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The pecking order: a Bourdieusian look at authority in virtual peer crits

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Abstract

Cultural capital having sway in establishing authority in educational fields, including architecture, has been prevalent in scholarly work discussing the traditional studio setup. With the growing use of multi-user virtual environments (MUEs) in architectural education, some studios, their occupants, and artifacts moved to the new medium. Such change places those studios in a precarious position vis-a-vis traditional architectural pedagogy, problematizing cultural capital and authority. This research examines the relationship between cultural capital and authority, focusing on MUE-mediated studio peer crits. It adopts a quasi-experimental approach, where twenty-four participants with varying design proficiencies in diverse peer compositions completed a timed design task. The research employs linkography for analysis and Pierre Bourdieu's theoretical framework for interpretation. The findings suggest that MUEs have a transformative effect on exogenous cultural capital, potentially disrupting previously established norms and hierarchies in architectural pedagogy and creating new hierarchical models, which add nuances to the existing models in the literature. A MUE-mediated studio has the potential to present the studio as a new exploratory ground not weighed down by pre-established notions of studio culture "habitus."

Keywords Architectural pedagogy · Peer crits · Virtual environments · Authority · Social dynamics · Mediation

Introduction

Architectural education has long relied on the design studio as a practicum to mold future architects. Students continually reflect on their actions, both alone and with others, in pedagogical events called critiques or "crits" (Schön, 1988). Crits occur in a social environment, with social dynamics significantly forming architectural identity and informing design decisions (Shaffer, 2003). A key part of these social dynamics is the manifestation of

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authority among peers during peer crits, as it informs each individual's roles in interactions within the studio (Fredrick, 2004; Sawyer, 2019). One can trace the catalyst for authority in educational fields to Pierre Bourdieu's notion of cultural capital, which is a set of exogenous and endogenous qualities that distinguish individuals within a field (Bourdieu, 1977; Stevens, 2002). With the rise of the metaverse's popularity, peer crits migrated from their formal in-person studio to a virtual online setting, where users are co-present in a multi-user virtual environment (MUVE). Different media present different affordances that shape users' actions and interactions (Chastain et al., 2002). Accordingly, MUVes as a medium can potentially have transformative effects on authority and its relationship to cultural capital, subsequently impacting social dynamics between peers and design decisions. The largely un-explored setting and social affordances of MUVes position them in an increasingly precarious status within traditional formal architectural pedagogy.

This paper explores the relationship between authority and cultural capital in MUVE-mediated peer crits, using Pierre Bourdieu's theoretical notions of cultural capital and habitus for interpretation. It offers qualitative insights through a quasi-experimental setting where participants of varying cultural capital complete a design task within a MUVE with varying peer composition scenarios. Thus, this paper poses a question: How does authority manifest itself in MUVes and relate to cultural capital? Moreover, the paper explores the transformative effect of MUVes as a medium, comparing its findings to existing theory on traditional architectural pedagogy, hoping to provide institutions with an understanding of MUVes' social role in their established culture.

Traditional architectural pedagogy

The traditional design studio setup is where students use tangible artifact representations and experience physical, temporal, and cultural immersion that represents the real world of practice (Dutton, 1987; Kuhn, 2001; Salama, 2005; Schön, 1988). Like other forms of design education, the studio has a particular social culture or ethos that tutors often attempt to socialize students into, dubbed as the hidden curriculum or the studio's "habitus" (Dutton, 1991; Stevens, 1995). The studio socializes the students through key pedagogical events such as crits (Webster, 2004). The crit is "learning together" through reflection. It is a dialogue comprising advice, suggestions, and questions regarding a design artifact (Gunday Gul & Afacan, 2018; Schön, 1988). Donald Schön suggests that students continually reflect on their actions, alone and with others, as it is critical in developing students as professional designers (Schön, 1988). The general discourse on crits has primarily focused on desk crits and the relationship between tutor and student.

Multiple research endeavors studied power asymmetries between tutor and student, considering them a catalyst of socialization towards a specified culture (Webster, 2004, 2007). On the other hand, authority in peer crits did not receive as much attention, assuming that dynamics among peers are not hierarchical but horizontal, with less emphasis on authority. Nevertheless, a body of theoretical work would argue that asymmetries exist among peers, informed by cultural capital (Stevens, 2002).

A Bourdieusian look at authority

When discussing asymmetries and authority, Pierre Bourdieu's theoretical framework becomes relevant. His interpretation of asymmetries in groups using "cultural capital" is

especially integral to this paper. Cultural capital exists within individuals in the form of accumulated tastes, social connections, and academic credentials, which impacts social hierarchy within a field (Bourdieu, 1984). Distinguishing qualities that act as cultural capital can be exogenous (acquired externally outside the educational setting) and endogenous (acquired actively within the educational setting) (Bochenski, 1964; Bourdieu, 1977). They establish arbitrary social hierarchies in a field where individuals have specific expectations on who should possess authority within a field or what Bourdieu calls "habitus" (Bourdieu, 1984).

When authority manifests itself, it can take two forms: epistemic and deontic authority. Epistemic authority is that of an expert who exhibits knowledge of a specific area, and deontic authority is that of a commander or superior who can issue orders and sanctions. However, these forms are not separate (Bochenski, 1964; Brożek, 2013). In the case of architecture education, the tutor is an expert in architectural practice and a superior who issues commands and, accordingly, possesses both epistemic and deontic authority. The university assigns tutors an institutionally-backed hierarchical academic position, granting them authority within the studio. This asymmetric relationship between tutors and students veers many educators towards peer crits under the impression that peer interaction is horizontal with no apparent authority.

Meanwhile, students' authority is not deontic as no hierarchical academic positions exist among them as peers. Students have different exogenous and endogenous qualities that grant them different degrees of cultural capital and, hence, different hierarchical positions. It is important to note that studies suggest the relationship between cultural capital and authority is directionally proportionate. The more capital individuals have, the more authority they possess (Stevens, 2002). The true effectiveness of authority established by cultural capital is its arbitrariness. When such arbitrariness is scrutinized, the authority established can dissipate (Brożek, 2013; Stevens, 2002).

The unique pedagogical methods of architectural education, including the studio system, crits, and high dependency on presentations, put students' cultural capital on display much more than any other field of education (Stevens, 1995). Cultural capital indicates students "feel" of the field of architectural education and subsequently creates an arbitrary hierarchy that all students willingly accept as normal (Stevens, 1995). One of the signifiers of cultural capital among architecture students is academic achievement or, in architectural terms, design proficiency (DP), which represents an individual's academic achievements through course grades and instructors' praise. While initially attained endogenously, DP carries over from one studio to the other as exogenous cultural capital that marks some students as gifted individuals with a "feel for the game" and bestows a sense of authority upon them among their peers (Sawyer, 2019; Stevens, 1995). In the authors' effort to understand the relationship between cultural capital and authority in peer crits, they use the exogenous quality of design proficiency as an indicator for cultural capital among participants.

Understanding peer hierarchy

Individuals are affected by their peers in educational fields, on achievement and social levels (Ali & Chin, 2023; Calvó-Armengol et al., 2009). Peers seek those of similar qualities to them, forming social groups or "cliques" (Frisby & Martin, 2010; Martin-Thomson et al., 2021) based on common endogenous or exogenous qualities and exclude other cliques (Angrist, 2014; Sacerdote, 2011). As a result, the social composition of peers

can also impact how social dynamics between peers unfold, subsequently impacting performance (Sacerdote, 2011).

Studies concerning student–student interactions in the traditional design studio suggest there are direct and indirect peer influences in studios. The direct influence is predominantly discursive through verbal peer interaction on design and pedagogy-related issues (Sawyer, 2019). It is commonly occurring among peer cliques. The broad equivalency of students in a cohort in terms of academic level is a fundamental enabler of peer dialogue and feedback (Martin-Thomsen et al., 2021). Otherwise, indirect interaction is usually through peer artifacts, which other peers observe to gauge the merit of their own work, and is often a "survival method" for students in the studio (Martin-Thomsen et al., 2021; Webster, 2006). The literature also identifies two potential models of hierarchies (Table 1) among peer compositions in the studio: (1) transfer of knowledge and (2) collaborative models (Haller et al., 2000; McClean & Hourigan, 2013). In the transfer-of-knowledge model, one or several students assume the role of a tutor, while the others willingly take the role of the "constant" student (Haller et al., 2000), a sign of their acceptance of the assumed tutor's authority (Langer-Osuna, 2016). On the other hand, the collaborative model has no clear hierarchies among peers who share equal roles in the studio (Haller et al., 2000). However, the discourse around these hierarchical models focuses on the traditional studio setup. It is unclear whether such models are applicable in new educational media such as MUEs.

Media and affordances

Since its conception, the educational design studio has predominantly been in the actual space, where a certain habitus has established the social norms of the architectural field. With the rise of metaverse popularity, MUEs usage as a tool to mediate the design studio also rose to prominence. In MUEs, students from geographically separated educational institutions work together using a mediated virtual environment as if they inhabit one design studio. In theory, MUEs have maintained the content of architectural pedagogy. It is still a studio setup where students tackle a hypothetical problem by creating design artifacts and undergoing different iterations subject to crits. Nevertheless, media are not merely transparent tools for transmitting content. They can transform it (McLuhan, 1967).

Different media present different affordances that shape human action's scale and form (Chastain et al., 2002). Through these affordances, individuals interact and re-learn previously known practices. This process of coding and decoding subjects the original content to metamorphosis, where the content is the same in spirit, but the practice surrounding it and how individuals interact with it is different (Hayles, 2008; McLuhan, 1967). Introducing a new medium in a field usually comes with resistance, which may be due to de-skilling, as individuals do not easily adapt or re-learn new practices (Berry, 2016). A notable

Table 1 Hierarchical models suggested by the literature on traditional studios

Hierarchy models	Description	Authority
Transfer of knowledge	A student–teacher relationship among peers, where a student assumes the role of a teacher who issues tasks to others	Exclusive to an individual
Collaborative	Balanced interaction among peers	No display of authority

example in architectural pedagogy is the early incorporation of computer-aided drafting (CAD), which encountered tutors and some students' resistance due to the de-skilling of previously established expertise (Berry, 2016). The metamorphosis of practice that media enacts takes time to occur fully (McLuhan, 1967). Now, CAD programs are a staple in architecture pedagogy.

MUVEs also present social affordances. One such affordance is presence and copresence. Presence is "being there," and copresence is "being there together" with other individuals in a joint space (Schroeder, 2006). Copresence occurs when individuals actively perceive others and feel that others are actively perceiving them and their actions in space (Goffman, 1963). The subsequent research highlights the importance of student-driven MUVEs, the role of co-present peers in creating an enhanced MUVE environment in terms of interaction and discussion of ideas, and the potential formative role peer crits can have on co-present students (Sopher & Lescop, 2023). If MUVEs are to be incorporated into architectural pedagogy, an understanding of their transformative effects on the design studio must be understood.

MUVEs in architectural pedagogy

Despite the vast implementation of MUVEs in design education, research investigating the social aspects of MUVEs in learning is scarce (Beck et al., 2020). Some existing studies focus on the validity of MUVEs as a continuation of the studio pedagogy by investigating user satisfaction and perception towards the medium (Grover & Wright, 2023; Schneider et al., 2022) and its relationship with student performance (Nubani & Lee, 2022). Other studies concentrate on cognitive aspects, such as creativity within MUVEs (Hong & Lee, 2019; Obeid & Demirkan, 2023) and spatial comprehension (Yassin et al., 2021; Zhao et al., 2020). With most of these studies leaving out the social dynamics of the studio outside their framework, studies on the social dynamics in MUVE-based design activities are even more scarce. Some studies investigate the correlation between MUVEs and collaboration (Boudhraa et al., 2021; Hong et al., 2019; Özacar et al., 2023). Others examine the impact of MUVEs on student-tutor communication patterns during crits, citing immersivity and presence as affordances of MUVEs that impact users' behavior (Sopher & Lescop, 2023; Sopher et al., 2022). However, there is a dearth of studies investigating how authority and hierarchy among peers exist in MUVEs.

Methodology

This paper presents qualitative insights on authority and cultural capital dynamics in MUVEs through a quasi-experimental approach (Fig. 1). It asks architecture students of varying cultural capital familiar with designing in MUVEs to complete a design task in varying peer composition. The authors reduce cultural capital to a singular exogenous quality commonly found in the design studio as an empirical measure: design proficiency (DP). The authors use linkography to gauge the manifestation of authority, representing the design conversation as a matrix to understand conversation structures. The authors also use observation, conversation data, and post-experiment retrospective interviews to gain further insight into how authority manifests in MUVEs.

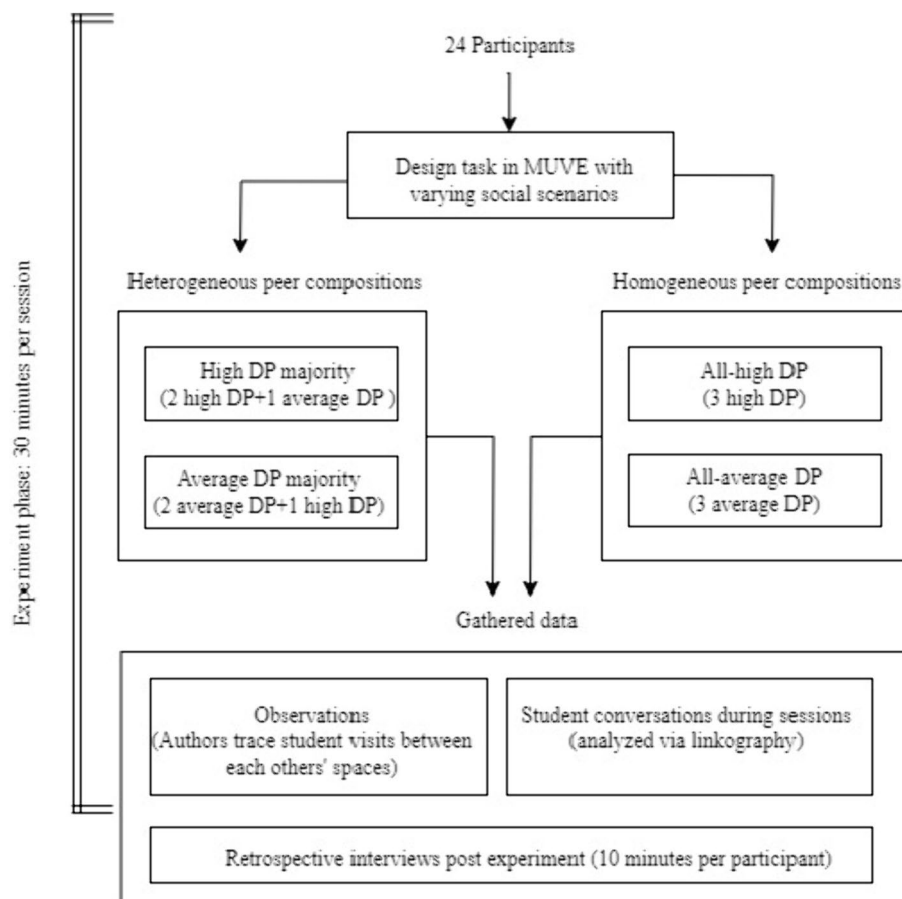


Fig. 1 Experiment design

Participants

The authors recruited a sample from a design studio familiar with metaverse applications. A total of 24 participants (14 females and 10 males) formed the research test sample, with an average age of 21.5. They were all year-four architecture students with previous experiences in design studios utilizing online virtual environments for design and crit sessions. Thus, they possessed a good knowledge of navigating virtual environments. Following participant selection, the authors assigned participants to multiple experiment sessions with varying peer compositions. All participants were familiar with each other, ensuring that unfamiliarity would not hinder interaction (Boudhraa et al., 2021; Hong et al., 2019).

In this paper, measuring DP from the participants' perspective was crucial to gauge authority. As a result, the authors used a survey with participant names and asked them to highlight those they saw as having high DP. Based on the survey results, the authors grouped participants into high DP and average DP groups. The average grade for the high DP group in design studios is A-, and for the average DP is B. This setup ensured that participants were aware of the cultural capital of co-present peers.

Experiment setup

While many studies opt for dyads for research involving groups, this paper opts for a triad formation for groups as it is the most stable small-group formation that encourages social dynamics and hierarchies to emerge (Moreland, 2010). Accordingly, three participants per session remotely shared a common online MUVE in Spatial.io (an online metaverse MUVE platform), where they completed a timed design.

The experiment setting consists of three identical rectilinear open spaces defined by three walls each. Each open space was 20 m in depth, 10 m in width, and 5 m in height (Fig. 2). The authors designed the spaces to mirror a traditional studio setup where students are all assigned a compartmentalized space for design. Many architecture schools use this setting when they introduce MUEs as a studio to maintain that the content of the traditional studio remains the same in the new medium (Grover & Wright, 2023). The space design ensured that participants could not easily glance at their peers' spaces from their own. Accordingly, peer intent was more observable by the authors as participants would have to move to their peers' spaces to start an interaction. The authors tasked participants to each select a space and furnish it individually as a gallery space using pre-existing assets in the Spatial platform (which included furniture) and assets provided by the authors prior to the experiment (including a red podium and panel asset). The authors opted for pre-existing assets to balance modeling skillsets among participants. Pre-existing assets are also easier to track if other participants copy them due to a participant establishing authority in a session. Each session lasted for 30 min.

The authors utilize MUEs running on Spatial.io to host the experiment sessions. The platform allows participants to navigate MUEs using avatars and communicate using avatar gestures, text, and voice. While the design task was individual, participants were free to talk, interact, and give feedback to one another. It is important to note that the authors enabled voice falloff (3D voice chat) during the experiment. Accordingly, if participants

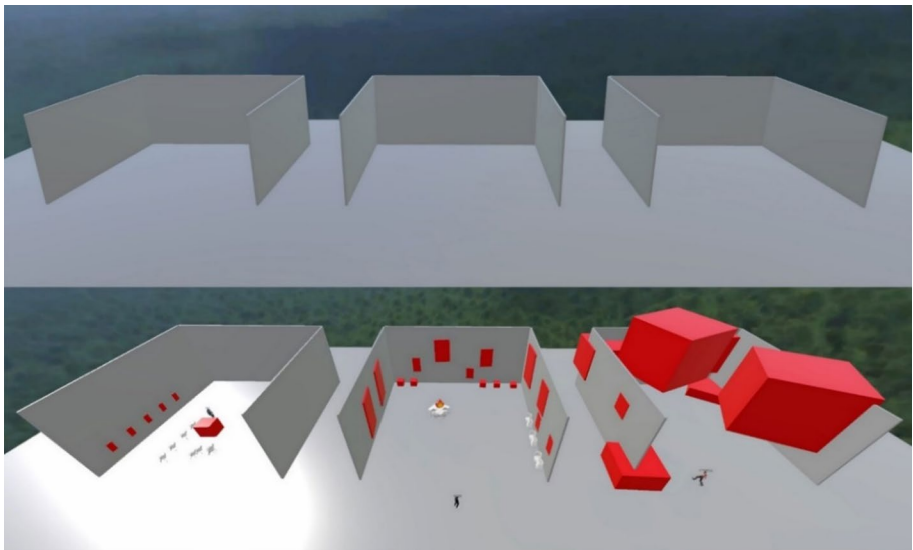


Fig. 2 MUVE design (above), three students each complete a design task within a space (below)

wished to communicate, they must be close, mimicking actual interactions in the traditional studio. After giving experiment instructions, the authors left the MUVE to eliminate the sense of surveillance and provide participants with a more comfortable setup for interaction to flourish. The participants continued the experiment session independently, recording it via their laptops. To capture movement data between participants' spaces, the authors used external software (Adobe After Effects) to trace the movement of participants to an analyzable movement diagram. The authors also used linkographs to reveal authority and hierarchy structures among peers. After the experiment session, the authors conducted retrospective interviews to unveil participant intentions.

Social scenarios

To understand the relationships between authority and cultural capital, the authors created different social scenarios where participants with varying DP (acting as the singular exogenous cultural capital) in varying peer compositions completed a timed design task (Table 2). The multiple scenarios allow for a thorough examination of how cultural capital in the form of DP informs hierarchies among homogenous and heterogeneous peer compositions. They offer a deeper understanding of authority and its subsequent impact on design decisions during peer crits in MUVEs. A total of 24 participants (12 high DPs and 12 average DPs) participated in the scenarios, with four session runs per scenario taking place (three participants per session run).

The scenarios were as follows: (1) high DP majority, (2) average DP majority, (3) all high DP, and (4) all average DP. The high DP majority scenario comprised two high DP participants and a singular average DP participant; this composition would provide insight into the hierarchy in a high cultural capital group composition. The average DP scenario comprised two average DP participants and a singular high DP participant; this composition would provide insight into the hierarchy in a low cultural capital group composition. The all-high DP scenario comprised three high DP participants; this composition would provide insight into the hierarchy in a group composition where all participants possess cultural capital. The all-average DP scenario comprised three average DP participants; this composition would provide insight into the hierarchy in a group composition where all participants did not possess cultural capital.

Linkography

This paper employs protocol analysis methods to study participant interaction during peer crits in MUVEs, using linkography to analyze verbalizations and unveil emerging social

Table 2 Social scenarios utilized in the experiment

Peer composition	Scenarios	Participant(s) description
Heterogeneous	High DP majority	Includes two high DP and one average DP student completing a design task
Heterogeneous	Average DP majority	Includes one high DP and two average DP students completing a design task
Homogeneous	All-high	Includes three high DP students completing a design task
Homogeneous	All-average	Includes three average DP students completing a design task

structures and dynamics during crits (Goldschmidt, 2014). The authors video-recorded scenario sessions, transcribed them, and parsed them into sequential verbalization units. A unit comprised each participant's verbalization until the other party took a turn speaking, creating a conversation turn. The types of links between conversation sequences are either backlinks or forelinks. Backlinks pertain to links among a sequence and preceding sequences, while forelinks emerge when a sequence has a subsequent effect on proceeding sequences. Although many conversation sequences have both backlinks and forelinks, sequences with more than three links (backlinks, forelinks, or both) are critical verbalizations (CV) in the protocol. The authors use a linkograph to highlight links between sequences and a simple matrix chart for easy analysis (Fig. 3). For this study, the paper focuses on interplay linkographs for conversational sequences initiated by one party and intended for the other. It omits internal verbalization links by the same party. Interplay linkographs allow for a closer look at participants' interactions as they occur in the crits (Goldschmidt et al., 2010).

Results

The following section highlights the findings of the experiment and their social scenarios. The paper categorizes findings into two typologies: (1) direct and (2) indirect interactions, investigating participants' verbalizations, behavioral observations, and responses from the retrospective interview. Direct interaction is conversations among participants. The authors gauge authority in direct interaction by transcribing peer conversations and analyzing them through linkographs. Indirect interaction is the unannounced participant visits to peer spaces. The authors gauge indirect interaction by observing participants' behavior and tracing participant movement patterns during experiment sessions.

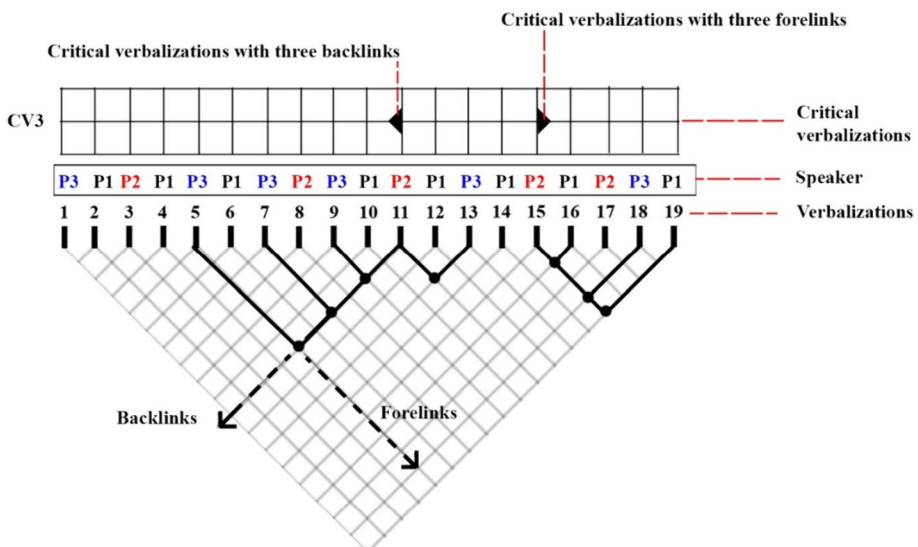


Fig. 3 Example linkograph, highlighting its elements: CVs, links, verbalization numbers, and speakers

Direct interaction

Participants' data (Table 3) in DP scenarios indicate that verbalizations were highest in the "all average DP" scenario (average of 36 per session). In contrast, the "all high DP" scenario had low verbalization (average of 20 per session). Verbalizations were lowest in the "high DP majority" scenario (average of 15 per session), with the average DP participant having little contribution to the conversation (average of four per session). The "average DP majority" scenario had a high verbalization count (average of 31 per session).

Observing critical verbalization (CV) data in conversations across scenarios (Table 3), the highest percentage of CVs was in the average DP majority scenario (26%), and the lowest was in the high DP majority scenario (11%). The all-average DP and all-high DP scenarios surprisingly did not have the most CVs despite having members sharing similar DP (19% and 11%, respectively).

The following section showcases example linkographs to give a representative glimpse of discourse structures in the different scenarios. They give insight into common interactions occurring in each scenario. In inspecting example linkographs of homogenous peer compositions, in all average DP scenarios, participant verbalization indicated a more collaborative model of hierarchy between peers as verbalizations and CVs were balanced (Fig. 4). While the conversation count was high, CVs were not dominated by a singular participant and were not frequently occurring. However, interactions in the all-high DP scenario were rare. Linkographs reveal that verbalizations and CVs were rare (Fig. 5).

Meanwhile, in inspecting example linkographs of heterogeneous peer compositions, in the high DP majority scenario, verbalizations were the least across all scenarios. The verbalizations in these scenarios manifested primarily between the two high DP participants, with the average DP participant being marginalized in conversations (Fig. 6). In the average DP majority scenario, initial CVs were predominantly from the high DP participant. However, as the conversation progressed, average DP participants contributed with their own CVs, and the high DP participants' CV count decreased (Fig. 7).

Indirect interaction

While verbalization data highlights direct interactions, indirect interactions such as movement traces between participant spaces further reveal social structures underlying peer

Table 3 Verbalization data for all social scenarios

Scenario variants							
All average DP	All high DP	Average DP majority			High DP majority		
Total	Total	Total	Verbalizations per participant		Total	Percentage per participant	
			High DP participants	Average DP participants		High DP participants	Average DP participants
<i>Average verbalizations per session</i>							
36	17	31	9	22	15	11	4
<i>Percentage of CV</i>							
19%	13%	26%	38%	62%	11%	94%	6%

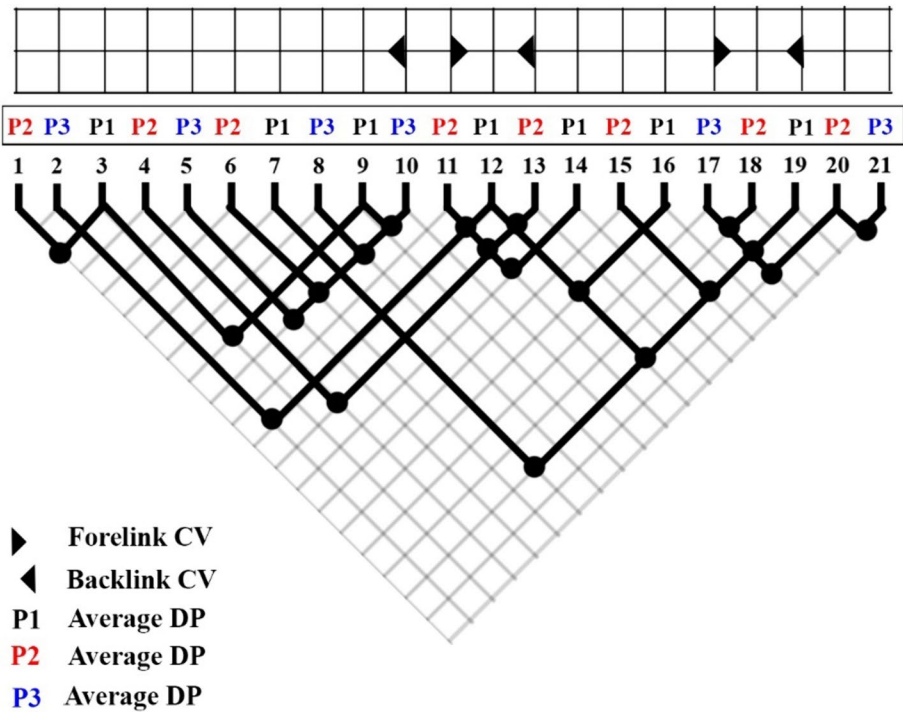


Fig. 4 An example of an all-average DP scenario linkograph

crits. Participants' visit data (Table 4) reveal that participants' visits were the highest in the "all average DP" scenario (59 total visits) and lowest in the "all high DP" scenario (28 total visits).

Observing movement traces in scenarios with peer homogeneity (Fig. 8), participants in the all-average DP scenario frequently visited each other's spaces. In contrast, participants in the all-high DP scenario seldom visited each other's spaces and showed little exploration in their own spaces. Further observations of participants' movement tracks shed light on the more complex scenarios with peer heterogeneity (Fig. 9). Movement tracks indicate that in the "high DP majority" scenario, participants with high DP frequently visited each other's spaces but not the average DP participants' space. While average DP participants in the "high majority DP" scenario interacted directly via verbalization occasionally, they indirectly interacted frequently with the high DP participants through multiple visits. In the "average DP majority" scenario, visits were balanced between all participants despite heterogeneity.

Discussion

Hierarchy among students is not simply horizontal. Exogenous and endogenous qualities endow students with authority (Langer-Osuna, 2016). They indicate an understanding of studio culture or "habitus." Those with cultural capital possess arbitrary authority, which their peers willingly accept (Stevens, 2002). Therefore, the authors argue that moving the

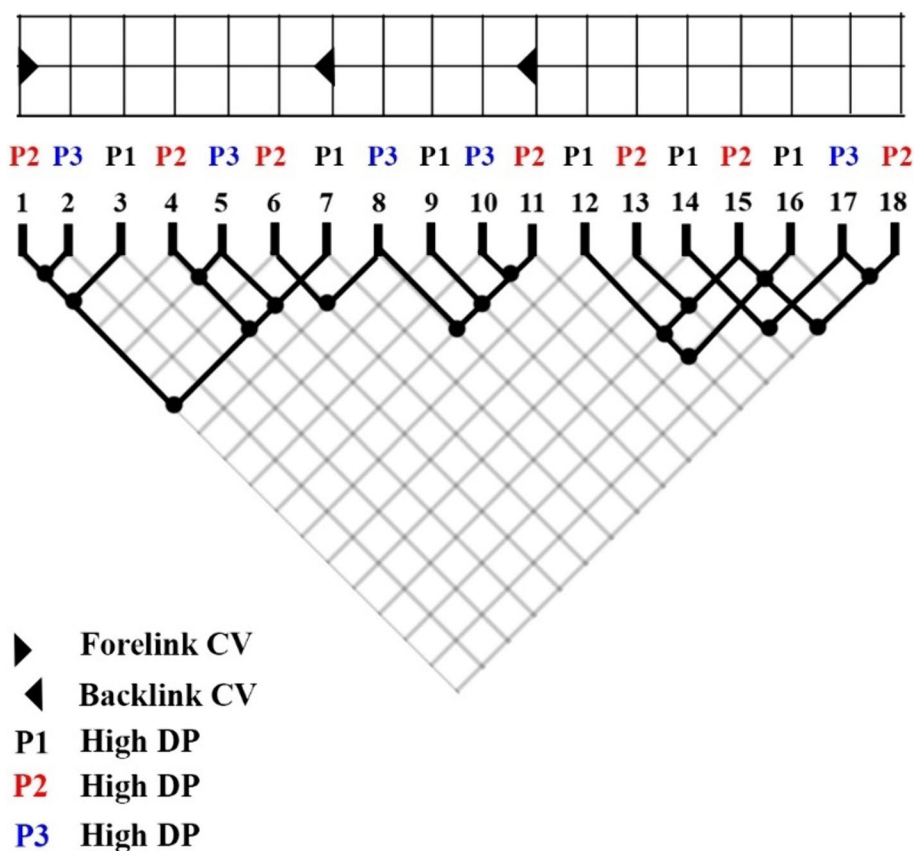


Fig. 5 An example of an all-high DP scenario linkograph

design studio to MUEs has a transformative effect on cultural capital and authority. The following section discusses this paper's findings regarding homogenous and heterogenous composition scenarios.

Homogenous peer compositions

Homogeneous peer composition scenarios include the all-average DP and all-high DP scenarios. In the all-average scenario, participants interacted frequently directly and indirectly in a more balanced collaborative hierarchy model (Fig. 10). While no clear authority manifested between the participants, interview responses highlight that a degree of epistemic authority is present when participants display endogenous qualities during experiment sessions. An example of one such response: "I saw them use some assets in really cool ways, couldn't help but go and see." Such responses by the participants linked endogenous qualities to the display of knowledge in participants' design artifacts present in the MUEs. This aligns with studies suggesting that peers of similar qualities tend to interact more willingly and in a collaborative model (Haller et al., 2000).

One would expect the all-high scenario to follow suit, with peers interacting frequently and peers displaying endogenous qualities to claim authority. The scenario had

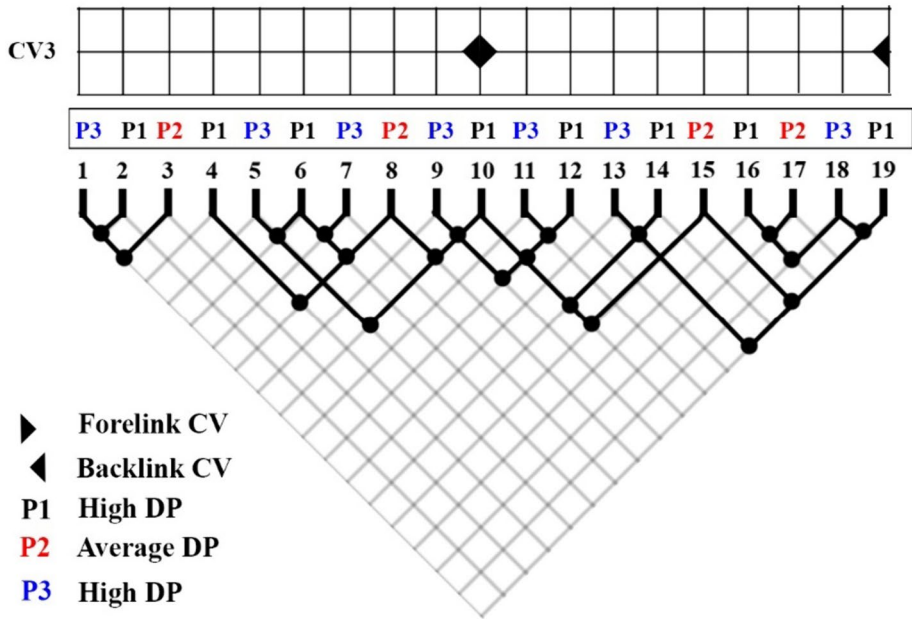


Fig. 6 An example of a high DP majority scenario linkograph (two high DP and one average DP participant)

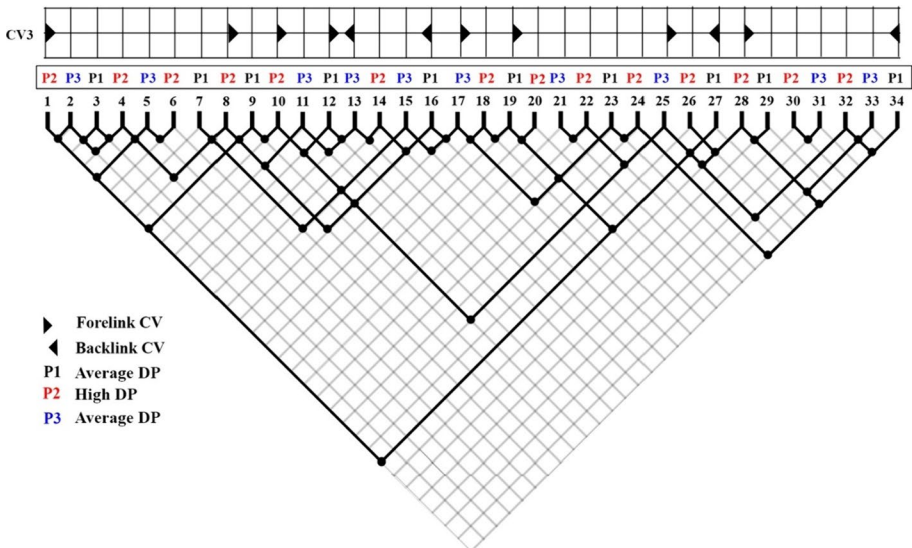
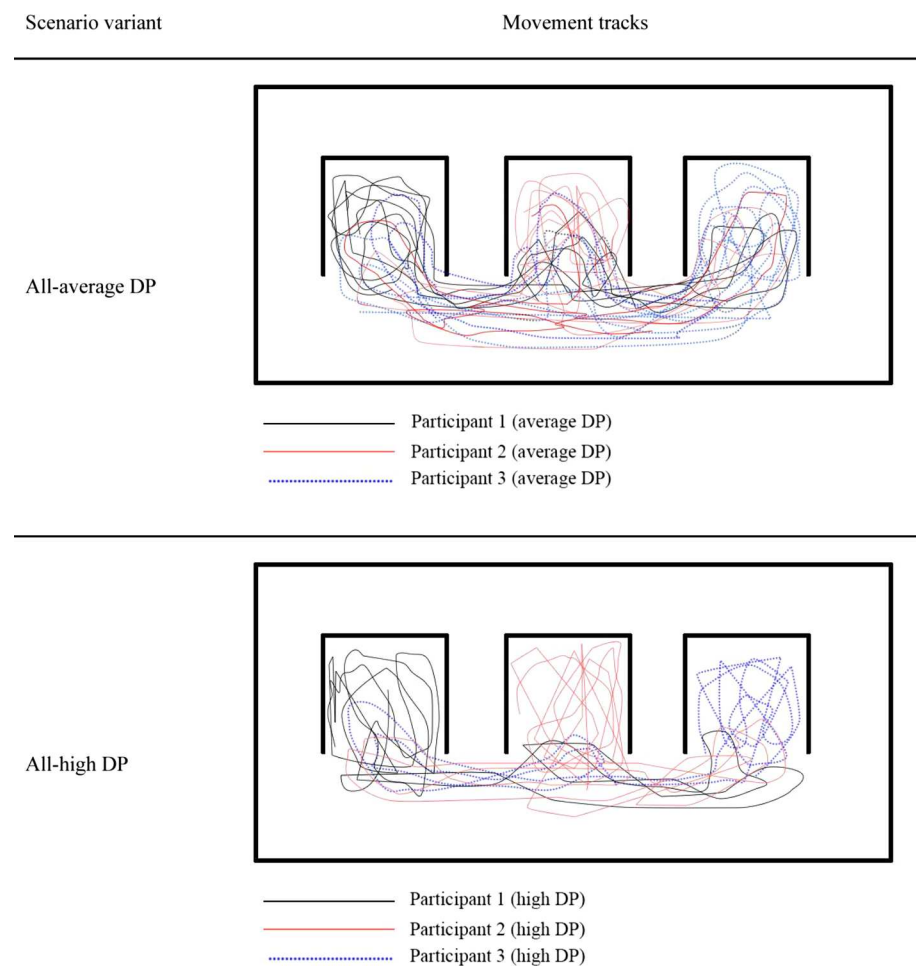


Fig. 7 Example of an average majority scenario linkograph (one high DP and two average DP participants)

Table 4 Participants' visits data across all scenario variants

Scenario	Total visits (across four sessions)	Average visits (per session)	Percentage of visits by participants (categorized by DP)	
			Average DP	High DP
All average DP	59	11	100%	–
All high DP	28	5	–	100%
Average DP majority	47	9	68%	32%
High DP majority	36	7	71%	29%

**Fig. 8** Examples of movement traces from scenarios with homogenous peer compositions

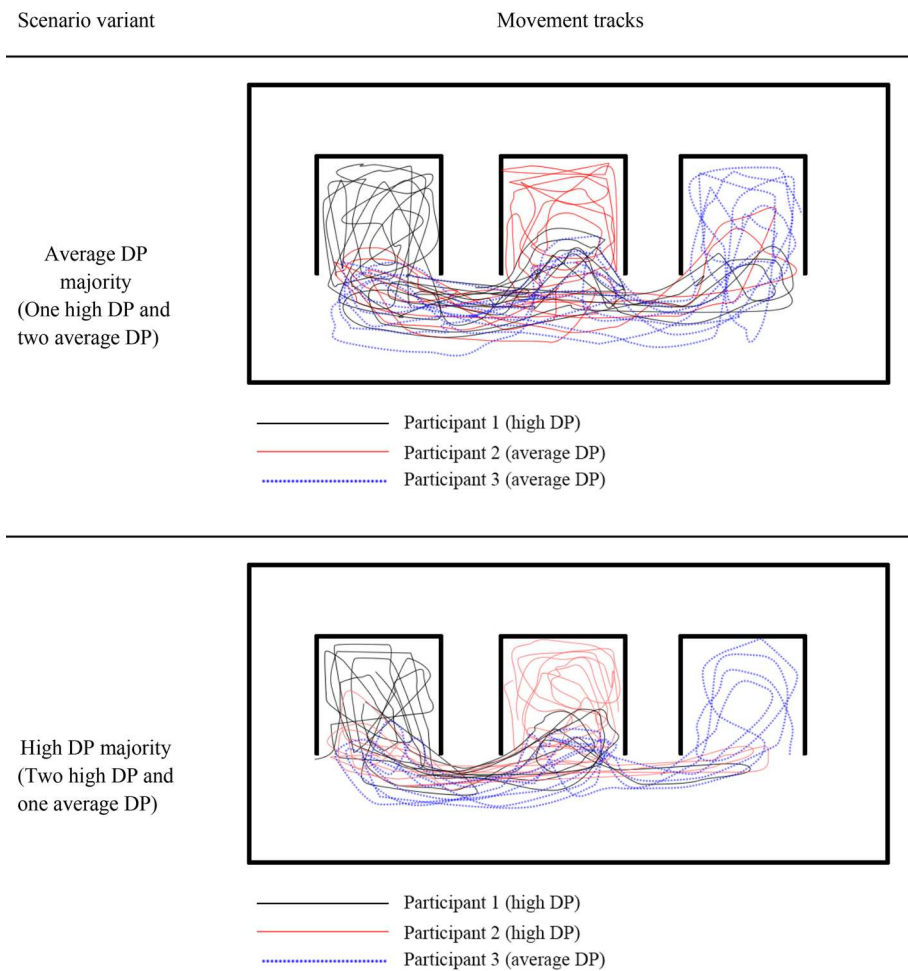


Fig. 9 Examples of movement traces from scenarios with heterogeneous peer compositions



Fig. 10 Average DP participant directly proposing a change for another average DP participant, highlighting a collaborative hierarchy model

very little direct interaction and the least indirect. Unlike the all-average DP participants, participants in the all-high scenario all possessed high degrees of cultural capital in the form of the DP acquired exogenously from traditional studio achievements. Higher cultural capital indicates these participants were highly socialized into the architectural pedagogy habitus before using MUVes. A potential explanation in the literature is that with new forms of mediation comes certain de-skilling (Berry, 2016). However, the experiment setup intentionally limits asset usage to pre-existing assets to minimize modeling skills, and the selection criteria for participants ensured that all participants had a comparable time using MUVes. While de-skilling is a potential, the experiment setup makes it an unlikely cause for resisting interaction in this scenario. The resistance on display is potentially not to re-learning tools but to deviation from an established habitus (Bourdieu, 1977). Indeed, participants showed disinterest not only in interacting with others but also in exploring their own space, as evidenced by their movement traces. Participant responses highlighted this disinterest with responses such as: "I couldn't get into it. For me, this is not design, not the correct process." Participants also cited fear of social judgment in their responses: "The scope and goal are just so different, and it felt frustrating to put that out there for all my friends to see." Participants felt they were expected to perform well, and a deviation from that expectation might impact their authority and be subject to ridicule. As a result, the participants opted for self-imposed isolation.

It is worth noting that the way participants interacted with their artifacts through Spatial.io's affordances indicated how different participants resisted new mediation through MUVes. High DP participants, for example, frequently used the zoom-out function and camera mode to view their spaces from top view spots akin to 2D artifacts, mimicking how their work would be assessed in the traditional studio, highlighting resistance towards disrupting a habitus that they have a strong understanding of (Fig. 11). Average DP participants showcased lesser resistance, instead actively experiencing spaces using their avatars and adopting a design-by-trial method.



Fig. 11 High DP participant zooming out to assess the space, similar to assessments in the traditional studio using 2D artifacts

Heterogenous peer compositions

In scenarios with mixed DP participants, social dynamics between peers were more complex due to the participants' heterogeneity. In the high DP majority, the two high DP participants interacted directly and indirectly often, and the average DP participant was marginalized in direct interaction but frequently interacted indirectly by visiting peers' spaces (Fig. 12). Such findings align with previously suggested notions of peers forming cliques with those of similar aptitude. In this case, peers with high cultural capital (DP) formed a clique in which the average DP participant did not see themselves. This is evidenced by remarks by average DP participants in interviews, such as: "They were doing their thing over there. I know them, and I'm friends with them. But for design, I just do not operate like that, and I do not think I need to. My design was fine." High DP participants also possessed authority indirectly, with the average DP participant observing and sometimes copying their spaces (Fig. 13). Lesser-able peers contributed to very few direct interactions. They took a student role, listened to the more able students, and observed their artifacts indirectly.

The high DP participants' willingness to interact with each other in the high DP majority scenario contrasts their self-imposed isolation in the all-high DP scenario. The intimate nature of dyad interaction potentially provides insight into this contrast as peers give weight to collective opinions and judgment over individual ones (Sawyer, 2019). The dyad formation of the two high DP participants did not form a collective group, potentially encouraging the two similar peers to interact more and reveal academic confusion without fear

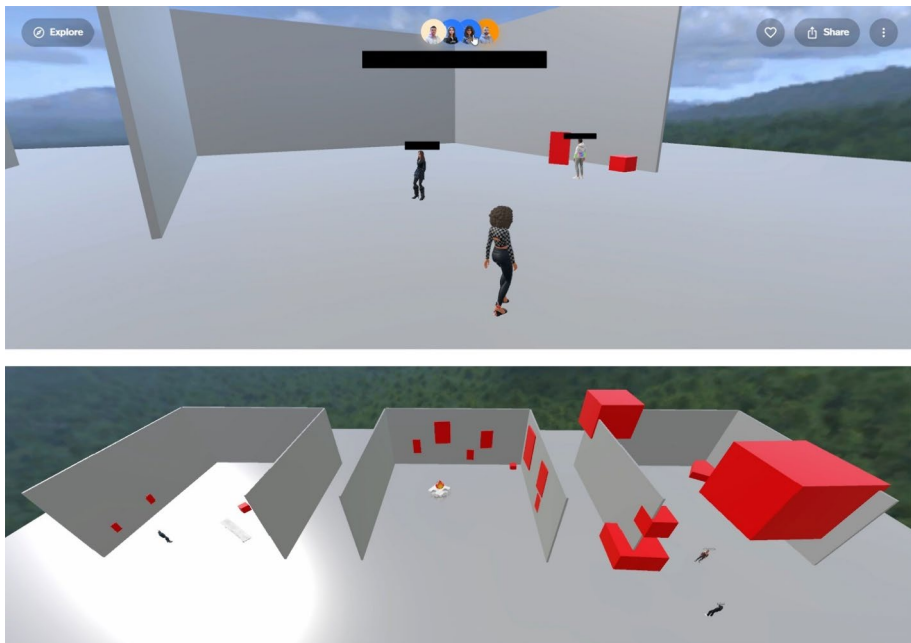


Fig. 12 Two high DP participants discuss design ideas, the third participant is an average DP participant and indirectly observes (above), two high DP participants discuss ideas, and the sole average DP participant is excluded from the interaction

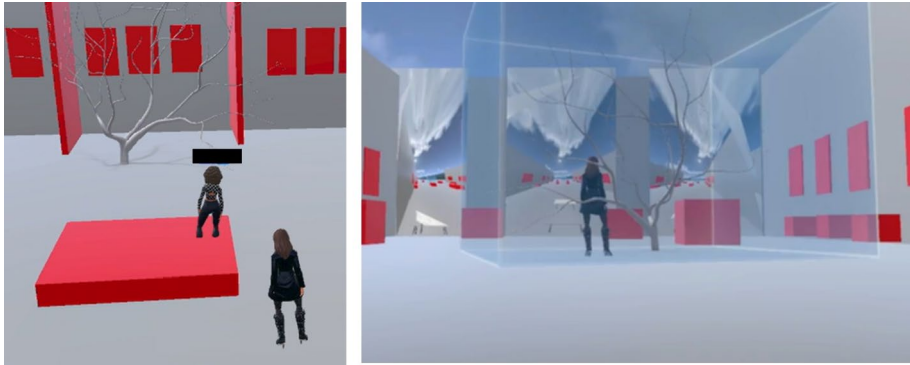


Fig. 13 A high DP participant uses a tree asset, and an average DP participant observes it by visiting their space (left). The average DP participant uses the same tree asset in their space (right)

of judgment. Examples of interview responses reinforce such suggestions: "I feel [High DP participant's name] understands my work and how my mind works. We always work ideas together and figure things out together." It is important to note that even though high DP participants interacted more, they showcased the same level of disinterest in exploring MUEs showcased in the all-high DP scenario with statements such as: "It was a fun side thing to do, but I don't think this is viable as a design tool."

The influence of cultural capital and the formation of cliques among participants with similar DP from the previous scenario suggest similar findings would follow suit in the average DP majority scenario. However, average DP participants did not form cliques and interacted directly and indirectly with the high DP participant. Inspecting linkographs from this scenario at first would suggest that cultural capital (DP) did distinguish the high DP participants and granted them authority where they had more CVs than other average DP participants. The high DP acted as exogenous cultural capital in MUEs and granted the high DP an initially accepted authority among average DP participants, which was vulnerable to shifts or erasure. At times, further declaration of such exogenous qualities had a counter effect that resulted in co-present participants questioning exogenous relevance to the present task, as evident in this exchange:

- High DP participant: In older studios, I would start with a layout visualization of what I wanted to design.
- Average DP participant: I don't think that would work here, though. This seems different."

While initially, the social dynamics between peers followed arbitrary expectations, as the conversation continued and artifacts emerged, authority shifted to other peers due to endogenous abilities manifested in artifacts or through continuous questioning of more able peers that revealed a lack of endogenous abilities (Fig. 13). The strength of an authority granted by acquiring cultural capital is in its arbitrariness. Individuals must willingly accept an established hierarchical authority model as "natural" for it to be established (Bourdieu, 1977). The findings suggest peers did not accept the arbitrariness of exogenous cultural capital, suggesting a disruptive effect on the very content MUEs mediate (Fig. 14). The norms of the traditional studio did not apply in MUEs from the perspective of co-present peers. Through continuous questioning and observations of artifacts, endogenous qualities



Fig. 14 A high DP participant asks an average DP participant about adding podiums below assets, and the average DP clarifies (above), suggesting a shifting hierarchical model where authority is acquired endogenously

manifest and grant authority based on epistemic logic. With artifacts being a large visible part of MUEs, authority is predominantly objectified through these artifacts.

Hierarchy models in MUEs

Discourse on hierarchy and power asymmetries among students during peer crits has mainly outlined two models: the transfer-of-knowledge and collaborative model, focusing on two extreme ends of the spectrum (McClean & Hourigan, 2013). The findings of this paper suggest that MUEs have more nuanced hierarchy models. Four hierarchical models can potentially exist within MUEs depending on peer composition: (1) collaboration, (2) self-imposed isolation, (3) indirect transfer of knowledge, and (4) shifting authority (Table 5). Collaborative models are balanced hierarchical models with no clear authority consistently established. This is commonly manifested among peers with no high cultural capital. The self-imposed isolation model does not establish a hierarchy. Peers opt not to interact with others out of potential collective judgment and loss of position in the established habitus. This model manifested itself among composition, with all peers possessing high cultural capital. The indirect transfer-of-knowledge model manifested itself in heterogeneous compositions where most peers possessed exogenous cultural capital. Lesser able students use indirect methods to observe favorable practices from co-present peers'

Table 5 Hierarchical models in MUVes

Heterogonous	Model	Peer composition	Description
No	Collaborative	All without exogenous cultural capital (DP)	Balanced hierarchy with no clear authority
No	Self-imposed isolation	All with exogenous cultural capital (DP)	Interaction is willingly cut off out of possible fear of collective judgment
Yes	Indirect transfer-of-knowledge	Majority possess exogenous cultural capital (DP)	Formation of cliques among able peers acting as indirect promoters of favorable practice for lesser able students
Yes	Shifting	Majority does not possess exogenous cultural capital (DP)	Authority shifts among peers due to endogenous capital establishing epistemic authority

artifacts. The shifting model showcases a hierarchical model where authority is established and shifted among peers due to endogenous qualities objectified in artifacts, with endogenous capital having more of an impact on that shift than exogenous capital due to the strong presence of artifacts in MUVes. This model manifested itself in a heterogeneous composition where most peers did not possess exogenous cultural capital, and arbitrary authority was scrutinized by co-present peers.

These new hierarchical models highlight shifts in power dynamics and relations between proficiency and authority due to the introduction of digital media to educational settings. Such shifts are potentially present in various educational fronts considering a migration to MUVes. Such fronts go beyond undergraduate student pedagogy to Initial Teacher Education (ITE). Such educational fronts and future research surrounding them would benefit from the qualitative insights present in this paper.

Conclusion: metamorphosis

According to the famous saying, "When all you have is a hammer, everything looks like a nail." Individuals define their practice based on media affordances (McLuhan, 1967). Architectural pedagogy has long relied on the traditional studio setup to mediate its practices. While the content for the pedagogy has carried over to MUVes, such content potentially undergoes metamorphosis and accordingly impacts social practice within MUVes.

This paper presents qualitative insights into the relationship between cultural capital and authority. These insights suggest that the relationship between the two constructs is not directionally proportionate. While exogenous cultural capital in the form of design proficiency (DP) can grant authority, such authority is scrutinized when design artifacts objectify endogenous capital. MUVes allow users' avatars to experience artifacts in real dimensions (not as scaled-down models) and give students a strong presence linked to epistemic authority. Due to medium affordance, the strong showcase of endogenous qualities through artifacts led to scrutinizing the arbitrariness of previously established authorities in the traditional studio. This metamorphosis saw resistance from participants. While it is easy to relate such resistance to an aspect of de-skilling, interview responses suggest that resistance is not to re-learning tools but instead to disrupting the established habitus. Participants with a high degree of exogenous cultural capital in the form of DP were the participants who showcased the most resistance, often stating that MUVes are invalid. Unsurprisingly, a newly introduced medium does not find immediate adopters, but these insights suggest that MUVes can potentially impact practice, how authority manifests, and student-artifact relationships over time. In this case, the new medium creates familiar content, a design studio, where hierarchy and favorable practices are present but metamorphosizes content that alters practice.

The literature on peer asymmetries and authority has highlighted two hierarchy models between students: peers are balanced in a hierarchy and collaborate or take a tutor role with authority to transfer knowledge (Sawyer, 2019). The findings highlight four potential hierarchical models existing in MUVes among peers depending on peer composition and heterogeneity. Such hierarchies present a more nuanced look at authority in MUVes and its relationship to different cultural capital. The paper emphasizes the role of peer composition in creating varied and complex hierarchies among students that is scarcely touched upon by discourse on architectural pedagogy. As a result, this paper presents educators with a

more nuanced insight into the interactions among students in MUEs and how authority manifests during it.

A limitation of this paper is the relatively small sample size and the limited number of participants per session run (three Future studies should explore larger samples that simulate larger MUVE design setups found in universities. In addition, this paper focused on peer crits. Subsequent research should also introduce studio instructors as co-present participants for a better understanding of authority and cultural capital between students and each other as well as with instructors. Accordingly, the authors strongly encourage the exploration of the impact of shifts in power dynamics caused by the migration to MUEs or other immersive media on educational discourse at large, notably in the field of Initial Teacher Education (ITE). Adaptation to changes in social dynamics resulting from digital technology should represent a crucial stage in a teacher's professional journey.

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