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A review of tools to support user-client involvement in architectural housing contexts

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ABSTRACT

This paper investigates the tools, techniques, strategies, and methods (TTSM) that can facilitate the involvement of user-clients in the design of single-family dwellings. We focus on TTSM found in the open-access online domain. We aim to clarify how they support collaboration and interaction between parties, bridging gaps (i) between architects and non-experts and (ii) between scientific and grey literature. This study uses a systematic qualitative document analysis to examine 123 TTSM that support collaboration between user-clients and architects across three areas of the design process: (1) Design, Activity, and Ordering; (2) Social, Communication, and Decision-Making; and (3) Management, Process, and Coordination. We also identify 'Mediation' as a transversal dimension, which, while not directly shaping projects, enhances understanding of architectural processes, culture, and vocabulary. This study underscores the importance of strategies that prioritise clear communication and engagement, with material and digital tools supporting both participatory design and professional knowledge transfer. Our overview of TTSM also addresses gaps in the literature regarding their practical and systematic use in architects' interactions with user-clients. It provides insights into how architects and architectural firms can enhance collaboration and user involvement while identifying future avenues for improving support for both parties in these interactions.

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Architectural tools; user involvement; design tools; design communication

1. Introduction: context and theoretical framework

The role of the user and client involvement in architectural design processes has evolved significantly in recent years, as designers and architects seek to create spaces that are not only functional but also reflective of the needs and desires of their users. Participation models such as those discussed by Sanders, Brandt, and Binder (2010) and Sanders and Stappers (2014) have highlighted the importance of engaging non-expert users in the design process, moving away from traditional hierarchical design approaches towards more collaborative, co-creative methods.

One critical aspect of this user and client involvement is the use of adapted Tools, Techniques, Strategies, and Methods (TTSM) that facilitate communication between designers and non-designers (Yönder et al., 2025a). Accordingly, this paper focuses

on examining the various TTSM currently employed in architectural practice to facilitate user and client involvement. We concentrate on single-family housing design contexts due to their unique nature: clients are also the future users of the building and are therefore naturally involved in the design and construction processes.

Previous research emphasises that interactions between architects and user-clients frequently show significant communication gaps, with user-clients often limited to providing primarily functional and structural feedback, while architects rarely capture inputs related to spatial meaning or embodied knowledge (Cairns 1996; Lawson 2006; Steen 2011; Tidafi 1996; Van der Linden, Dong, and Heylighen 2019). While notable participatory initiatives have been developed by seminal figures like Alexander (1968) and Habraken (2021), participatory models still fail to reconcile meaningful user involvement with architects' desire to maintain creative control and recognition (Luck 2007; McDonnell and Lloyd 2014; Steen 2011). Consequently, misunderstandings and frustrations remain prevalent, largely due to difficulties in mutual communication and the limited sharing of experiential knowledge (Defays and Elsen 2018; Oudshoorn, Rommes, and Stienstra 2004; Till 2009). However, research also shows that properly facilitated interactions enable user-clients to engage more meaningfully, fostering a deeper understanding of architectural design values (Luck 2007; Siva and London 2011; Van der Linden, Dong, and Heylighen 2017).

In Belgium, architects predominantly adopt conventional methods such as initial verbal consultations, site visits, and annotated sketches to engage user-clients. Digital tools such as virtual reality (VR) and detailed visualisations have emerged as promising approaches, yet their adoption remains limited due to concerns over costs, accessibility, and potential misunderstandings about their practical use (Yönder et al., 2025b).

Misunderstandings frequently arise from discrepancies in visual literacy between architects and clients, leading to significant friction points and diminished client satisfaction (Dokonal, Hirschberg, and Wurzer 2023). Moreover, architects' preference for consultation over participatory approaches reveals tensions in maintaining control over the creative and design process, despite acknowledging the benefits of deeper client engagement (Yönder et al., 2025b). Thus, there remains a clear need for further field research to bridge the gap between theory and practice, particularly through the development of effective, convincing participatory tools (Mertens et al. 2023).

Such tensions and misunderstandings are further exacerbated by misaligned expectations concerning budget constraints, aesthetic preferences, and the perceived roles within the project. These divergences often manifest as 'habitus¹ shock', defined as the confusion, stress, or frustration experienced by clients who find themselves confronted with an unfamiliar architectural environment, including technical jargon and procedures (Adler 1975; Bourdieu 1977; Schwaiger et al. 2019; Siva and London 2009, 2011). Consequently, while participatory methods, such as immersive walkthroughs and mood boards demonstrate potential for improving communication and satisfaction, significant resistance persists, highlighting the need for architect-client collaboration models that better integrate diverse client perspectives and expertise (Mertens, Hamarat, and Elsen 2023).

1.1. Definitions: tools, techniques, strategies, and methods

Here, we would like to briefly clarify our definitions of tools, techniques, strategies, and methods.

Tools: As Rabardel and Colin (1995) describes, tools are artefacts with both material and symbolic properties designed for specific goals. Tools such as cards, plans, and models possess agency, realised through human interaction. In architectural practice, tools like pen and paper or CAD tools can enable architects to communicate design ideas through sketches, physical plans, and 3D visualisations, and may help bridge the gap between abstract design concepts and user comprehension.

Techniques: According to Sanders, Brandt, and Binder (2010) and Sanders and Stappers (2014), techniques refer to the ‘way of doing’ things and are shared between human agents and tools. Thus, sketching, drawing, modelling, or real-time visualisation can be understood as different techniques to communicate design propositions. Some of them enable user-clients to engage more directly with the design process by providing a hands-on way of exploring and refining design elements.

Strategies: Strategies guide the overall approach to the use of tools and techniques. They are shaped by the architect’s assumptions, desired outcomes, and overall methodology. For instance, strategies like gamification in design games or materialisation in prototyping or model-making guide the tools and techniques to achieve specific objectives throughout a design process.

Methods: Methods, as complex procedures, arrange and combine tools, techniques, and strategies in ways that suit the specific context of a project. Tailored to each project, methods, such as scenario-based design games or workshops facilitate both user engagement and knowledge exchange (Kankainen et al. 2012; Tobar-Munoz, Baldiris, and Fabregat 2016).

1.2. Architectural tools, techniques, strategies, and methods

The architectural design process is facilitated by the use of TTSM that support various aspects of the design process. Weytjens, Verdonck, and Verbeeck (2009) group architectural tools into six categories, based on survey data from 319 architects in Flanders, Belgium. These are (1) knowledge, (2) evaluation and analysis, (3) structuring, (4) modelling, (5) presentation, and (6) communication. Knowledge-based tools provide information support for their design work, while evaluation and analysis tools ensure that designs meet the specified project requirements. Modelling tools are used to visualise and represent the design. Structuring tools help organise the design process. Presentation tools aid in disseminating design information to stakeholders, and communication tools facilitate the necessary communication among all involved parties (Weytjens, Verdonck, and Verbeeck 2009). In their everyday life, architects make use of modelling the most (%83,2), presentation (%90,1), and knowledge-based tools (%94,8). While they use fewer tools for communication and structuring, they also express a need for support in these areas (Weytjens, Verdonck, and Verbeeck 2009).

These needs or categories also relate to different dimensions of architectural design. Architectural design is a process which can be understood, as (1) ‘ordering of the built environment, both spatially and temporally’; (2) as ‘a process of

decision making based on human communication, negotiation and simulation in order to define a shared goal' and (3) as 'the scheme of activities, actions and plans to achieve defined goals' (Lawrence 1993, 300). From our understanding, the first dimension emphasises the object of architecture: the building and its design. The second dimension pertains to the relational dynamics involved in achieving the design, resulting from collaboration between experts, clients, users, and other stakeholders — i.e. the social domain. The third dimension highlights the architectural design process as a service, bringing the management aspects to the forefront.

Design and social dimensions address the design communication, which encompasses the sharing of needs, expectations, and ideas about the future building project, as well as architects' sharing of design propositions (Dokonal, Hirschberg, and Wurzer 2023; Segers et al. 2000). Design communication commences with the establishment of the design brief, which generally relies on verbal interactions, predominantly in the form of face-to-face meetings as well as site visits (Russell, Aeli, and Niamh 2017), with the occasional use of visual aids, such as inspirational photographs (Russell, Aeli, and Niamh 2017). Tools such as photographs help to overcome misunderstandings related to verbal communication and language issues, for example, when discussing more abstract concepts such as 'style', as every individual would have different connotations (Chuang and Chien 2021).

Following the initial design proposal from the architect, visual communication tools are then employed to share architectural ideas and enable feedback and revisions. These include two-dimensional representations such as hand-drawn or computer-aided design (CAD) sketches, plans, elevations, three-dimensional fly-throughs, renderings, or images of existing spaces to illustrate the 'look and feel' of spaces (Russell, Aeli, and Niamh 2017; Van der Linden, Dong, and Heylighen 2017). Again, visual tools are found useful for design communication, especially high-fidelity ones, such as photographs and renderings, due to the lack of user-clients understanding of reading technical representations (Chuang and Chien 2021; Norouzi et al. 2015).

Current literature mostly focuses on tools that are used generally solely by architects (Weytjens, Verdonck, and Verbeeck 2009) and that prioritise ordering and design, such as design representations, 2D drawings, 3D models, or simulations (Bueno and Turkienicz 2014; Lawrence 1993). Some studies include the social dimension and the collaboration of architects with clients and users. These studies generally focus on the communication of design proposals and decision-making through the intersection of modelling and presentation needs (Segers et al. 2000).

In the context of participatory design, we found a vast array of proposed tools and methods (for a recent literature review see Yönder et al. 2025a). Some of them, such as games, reflect a more holistic approach to simulate not only the design or the building in itself but also the design process in an engaging manner (Summers 1979). While participatory contexts are currently an exception in architectural practice rather than a norm, we argue that in single-family housing contexts this becomes the reality of the practice through the involvement of the user as client of the future building in question.

Following this, in this study we investigate the grey literature by combining the categorisation put forward by Weytjens, Verdonck, and Verbeeck (2009) and the dimensions of Lawrence (1993).

2. Focus

This research focuses on identifying existing TTSM that engage architects, users, clients, and/or the general public to facilitate collaboration and interaction in the design process for single-family housing. Specifically, we aim to analyse the possible uses and the nature of these tools. We examine how these TTSM enhance knowledge exchange and foster collaboration between architects and users/clients. In the specific context of private dwellings, end-users and clients are often the same individuals; therefore, we refer to them hereafter as ‘user-clients’.

3. Methodology

3.1. Data collection

We systematically identified and documented TTSM used by architectural firms or associations, independent architects (public) institutions, laypeople, and construction industry service providers. Our aim was to find tools that are either frequently used or considered innovative.

We used a combination of search engines (Google, Instagram), video platforms (Netflix, YouTube) and specialised platforms (Archdaily, LinkedIn, and Pinterest) to gather data. These platforms offered insights into how architects and related professionals communicate their projects to the public.

Data collection was conducted by two independent researchers following a double-blind protocol to minimise algorithmic bias. The two researchers did not work together prior to the research, nor did they know, were not in contact in any way, and had different backgrounds and ages. However, as both researchers were located in Belgium, our data collection strategy still holds geographical bias as a limitation.

The two researchers independently created lists based on their searches. The initial data comparison focused on identifying common sources, titles, and links between the two datasets. Tools with exact matches between sources and links were marked as strict similarities, while those with similar sources but unrecorded links were categorised as approximate similarities. After removing duplicates, a total of 123 tools were included in the data analysis.

3.2. Data analysis

We went through a two-step process in data analysis. Our analysis was based on the interpretation, categorisation, and coding of these tools by researchers with background in architecture, interior architecture and environmental design, and participatory design. First, the two researchers who conducted data collection categorised the TTSM following a combination of inductive and deductive logic. Tools were grouped into families based on their (1) function, (2) nature, and (3) use in architectural processes. Categories such as visualisation, checklists, and guides emerged from both researchers’ datasets. Sub-

categories were then refined iteratively based on a detailed analysis of tool themes, descriptions, and their practical applications.

In the second step of data analysis (Table 1), two other researchers introduced and superimposed the first coding with an inductive coding scheme based on the categorisation put forward by Weytjens, Verdonck, and Verbeeck (2009) and the dimensions of Lawrence (1993). During the coding process, each tool was assigned a single predominant category in both Categorisation 1 (Lawrence 1993) and Categorisation 2 (Weytjens, Verdonck, and Verbeeck 2009), thereby enabling a systematic cross-comparison between the two categorisation schemes. We also added a seventh code, 'Mediation', which did not find a place in these two categorisations. This code refers to the TTSM aiming to promote architectural culture. An example of our coding procedure, illustrated through three tools, is provided in the table.

4. Findings

4.1. Overview of TTSM

Here, we first provide an overview of our results based on the:

(1) author/diffusion and target audience, (2) formats, sub-formats, and strategies, (3) TTSM categorisations based on Weytjens, Verdonck, and Verbeeck (2009) and the dimensions of Lawrence (1993). We then present a more detailed analysis of the aim and nature of these TTSM based on our second categorisation through Lawrence's (1993) dimensions and through tool families.

4.1.1. Authors/disseminators and target audience

When we examine the authors or disseminators of TTSM, the majority of tools in our dataset was created and/or shared by individual architects ($n = 45$). This was followed by chambers of architects ($n = 32$) and construction industry service providers ($n = 26$). Cultural institutions ($n = 8$), individuals or laypeople ($n = 6$), associations of architects ($n = 5$), and academics ($n = 1$) had lower representation in this regard (Figure 1).

The target audience, or those who could benefit from using these TTSM, consisted of user-clients ($n = 88$), the general public ($n = 40$), and architects ($n = 35$). This coding category was not exclusive, so a single TTSM could address more than one type of audience (Figure 1).

4.1.2. Formats, sub-formats, strategies: materiality of TTSM

The TTSM were mostly available in digital form ($n = 104$), while only 19 were designed to be physical tools, or physical tools reported online. We share the sub-formats below (Figure 2). This coding category was not exclusive, so a single TTSM could have more than one type of sub-format.

To better understand the wide range of tools architects use to communicate with clients or the general public, we organised them into 'families' categories. Each group reflects a specific function these tools fulfil, whether to inform, guide, educate, or foster interaction. Table 2 offers an overview of these categories, accompanied by short descriptions formulated by the authors.

Table 1. Second round of coding scheme and three coding examples.

Name of the Tool			The illustrated glossary	5 Tips for Good Communication Between Architect and Client	Pre-design questionnaire
Format	Digital Physical		Digital	Digital	Digital
Sub-Format	document/pdf document/word/book/ booklet/image/video/audio/virtual reality model/webpage/website/social media channel/online post/event/toolkit/ podcast/simulation/drawing/installation/ animation/lexicon/questionnaire/online course/checklist/forum		webpage/ drawing/ lexicon	webpage/online post	webpage/ questionnaire
Strategy	Materialisation, Visualisation, Familiarization, Fiction, Narrativity, Conventional		Visualisation, Familiarization	Familiarization, Narrativity	Familiarization, Conventional
Diffusion	institution (chamber or cultural); architect; lay people; construction industry service providers; academics; associations of architects		institution	architect	architect
Categorisation 1 (based on Lawrence (1993))	C1.1 - Design/ Activity/ Ordering	"ordering of the built environment, both spatially and temporally" (p. 300)			C1.1
	C1.2 - Social/ Communication/ Decision Making	"a process of decision making based on human communication, negotiation and simulation in order to define a shared goal" (p. 300)		C1.2	
	C1.3 - Management/ Process/ Coordination	"the scheme of activities, actions and plans to achieve defined goals" (p. 300)			
	C1.4. Mediation	To promote architectural culture	C1.4.		
Categorisation 2 (based on Weytjens, Verdonck, and Verbeeck (2009))	C2.1.	To provide necessary information for design			C2.1.
	C2.2. Modelling	To facilitate design thinking through externalization			
	C2.3. Evaluation & Analysis	To check the alignment between requirements and design			
	C2.4. Presentation	To present design to other experts as well as non-experts (such as client, user)			
	C2.5. Communication	To support overall communication during project		C2.5.	
	C2.6. Structuring	To organize the design process			
	C2.7. Mediation	To promote architectural culture	C2.7		

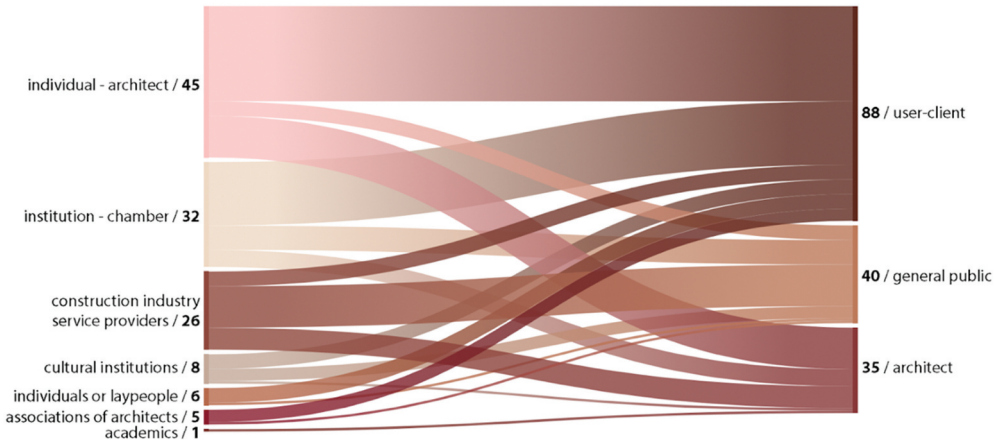


Figure 1. Comparative visualisation of authors/disseminators (left) and target audience (right).

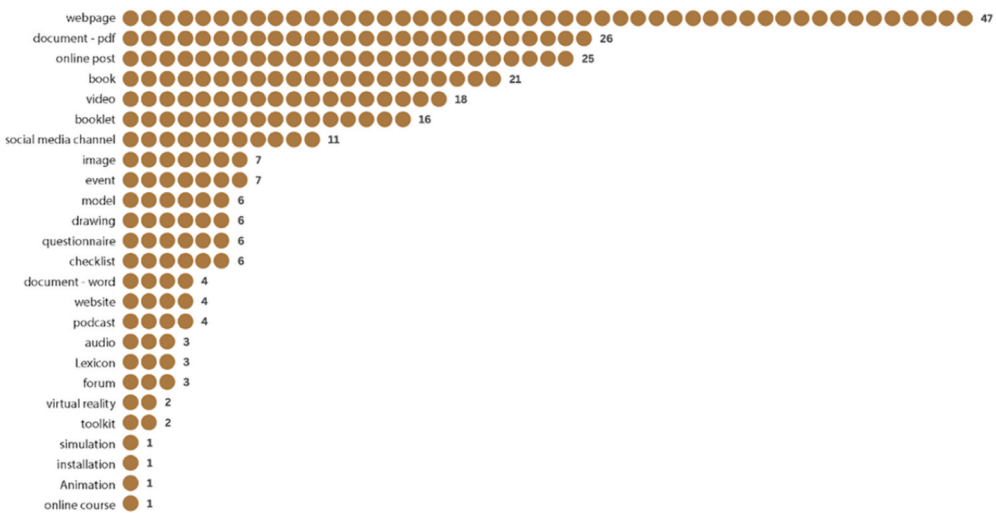


Figure 2. The sub-formats found in the dataset.

For the strategies (Figure 3, this coding item being also not exclusive), familiarisation (defined as presenting information in a more accessible form for the broader public, such as through streaming series or podcasts) was the most prominent. We also observed that more than half of the TTSM in current practice use conventional strategies, such as distributing text-based information through PDFs. This was followed by narrativity, which refers to using explanations, stories, and visual forms of narration to convey information. Visualisation was the fourth most common strategy, involving visual imagery, sketches, etc. Materialisation, observed in only eight TTSM, referred to the use of concrete materials to provide hands-on experiences. Finally, only three fiction-based tools were identified.

Table 2. Classification of tools and descriptions.

Category	Description
Visualisation	Tools that allow the client to understand the space and its layout from different perspectives.
Visit	A real immersion that enables the architect to gather crucial information the client considers while visiting the site.
Themed Interview/ Report	Video in which architects address specific themes of the architectural project to help the general public and potential clients to better understand it.
Experience Sharing	Tools presented as text or video, in which a stakeholder uses their experience to advise other architects and clients.
Educational/ Didactic	Tools engaging the general public's participation, whether through movement, handling, or simply playful approaches.
Glossary/Lexicon	Text- or image-based tools defining architectural or general construction terms.
Questionnaire	Questions addressed to the client before any contract signing, aimed at formulating the client's needs in greater detail.
Directory	Web page allowing a potential client to choose an architect in a suitable location and sometimes even verify their license to practice.
Template Documentation	Tools providing an example of standard project documentation or listing its contents.
Checklist	Checklist used to guide the client or architects on various subjects.
Guide	Tools advising the client more formally on various topics, in the form of a book, PDF, or training.
Advice	Tools offering less formal guidance to the client via web pages, images, or podcasts.
FAQ	Tools advising the client or general public through specific questions on forums, podcasts, videos, etc.
Services	The architecture firm's web page clearly defining the services included in its offerings.
Press	Tools informing the client and/or the general public about general topics or facts in the architectural world, aimed at educating the listener, reader, or viewer.

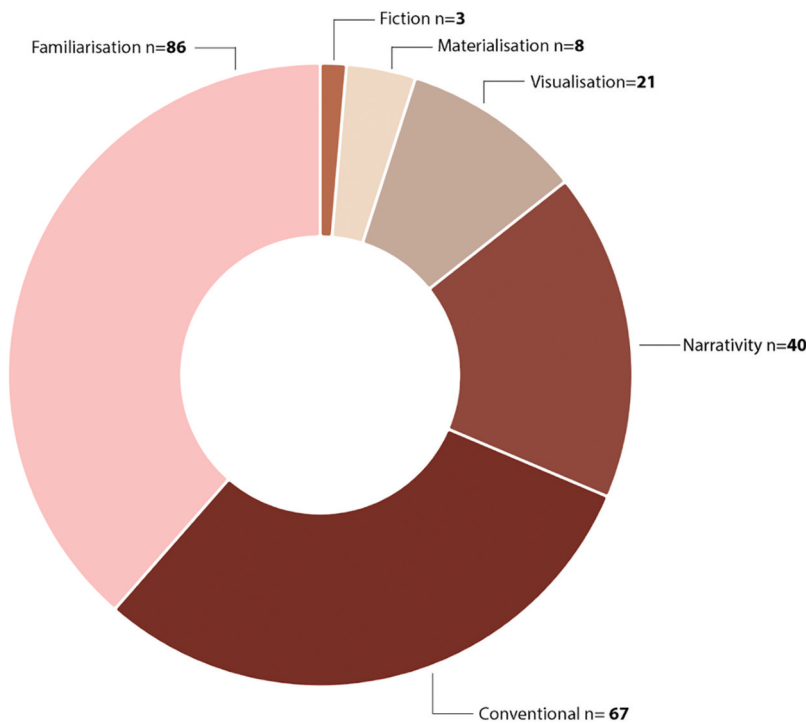


Figure 3. The strategies found in the dataset.

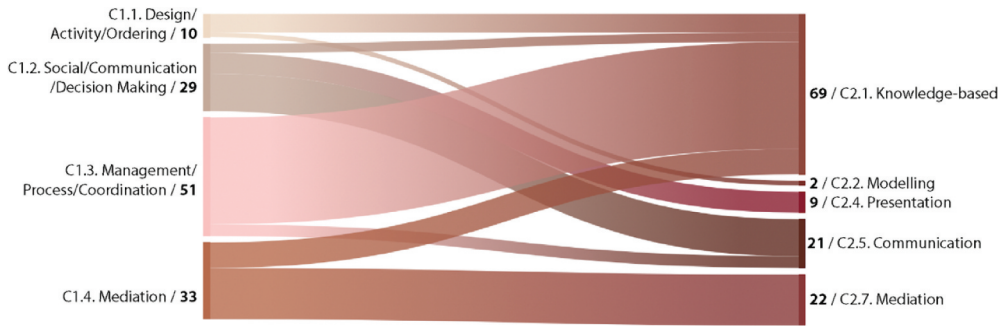


Figure 4. Comparative visualisation of categorisation 1 (left) and categorisation 2 (right).

4.1.3. Categorisation

Our first categorisation is based on the three dimensions of architectural practice proposed by Lawrence (1993). Here, we found that most of the TTSM were associated with ‘C1.3. Management – Process – Coordination’ ($n = 51$). This was followed by ‘C1.2. Social – Communication – Decision-Making’ ($n = 29$). ‘C1.1. Design – Activity – Ordering’ ($n = 10$) had the lowest occurrence in our dataset. In this categorisation scheme, 33 tools did not fit into any of the predefined categories and were assigned to our emergent category, ‘C1.4. Mediation’. This category captures tools that are not used directly in practical architectural project contexts but can indirectly have an effect by promoting architectural culture to a broader audience (Figure 4).

Our second categorisation, based on the framework proposed by Weytjens, Verdonck, and Verbeeck (2009), showed that most of the TTSM were oriented towards ‘C2.1. Knowledge-based’ use ($n = 69$), followed by ‘C2.5. Communication’ ($n = 21$) and ‘C2.4. Presentation’ ($n = 9$). For the categories ‘C2.2. Modelling’ ($n = 2$), ‘C2.3. Evaluation’ ($n = 0$), and ‘C2.6. Structuring’ ($n = 0$), we were able to code few to no examples. Meanwhile, we once again introduced a new category in this scheme for TTSM that fall under the ‘C2.7. Mediation’ category ($n = 22$) (Figure 4). This second categorisation demonstrated the prominence of knowledge-based TTSM in our dataset and revealed the lack of TTSM in the structuring, evaluation, and modelling categories. Now, we will delve into these categories in more detail. Our first categorisation provided a more robust understanding of our dataset. Accordingly, we decided to present our results based on our first categorisation while superimposing it with the second.

4.2. TTSM related to design as an activity and to the ordering of the built environment

Ten tools were categorised under ‘C1.1. Design – Activity – Ordering’ (defined as ‘ordering of the built environment, both spatially and temporally’ (Lawrence 1993, 300). When we superimposed this category with C2, eight of them fell under ‘C2.1. Knowledge-based’ and consisted of annotated documents, questionnaires, mood boards, or written briefs specifically aimed at identifying users’ needs and gathering information from clients to initiate the design process. These tools were oriented towards user-client use, to enable them to explain and communicate their projects in a more structured manner to their architects ($n = 7$). We

also found video explanations of client meetings and site visits, which can be useful for both architects and user-clients to improve their interactions in the early phases.

In these knowledge-based tools, we identified two main strategies: conventional and visualisation. Digital PDFs and written documents mostly employ conventional strategies, where users prepare and transmit design intentions or requirements, providing essential information for design in written form by answering questions or filling in forms. In some cases, user-clients are expected to share inspirational imagery, where visualisation emerges as an additional strategy that goes beyond verbal means.

Overall, these tools enable the inclusion of personal references, narratives, and inspirational materials, helping architects situate design choices within the lived experiences and expectations of the client. This supports architects in structuring the initial order of the project and enables users' voices to influence the spatial configuration from the outset, as well as their active participation in the spatial imagination and programmatic ordering of the project.

While these tools may seem to function primarily as means of communicating needs and desires and thus could also be categorised under 'C2.5: Communication' or 'C1.2: Social – Communication – Decision Making' (defined as 'a process of decision making based on human communication, negotiation, and simulation in order to define a shared goal' (Lawrence 1993, 300)), their primary function in this context aligns more closely with 'design activity' (Design – Activity – Ordering). Here, users not only communicate preferences but also actively contribute to the spatial and temporal structuring of the built environment through their input.

However, their input remains at a conventional level, where they do not engage hands-on in 'C2.2: Modelling' or in facilitating design thinking through externalisation, for instance. Here, we were only able to code two TTSM among the 123 that were directly oriented towards literally designing together. Both of these used materialisation as a strategy by proposing scaled or life-size models and plans to enable thinking and designing through material tools. In these cases, user-clients were more actively participating in the structuring of the built environment through their design actions.

4.3. TTSM related to social, communication aspects, and decision-making

Twenty-nine tools were categorised under 'C1.2 – Social/Communication/Decision Making' (defined as 'a process of decision making based on human communication, negotiation, and simulation in order to define a shared goal' (Lawrence 1993, 300)). When we superimposed this category with C2, we saw that four of them fell under 'C2.1. Knowledge-based', nine fell under 'C2.4. Presentation', and sixteen fell under 'C2.5. Communication'.

The four 'C2.1. Knowledge-based' tools in this category had a pedagogical orientation and were intended to share essential information with clients to support design communication — for example, by explaining technical drawing language and how to read architectural plans ($n = 4$). These tools aim to address the barriers clients and architects face when communicating design ideas, due to difficulties in reading technical drawings, for instance.

The nine 'C2.4. Presentation' tools in this category consisted of techniques, such as sketching, visual representations including plans, axonometric drawings, 3D drawings,

video animations, architectural models, and virtual reality. These emphasise a suite of both traditional and innovative representational strategies. While these tools used visualisation as a major and common strategy, most of them were well-known tools that can be considered as traditional representational and presentation techniques in architecture.

Iterative meetings (physical or digital), site visits, and real-time sketching potentially create space for negotiation and incremental decision-making. The use of shared online documents, annotated PDFs, and communication platforms enables ongoing feedback, clarifications, and updates. Storyboards, booklets, and presentations not only convey project information but also foster mutual understanding and trust by making the process transparent and participatory. Virtual reality is also highlighted as an innovative tool and technique that can enable clients to better understand the design before construction, compared to hard-to-read technical drawings. As a result, it enables greater collaboration and helps avoid misunderstandings.

Finally, the 16 ‘C2.5. Communication’ tools in this category consisted of relational communication tools. These were mostly presented as textual explanations providing guidance and advice. When oriented towards the user-client ($n = 5$), they aimed to help clients assess compatibility and clarify included services before signing, to explain how an architect builds a productive relationship with clients, to provide actionable tips for improving communication between architects and clients, and to empower clients to clearly communicate their vision to their architect. When oriented towards the architect ($n = 11$), they aimed to emphasise the importance of listening to clients during design development, to stress the importance of a positive first meeting, to provide insights and instruction for developing a strong architect–client relationship, to build and maintain trust, to help architects articulate their value and communicate effectively, and to warn architects about potential pitfalls in client relationships.

4.4. *TISM related to architectural processes, management, and coordination*

Fifty-one tools were categorised under ‘C1.3 – Management/Process/Coordination’ (defined as ‘the scheme of activities, actions, and plans to achieve defined goals’ (Lawrence 1993, 300)). When we superimposed this category with C2, we saw that forty-six of them fell under ‘C2.1. Knowledge-based’ and five fell under ‘C2.5. Communication’.

When we take a closer look at the 46 ‘C2.1. Knowledge-based’ tools in this category, we see divergent aims, ranging from helping user-clients find the right architect to informing, guiding, and educating clients about architectural processes.

Most of the tools focused on explaining to clients what to expect from the architectural design process and its steps. These tools were found to be useful for preparing and supporting user-clients who are not familiar with architectural services, the architect’s work or what to expect when engaging in design and construction.

Nine of these tools focused on guiding clients in finding an architect, with three of them being directories from architectural chambers designed to connect clients with local architects. The others primarily aimed to highlight important considerations to help clients make informed decisions when choosing an architect. Besides textual explanations, we also found guidance in the form of a checklist.

Additionally, we observed that some of the TTSM aimed to clarify both the architect's role and the client's role, helping clients become effective participants in a construction project and work successfully with an architect. While most of these tools focused on the architect's role, some also highlighted the contractor's role and position within the process ($n = 2$). We also found tools addressing legal aspects of the process and clarifying the responsibilities of different parties. Some of them outlined potential risks and provided guidance on what to do in the event of a dispute ($n = 3$).

4.5. Inductive dimension: mediation

The analysis of coded tools and strategies also revealed an emergent dimension best described as mediative ($n = 33$), which did not find a place in the first C1 or C2 coding scheme. This prompted us to propose, inductively, a new dimension titled 'Mediation'. These tools and strategies aimed at translating disciplinary knowledge, professional roles, and project constraints, as well as architectural culture into accessible formats, fostering laypeople's understanding and cultural accessibility between architects, user-clients, and the broader public.

Among these, 11 tools specifically targeted the augmentation of user-client agency by improving understanding: they clarified architectural jargon through lexicons, explained the architect's roles and missions, presented legal or procedural information, and offered accessible overviews of the architectural process as a whole. These tools aim to pre-empt misunderstandings and ease the friction often seen in early project phases. Within the mediation dimension, the most prominent strategies are those designed to bridge divergent viewpoints, clarify misunderstandings, and create shared meaning throughout the architectural process.

In addition to targeted client support, broader mediation tools ($n = 22$) addressed the general public. These include formats such as humorous guides ($n = 5$), open-building or site tours, exhibitions, and other cultural and artistic activities and documentation. Their aim is to increase collective literacy around the architectural habitus and expand cultural familiarity with design practices.

The mediative dimension, as revealed by this inductive phase of coding, functions as a meta-level support for the architectural process: it sustains participation even in moments of asymmetry or misunderstanding, fosters trust, and opens up channels of engagement that are not strictly project-bound. By strengthening the user's cultural and cognitive entry points into architecture, these tools serve to rebalance the expert-layperson dynamic in a more sustainable and inclusive way.

5. Discussion

5.1. An emphasis on knowledge

Our dataset shows that the tools currently available in the grey literature, which are intended for user-client use, mainly aim to fill the knowledge gap of user-clients or the general public in relation to architectural processes, techniques, and tools.

For example, several glossaries and lexicons identified in our corpus, some of which are visually aided, enable the recognition of architectural, landscape, and urban elements

through illustrated definitions. These tools primarily operate within the ‘*Mediation*’ dimension and indirectly contribute to the ordering of the built environment, both spatially and temporally. By making architectural vocabulary accessible, they support familiarisation with disciplinary concepts and reduce semantic asymmetries. However, their function remains largely educational: they equip the public and therefore user-clients with interpretative keys but do not necessarily create spaces for negotiation or shared authorship.

In the domain of ‘*Design/Activity/Ordering*’, pre-design questionnaires constitute another prominent example. These structured tasks aim to gather information about clients’ needs, lifestyles, and aspirations in order to inform an initial design proposal. While they formalise client input and provide a clearer starting point for collaboration, they often operate in a linear logic: information flows from client to architect, who subsequently translates it into spatial propositions. The decision-making framework itself generally remains architect-led.

Other examples include online advisory articles, such as the ‘5 Tips for Good Communication Between Architect and Client’, which provide practical guidance aimed at improving relational clarity and managing expectations. These tools foreground communication quality and mutual understanding, yet they primarily function as prescriptive guidance rather than as interactive or co-constructive devices.

While these tools can be useful for addressing knowledge disparities and bridging the gap for user-clients in the architectural realm, we argue that architectural practice can benefit from tools that not only aim to inform user-clients but also place them in a more active and engaged position within the architectural design process.

Our analysis suggests that tools fostering more active participation either (i) enable the externalisation of lived experience, allowing clients to articulate spatial needs through daily and hands-on practices rather than through abstract architectural categories; (ii) support iterative translation mechanisms, creating intermediate artefacts (diagrams, scenarios, and comparative options) that remain negotiable rather than finalised; and/or (iii) make roles, constraints, and decision boundaries explicit, clarifying what is open to negotiation and what is structurally constrained.

5.2. Going beyond architectural representations

The presentation tools remain rather traditional (such as sketches and technical drawings) and can be difficult to understand, interpret, or engage with for user-clients (Chuang and Chien 2021; Norouzi et al. 2015). Such tools risk operating in a ‘one-way’ mode, providing information to the user, but rarely creating feedback loops or mechanisms for users to adapt, question, or shape the mediating content in return.

Meanwhile, 3D digital models, animations, virtual reality walkthroughs, and screen-shared plans make spatial and material choices more accessible. While these tools can bridge the representational gap between architects and their user-clients, foster client understanding and participation, their use is often constrained by cost or perceived complexity. Besides, to enable participation, these tools need to go beyond representation and include modelling, doing together, as well as evaluation elements to enable co-design and to ensure the mitigation of risks of misinterpretation through making and dialogue.

5.3. *Too little space for designing together*

We suggest that architects and architectural practice need to go beyond traditional and presentational techniques to foster more active and meaningful user-client involvement in design. While we see that tools such as questionnaires, mood boards, inspirational imagery enable user-clients to share their needs, desires, and visions with their architects, there are far fewer tools that move beyond verbal expression and translation to enable co-design, co-production, shared authorship, or collaborative negotiation. Pre-design questionnaires, for instance, structures client input but ultimately feeds into a design process that remains architect-led. Likewise, communication advice articles promote relational clarity but do not necessarily create shared design artefacts.

While previous studies have put forward the extensive use of modelling tools by architects (%90,1 according to Weytjens, Verdonck, and Verbeeck 2009), this study showed that they rarely actively collaborate with user-clients in modelling but rather through presentation. A few tools such as real-size plans and ready-to-use model kits give some hints towards a more participatory architectural practice.

Our results showed that even though the housing context's special circumstances, such as clients also being the users of the future building and engaging in some kind of unstructured co-design process, there is little space for actually designing together. In this sense, the lack of evaluation tools also suggests a need to reconsider and develop approaches that support meaningful engagement and feedback mechanisms. This would both enable and ensure involvement in design processes by fostering continuous alignment between requirements and design within the problem-solution space (Dorst and Cross 2001).

This study investigated grey literature and highlighted a gap between research and practice. Despite the growing body of participatory approaches in design research, we observed that these have not sufficiently penetrated architectural practice. Architecture can learn from and engage more with participatory practices in professional practice. The use of participatory tools not only can enhance the client's understanding but also can foster more collaborative and inclusive design processes.

5.4. *Opting for inclusive practices*

Most of the tools in our dataset were based on traditional modalities and mostly based on verbal explanations or architectural representations that require specific skills such as reading a plan. Mediation strategies for less literate, marginalised, or differently abled users are underrepresented, as are tools designed for multicultural or multilingual settings.

Furthermore, few tools explicitly differentiate between user-clients with varying levels of architectural literacy, prior construction experience, socio-cultural capital, or digital competence. The majority appear to assume a relatively homogeneous, motivated, and cognitively available client profile.

We argue that it is urgent to question and introduce tools that can address different user and client profiles into architectural practice contexts. Future research could investigate adaptive or tiered toolkits calibrated to different user profiles, thereby preventing participation mechanisms from inadvertently reproducing new asymmetries.

5.5. *Being prepared to frictions and relational aspects*

While we traced some rare tools addressing potential risks as well as what to do in case of a dispute, we argue that there is a shortage of tools embedded at key decision points or critical moments of friction throughout the project lifecycle, such as during budget negotiations, major design pivots, or construction site disputes.

In addition, we identified a large number of knowledge-based tools under C1.3 Management–Process–Coordination in our dataset, highlighting the importance of these issues in the design process, particularly in preparing and informing clients. We had expected to find tools within this category that would also fall under C2.6 Structuring (to organise the design process), extending beyond mere information provision to enable forms of co-management in projects and processes. However, no such tools were identified in our dataset. This absence once again underscores the need to move beyond informing towards more collaborative forms of process co-management.

Similarly, only a few tools address the emotional and psychological mediation needed in high-stress phases, for example, when projects face setbacks, interpersonal conflict, or deep habitus shock.

The transversal category of ‘Mediation’ identified in our analysis plays a crucial role here. Tools such as illustrated glossaries, explanatory communication guides or exhibitions, and visits do not directly shape spatial outcomes, but they contribute to building shared interpretative frameworks. By explicating architectural culture and vocabulary, procedural norms, and professional expectations, mediation tools reduce cognitive and symbolic asymmetries between architects and user-clients.

In contexts of habitus mismatch, such shared frameworks can function as preventive devices against relational friction. They reduce the risk that professional hesitation is interpreted as incompetence, or that client uncertainty is interpreted as indecisiveness. In this sense, mediation shapes the relational infrastructure within which spatial decisions are negotiated.

While relational communication tools that we traced tried to highlight the importance of a good architect and user-client relationship, they remained textual explanations and guides. There is potential for tools (e.g. role-play scenarios, empathic storytelling, and conflict resolution protocols) to mediate not only knowledge but also trust, empathy, and psychological safety. Providing such tools can also be useful to prepare both parties for the relational aspects of the architectural process and foster stronger relationship management.

6. Conclusion

In this study, we investigated the tools, techniques, strategies, and methods (TTSM) that can facilitate the involvement of user-clients in the design of single-family dwellings. We collected, coded, and categorised a total of 123 tools from grey literature that can support collaboration and interaction between parties, helping to bridge the gap between architects and non-experts.

Our analysis of TTSM used in architectural practice reveals a broad spectrum of tools, and we present them by focusing on four areas they support: (1) Design, Activity, and Ordering; (2) Social, Communication, and Decision-Making; (3) Management, Process,

and Coordination; and (4) Mediation. Our overview highlights the recent grey literature concerning the practical and systematic use of TTSM in architects' interactions with user-clients.

While many tools effectively address knowledge sharing and process clarification, our findings reveal a predominance of informational and advisory tools over genuinely active participatory mechanisms.

Our results underscore the importance of tools that support knowledge sharing, clear communication, and engagement, as well as needs related to project management. We highlight the lack of tools for designing together and the need to go beyond traditional representational modalities that can be exclusive due to knowledge disparities and varying abilities among user-clients. We also emphasise the importance of supporting the relational aspects of architectural processes.

This study helps to valorise and give visibility to some of the existing tools in the grey literature and offers practical insights into how architects and architectural firms can enhance collaboration and user involvement. We also hope that our study will serve as a basis and framework for the development of new tools that can further nurture the architect–user–client relationship and support co-design. As this research is based on document analysis of open-access grey literature, future investigations could examine how such tools are actually implemented in practice, how they are perceived by diverse user profiles, and how they influence relational dynamics over time.

Note

1. In Bourdieusian terms, habitus manifests as tacit knowledge, which is objectified within a field (a relatively autonomous social sphere) and subjectified, internalised, and embodied by its agents through education. It guides agents in their practices within the social world (Sapiro 2015). Each agent in a given field (game) takes action with a 'feel for the game' (habitus). This 'feel for the game' 'produced by experience of the game', within the field and its 'objective structures', but it also refers to a subjective 'direction, an orientation, an impending outcome' held by agents (Bourdieu 1992, 66).

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Author contributions

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