SERVICE EVALUATION PAPER

Virtual Reality Check-In

A co-designed interactive VR feedback tool to improve paediatric self-reporting and autonomy to allow more patient-specific treatment modifications in Rheumatology.

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ABSTRACT

Virtual Reality Check-In is a co-designed interactive virtual reality (VR) questionnaire created to help children with Juvenile Idiopathic Arthritis (JIA) communicate their pain experiences in more engaging, expressive ways. This in turn allows clinicians to adjust treatment based on patient-reported data as opposed to parent-observed data of a child's pain. Developed by the Torbay and South Devon NHS Foundation Trust (TSDFT) Digital Futures Lab in collaboration with the TSDFT Children and Family Health Devon's Rheumatology Service, our prototype transforms traditional paper-based questions into an enjoyable, child-focused, interactive, mixed-reality experience. In a pilot with 14 children, VR was found to enhance engagement with feedback, reduce anxiety, and support clearer self-expression of a child's experience and response to treatment compared to parents' expression of children's pain and quality of life. Ongoing development will focus on accessibility, personalisation, and evaluation of clinical impact.

INTRODUCTION

Juvenile Idiopathic Arthritis (JIA) is the most common chronic rheumatological condition of childhood, affecting approximately 1 in 1,000 children under the age of 16 in the United Kingdom (NRAS, 2025). Characterised by persistent joint inflammation, pain, stiffness, and reduced mobility, JIA can profoundly affect a child's physical functioning, schooling, and emotional wellbeing. Effective management requires a multidisciplinary approach involving paediatricians, rheumatologists, and physiotherapists to optimise treatment outcomes and improve children's quality of life (Ravelli & Martini, 2007; McErlane et al., 2021; Consolaro & Ravelli, 2021).

Accurate assessment of pain, swelling, morning stiffness, and related symptoms is critical to care. Children's reports of pain guide therapeutic decisions, monitor disease progression, and shape psychosocial support. Yet clinicians often face significant challenges in eliciting reliable self-reported information from children, especially when pain fluctuates or is difficult to describe (von Baeyer & Spagrud, 2007; Eccleston et al., 2021). Historically, clinicians have often had to rely on parent-reported assessments of pain, informed by observations of behavioural and mood changes.

Challenges in paediatric pain communication

Children's ability to articulate their symptoms depends on cognitive development, emotional state, level of pain, and social context. Many struggle to find words that capture the quality and impact of their pain and other symptoms, leading to under-reporting or misinterpretation (Fitzgerald & McGrath, 2017). These challenges intensify amongst children with neurodevelopmental conditions, particularly Autism Spectrum Disorder (ASD). Research shows that children with ASD may experience pain differently — at times showing hypersensitivity to mild stimuli, at other times appearing unreactive to intense discomfort (Liu et al., 2020). Their expression of pain may be conveyed through behavioural or physiological cues rather than verbal descriptions, creating barriers for clinicians who rely on conventional tools such as the Visual Analogue Scale or the Faces Pain Scale (Liossi et al., 2019).

Beyond clinical challenges, these communication barriers carry wider psychosocial implications. When pain is misunderstood or dismissed, children may feel invalidated, anxious, or reluctant to engage with health services, whilst families experience frustration and helplessness. Lee et al. (2023) found that children with JIA value being asked about their pain and feel cared for when clinicians take the time to listen, yet many described difficulties expressing pain characteristics verbally and discomfort discussing it face-to-face. A companion study (Lee et al., 2025) revealed similar frustrations for parents, who often acted as translators of their child's pain, noting that their children were rarely given "a chance and a choice" to communicate directly. Both studies highlight the need for child-centred, emotionally safe, and developmentally appropriate tools that empower young people to express pain authentically.

Why virtual reality offers a unique opportunity

Virtual reality (VR) represents a promising medium for addressing these challenges because it combines embodied interaction, multisensory immersion, and symbolic visualisation whilst respecting a child's privacy, autonomy, and self-expression. Unlike traditional paediatric self-report and observational pain measures — which primarily focus on pain intensity and have limited ability to capture chronic, fluctuating, and functional aspects of children's experience — immersive VR may offer a way for children to express lived experience through visual, spatial, and interactive representations (von Baeyer & Spagrud, 2007; Liossi et al., 2019). By enabling children to communicate through action and exploration rather than verbal description alone, VR has the potential to reflect how symptoms affect movement, activities, emotions, and participation in everyday life.

For children who are younger or neurodivergent, this mode of expression may reduce linguistic demands and social pressure, allowing them to communicate through exploration and play. VR also offers a controlled, predictable environment that can be designed to reduce social pressure and support user autonomy. Its immersive quality fosters engagement, whilst interactive tasks channel attention away from anxiety and towards reflection on everyday experiences. These mechanisms have already demonstrated a reduction in perceived pain during clinical procedures (Malloy & Milling, 2010; Gold & Mahrer, 2018) and can be repurposed to help clinicians understand not just symptom severity, but how those symptoms meaningfully affect a child's life.

Current gaps and emerging innovations

Despite its potential, the use of digital or immersive tools to support paediatric pain communication remains limited. The only notable technological example is the "This Feeling!" iPad app, developed by Wendy Thomson and colleagues (NIHR Manchester Musculoskeletal Biomedical Research Unit) and presented at the European League Against Rheumatism (EULAR) Congress in 2015. The app allowed children with JIA to describe pain intensity, location, spread, and emotional impact using an interactive manikin, facial expressions, drawing tools, and free-text inputs. In the evaluation, 95% of children preferred the app to conventional scales, describing it as easier and more engaging. To our knowledge, no further tools have built upon this multidimensional approach, leaving a significant gap between what children need and what clinical practice currently provides.

RATIONALE FOR VIRTUAL REALITY CHECK-IN

This project emerged through collaboration between the Digital Futures Lab at Torbay and South Devon NHS Foundation Trust (TSDFT) and clinicians from the Rheumatology service, jointly run by TSDFT and Children and Family Health Devon. During one of the Lab's Digital Deep Dive sessions (Galvin et al., 2025) — interactive workshops that introduce clinicians to emerging technologies — Johanna Packer (Clinical Specialist Physiotherapist) and Tracey Williams (Rheumatology Specialist Nurse) recognised the potential of immersive technology to support their patient group and approached the Digital Futures Lab to explore whether VR could provide a more engaging and effective way for children with JIA to communicate their experiences.

Within the existing service, self-report tools such as the Visual Analogue Scale (VAS) and the Faces Pain Scale – Revised (FPS-R) were felt to be insufficient in capturing the nuanced, fluctuating, and often emotionally complex experiences of pain. Many patients are young and/or neurodiverse, and clinicians frequently encountered barriers including limited verbal communication, reduced attention, and low engagement during face-to-face consultations — with parents often answering on their children's behalf.

To address these challenges, the Digital Futures Lab and rheumatology team co-designed an interactive VR feedback questionnaire. Questions were based on the current evidence-based questions used in clinic. The experience integrates hand-tracking instead of controllers to ensure accessibility for children with joint pain or limited dexterity and uses mixed-reality passthrough on Meta Quest 3 headsets to maintain visual contact with parents and clinicians, thereby reducing anxiety. The environment was deliberately designed to be bright, friendly, and intuitive, featuring a cartoon-style character that guides children through each question using voice, gesture, and visual prompts. Questions are presented in multiple modalities — spoken, written, and visual — to accommodate different learning and communication styles. The experience concluded with the child posting their answers into a virtual post-box, with responses made viewable via a spreadsheet for the clinical team.

Below are some screenshots that demonstrate what the experience looks like, with Quest headset captures that show the scenes through the user's eyes.

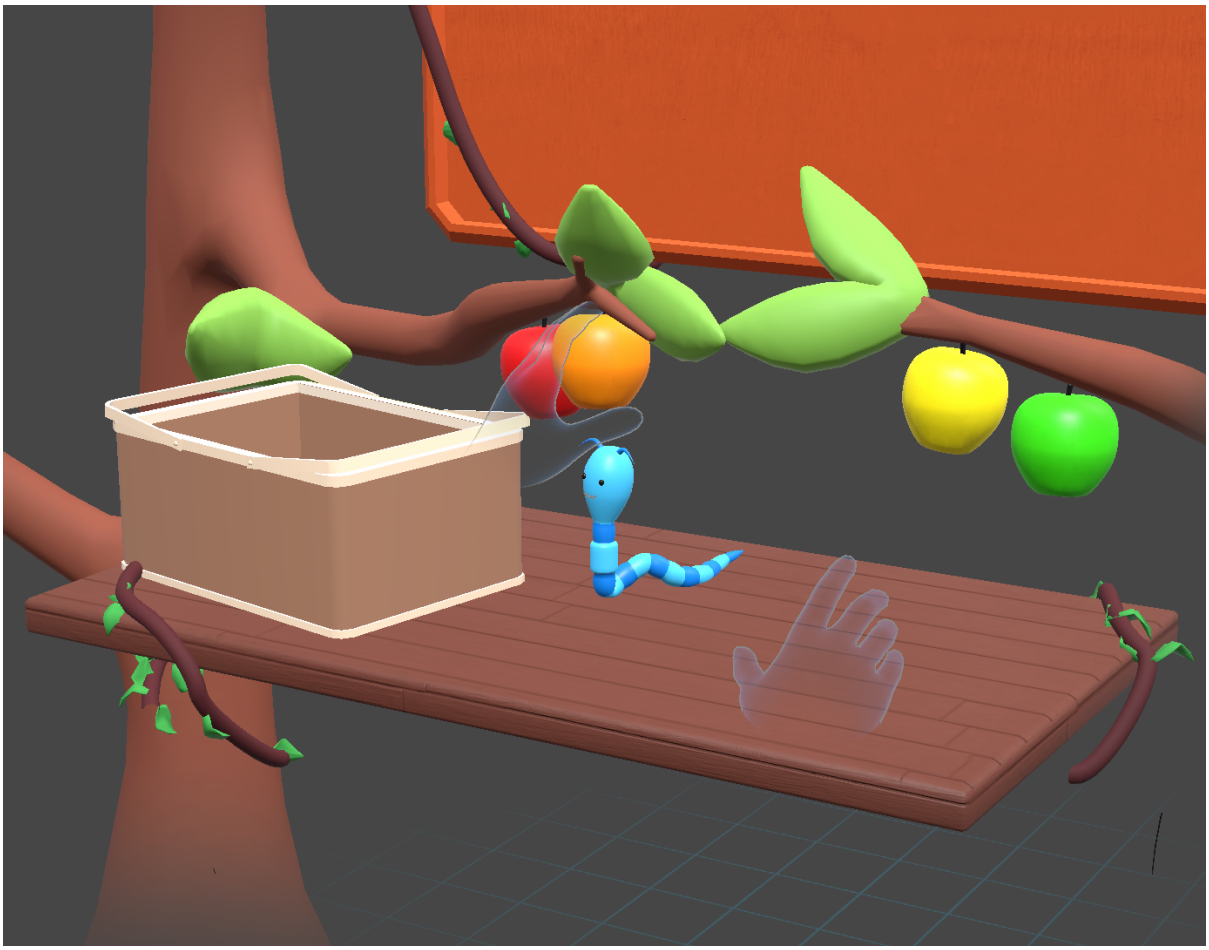

Image 1A: An isometric image of a user picking an apple to answer a question, as shown by the virtual overlay of their hands reaching out.

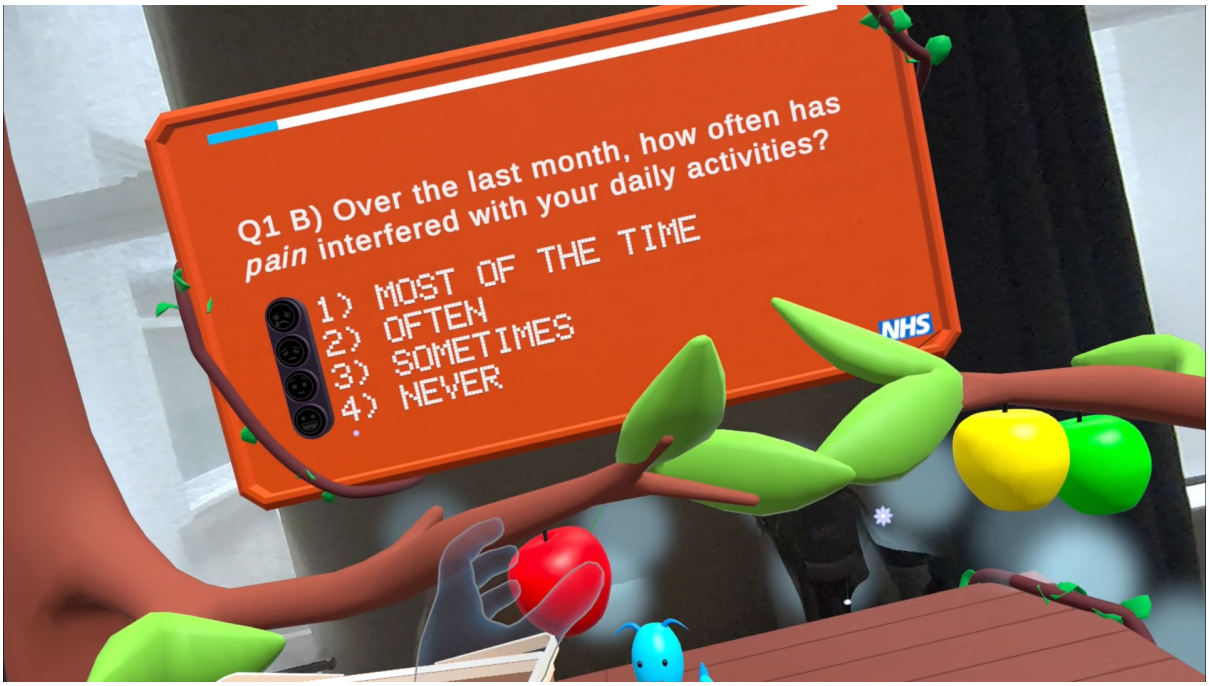

Image 1B: A mixed reality capture of a user reaching out to grab an apple that represents an answer to a question. Their hand is virtually outlined.

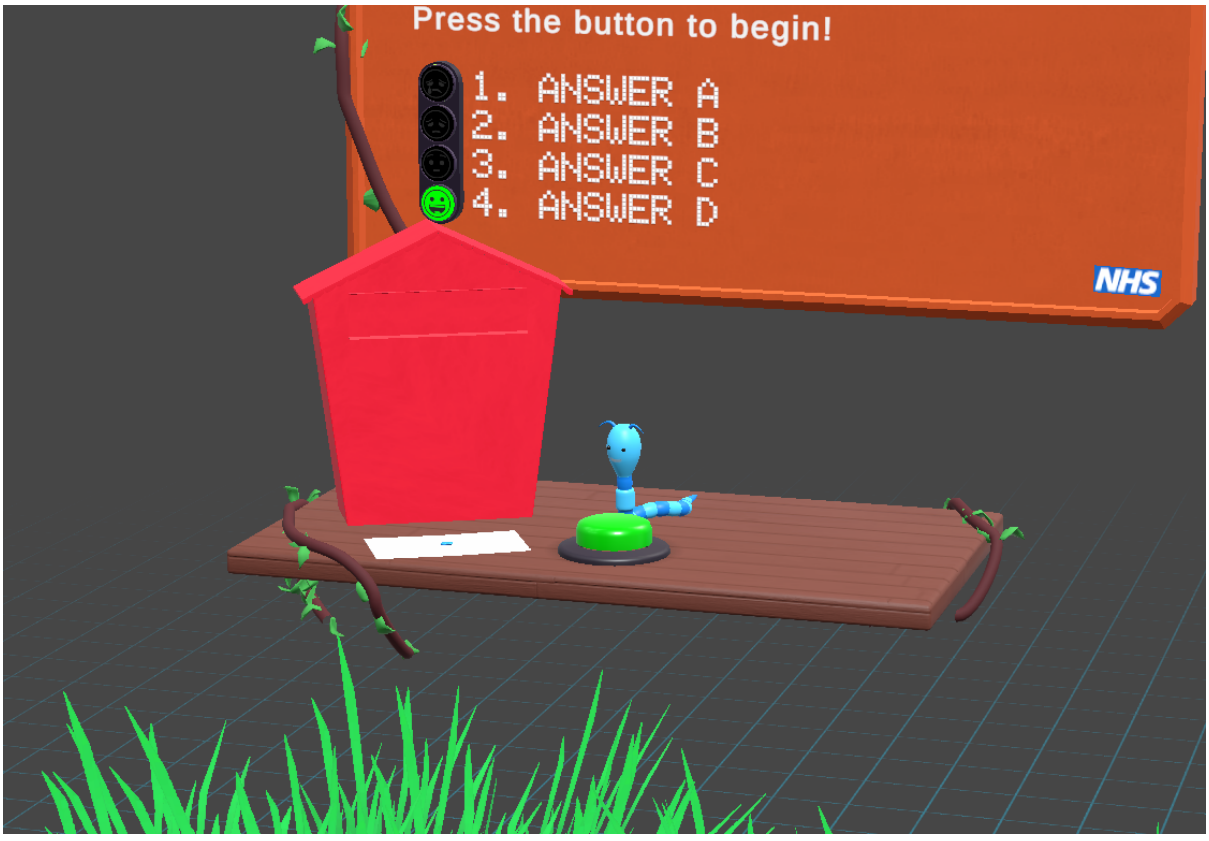

Image 2A: An isometric image of the visually engaging 3D models used for the 'Answers Submission Postbox'.

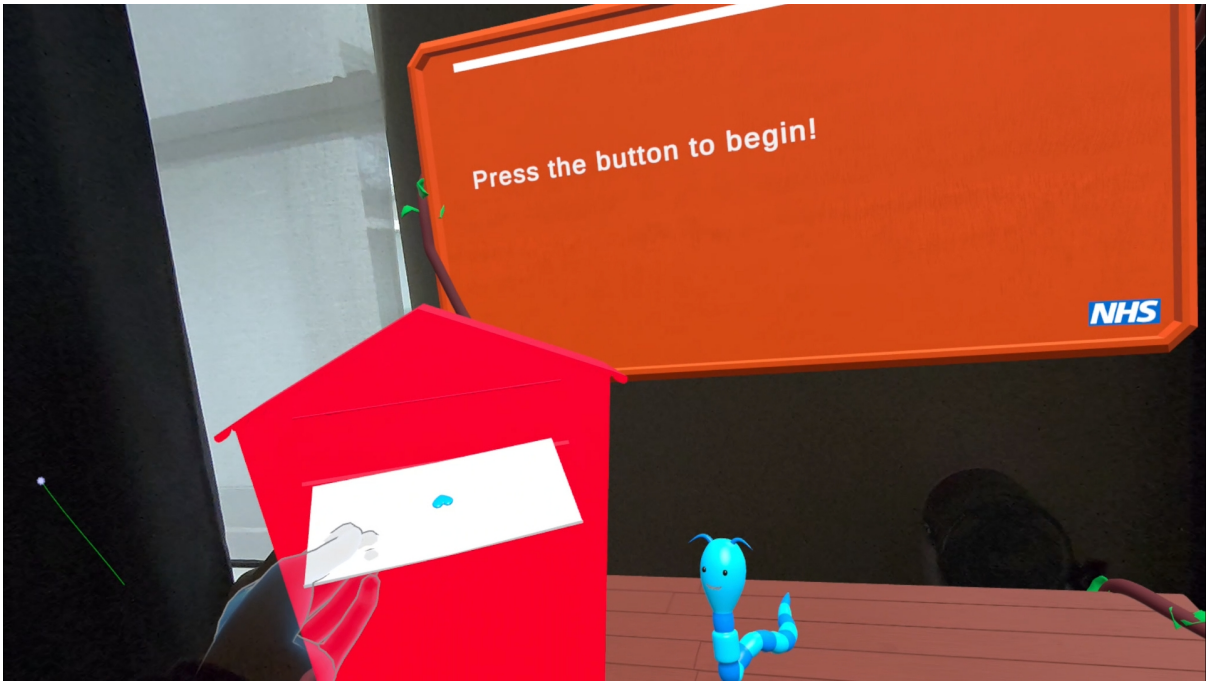

Image 2B: A mixed reality capture of a user submitting their answers into the post-box, allowing them to be recorded on the clinician's spreadsheet via the cloud. Their hand is virtually outlined.

The experience co-design process was iterative and user-centred involving the Digital Futures team, clinicians, patients and their parents. Clinicians provided input on question content and phrasing to align with clinical outcome measures, while technologists ensured usability, comfort, and safety for paediatric settings. Early testing in clinic sessions confirmed strong engagement. Many children who were typically quiet or disengaged became more expressive within the headset, and parents reported that the experience helped their child articulate pain in new ways. The result is a prototype that combines clinical validity with emotional accessibility, enabling children to express how they feel in ways that are both meaningful to them and interpretable by healthcare professionals.

THE PILOT

14	9–14	2	0
Children participated	Age range (years)	Clinic sessions	Headset removals

Over multiple sessions, young patients attending the Rheumatology clinic were offered the option to try the interactive VR questionnaire. Parents and guardians were informed about the intervention and provided informed consent. Data were collected as part of a service improvement initiative. Children (with parental support) completed responses on MS Forms following the experience. Technology experts from the Digital Futures Lab assisted clinical staff in setting up the experience and supporting the children. Children were given the option to remove the headset at any time if they felt unwell or uncomfortable. None did so.

FINDINGS

Using Braun & Clarke's thematic analysis (2006), seven themes emerged from the data:

1

VR as a communication bridge ("show, don't tell")

Interacting with objects/answers was easier than explaining verbally or filling in a paper questionnaire. This reduced avoidance and enabled clearer signalling of what hurts and how.

2

Playful immersion reduces anxiety

Light, game-like moments kept attention and made clinical questioning feel less threatening, supporting calmer engagement throughout.

3

Learnability and independence

Most children grasped the interface immediately and navigated without assistance, reinforcing confidence and ownership over their responses.

4

Friction: pacing and controls

A small number of users noted slow narration, forced waits, occasional fine-motor friction with sliders, and some tracking lag.

5

Accessibility and sensory comfort

Needs varied by age and sensitivity. Some older children wanted a less juvenile theme; a few noted text clarity and scene-height adjustments for those with limited arm movement.

6

Agency and personalisation

Children requested theme choices for different age groups and optional "micro-play" breaks whilst thinking through their answers.

7

VR preferred, but keep options open

Most preferred VR to paper, though one did not — highlighting the importance of maintaining multi-modal options in clinical settings.

Children generally found the experience to be fun, easy to use, and more engaging than paper. The small frictions identified (narration speed, slider precision) are solvable through iteration. Findings suggest VR may lower the social and cognitive load of pain reporting, enhancing expressiveness and completion without replacing more traditional options for those who prefer them. This can only be explored further through an investigative research study with a larger sample.

CONCLUSION

The aim of this paper was to present a novel VR intervention developed at the Digital Futures Lab (Torbay and South Devon NHS Foundation Trust), in collaboration with clinicians from the Rheumatology service jointly run by Torbay and South Devon NHS Foundation Trust and the Children and Family Health Devon Rheumatology Service, that aims to help children with JIA communicate their pain to allow more precise management of their condition.

Traditionally, clinicians have asked patients about their pain and its impact on their lives, but frequently encountered disengagement from children, leaving parents to express their child's experience on their behalf. Using informed consent, the Virtual Reality Check-In interactive VR questionnaire was piloted with 14 children with the aim of improving future iterations. Our findings show that VR lowers the expressive burden for many children, allowing them to communicate their symptoms and the effect on their lives more effectively, whilst keeping them engaged and reducing potential anxiety.

Children have provided valuable design suggestions — including age-banded theming, skip/advance narration, text and contrast settings, motion-reduction toggles, automatic height calibration, reduced lag, and micro-play moments — that will guide future development. We would like to pair this with a clinician dashboard presenting time-series signals and confidence indicators (hesitations and dwell times) to support clinical discussion.

LIMITATIONS

Our pilot comprised a small, single-service sample (n=14). Novelty of the experience may have inflated the 'fun/excitement' element. The feedback survey included only two open-ended questions, limiting qualitative insights. Reflections from clinicians and parents were not incorporated. Due to the nature of service

evaluation, we could not provide a control condition or compare completion rates, child affect, and concordance with clinical assessment.

ACTIONABLE PLANS

1. **Pacing:** Add "skip/fast-forward" and variable narration speed controls.
2. **Clinical tablet integration:** Incorporate a tablet alongside VR so clinicians can view answers, capture notes, and store information — enabling trends to be established over time.
3. **Controls:** Replace sliders with large, embodied selectors (tokens, bins, or radial picks).
4. **Accessibility presets:** Quick toggles for text size and contrast, motion reduction, and sensory-lite audio.
5. **Age theming:** Two or three visual skins tailored to younger, middle, and older age groups.
6. **Calibration:** Automatic height and desk scaling, "re-centre" option, and seated-mode default.
7. **Technical robustness:** Hand-tracking hardening and optional controller support.
8. **Formal evaluation:** Run a short RCT-style service evaluation (VR vs. paper) measuring completion, acceptability, and clinical usefulness.

KEY TAKEAWAYS

- VR can bridge communication gaps by letting children "show, not tell".
- High learnability and positive affect make Virtual Reality Check-In a feasible option for busy clinics.
- A few small frictions (pacing, sliders) are straightforward to address through iteration.
- Keeping VR optional respects individual preference and sensory needs.
- With inclusive design, VR may meaningfully improve paediatric pain reporting.

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