

A black and white photograph of a herd of cattle in a field with trees in the background. The cattle are in the foreground, and the trees are in the background.

ID 7: Capstone Research Report

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Statement of Authenticity

This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

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05/09/2025

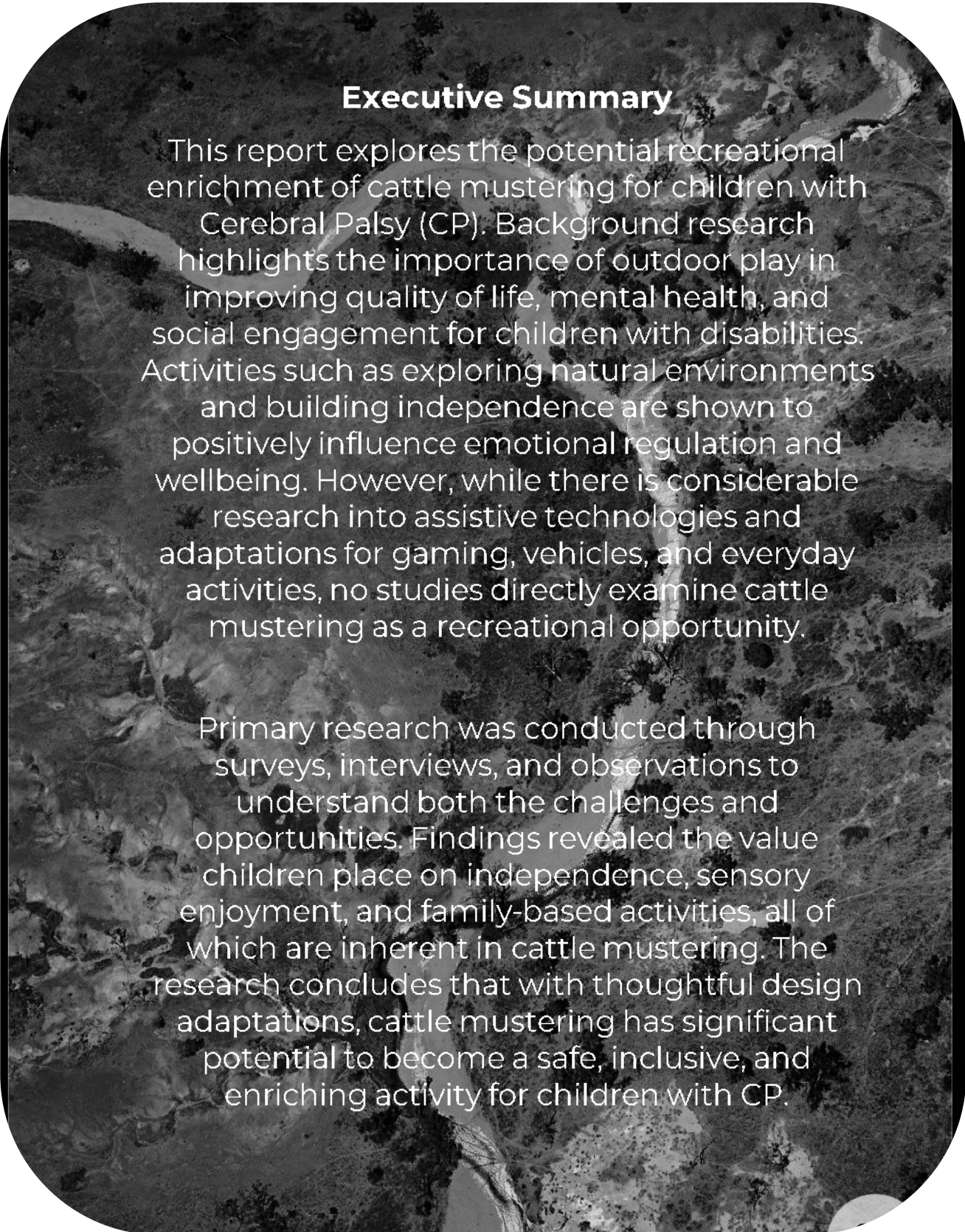
Statement of AI Use

I have utilized Generative AI in this report, Chat GPT, to assist in various ways. The way I have used AI includes assisting audio transcriptions from interviews. As well as checking spelling, grammar, punctuation and tense within the introduction, background research, methodology, results, discussion and design implications. It was also used to assist formatting the results section and conclusion, to have consistent flow.

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05/09/2025

An aerial, black and white photograph of a desert landscape. A dry, winding riverbed or gully cuts through the terrain, surrounded by sparse, low-lying vegetation and rocky patches. The image has a grainy, textured appearance.

Executive Summary

This report explores the potential recreational enrichment of cattle mustering for children with Cerebral Palsy (CP). Background research highlights the importance of outdoor play in improving quality of life, mental health, and social engagement for children with disabilities. Activities such as exploring natural environments and building independence are shown to positively influence emotional regulation and wellbeing. However, while there is considerable research into assistive technologies and adaptations for gaming, vehicles, and everyday activities, no studies directly examine cattle mustering as a recreational opportunity.

Primary research was conducted through surveys, interviews, and observations to understand both the challenges and opportunities. Findings revealed the value children place on independence, sensory enjoyment, and family-based activities, all of which are inherent in cattle mustering. The research concludes that with thoughtful design adaptations, cattle mustering has significant potential to become a safe, inclusive, and enriching activity for children with CP.

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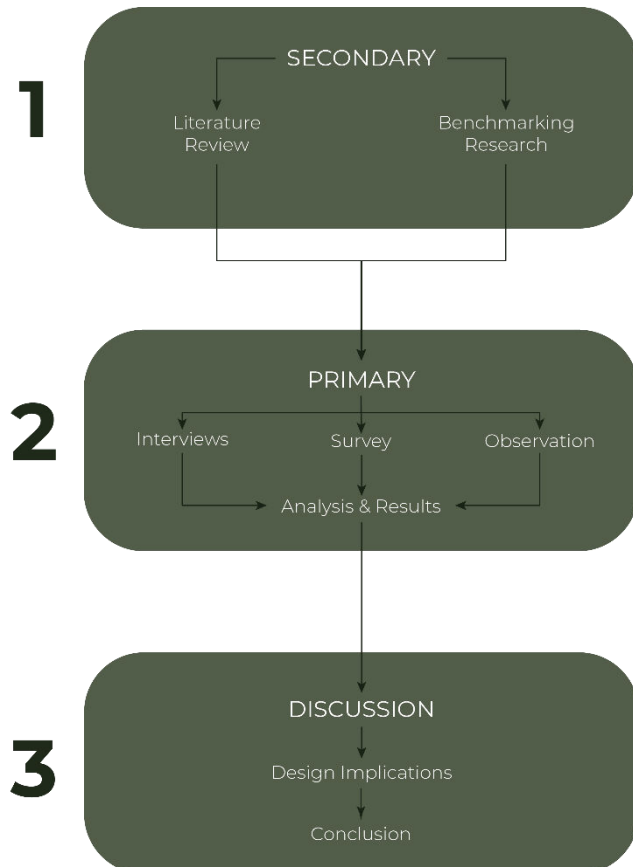
PHASE 1

INTRODUCTION

This research report explores the potential recreational enrichment of cattle mustering for a child with cerebral palsy (CP). CP affects two to three out of every 1,000 live births each year, which equates to an average of 718 live births annually in Australia (Paul et al., 2022). Despite the prevalence of this condition, there remains relatively little development in this area.

Cerebral palsy refers to a group of disorders that primarily affect muscle movement, posture, coordination, and communication abilities. The exact characteristics vary depending on the individual. These physical challenges significantly impact the Quality of Life (QoL) of children with CP and their families, largely due to the demands of long-term care.

Such physical limitations reduce opportunities for young people with CP to engage in physical and outdoor activities. Cattle mustering represents an underexplored activity that promotes physical engagement and connection with nature. Within this research, the potential for enhancing QoL for children with CP is examined. A case study focuses on an 11-year-old child with CP and his parents, enabling the project to be tailored to his specific abilities.



BACKGROUND

CEREBRAL PALSY

By definition, **“Cerebral palsy (CP) describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to nonprogressive disturbances that occurred in the developing fetal or infant brain.”** This disability is caused by brain injuries, which directly affect an individual's ability to control bodily functions (Vitrikas et al., 2020).

Due to the complexity of this disability, many attempts have been made to categorise its characteristics. One of the main distinctions is between *Spastic* and *Non-Spastic* CP. Spastic CP is defined as an increase in muscle tone, whereas Non-Spastic CP is defined as a fluctuation in muscle tone (Cerebral Palsy Alliance, 2023).

Another framework is the Gross Motor Function Classification System (GMFCS), which categorises a person's ability to move. This system is visually represented in Figure 1 to visually represent each level of motor ability and body control (Graham, 2025). In relation to muscle tone, it is defined as **“the tension in the relaxed muscle’ or ‘the resistance, felt by the examiner during passive stretching of a joint when the muscles are at rest’ ”** (Ganguly et al., 2021). Individuals with CP do not have balanced muscle tone, meaning their muscles are not synchronised and may tense at inappropriate times (Cerebral Palsy Alliance, 2023b). This muscle tone also changes with waves of fatigue and strength. (Cerebral Palsy Society, 2024)

The use of these classification systems not only allows parents to identify the challenges faced by their child but also provides a basis for accurate and effective treatment and therapy (Cerebral Palsy Alliance, 2023a).

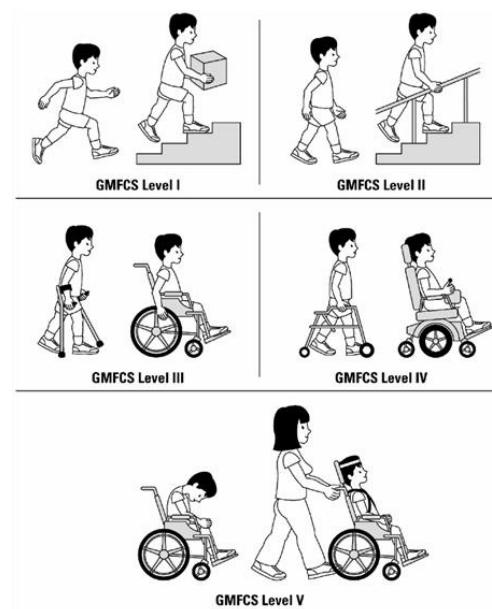


Figure 1: Visual Representation of GMFCS Levels (Cerebral Palsy Alliance, 2023a)

QUALITY OF LIFE

The impact of cerebral palsy (CP) extends beyond its physical symptoms, often leading to a decreased Quality of Life (QoL) for affected children. Studies demonstrate a direct link between Gross Motor Function Classification System (GMFCS) ratings and QoL outcomes. The sense of reduced functionality restricts the variety of activities in which children with CP can participate (Shelly et al., 2008). Further research highlights that among five categories of activities, physical activities provide the most significant improvement in mood for children with CP (Shikako-Thomas et al., 2012). These studies suggest that while physical activities are strongly associated with enjoyment and dopamine release, physical limitations frequently reduce access to such opportunities. Reinforcing this idea, one study states, ***“Children with CP appreciate a wide range of activities in the home and community, which emphasizes the importance of providing opportunities for such participation in order to fulfill their desires and interests”*** (Kalleeson et al., 2021).

In addition to the challenges faced by children, caregivers and guardians of children with CP experience significant stress due to the long-term adaptations required in daily life (Miller & Springerlink (Online Service), 2005). Caregivers frequently express concerns about their child's QoL, particularly regarding an ***“increased prone to injuries or increased social problems”*** (Shelly et al., 2008). These findings emphasise that CP not only affects the QoL of children but also has substantial implications for the wellbeing of their parents and caregivers. Demonstrating the importance of safe and engaging activities for an improved QoL.

FLORA & FARMING ENRICHMENT

The connection between natural environments and wellbeing has been extensively researched, with studies consistently demonstrating positive effects on mental health. For instance, Barnes et al. (2019) report that ***“the majority of studies that found positive mental health benefits. Almost universally green spaces contained a trail of some kind, either gravel/dirt or paved.”*** This emphasises the fundamental human need to engage with and be immersed in green spaces.

When focusing specifically on children with disabilities, several studies highlight the significance of outdoor environments. Horton (2016) observes;

“Even whilst describing how they experienced and anticipated all manner of ‘heart-breaks’ and ‘headaches’ in these spaces, parents/carers could usually describe ‘special’ moments of ‘joy’, ‘family love’ and ‘quality time’ at The Woods and The Lake.”

This indicates that, despite the challenges associated with outdoor play, the rewards are meaningful and substantial. Likewise, another study states, **“Having space to play outside stimulates and encourages children with sensory sensitivities to explore all of their senses.”** (Homan, 2018) This demonstrates that outdoor environments provide value not only for mental health but also for sensory development and exploration.

Cattle mustering, defined as **“the process of gathering livestock,”** is considered the lifeblood of any cattle farm (Farm - the Livestock Collective, 2024). It is a highly hands-on activity that brings families and communities together. For example, Chapman Valley is a family-operated cattle farm that has been managed for six generations (Cattle Muster – Chapman Valley, 2025). Like many other privately owned cattle properties across Australia, such farms play a vital role in sustaining community income and strengthening social connections through their mustering practices (Home - Gibson Livestock, 2023).



Figure 2: Local Community horse back riding through chapman valley

In Summary, existing research highlights the strong benefits of outdoor environments for children with disabilities, particularly in supporting mental health, sensory engagement, and social connection. Cattle mustering provides a unique opportunity to combine these benefits within a meaningful, community-based activity.

BENCHMARKING

Benchmarking is undertaken to identify existing solutions and technologies that may inform the development of design opportunities. Initially, research focuses on discovering assistive devices specifically designed for cattle mustering in vehicles. However, no such devices are currently available on the market, as this represents an extremely niche focus area. Consequently, the scope is broadened to include assistive gaming devices and assistive adaptations for motor vehicles. This broader perspective enables a more comprehensive understanding of relevant research and potential design directions.

GAME CONSOLES

The overview of adaptive products in gaming consoles is quite extensive. These devices are used for difficulties with fine motor skills and muscle tone challenges. The range varies from one-handed additives to completely redesigned consoles, as seen in Figure 3.



Figure A: 3D Printed One handed Switch controller adapter (One-Handed Switch Joy-Con Adapter, 2023)



Figure B: One-handed Xbox controller (Xbox Series X + PC One-Handed Controller, 2024)



Figure C: Thumbstick extenders for Xbox controller (Controller with Thumbstick Extenders (PS4, PS5, Xbox Series X), 2024)



Figure D: Re-designed Xbox controller (Axis 4 pro Blue Tip Gaming, 2025)



Figure E: Xbox accessible adapter set (XBOX, 2023)

Figure	Cost	Customizability	Installation
A	\$495.31	Left-hand or Right-hand Orientation	Slide switch into slots
B	\$174.95	Left-hand or Right-hand Orientation As well as Cable Length, Colours	Connect to Xbox via Bluetooth
C	\$149.95	Length of Thumb stick Extender	Attached to existing thumb sticks
D	\$499.00	Suitable for different Consols	Connect to consol via Bluetooth
E	\$99.99	Plug in additions changes from the accessibility range	Plug into Xbox

Figure 3: Adaptable Game Controllers product analysis table

MOTOR VEHICLE ADAPTATIONS

In terms of motor vehicle adaptations, there have been many variations to improve usability of cars for people with disabilities. This includes adapted acceleration/deceleration, assistive steering, altered break controls and new placement controls. (Seen in Figure 4)



Figure F: Steering wheel additive that moves acceleration/deceleration to hand controls (*Hand and Driving Controls for Vehicles - Mobility Engineering, 2024*)



Figure G: Specialised Hand control set (*Specialised Hand Controls - Mobility Engineering, 2025*)



Figure H: Steering wheel adapter for reduced grip users (*Steering Aids for Assisting with Driving | Jeff Gosling, 2025*)



Figure I: Adjustable button controls (*Capital Special Vehicles, 2025*)



Figure J: Adjustable lever for acceleration and button controls (*Trigger Accelerator and Brake Lever | Total Ability Australia*)

Figure	Cost	Customizability	Installation
F	Quote based	Different model styles that use different movements to accelerate	Installation is done by the company into your car
G	Quote Based	Options to change the position of buttons, levers and triggers for alternative hand controls	Company sends someone out for Installation
H	Quote Based	Multiple grip versions for different fine motor skill abilities	Company sends someone out for Installation
I	Quote Based	Relocated buttons and switches for easier access depending on physical capabilities. Moving buttons to feet, knees, elbows or head bump switches.	Due to extreme customizability, these products will be installed by the company
J	Quote Based	Accelerator and brakes attached to a lever with customizable buttons. Colour choices and left/right hand options.	Installation is done by the company into your car

Figure 4: Adaptable Motor Vehicle Controls product analysis table

RANKING

Figure 5 identifies the strengths and weaknesses of each product and grades them against each other. This is to determine the potential market gaps.

Product	A	B	C	D	E	F	G	H	I	J
Affordability	3	7	7	2	7	N/A	N/A	N/A	N/A	N/A
Adaptability										
Different Body Types	7	5	5	5	8	8	7	8	5	6
Easy Self Installation	9	10	7	9	10	7	1	8	1	1
Customizability	7	5	4	3	7	5	9	8	8	7
Using Gross Motor Skills	3	4	7	2	6	9	6	10	5	6
Adjustable	5	3	7	3	9	5	8	7	3	5
Durable	5	8	5	8	9	8	9	9	7	7
Total /70	39	41	42	33	56	42	40	50	29	32

Figure 5: Product Ranking Matrix

A key observation from the benchmarking table is the inability to rank motor vehicle adaptations within the affordability criterion. This limitation arises because such products are provided on a quote basis rather than being readily available for purchase. While this format allows for greater customisation, it often results in higher overall costs. Notably, the product ranked the highest is the Xbox controller adapter, primarily due to its off-the-shelf availability combined with strong adaptability and customisation options. However, achieving full customisation requires additional purchases, which decreases overall affordability. Another high-ranking product is the assistive steering grip, which performs well as it accommodates different body types and prioritises gross motor skills rather than fine motor skills.

At the opposite end of the spectrum, the lowest-ranking product is the adaptable button and lever controls. Given that cerebral palsy frequently affects fine motor skills, the use of small buttons and controls remains a significant challenge. In addition, this product involves a costly and complex installation process that requires the rewiring of electrical components in a vehicle. Another lower-ranking product is the thumb stick extenders, which are limited by their singular functionality and lack of customisation. Nevertheless, their ease of self-installation makes them consistently accessible to users.

OPPORTUNITIES AND GAPS

The ranking process makes it possible to identify clear gaps in the market. Most notably, there is a complete absence of assistive devices designed specifically for cattle mustering. This highlights the underdeveloped nature of this area and reinforces the value of drawing on existing assistive products to guide future design opportunities.

It is also important to consider adaptability in relation to fluctuating levels of fatigue and strength, as well as the varying body types and physical abilities of users. A product that combines customisability with commercial accessibility would hold significant potential to fill these gaps and generate meaningful market impact.

PHASE 2

RESEARCH

METHODOLOGY

To conduct high-quality primary research, a triangulation approach is employed, incorporating both qualitative and quantitative data collection methods. The triangulation approach uses two or more research methods to provide a comprehensive perspective for analyzing and reporting relevant data. This report utilizes survey responses, interview transcripts, and observation videos to address the research question, combining quantitative and qualitative data. Such an approach enables both statistical and reflective analysis procedures.



METHOD

Research Scope:

The research focuses on exploring the potential recreational enrichment of cattle mustering for a child with cerebral palsy. This study aims to understand the limitations experienced by children with CP, particularly in relation to quality of life (QoL) and participation in activities. Cattle mustering is investigated as a potential activity to enhance both QoL and mental health for these children.

Participant Selection:

To ensure accurate and meaningful research, the participant pool is carefully selected. The case study focuses on a young boy with cerebral palsy, referred to in this report as Max. To respect issues of consent, Max’s mother is interviewed as a key stakeholder, and Max’s behavior is observed with his mother present in the room. To provide external perspectives, a Support Worker, Farmer, Farmer’s wife we’re interviewed. Additionally, a small survey is conducted and distributed on CP support online forums for family members and caregivers to complete.

Recruitment Phase 1		Recruitment Phase 2		Recruitment Phase 3	
Interview	Observation	Survey	Interview	Observation	Interview
Farmer & Farmer’s Wife	Farmer’s Family Cattle Mustering	CP online support forums	Support Worker for Disabled Children	“Max” a Child with CP	“Max’s” Mum a Nurse
Audio Recording	Video Recording	Graphs	Audio Recording	Video Recording	Audio Recording

Figure 6: Table of recruitment phases, and who was involved

Survey:

The survey consists of 13 questions employing mixed response styles (see Appendix 1). The first five questions gather contextual information about the respondents, using multiple-choice questions to determine the age range and severity of CP for the children in their care. The remaining questions use two response formats. Likert scale questions provide quantitative data on the perceived importance and enrichment of specific activities for children with CP. These are complemented by short-response questions, which offer more detailed insights into individuals' physical capabilities, concerns, and interests.

Interviews:

Three interviews are conducted with key stakeholders in this research area. Two of these interviews use a semi-structured format, while the third is a short, structured interview conducted with the farmer and his wife. In the semi-structured interviews, open-ended questions are asked to allow respondents to elaborate on their experiences. This format enables the exploration of new areas of research and allows the line of questioning to deviate from the original structure as necessary. Consequently, the interviews are more fluid and conversational in nature, while still ensuring that relevant information is collected.

Observations:

Two observations are conducted to complete the triangulation of research methods. One employs a naturalistic approach, and the other uses a participant observation method. In both observations, there is a clear understanding of the information required, allowing data collection to be focused within these predetermined boundaries.

The cattle mustering observation is conducted in a naturalistic setting at a farm while farmers perform their usual activities. This approach provides accurate insights into terrain, routines, and behaviours. The participant observation involves Max, who is observed playing video games in his living room. Conducting this observation in his home ensures a comfortable and safe environment. While he engages with the games, he is asked a series of questions, allowing researchers to observe his responses to external stimuli in real time.

ANALYSIS & FINDINGS

SURVEY

The results of this survey display the potential enrichment from exposure to flora and fauna, as well as the safety issues that come with this.

Medical Condition & Safety

The survey indicates a wide variety of CP levels and abilities among participants. Figure 7 displays an almost even distribution across the five levels of the Gross Motor Function Classification System (GMFCS). Each child presents with a unique combination of needs, all experiencing some form of muscle tone irregularity or physical challenge. These challenges are frequently accompanied by additional medical conditions, with **33%** of respondents reporting that their child is non-verbal and experiences developmental delays.

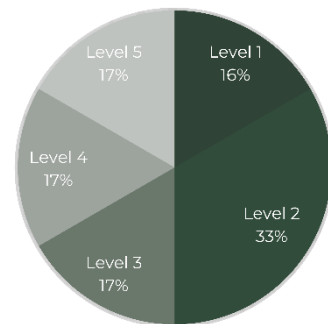


Figure 7: Pie Chart of Survey GMFCS Levels

All respondents express concerns regarding outdoor play, primarily related to safety. The main issues identified include limited danger and safety awareness, overheating, and breathing difficulties.

Enjoyment

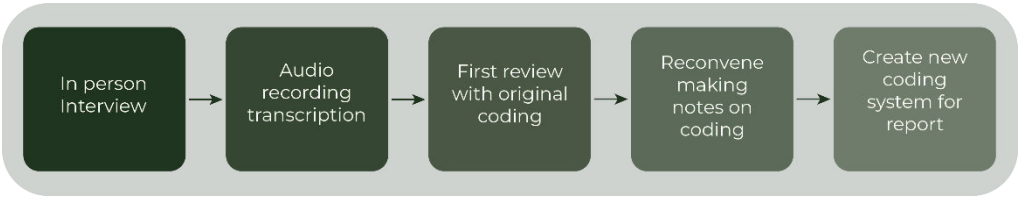
The survey data shows that **83.3%** of parents and caregivers believe that spending time outdoors improves their child's mental health (see Appendix 2). Even if children do not spend a great deal of time outdoors, parents still consider these experiences to be positive. Additionally, **66.7%** of participants report that their child enjoys interacting with flora and fauna (see Appendix 3).

Responses regarding cattle mustering as a recreational activity are largely positive. While **33.3%** of respondents indicate that this activity would not be suitable for their child due to physical limitations, **66.6%** agree that it would be a beneficial and enjoyable experience (see Appendix 4). Overall, parents and guardians demonstrate strong support for the idea that outdoor play has a positive impact on the mental health of children with disabilities.

INTERVIEWS

Analysis Style

To fully unpack and understand the data collected through interviews, both inductive and deductive analysis processes are employed. Prior to the interviews, a coding framework is created to highlight the key aspects of interest for the research, representing the inductive analysis approach. Following the interviews, the transcripts are reviewed, and new notes are taken to adapt and re-arrange the coding to reflect the data collected, representing the deductive analysis approach. Combining these methods enables a comprehensive and in-depth understanding of the research findings. (See Appendix 5)



Physical Ability Adaptations

Max's Physical Capabilities
"challenges with mostly that right side, the right side of his body is more affected with muscle tone."
"it's great if it has neck support, back support and support at his sides."
"sometimes the opposite arm will do the opposite thing to what the other arm's doing or what he wants it to do."
"his body moves to kind of keep him stable."
"He'd be like down and out for like a week if you spent a whole day at the beach."

Figure 8: Table of quotes from Interview with Max's Mum

Max presents with complex physical capabilities, as described in Figure 8, which includes quotes from his mother detailing his condition. His fine motor skills are particularly limited. As his mother states, ***"I think anything that is slow, or I guess like fiddly things that require precision are really difficult."*** To support Max, his mother uses assistive devices such as grips for cutlery and pencils. The Support Worker observes, ***"I find that it can take a bit longer even into their teens or young adulthood to really sort of master those skills,"*** highlighting how children with disabilities often struggle with tasks that require fine motor control.

In addition to his CP diagnosis, Max has ADHD and a cortical vision impairment. These conditions significantly affect his emotions. His mother explains, ***“I’d say high emotions. So, anger, frustration, and excitement definitely affect his movement,”*** showing how his emotional state directly influences his physical actions. The Support Worker adds, ***“Their perceptions of emotions, tone of voice, sounds around them can be a lot more heightened and they’re more sensitive to it,”*** emphasizing the differences in nervous system responses among children with disabilities. She further explains that interventions, such as structured boundary setting, are necessary: ***“It helps with that boundary setting because transitioning children from one space to another can be a big challenge, especially from a preferred activity.”***

Max’s complex physical and neurological conditions, combined with fine motor limitations and heightened emotional responses, significantly influence his daily functioning and require targeted support strategies.

Independence

Independence is a central focus of Max’s growth, particularly on the farm. His mother states, ***“Independence is a big thing for him or to have more of a sense of independence and responsibility about doing something and helping out on the farm.”*** The Support Worker echoes this, observing, ***“I loved getting to see their independence grow and then learning new things as well and exploring.”***

Developing independence is particularly important for Max, given that his fatigue affects his ability to complete daily tasks.

Max also shows interest in more physically challenging activities. His mother notes; ***“In saying that he would do, you know, um, a treetops challenge or rock climbing. He does, like, loves a challenge.”*** However, due to his physical limitations and fatigue, modifications are often required: ***“Probably we have to alter that quite a bit for Max’s physical needs, but also his fatigue as well can be a pretty significant thing with day-to-day life.”***

Independence extends to everyday tasks such as preparing breakfast and dressing, as well as social interactions with peers. His mother observes, ***“I think that’s kind of a challenging thing is his friends will all... they’re starting to independently ride around the gap or catch a bus to go somewhere.”*** To accommodate this, she allows Max small trips with friends, noting, ***“He’s nearly 12. So, I do big kid things now.”*** The Support Worker supports this, adding, ***“Watching them develop in social interactions with their friends... that may look different to typical children.”***

Fostering independence is essential for Max’s personal growth, allowing him to engage in daily tasks, social activities, and challenging experiences while accommodating his physical limitations and fatigue.

Safety

Safety is a primary concern when Max is on the farm. His mother explains, ***“I think safety is a big one, safety and independence.”*** Being a mother, she worries for his health and wellbeing, always wanting what is best for him. Using buggies during cattle mustering can be challenging due to his physical capabilities:

“Even like opening the doors of that buggy can be tricky and fiddly,”

“Control of the accelerator can be quite tricky because his movements are... quite jerky.”

“uneven surfaces, not great. Um, he'd probably fall over or trip.”

The terrain further complicates mobility: ***“And out there, there's a lot of sticks. There's a lot of, um, big tussocks of grass,”*** making it difficult for him to participate in certain activities. These challenges contribute to her concern about accidents, stating, ***“I think his risk awareness is pretty low.”*** The Support Worker reinforces this, observing, ***“Their understanding of safety can look different,”*** indicating that children with disabilities perceive and respond to environmental risks differently. Safety concerns, including difficult terrain, buggy control, and limited risk awareness, are key considerations when Max participates in outdoor and farm activities.

Enjoyment

Sensory stimulation is a significant factor in Max's enjoyment. His mother explains, ***“He's very, um, very sensory orientated,”*** which aligns with the Support Worker's observations: ***“Like, it's those different sensory... Shoes off on the grass, like really simple.”*** These small sensory experiences are highly rewarding for children with disabilities.

Time on the farm also serves as a source of family bonding. Max's mother notes, ***“You have lots of your relatives, cousins, his grandparents, his cousins, aunts, uncles,”*** and, ***“It's quality family time. It's the adventures that we do.”*** Max demonstrates a strong connection to the land, stating;

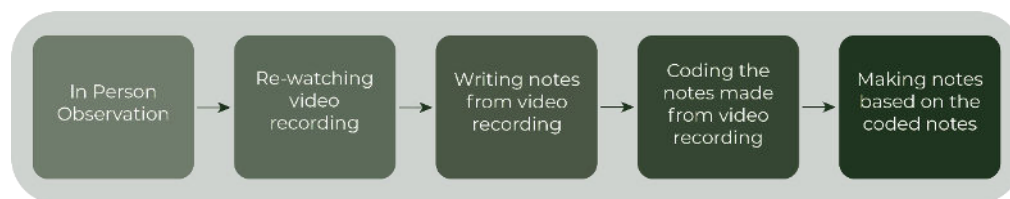
“One thing he sort of says is when I get out here, I just picture my own house and I, yeah, so it's sort of in, he feels very safe here.”

Similarly, the farmer remarks, ***“You just get to enjoy the countryside,”*** emphasizing the enjoyment of the slow-paced, natural environment. Max experiences enrichment through sensory engagement and meaningful family interactions, highlighting the positive impact of outdoor activities and connection with nature.

OBSERVATIONS

Analysis Style

Observation findings can be influenced by bias due to the nature of the study. To minimize this, the observations are analyzed using a deductive reflective process. In this approach, observations are first recorded and then reviewed at a later time. While reviewing the video's, detailed notes are taken to capture key behaviors and interactions. These notes are set aside for several days and subsequently re-examined and coded according to the established inductive coding system. The quotes presented in this section are drawn directly from the notes taken during the video review process. (See Appendix 6)



Cattle Mustering Context

To understand cattle mustering, a muster was recorded and analysed. The terrain of the environment is a critical factor, providing context for the activity. Observations reveal that ***“terrain can change quite dramatically so it’s important to be cautious and aware,”*** and ***“again the terrain has changed, having lots of valleys and a lake.”*** The ground is scattered with rocks and twigs, making it unstable and difficult to navigate. Tall grass and trees further hinder vehicle movement: ***“Well-worn track. Lots of high grass and scattered trees,”*** and ***“need visibility through the grass.”***

Coordination is crucial for a successful muster. A plan must be established and frequently updated, often during regrouping moments:

“Quick communication and understanding of the property is key,”

“pulled up next to each other, pointing in directions and discussing a game plan before they split up and continued mustering.”

Trust among team members is vital, and communication often occurs while vehicles are off to overcome engine noise: ***“When the vehicles have stopped you can see it is a lot calmer and you can hear the cows mooing.”*** These breaks also provide opportunities for rest and social interaction.

Safety is a constant concern due to the complexity of the activity:

- “It can be quite isolating driving off by yourself without being able to see the other people in the group,”*
- “when driving faster you need to keep both hands firmly on the steering wheel as the terrain can throw the steering off,”*
- “need to watch out for other drivers and when they speed up and stop. Needs to be coordinating timing.”*

Overall, mastering cattle mustering requires patience, practice, and awareness of both the animals and the environment. It is a physically demanding and coordinated activity, requiring careful attention to terrain, livestock behavior, and safety, alongside strong teamwork and communication.

Case Study Context

This observation focused on the physical and emotional capabilities of Max. Table 9 explores his physical abilities. Max often relies on momentum and movement to maintain balance.

Max's Physical Capabilities
"He goes off touch. Particularly when his controller is up next to his face. On the right side of his face where his blind spot is.
"His movements often cause obstacles for himself, such as blocking his line of vision."
"His fingers mostly move all together in one motion rather than in individual fingers. "
"Because he isn't always quite grabbing the controller just having it rest between his hands, it isn't the most secure."
"he has the best control over his thumbs, rather than his other fingers."
"his back was tensely pressed back up against the back of the chair. And his legs are straight out. Then his toes are pointed and flexed."
"his head follows his eyes slightly when he's calmer, his head slightly tilting to allow his eyes to be in the center. But when he isn't calm his eyes tend to be looking from the corners."

Figure 9: Notes on physical capabilities from observation where Max plays video games

Max is a lively and sociable child. Despite speech difficulties, he actively communicates while playing video games, often reacting to background music: **“Humming along with the song whilst playing,”** and **“He sings along to his favourite song ‘Old Town Road’.”** He displays a playful sense of humour, bragging about how cool his game is and asking me if I had heard these songs before because I might be too old. Also seen in this quote, **“I asked him why the music started to play and he responded straight away saying that it was because he got into the car. And then he said ‘obviously’, he has a very cheeky sense of humour.”**

Max's enthusiasm extends to social interactions. He is eager to engage with others: ***"He asks if I like handball as he steps out of his chair. And asks me to play handball with him later,"*** and ***"he's still chatting to me and making comments about what he's doing."*** Displaying his love for people and his compassion.

Emotional regulation for Max differs from typical children. He uses physical movement to manage feelings, particularly during challenging moments in video games:

"Likes to bend and straighten legs, typically one at a time. To balance each other out,"

"It is his body regulating and balancing himself out. Lots of mental stimulation = lots of movement,"

"His body reacts to the level of concentration he needs to have. The more mental strain, the more body moves."

This is a direct correlation between emotions and physical movement, showing how his bodily functions are not always controlled. Even though there are negative challenges, excitement and happiness are also visibly expressed through facial and bodily gestures, reflecting his passion for his hobbies: ***"Has more animated facial expressions when discussing his favourite skin."***

Max demonstrates high energy, social engagement, and unique emotional regulation strategies, using physical movement to manage concentration, excitement, and stress during activities.

PHASE 3

DISCUSSION

Market Gap & Accessibility

Benchmarking revealed a significant gap in the market: the absence of mobility adaptations for children with CP to participate in cattle mustering. This indicates that the activity is largely inaccessible to the disabled community, a finding supported by secondary research. No existing studies explore the positive or negative impacts of cattle mustering on children with CP.

Safety & Physical Capabilities

Primary data identified key concerns regarding outdoor play and cattle mustering, particularly safety and physical limitations. Both primary and secondary research highlight consistent characteristics of CP, including limited fine motor skills, fatigue, and challenges with emotional regulation. These factors help explain the lack of existing research and products in this field.

Quality Of Life & Activity Engagement

Secondary research demonstrates a clear link between CP severity and reduced Quality of Life (QoL). Primary interviews reinforce this, describing increased physical difficulties and feelings of frustration. Introducing mentally stimulating and enjoyable activities can improve QoL, yet physical limitations restrict participation. Observations of Max and interviews with his mother illustrate that engaging in activities such as video games, soccer, walking with friends, and farm mustering fosters independence and positive experiences. Independence is emphasized in the support worker's interview as a critical factor in development. By bridging the gap between differences in physical abilities and independence, it can create feelings of importance, capability and confidence in children with CP.

Cattle Mustering & Environmental Considerations

Observations confirm that cattle mustering involves navigating rough terrain and complex vehicles, which presents challenges for children with CP. These challenges were also highlighted in interviews and survey responses. Physical restrictions, combined with emotional responses, fatigue, and cognitive load, create additional safety concerns particularly when alone or in a new environment.

Sensory Engagement & Emotional Regulation

Children with CP often display heightened sensory sensitivity, which can be both beneficial and challenging. Sensory experiences can foster excitement and engagement, as noted by the support worker. Conversely, difficulty regulating emotions may result in exaggerated physical reactions. This may cause issues when participating in activities as they may struggle to self emotionally regulate.

Benefits Of Outdoor Play & Social Interaction

Both primary and secondary data confirm that outdoor activities positively influence social and emotional development. Structured, safe outdoor play provides opportunities for new experiences, green space interaction, and social engagement, all of which support development and well-being.

Community & Family Engagement

Cattle mustering is inherently a family- and community-based activity, providing a supportive environment for children to engage safely. These social and collaborative elements further contribute to positive experiences.

Conclusion

Cattle mustering has the potential to positively impact a child with CP's independence, social interactions, and emotional development, provided that adaptations bridge the gap between the activity's demands and the child's physical abilities.

DESIGN IMPLICATIONS

As explored in the discussion, there is a suitable gap in the market for an adaptive or assistive device that allows children with CP to participate in cattle mustering. A series of opportunities were identified through both primary and secondary research to support this activity. These rock blocks include Safety Concerns, Lack of Fine Motor Skills, Limited Physical Controls, Lack of Comfort, a Desire for Social Connections and Difficulties Regulating Emotions.

Safety

The main roadblock to independence is a parent's concern for their child's safety. There is an area of opportunity to explore safety additives to cattle mustering buggies that reminds the driver of potential hazards and risks when participating in a muster. Potentially having suggestions or advice to change their actions when in difficult situations. Safety-focused design features would reassure caregivers while enabling children with CP to participate more independently in cattle mustering.

Fine Motor skills

Another issue identified was a lack of fine motor skills. This makes things like pressing buttons, opening doors and gripping the steering wheel difficult. Having a wearable or adaptation to the vehicle that supports gripping and fiddly tasks would improve this experience and reduce frustrations. Reducing the number of frustrations also allows the user to be focused on the other elements of cattle mustering.

Physical Control

With constant and involuntary movements, multi-tasking with acceleration, breaks and steering may become a challenge. Introducing a simple, analog device that can minimize the mental and physical strain of completing these tasks would reduce fatigue and lack of control over the vehicle. This might look in the form of assistive steering adjustments or redesign. Potentially exploring moveable steering wheels to support constant bodily movements. Devices that support physical control would reduce strain and increase confidence when driving during cattle mustering.

Comfort

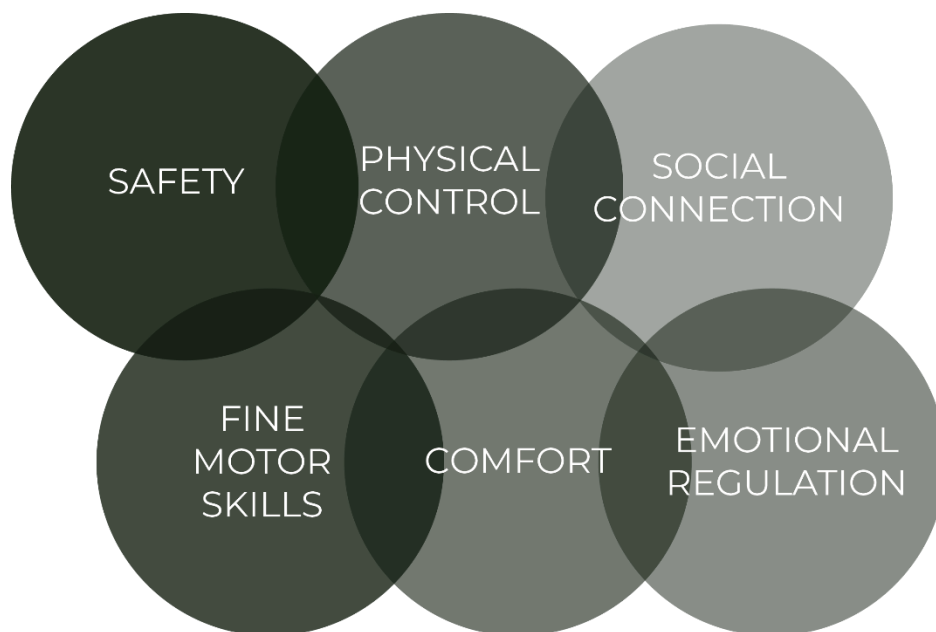
Sensory familiarity can provide comfort when in new and stressful situations. By creating a sense of safety for the user, their focus can be used on other aspects of the muster. There is a space to create a comfortable back rest that supports posture and movements, as well as having sensory safe textures. Enhancing comfort through supportive and sensory-aware design would create a safer and more enjoyable mustering experience.

Social Connection

The positive social connections fostered a safe space of a family farm, allowing the users to grow. Being able to stay connected with other people in the muster in an interesting avenue to explore. There is potential to design a system or device that provides visual communication between group members in a cattle muster can increase positive experiences. Facilitating social connection during mustering strengthens inclusion and fosters meaningful participation.

Emotional Regulation

Emotional regulation can be difficult for a child with CP. When mustering it is important to consider the internal aspects as well as the external. When mustering there may be times when a child is on their own, having a device that helps them regulate would be vital. This would need to be in accessible view, not distract the driver and attach to the existing structure. Having a Tool that assist with emotional regulation would ensure safety, independence, and positive engagement throughout the muster.



CONCLUSION

This research set out to explore the potential for recreational enrichment for children with Cerebral Palsy (CP) through the activity of cattle mustering. Findings from primary and secondary research revealed that while outdoor play is consistently associated with improvements in mental health, independence, and social connection, cattle mustering in its current form remains largely inaccessible to children with CP.

Despite these barriers, the research also demonstrated strong opportunities for enrichment. Children with CP, such as Max, expressed enthusiasm for adventurous activities, social interaction, and sensory experiences. Parents and carers emphasised the importance of fostering independence and ensuring safety, highlighting a critical balance between enabling participation and reducing risk.

By addressing these roadblocks through adaptive and assistive design, cattle mustering could evolve into a safe, inclusive, and rewarding activity. Ultimately, this research concludes that cattle mustering holds significant potential to enhance the quality of life for children with CP if carefully adapted to their needs. Future stages of this project will focus on prototyping adaptive solutions that directly respond to these findings.

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