateful and criminal actors

What can bad actors do with your technology?

This category has not been filled yet.

Privacy

Are you considering the privacy & personal data of the users of your technology?

This category is only partial filled.

Does the technology register personal data? If yes, what personal data?

At this stage, it is not yet defined whether the chair will collect personal data. However, if the final design includes sensors or user tracking, it may process movement or session-related data. These aspects will be further specified during the functional requirements phase, following GDPR principles.

Do you think the technology invades the privacy of the stakeholders? If yes, in what way?

No direct privacy risks exist yet, as the system is still conceptual. Possible concerns may arise later if user data is stored or shared without proper consent. These risks will be evaluated once the technical data flow becomes clearer.

Is the technology is compliant with prevailing privacy and data protection law? Can you indicate why?

Compliance with GDPR and Dutch data-protection standards will be a design requirement once data processing features are confirmed. Future iterations must include clear consent mechanisms, limited data collection, and secure storage protocols.

Does the technology mitigate privacy and data protection risks/ concerns (privacy by design)? Please indicate how.

This question has not been answered yet.

In which way can you imagine a future impact of the collection of personal data?

it could support personalized rehabilitation and long-term progress tracking. However, it may also raise concerns about data ownership and access. Therefore, transparent policies will be essential to maintain user trust.

Now that you have thought hard about privacy and data protection, what improvements would you like to make? List them below.

- Define early whether personal data will be collected and why
- Integrate privacy impact assessment in the design process

- Apply GDPR compliance as a baseline requirement for all data features
- Provide users and therapists with full control over data access and deletion

Human values

How does the technology affect your human values?

How is the identity of the (intended) users affected by the technology?

The Rehabilitation Chair helps users, particularly stroke patients, rebuild a sense of capability and confidence during the recovery process. By performing simulated daily-life exercises in virtual reality, patients can reconnect with meaningful actions such as reaching, grasping, or maintaining balance. This restores part of their pre-stroke identity as independent individuals.

How does the technology influence the users' autonomy?

The chair supports autonomy by allowing patients to train at their own pace without continuous supervision from a therapist. It gives them control over exercise timing, repetition, and level of challenge. This independence can increase motivation and reduce reliance on medical staff for routine training.

At the same time, the systems automation must not limit decision-making. If the VR environment or motion programs restrict users to fixed scenarios, they may feel controlled rather than empowered. Autonomy can be protected by enabling the patient (or therapist) to adjust the program parameters manually and by including options for rest, difficulty scaling, and free exploration.

What is the effect of the technology on the health and/or well-being of users?

The Rehabilitation Chair contributes positively to both physical and mental well-being. Physically, it enables repetitive and safe movement training that supports neuroplastic recovery after stroke. Mentally, the immersive VR environment can make rehabilitation more engaging.

Nevertheless, possible negative side effects should be recognized. Long sessions could cause fatigue, dizziness, or frustration if exercises are too difficult. To mitigate this, the system should monitor exertion levels, limit session duration, and provide clear feedback on progress to maintain motivation. Regular supervision by therapists remains essential to ensure safety and correct usage.

Now that you have thought hard about the impact of your technology on human values, what improvements would you like to make to the technology? List them below.

1- Implement clear safety protocols to prevent physical overexertion and VR-related discomfort

2-Introduce adaptive exercise programs that adjust automatically to the patients ability and fatigue level.

Stakeholders

Have you considered all stakeholders?

This category is only partial filled.

Who are the main users/targetgroups/stakeholders for this technology? Think about the intended context by answering these questions.

Name of the stakeholder
RevSim

How is this stakeholder affected?
The company will receive the functional requirements and user needs that can guide future product and design.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
RefeRox

How is this stakeholder affected?
Referox is responsible for translating the functional requirements into an actual physical product. The clarity and accuracy of our findings directly influence their ability to build a chair that is technically feasible, manufacturable, and safe to use. Their work depends on having well-defined specifications so they can plan materials, engineering decisions, and production steps with confidence

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Did you consider all stakeholders, even the ones that might not be a user or target group, but still might be of interest?

Name of the stakeholder
Stroke patients

How is this stakeholder affected?
They are the final users who will benefit from improved rehabilitation outcomes and comfort. Their needs are studied indirectly through therapists and literature, as direct patient interaction is not part of the current project scope.

Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Therapist

How is this stakeholder affected?
For this stage, therapists and physicians acted as the patient representatives, as reaching actual patients was not feasible. Their input helped us understand the user needs and clinical context from an informed perspective.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.
This question has not been answered yet.

Data

Is data in your technology properly used?

This category has not been filled yet.

Inclusivity

Is your technology fair for everyone?

Will everyone have access to the technology?

In 2nd phase of the project , the chair could be adapted for home use to increase accessibility. The goal is to make the chair affordable and easy to operate for both patients and caregivers.

Does this technology have a built-in bias?

At this stage, no data or algorithms exist that could create bias. However, bias could arise later if motion or performance data are based on a limited user group (such as only younger patients). Therefore, user testing in diverse age and mobility groups will be planned before final development

Does this technology make automatic decisions and how do you account for them?

These features will be designed with therapist oversight and adjustable parameters to prevent over-reliance on algorithms.

Is everyone benefitting from the technology or only a a small group? Do you see this as a problem? Why/why not?

Initially, it will mainly benefit stroke patients in rehabilitation programs. In the long term, it can be extended to other patient groups such as those with mobility impairments or post-surgery recovery needs. The aim is to maximize accessibility and not limit usage to one diagnosis.

Does the team that creates the technology represent the diversity of our society?

The development involves collaboration between engineering and healthcare professionals, including physiotherapists, system engineers, and students from different backgrounds. Future involvement of patients and rehabilitation experts will help ensure the solution fits diverse needs.

Now that you have thought hard about the inclusivity of the technology, what improvements would you like to make? List them below.

- Involve stroke patients with different severity levels (mild, moderate, and severe) in the next testing phase
- Design adjustable components such as seat height, arm support, and interface position to fit different physical abilities
- Simplify the VR interface with clear visuals and optional multilingual support

Transparency

Are you transparent about how your technology works?

This category is only partial filled.

Is it explained to the users/stakeholders how the technology works and how the business model works?

This question has not been answered yet.

If the technology makes an (algorithmic) decision, is it explained to the users/stakeholders how the decision was reached?

This question has not been answered yet.

Is it possible to file a complaint or ask questions/get answers about this technology?

Currently, this process does not exist, as the product is conceptual. However, once the prototype is tested in rehabilitation centers, users and therapists will have feedback channels to report issues, suggest improvements, or express concerns about functionality and data use.

Is the technology (company) clear about possible negative consequences or shortcomings of the technology?

Potential limitations, such as motion sensitivity, physical fatigue, or VR discomfort, will be communicated transparently during pilot testing. The development team aims to maintain open communication with rehabilitation professionals to identify and minimize such effects early.

Now that you have thought hard about the transparency of this technology, what improvements would you like to make? List them below.

- Add visible or verbal cues when automated adjustments occur in VR sessions
- Create a feedback channel for users and therapists to report unclear or unexpected system behavior

Sustainability

Is your technology environmentally sustainable?

This category has not been filled yet.

Future

Did you consider future impact?

This category is only partial filled.

What could possibly happen with this technology in the future?

In the future, the rehabilitation chair could evolve into a smart, adaptive system used widely in rehabilitation centers and even home-based care. Initially developed for stroke patients, it could later be adapted for Parkinsons patients or individuals with other motor impairments. The integration of AI and real-time data analysis might personalize therapy sessions and improve recovery outcomes.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one utopian scenario.

In an ideal future, rehabilitation chairs are seamlessly integrated into healthcare systems worldwide. They automatically adjust exercises to each patients condition, reducing recovery time and improving quality of life. Patients can train independently at home, supported by virtual therapists and real-time progress tracking shared with medical professionals.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one dystopian scenario.

In a less desirable scenario, rehabilitation technology becomes expensive and limited to high-end clinics. Data privacy concerns or over-reliance on automation might reduce human supervision in therapy, leading to misuse or ineffective treatments for vulnerable patients.

Would you like to live in one of this scenario's? Why? Why not?

This question has not been answered yet.

What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?

If acquired by another company, the direction of development could shift toward profit-driven goals rather than patient-centered design. To prevent this, ethical agreements and open innovation principles should be embedded early in the project to protect its therapeutic purpose.

Impact Improvement: Now that you have thought hard about the

future impact of the technology, what improvements would you like to make? List them below.

- Ensure affordability and accessibility for all patient groups
- Build transparent data and privacy policies for future connected versions
- Involve medical experts and rehabilitation centers in long-term planning
- Explore scalability to include Parkinsons and other neurological conditions responsibly