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Virtual production for the micro: Investigating obstacles and tailoring workflows for small UK production studios

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Abstract

Virtual production (VP) is rapidly reshaping film and video workflows through its combination of digital and on-set processes. However, micro and small production companies often struggle to embrace these techniques. This paper investigates the barriers to VP adoption among smaller UK studios and explores a workflow tailored to their existing resources. Two surveys were conducted to assess companies' equipment inventories, skill sets, and openness to innovative methods. Guided by these insights, a series of practical tests was then designed to demonstrate accessible VP approaches suited to limited budgets and foundational levels of skills. By focussing on commonly available tools, simplified technology, and minimal hardware requirements, the proposed workflows aim to encourage broader use of VP processes across diverse fields such as commercials, corporate videos, and digital marketing. The study's methodology highlights how careful alignment of project scope and resource constraints can enable smaller studios to incorporate a simple form of VP techniques without excessive costs or requiring specialized skills. This work offers a foundation for future collaboration and training initiatives that may help integrate VP more seamlessly within micro and small-scale production studios.

Introduction

Virtual production (VP) is redefining the filmmaking process by integrating real-time digital environments with live-action footage. By leveraging technologies such as LED volumes, motion

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capture, and game engine-powered rendering, VP allows filmmakers to visualize and manipulate digital assets in real-time, thereby enhancing creative flexibility and efficiency (Cinzia et al., 2023). It is increasingly seen as a more efficient way for filmmaking, offering directors more flexibility (Swords and Willment, 2024). Unlike traditional production methods that rely heavily on post-production for visual effects, VP enables many of these tasks to be completed during pre-production and on set, reducing costs and increasing production speed (Susan and Okun, 2024). Initially popularized by high-budget productions such as *The Mandalorian* (2019), VP has since gained traction across the industry, including in television, advertising, and independent filmmaking (Bodini et al., 2024). As the technology continues to evolve, its widespread adoption is reshaping not only production workflows but also industry roles and skill requirements (BFI, 2023).

Virtual production has roots in virtual television studios developed in the 1990s, where keyed sets, camera tracking, and real-time graphics systems combined to place presenters within computer generated environments during live or near live production (Gibbs et al., 1998). The recent rebirth of VP in film and high end TV, widely associated with *The Mandalorian* (2019), reflects technical advances in real time rendering, game engine workflows, camera tracking, and high quality display systems that enable in camera integration of digital scenes during principal photography (Swords and Willment, 2024).

In current practice, virtual production tends to cluster around two workflows: in-camera backgrounds on LED displays and chroma key acquisition with real-time preview. LED volumes can deliver on-set integration with photographed performance, including physically plausible reflections and illumination from the screens, reduced or no keying in post-production, and parallax when camera tracking is available, which can accelerate decision making during principal photography (Swords and Willment, 2024). Their limitations are primarily practical and economic, including stage cost, power and space requirements, content latency and sync management, moiré and brightness constraints, and the need for specialist crews (Swords and Willment, 2024). Chroma keying remains attractive because it is inexpensive, scalable to small stages, and flexible for a wide range of briefs, with reliable results when lighting and spill control are correctly managed; however, integration burdens shift to postproduction, reflections and interactive lighting must be recreated, and green spill and matte edge issues can degrade composites if poorly lit (Brinkmann, 2008; Susan and Okun, 2024).

Recent studies highlight the growing interest in VP as an alternative filmmaking process that integrates real-time game engines, augmented reality (AR), and artificial intelligence (AI) to enhance production efficiency and flexibility (Bodini et al., 2024). Additionally, VP is recognized for its economic and environmental benefits, as it allows productions to avoid costly location shoots while reducing carbon footprints (Fair, 2023). However, despite its advantages, challenges such as high initial investment, skills shortages, and limited access to technology remain significant barriers for smaller production companies (Hitchen et al., 2023). By addressing these challenges, this study contributes to the ongoing discourse on making VP more accessible beyond high-budget studio productions (Bodini et al., 2024). The United Kingdom has established itself as a major hub for VP, with significant investment in cutting-edge production facilities and technological advancements. Leading studios such as Pinewood, Warner Bros. Leavesden, and Shepperton4 have integrated VP infrastructure, making the UK a key player in the global VP ecosystem (Hitchen et al., 2023). Government initiatives and tax incentives have further accelerated the adoption of VP attracting international productions and fostering a growing demand for VP expertise (Hitchen et al., 2023), (UK's modern industrial strategy, 2024; Uwazuruike et al., 2025; Creative industries sector vision, 2023). However, despite these advancements, the benefits of VP remain unevenly distributed across the industry, with smaller production companies struggling to keep pace with these developments. While major studios have the financial resources to invest in VP, independent and regional

filmmakers often face significant barriers in accessing the necessary technology and training (Fair, 2023).

The upfront investment required for LED walls, real-time rendering systems, and motion capture technology can be prohibitive for independent filmmakers and lower-budget productions (Jasaui et al., 2024). Additionally, VP requires specialized expertise in game engines such as Unreal Engine, as well as real-time compositing and virtual cinematography, which many traditional filmmakers lack (Barnett et al., 2025). Training programs are still catching up with the demand for VP skills, leaving a gap in the workforce that further limits industry-wide adoption (Boutellier et al., 2023). These challenges create a divide between large-scale productions that can afford VP and smaller studios that struggle to integrate these tools into their workflows, potentially leading to a monopolization of VP by major industry players (Fair, 2023).

Existing research has extensively examined the technological advancements and industry impact of VP but has largely focused on high-budget productions and major studios. Studies such as those by Cinzia et al. (2023) emphasize the shift in filmmaking methodologies enabled by VP, while others highlight methods for remote virtual production collaboration (Bodini et al., 2024). However, there is limited research on how VP can be made more accessible for smaller studios and independent filmmakers. This research aims to address this gap by exploring cost-effective and scalable VP workflows that can be adopted by small and independent studios. Specifically, it asks: What are the barriers preventing micro and small UK production companies from adopting virtual production? And how can a simplified, low-cost workflow built around their existing equipment and skills, enable them to start using VP effectively? By identifying more accessible VP solutions, this study seeks to contribute to the democratization of VP technology, ensuring that its benefits are available to a wider range of filmmakers and fostering a more inclusive and innovative production landscape.

This paper advances the conversation on small-scale virtual production in three ways. First, it provides a current, data-driven snapshot of micro and small UK studios' readiness by detailing their equipment inventories, skill profiles, prior exposure to VP, and stated intentions to adopt. The evidence comes from two surveys (n = 71 and n = 40) and is reported with proportions that clarify where capability and willingness align or diverge. This clarifies the starting conditions that realistic adoption strategies must address.

Second, it translates those conditions into practical demonstrations of low-cost, accessible VP methods using widely available tools. The study utilises a small-screen, no-tracking, non-real-time approach with large television displays as backdrops, stock or basic 3D assets, and straightforward lighting and calibration, illustrated through interview and tabletop product scenarios. The emphasis is on procedures that generalist crews can reproduce without specialist hardware or deep engine expertise.

Third, it contributes insights into how small studios perceive the trade-offs in real versus CGI backgrounds and single versus multi-monitor setups. Preference data, perceived complexity, and likelihood of adoption are analysed together to show where simple methods are judged, where added screens improve integration, and where complexity begins to outweigh benefit. These findings inform incremental training paths and procurement decisions for teams seeking to add VP capabilities proportionate to their budgets and skill levels.

Methodology

Research design

This research adopted a mixed-methods, three-stage design approach to investigate the key barriers that prevent micro and small UK production companies from adopting VP and to propose an

accessible and entry-level VP workflow. The research was conducted in three phases. The first phase involved a survey designed to assess the perspectives of small production studios on VP. In the second phase, data gathered from the initial survey was analysed to develop and test practical pipelines tailored to these studios. Finally, the third phase introduced a follow-up survey to gather feedback on the proposed methods from phase two, evaluating their feasibility, effectiveness, and potential for adoption (Figure 1). By integrating survey data with practical experimentation, the study aimed to derive both statistical trends and in-depth insights into VP adoption in smaller production companies.

The three-stage design maps to the Design Science Research Methodology. Stage 1 (Survey 1) identified the problem by describing obstacles, capabilities, and needs among UK micro and small studios, including cost and 'do not need' responses and low prior exposure to VP. Stage 2 designed the artefact by building simplified VP workflows suited to the reported equipment and skills, comparing single versus multi monitor setups and real versus CGI backdrops. Stage 3 evaluated and reflected through Survey 2, where participants viewed example outputs and reported preferences, simplicity rankings, and likely adoption. Stating this alignment situates the study within a recognised design-oriented tradition while keeping the focus on small studio constraints.

Participants and sampling

The two surveys involved a combined effort to gather insights from micro and small production companies across the United Kingdom (UK). In the initial phase, a total of 71 companies participated, with potential participants having been identified through publicly accessible business directories and their operational status verified via Companies House (Companies House, 2025) to confirm if they were active within the UK. Companies focussing solely on specific services incompatible with the research focus, such as those exclusively engaged in aerial shooting, were excluded to ensure participants were relevant to the study. The companies varied in size, employing between 1 and 49 individuals, and spanned diverse fields including film and television production, commercials, live events, and corporate media, representing a wide cross-section of the industry. In the third phase, 40 UK-based companies, including some from the initial phase alongside additional participants, provided follow-up feedback. Given that both questionnaires were anonymous, it was not possible to determine how many of these 40 had also responded to the first survey. Recruitment for this stage utilized invitation emails and social media outreach, ensuring participants were familiar with the research aims and methods before contributing. This approach helped maintain continuity and informed engagement, building on the insights gathered in the initial stage of the study.
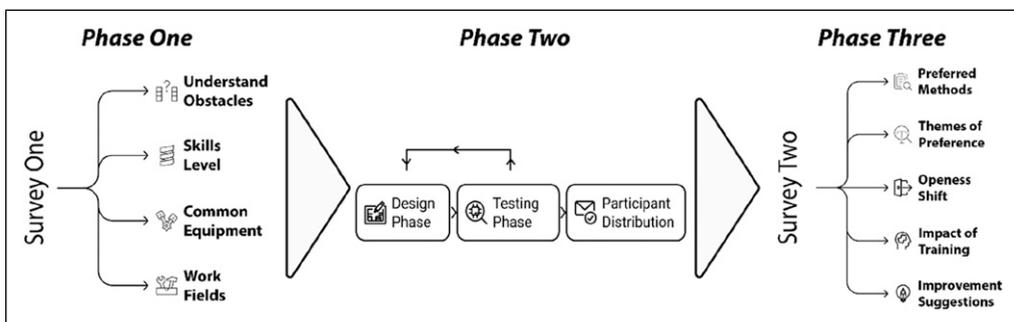

Figure 1. Research design.

Companies were sourced from business directories and screened against Companies House entries to confirm status and size. Invitations were sent to listed production contacts, and a public call was shared on professional social channels. One reminder cycle was issued. Because outreach combined direct emails and open calls, a precise denominator of all eligible companies was not available, so a formal response rate could not be calculated. The resulting samples comprised 71 respondents for Survey 1 and 40 respondents for Survey 2.

The samples predominantly consisted of micro companies with 1 to 9 employees and small companies with 10 to 49 employees, which reflects the long-tail structure of the UK screen sector. Responses covered film and TV, commercials, and a broad set of adjacent categories such as corporate video, branded content, and online promotional work. Although coverage across the intended strata was achieved, the strategy constitutes non-probability sampling. Findings should therefore be interpreted as indicative of readiness and perceptions among actively engaged micro and small studios, rather than as population estimates for the entire UK industry.

Data collection instruments

Questionnaires (Phase 1 & 3). At the first and third phases of the research, questionnaires were used to gather the necessary data. The questionnaires for Survey 1 and Survey 2 were crafted as mixed-format questionnaires, blending three question types: open-ended, multiple-choice, and Likert-scale items. This approach, widely recognized in research for its ability to collect both qualitative and quantitative data (de, 2018), allowed for a comprehensive exploration of participant's perspectives. By combining these formats, the two surveys effectively captured detailed insights alongside structured, measurable responses, providing a robust foundation for analysing the adoption and impact of VP among micro and small production companies.

In the Survey 1, a mixed-format questionnaire featuring multiple-choice and open-ended questions was employed to assess participants' familiarity with VP and their readiness to integrate it into their operations. It delved into key areas such as equipment availability, financial constraints, and skill levels, specifically skills like 3D environment creation and experience with gaming engines. Additionally, the survey gauged the company's overall interest in adopting VP, offering a broad snapshot of their current capabilities and attitudes toward this emerging technology.

Survey 2 focused on gathering qualitative feedback, relying on multiple-choice questions with text entries and ranking preference. This design enabled participants to evaluate several VP setups, comparing elements like real versus computer-generated imagery (CGI) backdrops and single versus multi-monitor approaches. Through these responses, the survey gathered insights into which methods participants preferred or might consider adopting in the future, providing valuable feedback on the practical applicability of VP in their workflows.

Technical setup and calibration. **Technical setup and calibration:** Practical tests were filmed on a Canon 5D camera with a 70–200 mm zoom lens mounted on a tripod. Foreground subjects (interview) and a reflective tabletop object (perfume bottle) were staged at fixed marks. Backgrounds were played on a 55-inch LG television positioned behind the subject/object; for the three-monitor condition, two additional side displays were angled to introduce controlled reflections. Signal was delivered over HDMI at the panel's native resolution using standard video playback. To minimise refresh interference, shutter speed was set as a stable multiple of the display refresh; exposure was adjusted to avoid clipping of both foreground highlights and background whites.

Perspective and scale matching: For single-monitor tests, camera height and distance were set so that horizon lines and dominant verticals in the background plate aligned with the physical set's

eye line and lens height. Focal length was adjusted to hide any artefacts, 'Moire' that may occur on the screen. For the product shots, the bottle-to-screen distance and camera position were iteratively refined so that edge contours, ground plane cues, and reflections felt consistent with the background's perspective.

Colour and lighting: White balance was fixed for each setup. It was first fixed in the physical camera; after that, it had to be fixed in the virtual camera for a consistent match between the virtual and the physical. Key and fill were set to match the directionality and approximate colour temperature of the background (e.g. cool side-light for the 'interior library', warmer/ambient for the 'beach'). Screen brightness was trimmed to sit below foreground key levels to reduce bloom and to help the subject read cleanly. For the product shots, side displays were introduced to produce controlled reflections on glass and metallic surfaces; diffusion and flagging were used to shape specular highlights and suppress unwanted spill.

Operational simplicity: No camera tracking was used. Backgrounds were either stock footage or pre-rendered CGI clips; the CGI beach scene was authored at an entry/intermediate level (basic layout, sky/water animation, simple materials), exported to a standard playback format, and displayed full-screen. The intent was to keep the pipeline reproducible by generalist crews using readily available tools, while allowing systematic comparison of real versus CGI and single versus multi-monitor conditions.

Practical tests (Phase 2). In the second phase, practical tests were designed based on the findings from Phase 1. The practical testing consisted of three tests comparing (1.) real versus CGI backdrops, and (2.) single versus multiple monitor setups. Designed with the equipment and skills that micro and small production companies already have or can access, as identified in Survey 1, the practical tests ensured relevance and feasibility for participants.

Test 1 involved a person speaking in front of a large TV displaying a library background (Figure 2). Two variations were produced. Result A featured a real library image as the backdrop, while Result B used a CGI-generated version of the same library scene (see results in 4.3.1, Figure 3). This setup allowed for a direct comparison between the visual quality and practicality of a physical image (background) versus a digitally created one, offering insights into how each might suit the needs of smaller production teams.

Test 2 involved a perfume bottle placed on a bed of sand and seashells, positioned in front of a large TV showing beach footage (Figure 4). The small product (perfume bottle) was included to mirror the common deliverables, commercial, corporate, branded, and online promotional work, produced at micro-budget scales, as indicated in Survey 1 responses. Two outcomes were compared. Result A showcased real beach footage, capturing authentic environmental details, while Result B presented CGI-generated beach footage replicating the same scene (see results in 4.3.2, Figure 5). This test explored how well each method conveyed realism and atmosphere, which are key considerations for companies producing commercials or similar content.

Test 3 built upon the second test by incorporating additional side monitors to enhance reflections and immersion (Figure 6). Result C utilized real beach footage displayed across three monitors, one main background screen and two side monitors, creating a broader, more enveloping visual effect. Result D employed CGI-generated beach footage across the same three-monitor setup, aiming to improve immersion and reflective accuracy. This extension of the previous test (see results in 4.3.3, Figure 7) provided deeper insights into how multi-monitor configurations could elevate the quality of the visual output, offering participants more practical examples to assess for potential adoption in their own workflows.

Figure 2. Test 1 method.

Procedure

Phase 1. The Survey 1 online questionnaire was emailed to 71 companies, and focused on obstacles to VP adoption (financial, technical, perceptual), current equipment (cameras, lighting, projectors, monitors, tracking devices), and experience with or openness to hiring VP talent. It collected quantitative data (e.g. VP familiarity percentage) and qualitative insights (e.g. open-text fields for further explanation of the perceived barriers).

   Phase 2. Based on the Survey 1 findings, three low-cost VP tests were created using real and CGI backgrounds. Filmed under consistent lighting, Test 1 featured an interview scenario (actor in foreground), while Tests 2 and 3 used a product setup (perfume bottle) to evaluate how background, lighting and reflections impact on how the product integrates with the background environment. Clips resulting from the tests were prepared for inclusion in Survey 2.

   Phase 3. 40 participants, including some from Phase 1 and additional small production companies, were recruited via email and social media. They reviewed Phase 2 results and completed the
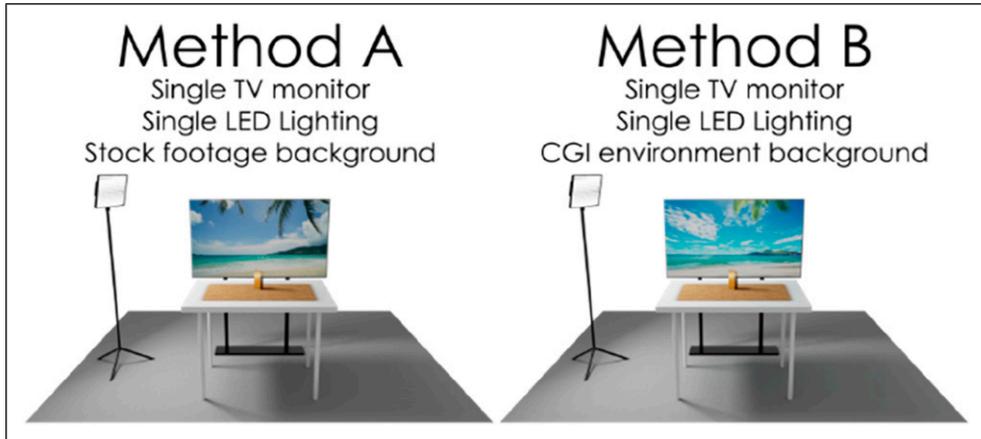

Figure 3. Test 1 results.

Figure 4. Test 2 method breakdown.

Survey 2 online questionnaire. Survey 2 focused on gauging preferences for visual appeal, method potential, complexity, and adoption likelihood, alongside open-ended sections for improvement suggestions, and ideas for enhanced approaches. Quantitative data gathered included preference percentages and complexity rankings, plus qualitative input such as lighting critiques, reflection suggestions, and overall feedback on foreground (physical) and background (virtual) integration to assist in future fine-tuning of VP workflows.

Data analysis (phases 1 & 3)

Quantitative Analysis. Survey data was analysed using percentages and mean ranks to sum up preferences, complexity views, and adoption readiness, with results like background (real vs CGI) and monitor setup preferences shown in bar charts. Method rankings (A to D) were compiled to spot trends and gauge how much each approach was favoured.

Qualitative Analysis. Open-text responses were sorted into themes driven by the data (inductive) (e.g. lighting issues, cost concerns, setup complexity, client demand), highlighting common suggestions and feelings about method choices. Researcher notes from practical tests on lighting,
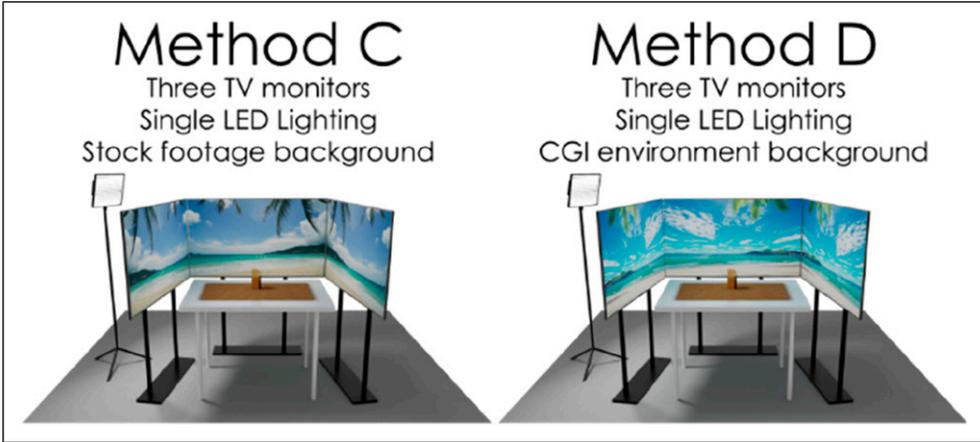

Figure 5. Test 2 results.

Figure 6. Test 3 method breakdown.

reflections, and colour issues were matched with Survey 2 findings to further inform the study's findings.

Statistical tests. In addition to descriptive summaries, a simple non-parametric test was used. For rank-order tasks (1 to 4 across Methods A–D), agreement was summarised with Kendall's W (0 = no agreement, 1 = perfect agreement). We interpret W with a simple guide: about 0 to 0.2 weak, 0.2 to 0.5 moderate, above 0.5 strong. For the A–D rank tasks, if a respondent left the default order unchanged and submitted the page it was treated as a valid ranking.

Results

Survey 1

Participants. 71 micro and small production companies from across the United Kingdom completed the first survey. Most respondents (89%) classified themselves as micro (1–9 employees) (BEIS, 2021), while 11% had between 10 and 49 employees (Figure 8). Nearly all participants (93%) indicated having basic photography/videography equipment, but more specialized tools such as 3D trackers, high-end GPUs, and knowledge of advanced gaming engines were far less common (Figure 9).

Familiarity. Half of the respondents (51%) claimed familiarity with VP, although only 37% had any practical experience (e.g. LED walls, Simulcam).

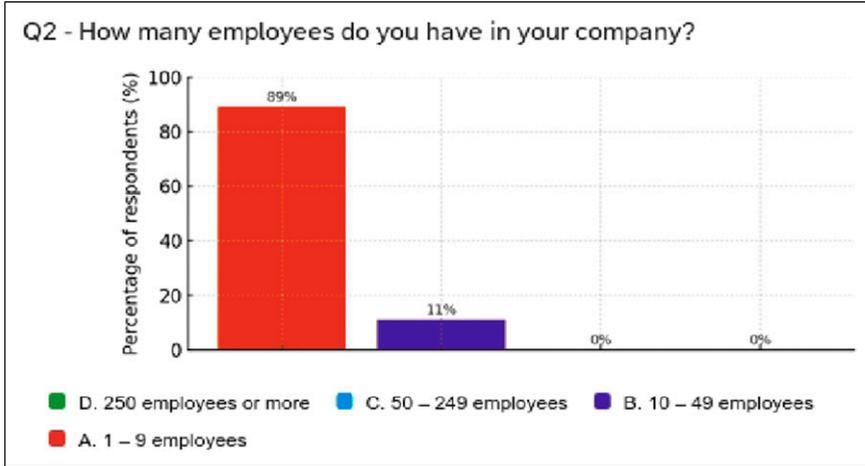**Figure 7.** Test 2 and test 3 results.

Figure 8. Scale of participants companies.

Future Intent. Around 24% expressed firm plans to adopt VP, and 59% said they 'might' incorporate it depending on budget, client demand, or project suitability. The remaining 17% reported disinterest in VP (Figure 10), largely because they perceived it unnecessary for their niche projects or felt more comfortable with conventional production methods.

Obstacles to Adoption. When asked about the main factors preventing VP implementation, cost and financial concerns (32%) and a perceived lack of business need (32%) emerged as the top two barriers. About 12% cited limited expertise, while the remainder mentioned other issues, including low client demand, difficulty justifying equipment investments for small-scale projects, and scepticism about whether VP techniques would visibly enhance their current outputs (Figure 11).
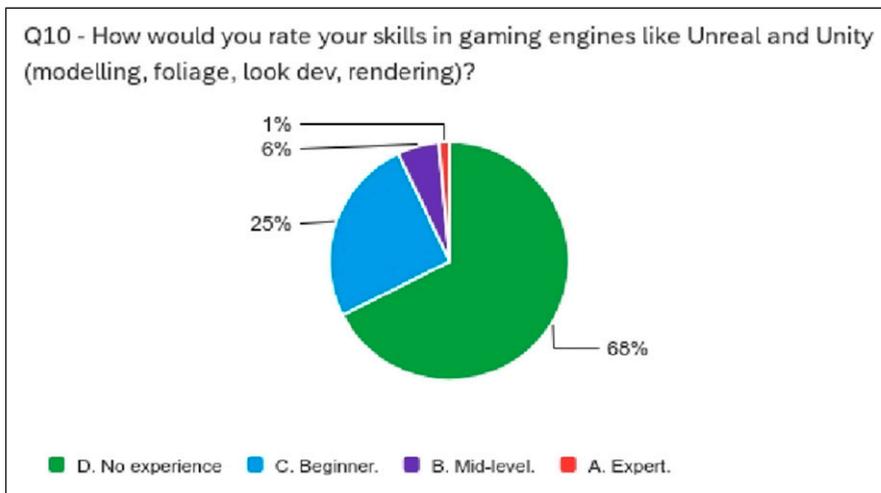

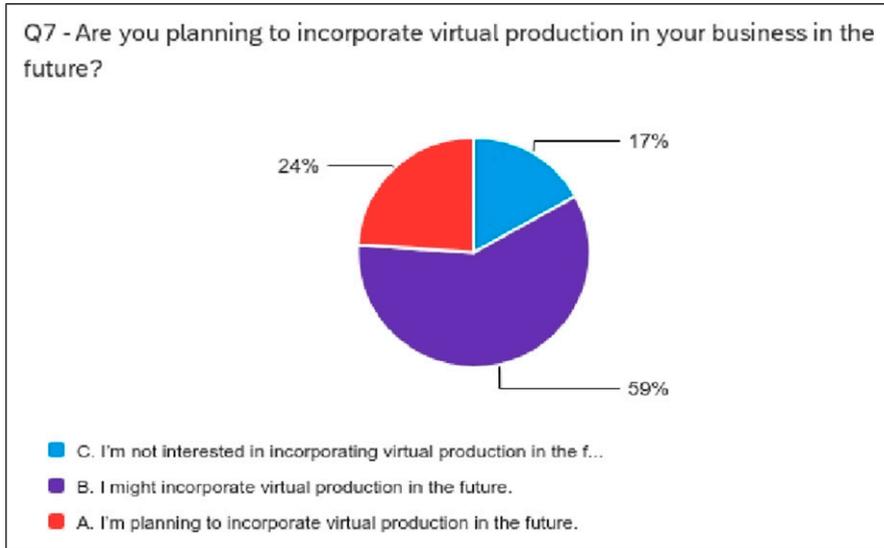**Figure 9.** Game engines experience level.

Figure 10. Virtual production future intents.

Equipment readiness. Only 7% owned a professional 3D tracking system, with minimal willingness (6%) to purchase one (Figure 12), and nearly half (49%) had no projectors available and were not willing to hire projectors for a project, and only 17% possessed three or more (Figure 13). Regarding large TV screens (≥55 inches), a significant subset (27%) was unwilling to hire or purchase any, whereas the rest (73%) either owned or were open to hiring between 1 and 4 screens.
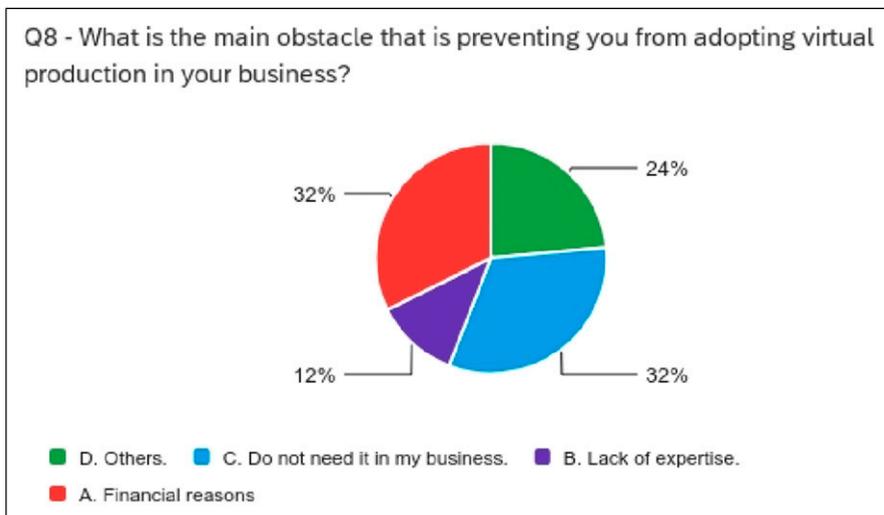

Figure 11. Virtual production adoption obstacles.
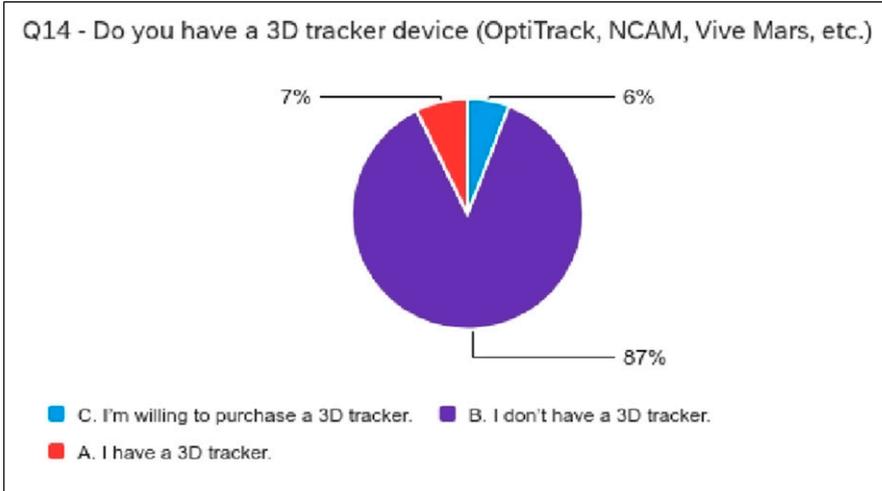
Figure 12. Openness to 3D trackers.

More than half (51%) did not have a single high-performance PC (e.g. with RTX 3070 or greater GPU) to dedicate to VP processing, indicating limited capacity to run real-time 3D or cluster-rendering setups.

Skills readiness. The survey highlighted a notable gap between the respondents' interest for future virtual production adoption and the readiness in terms of the required specialized skills to implement it effectively, a finding that contributes new knowledge to the field. While (83%) of the respondents showed interest in adopting virtual production in the future, only 17% felt confident designing 3D

Figure 13. Openness to using projectors.

environments. Meanwhile, 41% admitted they lacked these skills, and 42% said they would be willing to hire a 3D artist to fill this gap.

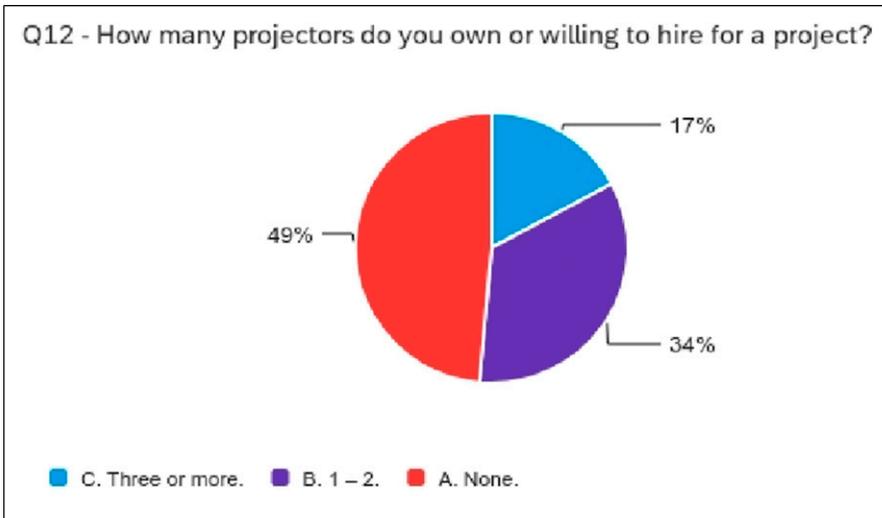More than two-thirds (68%) had no experience working with gaming engines such as Unreal or Unity. A quarter (25%) identified as beginners, and only 7% (combined expert and mid-level) reported higher competencies in modelling, foliage, look development, or rendering (Figure 9).

A large majority (89%) were unfamiliar with cluster rendering or nDisplay setups for multi-monitor integration, suggesting that most had not ventured into more complex real-time rendering workflows. Similarly, 90% did not have the knowledge to set up a Virtual Reality Peripheral Network (VRPN), underscoring the scarcity of advanced VP expertise in smaller studios.

Taken together, these findings are consistent with the reported severe skills shortage across the creative industries (BFI, 2023; James Bennett et al., 2023;). Even though many respondents showed interest in VP technology, skill shortages in key areas such as 3D environment creation, real-time rendering, and advanced system configurations present a substantive obstacle to adoption.

Overall, Survey 1 underscored significant interest in VP paired with notable financial and technical barriers. These findings guided the subsequent Practical Testing phase that aimed to explore simpler, lower-cost methods that align with the equipment and skill constraints reported by these micro and small production studios.

Practical testing

Various methods were explored to create on-screen backgrounds, including real-life footage, photogrammetry, LiDAR scanning, and generative AI. Photogrammetry produced undesirable artifacts, whereas phone-based LiDAR offered quick, accurate references when refined in dedicated software. Generative AI yielded realistic images but required repeated edits, ultimately leading to a preference for assembling 3D environments for easier adjustments. Technical issues such as moiré, flicker, perspective mismatches, inconsistent lighting, and white balance differences were resolved by fine-tuning camera angles, frame rates, screen brightness, and colour temperatures across both real and virtual elements.

To address the gaps identified in Survey 1, three sets of tests were conducted. Each test featured a foreground subject (either a person or a product) and a backdrop displayed on one or more TV screens. Two versions of each test were filmed, one using real footage and another using CGI footage of the same scene. Testing real versus CGI footage has already been a focal point in VP research, where audience perception studies have shown that 'an audience would be challenged to identify which is real and which is virtual' when comparing traditional and virtual screen techniques (Susan and Okun, 2024).

A variation for the product (i.e. perfume bottle) tests was the introduction of extra side monitors to study the impact of reflections (see 4.3.3, Test 3, Figure 7). Reflections play a crucial role in achieving realistic integration between virtual and physical elements. In high-end volumes, LED panels are particularly effective at creating specific lighting atmospheres because they can produce light that interacts well with reflective surfaces, enhancing the visual quality of the scenes that are being shot (Swords and Willment, 2024). Typically, careful consideration needs to be given to reflections during set design and shot planning, to what props, materials, and other elements will be reflective, and to where they will be positioned in the shot (Susan and Okun, 2024).

Moreover, reflections from LED walls offer significant advantages over traditional green screens. Unlike green screens, which can cause unwanted colour spill, LED walls naturally contribute to the illumination of the scene. The perspective and illumination displayed on the LED wall change in accordance with the movement and position of the camera. In contrast to the usual struggle to

prevent colour contamination from the green screen overflowing onto the subject and causing undesired reflections, all the reflections and lighting from the screen contribute crucial artistic signals and improve the authenticity of the imagery (Hitchen et al., 2023). This additional set of tests (Test 3, Methods C & D) presented a miniature LED volume setup with 3 monitors using commonly available TVs to take a closer look at how the additional monitors influence the overall outcome in terms of lighting and reflections.

When designing these tests, insights from Survey 1 played a pivotal role in determining which VP methods would be both feasible and appealing to participants. The survey data revealed users' equipment inventories, skill levels, and budgetary limits; these factors helped shape an approach that prioritized solutions matching their reported capabilities. Since approximately half of the respondents did not own or plan to rent projectors (Figure 13), the practical tests exclusively utilized TV monitors as the display method. Moreover, given that a large majority either lacked 3D trackers or had no intent to purchase them (Figure 12), tracking-based techniques were deliberately excluded, additionally the tools involved can be complicated and difficult to use, requiring significant training as well as sophisticated and expensive hardware (Deloitte Global, 2023a). The background content was sourced from stock footage and kept at a relatively basic level of 3D design to accommodate the limited expertise in 3D environment design. This approach aligns with research indicating that many prioritize accessibility and affordability, opting for simpler workflows that integrate existing assets rather than developing custom, high-complexity environments (Jasaui et al., 2024). By avoiding overly sophisticated VP approaches, these tests aimed to demonstrate workflows that were technically feasible and financially accessible to the survey participants.

Test 1: Interview scenario. A single large TV was used to display a library setting behind a seated interview subject (Figure 3). Result A consisted of a real image background of the library displayed on a large TV screen, while result B displayed a CGI image of that same library.

The main difference was the setup process, setting up the real image method **took longer** than the CGI, given that the physical camera had to have the same angle as the image, and the lighting setup had to match as well. On the other hand, in CGI method, the virtual camera and lighting could be adjusted to match the physical elements in the real world.

Test 2: Product shot (single monitor). A perfume bottle was placed on sand and seashells, with a single TV monitor as the beach backdrop. Result A displayed real beach footage, while result B showed a CGI-rendered beach environment matched to the real footage's layout. The main differences were colour gradients, the motion of the water and waves, and how well each background showcased the product (Figure 5).

Test 3: Product shot (three monitors and reflections). The same perfume-sand setup was tested with three monitors: one directly behind the product and two angled on the sides (see section 2.3.2, Figure 6) to produce reflections on the bottle. Result C showed real beach footage while result D displayed CGI beach footage, both C & D displayed on all three monitors.

Reflections on the bottle and sand were observed to enhance integration and hence were included as an additional option of increased technical complexity which could improve the overall realism of the scene.

These test videos (A–D) (Figure 7) were then compiled and presented to a new sample of small production companies in Survey 2 to collect participant preferences, method rankings, and qualitative feedback.

Survey 2

We invited 40 production companies to review the test results and complete a follow-up questionnaire. Findings from this second survey are presented below.

Test 1 (Interview scenario with library background). In an interview setup featuring a library background, participants were asked about their overall preference for either a real or CGI backdrop (without being told beforehand which background was which). The results revealed that 40% of respondents favoured the real footage background (Result A), while 60% preferred the CGI background (Result B) (Figure 14).

When asked to evaluate only the backdrop itself, excluding the foreground subject, preferences were nearly split, with 51% preferring the real footage and 49% favouring CGI (Figure 15). This close division indicates that while many viewers value the authenticity of real-life footage, an almost equal number appreciate the potential benefits of computer-generated environments.

Respondents who preferred the real background cited its warm detail and authentic feel as the main reasons for their choice. On the other hand, those who preferred the CGI background highlighted its superior control over lighting and colour grading. This level of control, they noted, served to highlight the subject's face while simultaneously minimizing any potential distractions in the background.

Test 2 (Perfume bottle, single monitor). In a product-centric setup featuring a perfume bottle on a single monitor, participants were asked to compare the visual appeal of real beach footage (Result A) against CGI beach footage (Result B); again without being told beforehand which background corresponded with which technique. Feedback revealed that only 23% chose the real backdrop, whereas a significant 77% showed a clear preference for the CGI version (Figure 16).

When evaluating the background by itself, the results were even more decisive. An overwhelming 81% of respondents favoured the CGI beach setting (Figure 17), citing its dynamic colour range, controlled lighting, and the way it effectively directed attention to the perfume bottle. In contrast, only 19% supported the real-world footage.
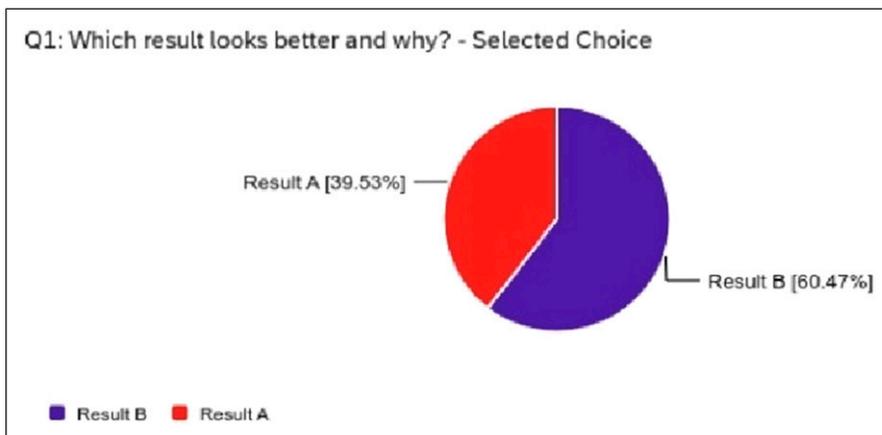

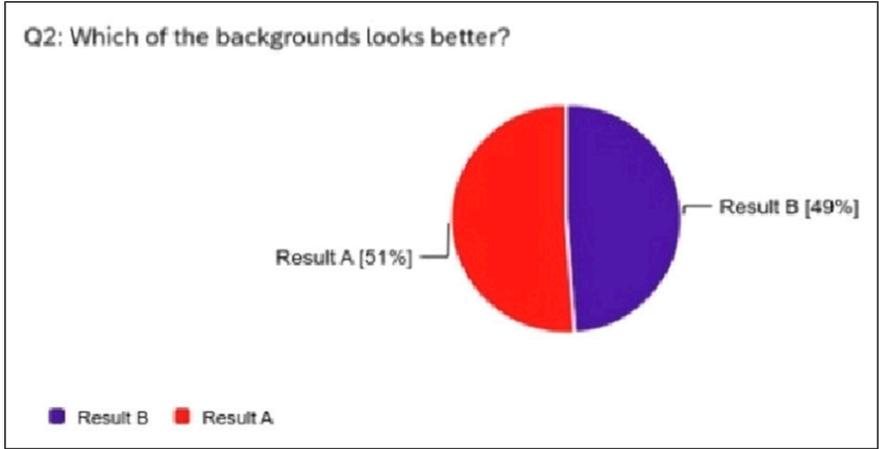**Figure 14.** Test 1 overall preference.

Figure 15. Test 1 background preference.

Several participants specifically noted that the CGI waves moved closer to the product, subtly guiding the viewer's gaze. This movement increased the overall promotional appeal by drawing attention to the perfume bottle and enhancing its connection with the background, and hence its visual presentation.

Test 3 (Perfume bottle with three monitors). In this test, participants were asked to rank four setups (A, B, C, and D) from their most to least favourite. The data showed that Result B (CGI, Single Monitor) was the clear winner. With 25 participants ranking it in first place, the simplicity of the single-monitor CGI approach appeared to be particularly appealing.

Meanwhile, result A (Real, Single Monitor) typically ended up in the middle positions, with participants often assigning it second or third place. Result C (Real, Three Monitors) elicited mixed reactions; while some people liked the additional reflections and layered effect it created, selecting it
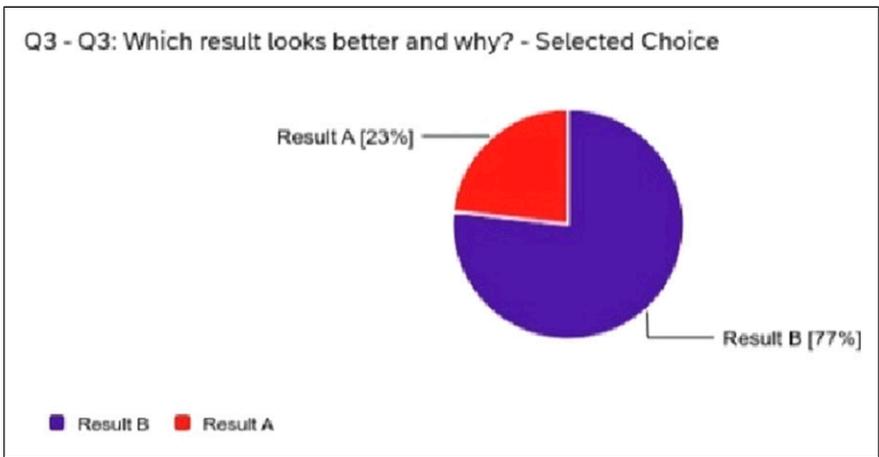

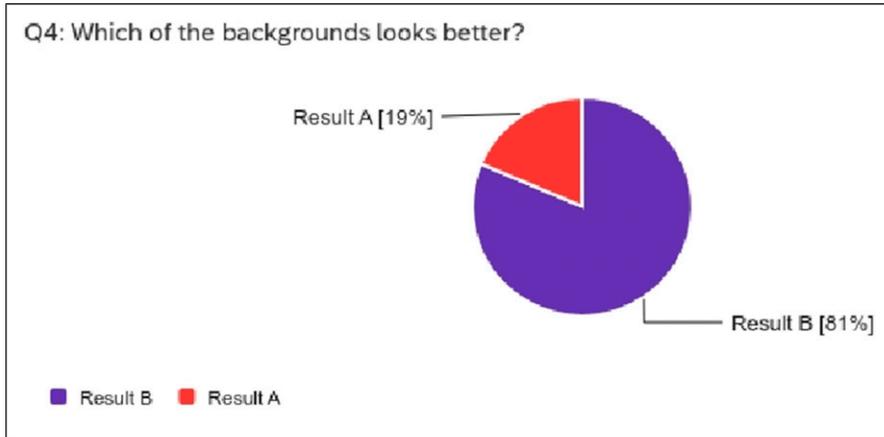**Figure 16.** Test 2 overall preference.

Figure 17. Test 2 background preference.

as their second or third preferred method, others found it too complicated and questioned whether the extra details and visual enhancements offered enough benefit to justify the complexity.

Finally, result D (CGI, Three Monitors) emerged as the most polarizing option. Although 15 participants placed it last, 5 participants ranked it first, citing its potential to merge with the background, with enhanced reflections as its notable strength. These divergent opinions highlight the range of audience perspectives on how best to showcase a product that affords reflections within different display configurations (Figure 18).

Method complexity and Preferences. When asked to rank the four methods from simplest to most complex, participants largely viewed Method A (Real, Single Monitor) as the easiest to implement. Method B (CGI, Single Monitor) followed closely (Figure 19), with respondents describing it as moderately simple and still offering valuable flexibility. Method C (Real, Three Monitors) garnered
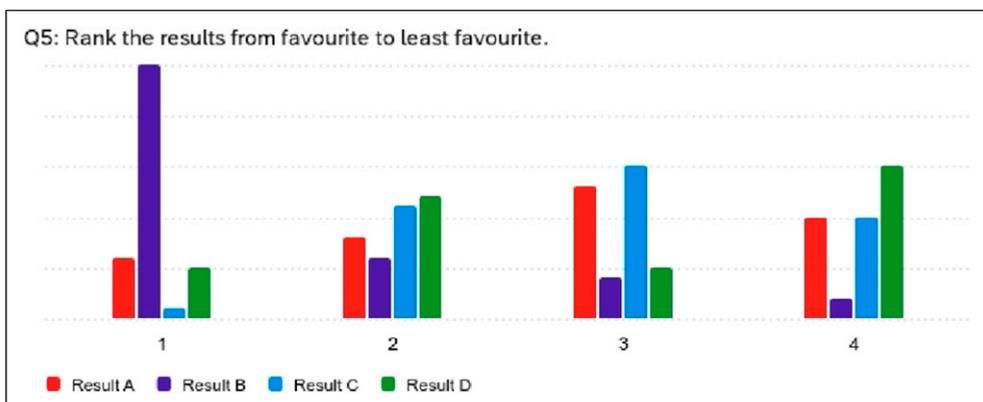

Figure 18. Test 2 and 3 results ranking positions (1 = most preferred, 4 = least). Each group of bars represents one rank position; bar colours indicate the method. A = Real footage, single monitor; B = CGI, single monitor; C = Real footage, three monitors; D = CGI, three monitors.
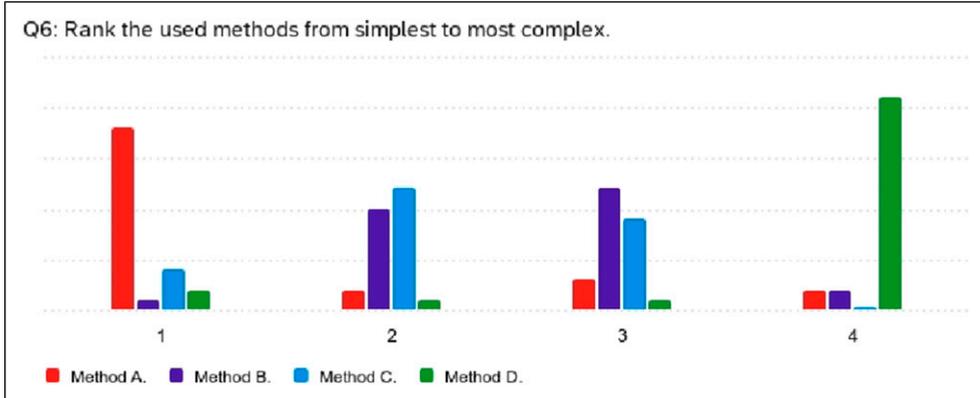
Figure 19. Test 2 and 3 methods complexity rankings.

mixed reactions; although some participants found it only slightly more involved, others perceived it as moderately complex. By contrast, Method D (CGI, Three Monitors) was widely considered the most technically demanding, with participants reflecting on both its expanded creative possibilities and yet also higher setup requirements.

Regarding which method participants would prefer to use, 34% selected Method A due to its minimal setup and cost-efficiency. Method B was chosen by 26% of respondents who cited CGI's adaptability without the overhead of complicated hardware. Meanwhile, 20% favoured Method C for its blend of real-footage authenticity and the added benefit of reflections. The remaining 20% preferred Method D (Figure 20), praising its possibilities for creative control but acknowledging its greater technical complexity and resource investment.

Inferential highlights: For the A–D favourite result ranking (n = 40; k = 4, including 3 respondents who left the default order unchanged), Kendall's W indicated low-to-moderate agreement, consistent with the mixed but interpretable preferences showed in the graph (Figure 18).
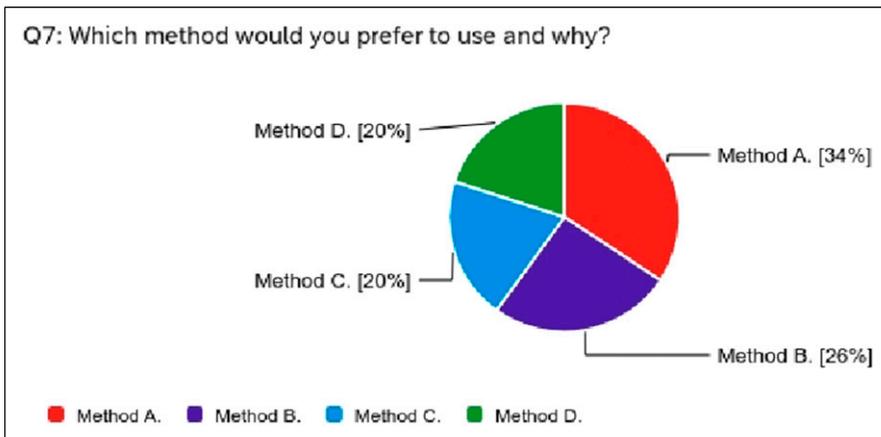

Figure 20. Method most likely to be used.

In the simplicity ranking, Kendall's W indicated moderate agreement, consistent with a clearer consensus on which methods felt simpler (Figure 19).

Additional comments, training needs, & confidence. **Potential Improvements.** Common suggestions involved refining lighting (e.g. adding fill lights, controlling reflections), enhancing colour calibration for real or CGI footage, and considering additional foreground elements or more realistic reflections for product shoots.

Impact of Training. While 78% reported they would keep their chosen method even if training were offered, 22% said better CGI or virtual studio training could prompt them to adopt more advanced workflows (e.g. multi-monitor setups) (Figure 21).

Confidence in Implementation. Over half of respondents (56%) **felt more confident** to incorporate these VP approaches into their work after seeing the tests, whereas 44% remained hesitant due to concerns about costs, time, or technical expertise (Figure 22).

Overall, the findings from the two surveys and the three practical tests offer a refined perspective on key considerations for small studios. Firstly, cost and simplicity remain dominant factors, underscoring the importance of efficient setups that are both budget-friendly and straightforward to manage. Secondly, CGI backdrops generally outperformed real footage in terms of viewer preference, primarily because of the enhanced control over lighting, composition, and colour flexibility that they provide. Finally, while multiple monitors can create an environment where the object becomes better integrated with the background, many participants questioned whether the added complexity was worthwhile. Instead, it transpires that such setups are best utilized when the project's creative objectives, such as detailed reflections or dynamic scenes, would truly benefit from a more elaborate technical arrangement.

Discussion

This study set out to identify the barriers preventing micro and small production companies in the UK from adopting VP and to propose a viable, entry-level low-cost VP workflow. The two surveys and a series of practical tests have collectively contributed to filling this knowledge gap by clarifying
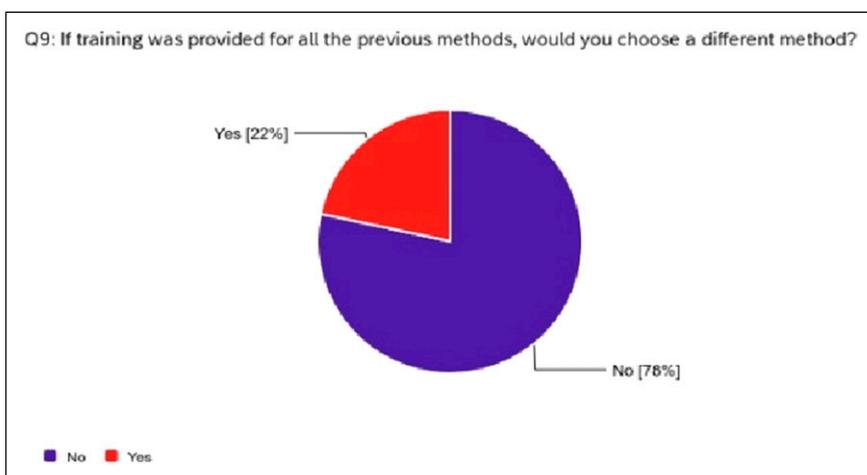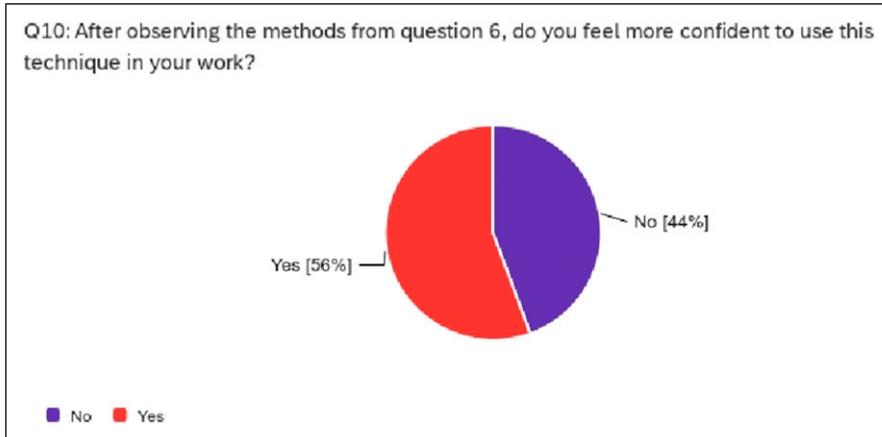

Figure 21. Impact of training.

Figure 22. Confidence in implementation.

what equipment and skills these smaller studios possess or are willing to hire, how they perceive the relevance of VP for their diverse business focus, and which simplified methods might be most suitable for their budgets and skill levels. In the following sections, a discussion of content creation and technical issues is also included.

Conceptual framing of VP in this study

The use of television screens rather than purpose-built LED volumes in this study's experimental setup warrants explicit conceptual clarification regarding what constitutes VP. While much of the existing literature focuses on high-end VP infrastructure such as LED walls and advanced tracking systems, VP is fundamentally defined by its integration of real-time digital environments with live-action footage during production, rather than by specific hardware implementations (Cinzia et al., 2023; Susan and Okun, 2024). It has been recognised that VP encompasses a wide spectrum of technologies and approaches, from multi-million-pound LED volumes to more modest real-time compositing setups (Hitchen et al., 2023). The core principle that distinguishes VP from traditional production is the shift from post-production visual effects to in-camera effects achieved through digital backgrounds displayed during filming (Bodini et al., 2024). In this respect, television screens displaying real-time or pre-rendered digital content function as accessible entry points into VP methodology, maintaining the essential characteristic of on-set visualisation and in-camera integration that defines the approach. This study deliberately positions itself at the lower end of the VP technological spectrum, demonstrating that the conceptual benefits of VP (i.e. enhanced creative control, reduced post-production time, and the ability to visualise final compositions during shooting) can be accessed through simplified implementations. This framing aligns with calls for democratizing VP technology, recognising that small studios must begin somewhere along the VP adoption continuum, even if that starting point differs substantially from Hollywood-scale implementations (Fair, 2023; Jasaui et al., 2024).

Industry tools converging on simplified VP. Parallel to our small-screen, low-complexity approach, vendors are packaging VP for modest crews and spaces. Brainstorm's Edison/Edison PRO targets single-camera, track-less chroma workflows with template-driven virtual sets, on-the-fly keying,

Unreal Engine scene support, and its TrackFree™ feature that synthesizes virtual camera moves from a fixed camera feed, useful when parallax demands are low but editorial variety is needed. These capabilities are explicitly marketed for presentations, corporate video, events, and lightweight studio setups rather than large LED stages (Brainstorm, 2022).

On the hardware side, Vū One and Vū One Mini bundle an all-in-one LED wall system (LED display, media server/computing, camera tracking, control UI, and a pre-loaded environment library) to simplify installation and operation for smaller footprints; the Mini variant centres on a compact $12'\times7'$ screen and is designed to run from a standard wall outlet, signalling an intent to lower infrastructure barriers for corporate, education, and indie use cases (Vū Technologies, 2022).

Collectively, these products illustrate a commercial push toward accessible, workflow-oriented VP that matches the constraints of our respondent cohort 'micro and small UK studios'. In Survey 1, 89% of respondents were micro (1–9 employees) and 11% small (10–49), with 51% reporting no high-performance PC suitable for real-time 3D, only 7% owning a tracking system (and 6% willing to buy one), 49% unwilling to use projectors, and 73% either owning or open to hiring 1–4 large TVs; 68% reported no experience with game engines. Against that profile, track-less virtual-set packages (e.g. Edison) and compact, all-in-one LED solutions (e.g. Vū One Mini) speak directly to limited space, budget, and specialist skills, while preserving the core on-set benefit we target, composing and judging shots against the intended digital scene during capture.

Positioning within virtual production practice. The proposed workflow aligns with core VP practices that bring digital environments into the cinematography process for on-set decision making, namely real-time or near-real-time visualisation of backgrounds during principal photography, in-camera integration of physical and virtual elements, and iterative art direction with immediate feedback for framing, lighting, and composition. It diverges from conventional LED volume pipelines in three main respects: it relies on small screens rather than tiled LED walls, it operates without camera tracking, and it accepts non-real-time or pre-rendered backplates when this is sufficient for the brief. These choices constrain parallax, limit interactive lighting from the background, and reduce dynamic set reactivity, yet they preserve the essential benefit of VP for the targeted use cases, which is to compose and judge shots against the intended digital scene at the time of capture. In this sense, the contribution is to define a clear, lower-cost envelope of VP practice that is proportionate to micro and small studio contexts, specify where it converges with established methodologies, and make explicit where it trades capability for simplicity so that practitioners can select an approach that matches content type, budget, and skills.

Addressing diverse fields of work

One crucial insight from Survey 1 is the wide spectrum of fields in which these companies operate. While 20% focus on film and TV, 21% on commercials, and 13% on live events, an even larger 49% work on a diverse array of projects such as corporate video production, digital marketing, or mixed online content (Figure 23). This variety underscores the versatility of small production companies, which often tailor their offerings to different client needs and smaller-scale budgets. However, it also highlights a knowledge gap. Despite many of these fields (advertising, corporate videos, or short-form branded content) potentially benefiting from VP for cost savings and more creative possibilities, 32% of respondents said they 'do not need' VP in their business. This strongly suggests a misunderstanding or underappreciation of how VP could streamline production for commercials, add value to corporate shoots, or quickly create multiple location looks without travel (Deloitte Global, 2023b).
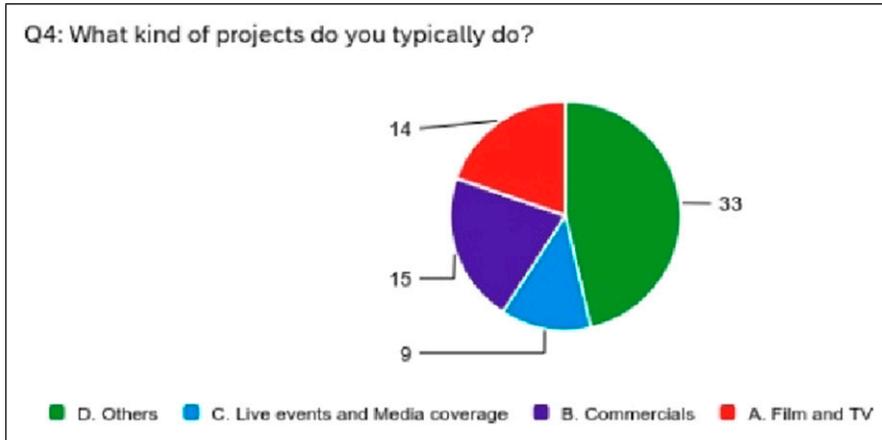
Figure 23. Participant companies' field of work.

The proposed small-screen, no-tracking, non-real-time workflow is most suitable for short-form deliverables with locked-off or minimal camera movement and modest art direction. Typical uses include interviews and testimonials, executive messages, simple corporate explainers, training and recruitment videos, branded and social promos, and tabletop or product shots where strong parallax and interactive lighting are not required. These categories align with what many small studios report producing in practice, including commercials and a broad mix of corporate and online content, and they reflect the simplicity and turnaround priorities seen in respondent preferences for single-screen setups and straightforward methods.

Bridging the awareness-implementation gap

Although more than half of respondents indicated at least some familiarity with VP, the vast majority had not yet employed it in their work. Along with cost and a lack of expertise, many participants dismissed VP as irrelevant to their current projects, an outlook that emerged as a primary barrier in Survey 1. Yet, the subsequent Practical Testing and Survey 2 results demonstrate that simpler VP setups, especially single-monitor displays using real or CGI backgrounds, can offer significant advantages for rapid turnarounds, brand customization, and controlled lighting. This tension between perceived irrelevance and the tangible benefits of VP, particularly for commercial and corporate videos, underscores the need for greater awareness and targeted demonstrations of VP's potential (Hitchen et al., 2023).

In addressing this long-standing gap, this study shows small studios, operating in fields that include TV, commercials, and corporate video, how they may still take advantage of VP on a smaller scale. Notably, nearly a third of companies deemed VP unnecessary, despite being active in production areas that could benefit greatly from its applications. These insights highlight the potential of educational outreach, targeted demos, and training initiatives to emphasize both the cost and time efficiencies, as well as the creative opportunities that VP can provide particularly for those focussing on short-form or branded content who may not yet grasp how VP can elevate their work.

Content creation

Several methods were tested to determine a simple way to create content for display on the screen in the background. The first approach involved using real-life footage, either by capturing a video of the desired environment, such as a library, or by sourcing suitable stock footage, as was done for a beach setting. The primary challenge was to digitally recreate both environments to compare the effectiveness of real footage versus CGI.

Content was created from a mix of custom assets and stock material. Custom elements were modelled in Autodesk Maya, photogrammetry and LiDAR captures were processed in Polycam app, and scenes were assembled and rendered in Unreal Engine 5. Stock material was used where appropriate, for example, beach footage from online vendors for comparison with a matched CGI scene. This kept the build within skills commonly reported by small studios: basic 3D layout, importing assets, assigning materials, establishing simple lighting, and setting a camera for render. The aim was to keep the art and technical load at an entry to intermediate level so that teams with limited 3D expertise could reproduce the workflow using off-the-shelf tools and minimal scripting.

The beach setup was built in UE5 using a simple horizon layout, animated water, a sky dome, and a small set of proxy objects to guide lighting and reflections, then rendered for playback on the display. Replication requires familiarity with basic scene assembly in a game engine, simple colour matching to plate footage, and export to a standard video format for display. These steps were chosen to be achievable by a generalist editor or junior 3D artist rather than a specialist technical artist.

To begin the digital recreation of the library environment, we first explored photogrammetry, a method for measuring physical objects and environments by analysing photographic data from which to extract multiple digital representations of physical objects or environments (Frazer, 2021). This method was expected to offer a straightforward solution to recreate an accurate digital replica of the library environment. However, the final output contained numerous artifacts, making it unsuitable for use in a final production (Figure 24) and was therefore discarded.

Another method used to recreate the library environment involved using a LiDAR scanner on a smartphone to generate a draft 3D model with accurate measurements (Figure 24), this is now possible on low-cost platforms, such as a mobile phone, thanks to the introduction of mobile LiDAR camera sensors (Azzarelli et al., 2025). The model was then refined in 3D software by adding additional details (Figure 25). This approach proved to be highly effective as it was fast, precise, and well suited for beginner-level 3D artists.

For the beach environment, the first attempt to recreate the environment was by using Generative AI, a technology that is rapidly developing and expanding into creative fields (Hales, 2021). To replicate a similar beach environment, DALL·E 2.0 was utilized, which is described as the ever-best AI painting tool (Wang et al., 2023); now surpassed by OpenAI's DALL·E 3.0. The text-to-image AI model generated a highly realistic image that closely resembled the target environment (Figure 26). However, the result contained some unwanted elements. When an attempt was made to remove them using DALL·E's editing tool, it introduced artifacts that compromised the image quality (Figure 26). To achieve the desired result, the image had to be refined using Photoshop's generative fill tool before being processed with an image-to-video AI model (Figure 26). This method successfully achieved the desired result, however, any modifications to the resulting video would require repeating multiple steps, with inconsistent outcomes. To produce prompt templates, one would start by inputting a prompt, identify high-quality outcomes, and rewriting the prompt to try to produce that same outcome again. This process could involve several iterations until a reliable prompt is produced (Chang et al., 2023) a challenge which could be mitigated by employing a prompt artist
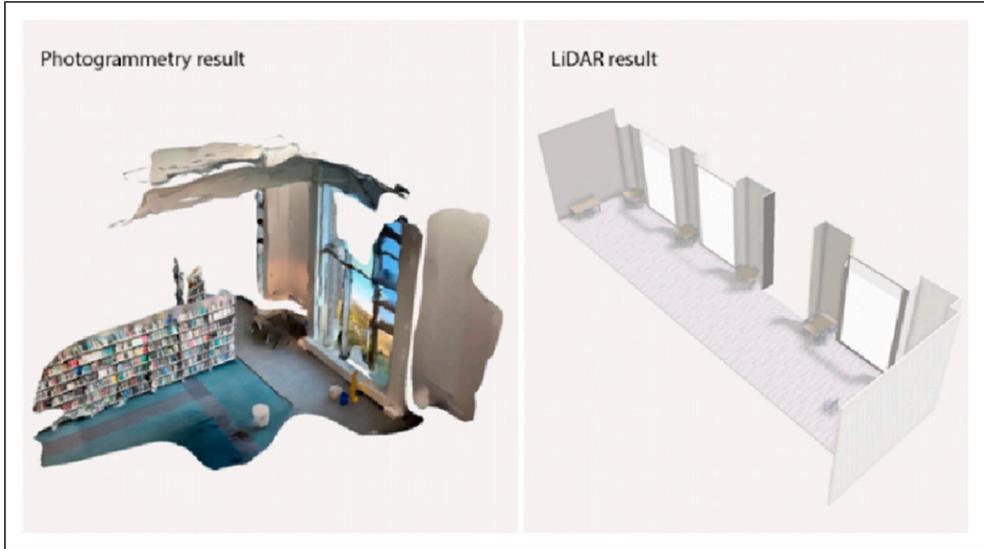
Figure 24. Photogrammetry versus LiDAR.

who could develop a distinct visual concept and style and descriptive text-based prompts that are rendered by text-to-image models (Chang et al., 2023).

Eventually, the most reliable way to create the desired environment was to obtain 3D assets and recreate the environment in 3D software. This method enabled rapid environment creation thanks to the pre-made assets, while also offering full control over lighting and the virtual camera, facilitating quick changes and more efficient decision making.

Figure 25. Final 3D result.

Figure 26. Generative AI environment attempt.

Technical challenges

LED Moiré. A distinct moiré pattern became visible due to the interaction between the camera sensor and the sub-pixel layout of the LED screen. To reduce this effect, the camera angle was slig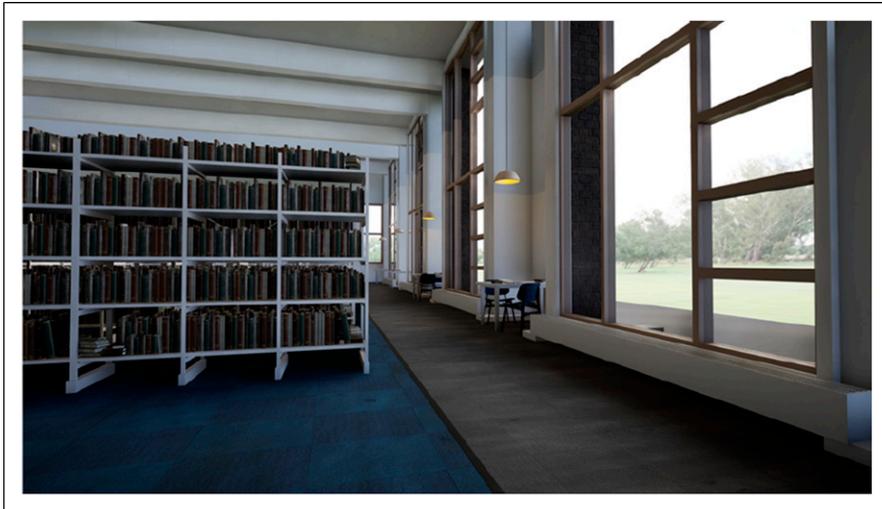htly adjusted, another common way to overcome this problem is to introduce a shallower depth of field (Qu et al., 2023), thereby blurring the fine patterns on the LED panels and minimizing the interference in recorded footage.

Screen Flickering. This is generally defined as a sudden luminosity change in a video sequence causing the impression of the instability of visual perception (Nowisz et al., 2021). Flickering occurred because the camera's shutter speed and frame rate did not align with the LED screen's refresh rate. This issue was resolved by matching the camera's shutter speed and frame rate to the panel's frequency, ensuring the refresh rate did not clash with the capture rate, and thus producing smoother, flicker-free images.

Difference in Perspective. The discrepancy between the physical camera's perspective and that of the virtual environment posed a significant challenge. In CGI-based setups, the virtual camera was recalibrated to match the real camera's focal length and viewpoint, achieving alignment between on-screen content and physical space. However, when stock footage was used, footage had to be selected with a perspective close to the intended composition, which may limit the creative choices, and the physical camera position was accordingly adjusted to maintain visual coherence.

Lighting Inconsistencies. Ensuring that the lighting on the foreground subjects matched the lighting conditions displayed on the screens proved complex. Owing to the difficulty in balancing the physical lights and the luminous content of the screens, it was determined that future productions would benefit from the expertise of a director of photography, typically the person who is responsible for all visual matters (Utami and Arifianto, 2019), and who can fine-tune these elements for improved consistency and realism.

White Balance Mismatch. An object may appear different in colour when it is illuminated with different light sources (Liu et al., 1995). A noticeable difference in white balance emerged between the camera settings and the colour temperatures depicted on-screen because of the difference in virtual and physical lighting. The solution involved adjusting the white balance both in-camera and within the media itself. For stock footage, colour correction was performed in After Effects to align hues and colour temperatures. In the CGI environments, white balance values were modified in the virtual camera settings, creating a more consistent blend between virtual and physical elements.

Validating simpler methods

The practical tests were documented with setup diagrams and short example clips, then embedded in Survey 2 so participants could review each method and provide preferences and rankings. The

survey presented concise descriptions of the workflows, still frames, and short videos for Methods A–D, and asked respondents to judge visual appeal, setup complexity, and likely adoption, with open fields for suggestions. This gave companies a clear view of the production steps and outputs before they evaluated feasibility.

The Practical Testing confirmed that small studios, even those not involved in large-scale film and television production, could successfully adopt a low-complexity approach to VP. Research suggests that VP is becoming more accessible, allowing smaller teams to create high-quality content without requiring extensive technical expertise or expensive equipment (Jasaui et al., 2024).

Using TV monitors instead of more advanced VP setups aligns with the financial and skill-based constraints often reported by independent creators. Studies indicate that single-monitor configurations provide an affordable entry point into VP, enabling studios to integrate digital workflows while maintaining budget control (Hitchen et al., 2023).

The positive reception of Methods A (Real Footage, Single Monitor) and B (CGI Footage, Single Monitor) in Survey 2 highlights that micro-companies may adopt these methods to achieve strong visual results without the need for multi-monitor setups or complex real-time engines. This is particularly relevant for corporate, advertising, and social media-focused productions, where maintaining visual consistency and creating engaging digital environments can significantly enhance storytelling and streamline content creation (Deloitte Global, 2023a).

Skill readiness & resource allocation

Survey 1 revealed limited skill levels in 3D design and gaming engines, with 32% of participants explicitly stating they do not see a need for VP. This finding reflects broader industry trends (BFI, 2023), where VP tools remain underutilized in small-scale studios due to a combination of technical complexity, lack of training, and high initial setup costs (Deloitte Global, 2023a).

However, the practical tests showed that basic 3D or stock footage can be adapted to fit small-scale marketing productions, as the ongoing democratization of VPX technology is progressively putting advanced filmmaking capabilities within reach of even the smallest indie teams (Jasaui et al., 2024).

This suggests that once producers recognize VP's potential, such as quick setup of multiple background scenarios for brand consistency, they may revise their stance on its usefulness, given that utilizing game engine-based virtual environments, marketing teams can create highly dynamic and customizable visual assets without the need for expensive physical sets (Deloitte Global, 2023a).

As identified in Survey 2, where a majority of participants preferred the simpler, single-monitor methods (A & B), a low-entry point will allow producers to start small, familiarize themselves with cost-effective technology, and eventually, consider more sophisticated VP solutions as they progress along the learning curve and if client needs and budgets grow.

Study limitations

This study uses a mixed methods approach to explore the perspectives of small and micro production studios on adopting virtual production, however, there are some notable limitations. The practical tests were intentionally constrained to the most accessible workflow (TV monitors, no camera tracking or high-end computers, and no advanced skills) to mirror participant resources. Accordingly, preferences captured in Survey 2 may not transfer to contexts that deploy more advanced VP infrastructures such as real-time gaming engines, LED volumes, or live camera tracking.

Participants assessed the test footage remotely in uncontrolled environments on their own devices. Variability in screen size, colour calibration, refresh rate, brightness and ambient lighting, and used device (phones or computer screens) could have influenced perceived image sharpness, colour, reflections and overall quality.

The study represents a temporal snapshot. VP technology, costs, and training provision are evolving rapidly, some barriers identified here may diminish, and new challenges could arise. Ongoing studies and case examinations are therefore recommended to validate and extend these findings.

Because both questionnaires were anonymous, individual responses could not be linked across stages, so any change over time can only be described at the overall level. In the rank-order items, a small subset of respondents submitted the default order without changes; these were retained as valid rankings to avoid bias toward 'active changers', but this may slightly attenuate the measured consensus (e.g. Kendall's W) and should be interpreted accordingly.

Future iterations should consider an optional unique code so that longitudinal within-participant analyses are possible without compromising privacy.

Finally, perceptual bias is possible: some respondents may rate CGI outputs as better because they appear more polished or stylised, even when realism is equivalent or lower. Standardised viewing guidance, basic device metadata, and side-by-side reference stills would help reduce these effects in follow-up studies.

Conclusion & future work

The results from this study illustrate that micro and small UK production companies, encompassing diverse fields like film/TV, commercials, and corporate media, could adopt basic VP techniques without the additional expense of projectors, advanced real-time engines, or complex tracking systems.

Crucially, a large segment of participants initially claimed VP was irrelevant to their work, even though many of the fields they operate in, such as advertising or corporate branding, stand to benefit substantially from the visual control and creative possibilities offered by VP. This disconnection reflects broader industry trend, where many film professionals do not fully know or understand the possibilities of VP. Furthermore, the terminology to express VP processes is not fully developed yet (Hitchen et al., 2023), which broadens the technical gap between larger and smaller studios even more, where the former have hands-on expertise in house, while the latter may struggle to comprehend basic technical concepts and processes and hence resist exploring even simple VP setups. This disconnection between perceived irrelevance and actual potential, underscores the need for more focused communication and demonstrations of VP's advantages, particularly to small production companies and younger generations. Future advocacy or training initiatives could highlight concrete examples, for instance, how a single-monitor CGI setup can simulate multiple brand environments, speeding up commercial shoots or raising production values in corporate videos. Sharing success stories from micro studios that have effectively integrated VP into their processes could also boost confidence among sceptics.

Furthermore, incremental adoption appears to be the most promising path for these companies. Research suggests that access to VP technologies remains a significant barrier, with affordability and funding as a major limiting factor (Hitchen et al., 2023). By starting with a simple single-monitor workflow using either real or CGI backgrounds, production teams can familiarise themselves with basic compositing, screen calibration, and lighting for in-camera effects. Over time, as budgets and skillsets increase, they may transition to more advanced methods, such as multi-monitor reflections or real-time rendering engines, if their projects demand greater complexity.

Given that nearly half of participants in this study target a diverse types of video projects, from social media content to corporate videos, future VP skills development for small-scale adopters should emphasize customizability and ease of use. Setups must balance accessibility and performance, offering an entry point into more sophisticated VP techniques for users across a spectrum of resources and technical proficiency levels (Jasaui et al., 2024). Software solutions that integrate basic 3D backdrops, adjustable lighting, and minimal hardware requirements could also encourage smaller studios to view VP less as a costly Hollywood tool and more as a flexible production technique suited to commercials, social media content, and small-budget projects (Jasaui et al., 2024).

While this study presents accessible approaches to VP for micro and small production studios, multiple avenues remain for further exploration. First, future research could build upon the simplified workflows described here and integrate more advanced techniques, such as camera tracking, rear projection or real-time chroma keying, to determine which gradual steps offer the greatest return on investment for smaller teams. Comparative case studies that evaluate different entry-level VP toolkits could be conducted to distinguish between methods that are simply feasible and those that can profoundly enhance production speed, creativity, or client satisfaction.

Virtual detached cameras could be explored as a low-cost way to add editorial variety without full camera tracking. Two routes would be practical for small teams: (1) synthesize gentle pans, tilts, and push-ins from a locked-off plate by rendering pre-animated virtual camera moves over pre-rendered or stock backplates, and (2) create shallow parallax by projecting the background onto simple 3D proxy geometry or by using depth maps to enable limited 2.5D moves. These approaches keep acquisition simple while offering more dynamic framing, but they require careful limits on move amplitude, attention to perspective alignment with foreground subjects, and basic depth or proxy setup to avoid mismatches. In future tests these variants could be compared based on cost, setup time, and perceived realism for typical small-studio briefs such as interviews, corporate explainers, branded promos, and tabletop product shots.

Second, given that many participants perceived VP as irrelevant to their fields, investigations into how to present and market these workflows to varied client bases, particularly those in corporate video, events, and digital marketing, could be fruitful. Mixed-method approaches involving client feedback, consumer engagement metrics, and brand identity studies would shed further light on whether the immersive capabilities of low-cost VP can tangibly elevate project value and audience impact.

Third, future work might dig deeper into training models and skill development strategies. Quantitative assessments of how short courses, online tutorials, or mentorship programs affect adoption rates and creative confidence would be invaluable. As smaller production teams often comprise generalists, structured courses that integrate introductory 3D design, game engine basics, and lighting for in-camera effects could be tailored for micro-studio environments and evaluated for effectiveness.

Lastly, while this research concentrated on the UK market, larger international surveys could reveal whether the identified obstacles, lack of awareness, limited budgets, and minimal specialised skills, apply more broadly. Investigating how different funding models, regional incentives, or local training initiatives influence adoption would offer valuable lessons for all stakeholders seeking to democratize VP. By extending the scope of these methods across varied cultural and economic contexts, researchers can contribute to a more inclusive global framework for small-scale virtual production.

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