Scaffolding practices: A study of design practitioner engagement in design education

Janet McDonnell

Central Saint Martins, University of the Arts London

j.mcdonnell@csm.arts.ac.uk

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Abstract: The paper presents a study of tutor-student design reviews that form part of formal Industrial Design education. It is motivated by interests in how design expertise is acquired through experiences of designing and how novice designers are assisted to develop their own positions as designers. It explores the ways a professional designer tutor directs, guides and encourages students' engagement with a design task, and presents them with opportunities to develop their own design values, preferences, and design sensibilities. It uses the empirical data to draw attention to how the potential of design proposals as rhetorical instruments to serve both designers 'own thinking and the presentation of their designs to others is a prominent theme in the professional designer tutor's engagement.

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Professional designers have to contend with the complex and unpredictable problems of practice. Although design professions are not unique in this respect, designers' practices, the strategies they learn, and the ways in which they acquire competence are fundamentally influenced by the nature of design tasks. In essence, 'any design process can unfold in an infinite number of directions … first judgments in conjunction with a systematic assessment of the design situation codetermine the stance of the designer in relationship to that which is being designed' (Nelson & Stolterman, 2012: p.245). The central role of judgment not only positions the designer as the one who shapes the design through the way s/he frames the task, but also implies a necessary awareness that choices have been made and that they have consequences. These relations between designers, designs, and design justification, in turn, have consequences for how design skills are acquired. In the context designer formation, Donald Schön's 'Educating the Reflective Practitioner' (1987) presents extensive explication of the case for why experiences of designing, through the 'studio', or through project work, are deemed critical to formal design education. The characteristics of experiences that offer the potential for becoming more skilled at designing, and how one might assess their presence and precise contributions, continue to engage

pedagogical researchers. Among the matters of interest is what goes on in the interaction between novice designers and those who teach or coach them; a concern to understand better what are the competences novices are acquiring through practicing their craft and being critiqued in the process. The goal of the research reported here is to contribute to better understanding of what may be contributed to designer formation by one particular type of educational experience, namely, the formative review of individual students' design work by a design practitioner engaged as tutor.

On the one hand, novice designers must develop a command of technical matters and the norms of practice in their discipline. They submit to inculcation to achieve this end. On the other hand they need to develop their own sensibilities; to develop their own values and preoccupations and the confidence and ability to manifest these in what they design. Professionals have to take responsibility for what they propose; becoming a design professional therefore implies finding one's own 'place' or 'voice' and being aware of what that is and the consequences. The study presented here examines the face-to-face interactions between a professional designer and some of the student designers he is tutoring to expose what his critique offers them. It comprises a close examination of a small number of 1:1 design reviews to explore how the students are presented simultaneously with opportunities to practice designing, to find their own voice as designers and to learn what is expected from them as members of a profession. The broader motivation for the study is an interest in how working on design projects serves to develop novice designers' competence as practitioners and their understanding of what becoming a designer entails. The paper first describes the material analyzed and the setting in which the design reviews take place. The ensuing analysis is in two parts. The first is an interpretation of the conversations between tutor and student; it draws attention to the repertoire of roles the tutor plays during the meetings. In these roles he retains control over the interactions that take place, conforming to established social practices in the pedagogical setting. The interpretation of the tutor's performance is presented through the lens of prior work that has characterized role profiles for tutors operating in a design studio context. The second part presents particular observations that arose *as a result of* examining the material with the broader motivation outlined above. In particular, attention is paid to how the novice designers are encouraged to use their emerging design ideas as resources for the development of their eventual design proposals and justify them to others. To do this the notion that designs serve as *rhetorical instruments*

(Buchanan, 1989/1985) is introduced to draw out some very particular ways, in which the novice designers are invited to see how Nelson and Stolterman's notion that 'process and outcome are entwined and equally important to the designer' (2012: p.243) can play out in their practice. It is important to emphasise that in both parts of the work attention is being drawn to the tutor's interactions with the students and their work as *opportunities* for the student designers to learn about designing and as *invitations* to explore their own stances. It is beyond the scope of the study, which is limited by the empirical data analysed, to make claims that these particular encounters are causally linked to specific advances in students' proficiency as designers.

1. Data and approach

The data examined forms a small part of the large DTRS10 shared corpus (Adams, 2013). It comprises five single view-point video recordings and transcripts of design review meetings. In these one to one meetings the tutor, Gary, meets each of five industrial design students (Todd, Lynn, Adam, Alice and Sheryl) at two key moments in a semester long project (dubbed ID-jr) to design occasional-use 'quirky' seating to complement the traditional comprehensive office furniture range of an external client. 'The design project is client inspired, and after the final presentations the client will select one or more students for a design award and a summer internship.' (Adams, 2013, p.24) Two of the recordings relate to Gary's first reviews (1-ID-jr) with Todd and Lynn respectively R1 (duration 20 mins.) and R2 (26 mins.) and three relate to second reviews (2-ID-jr) with Adam, Alice and then Sheryl; R3 (16 mins.), R4 (21 mins.) and R5 (only a 5 minute fragment recorded). Quotation of fragments of conversation below are italicized and use the labels R1-R5 with transcript timestamps, thus R2:18 refers to an exchange during the 18th minute of the first review meeting between the tutor and Lynn.

1.1 Rationale for data selected

There are many different legitimate approaches to research which *starts* from a common data corpus. The introductory chapter in the edited collection of contributions to DTRS7 (McDonnell & Lloyd, 2009) discussed these in some detail. Here, the research goal outlined in the introduction influenced selection of the data examined. The students are at a relatively advanced stage in their formal education majoring in Industrial Design. One is a graduate student; the others are in their third year of a four-year bachelor programme. Their project has an external

client. There are stakes for the students taking part beyond fulfilling educational assessment: namely, the opportunity to compete for a prize and the award of an internship at the client company. This project, therefore, gives scope for students not only to gain technical knowledge but also to apply it within a credible professional context. The task requires them to develop designs to meet a brief, and to communicate these in a setting beyond the academy. This scenario, thus, offers an opportunity to inspect an educational experience that is expressly intended to support students' acquiring technical know-how, whilst simultaneously developing their own design values.

The collection of recordings relating to this project also includes presentations to clients (3-ID-jr and 5-ID-jr); these show the clients' interactions with the students are suggestions, clarifications, and encouragements focused on the design proposals. The clients are concerned with seeing designs that meet their brief: their interactions focus on the quality and potential of the design proposals themselves. In contrast to the recordings of these presentations to the clients, the recordings relating to the first and second design reviews between each student and the tutor show a richer variety of subjects of attention. At these two review stages, the tutor moves fluidly beyond direct critique of any particular design to encourage students to step back, to reflect on their designs, to evaluate their potential, to think differently about them, and to develop self-awareness of themselves as designers who have particular preoccupations and enthusiasm that can, and should, influence what they develop and propose. The differences in focus between the clients and the tutor is not surprising as we might expect the tutor's concerns to be with how the design project can be made to serve as an opportunity for learning about the practice of designing whereas the clients' concerns are with how well design proposals respond to their brief. Recordings of the tutor's third, and final set of review meetings with the students (4-ID-jr) during the project show a focus on technical matters almost exclusively as he advises them on finalising the development of the designs they have selected to present to the clients.

The broad characterization given here of the topic orientations of the design reviews at each of the stages is consistent with that of other researchers' inspection of the same data (cf. Gray and Howard, 2015, for example). The five meeting recordings selected for inspection present an opportunity to draw out what the tutor is doing in his formative design reviews to direct, guide and encourage students to accomplish the project they are undertaking and to see how he uses

their work as opportunities to encourage them to explore and develop their own professional stance (Nelson & Stolterman, op.cit.) towards design.

1.2 Approach to interpretation

The interpretation of the five design reviews selected is based on a close inspection of what the participants *say*. The conversations, as discourse, are constrained by a number of factors. There are physical and practical constraints that include the locations of the meetings, how long they last, and how the topics of discussion are confined by prescription of the design process within which the review meetings play a formal, stage-delimiting role. These aspects of the events interpreted are described in the next section to set out the context in which the conversations take place. It is also understood that the discourse is shaped by being played out in what Gray (2014) describes as two fields of action: one oriented towards the academic community (the interlocutors are performing as tutor and as student), the other oriented towards professional behavior (here professional furniture designer and neophyte designer). Gray's work includes extensive elucidation of the potential for interference between these two fields of action. Here, however, it is simply recognized that we are inspecting how a professional designer tutor performs design reviews conversationally. With this in mind, prior research from the setting of design studio crits, in which practicing designers traditionally participate, is used as a lens for closer inspection of the types of exchanges taking place.

Much of the research into design crits (e.g. Sacks (1999); Heylighten & Neuckermans (1999); Uluoglu (2000); Oak (2000)) examines resource-intensive studio experiences in which students' individual progression during a project is served by frequent, intensive, personal attention from a studio master. For example, Goldschmidt, Hochman and Dafni characterize the studio experience in architecture as typically, 'meeting two or three times a week for a number of hours, during which students present and discuss their work in progress with their teachers and sometimes also with classmates and guests' (2010: p. 285). Despite some differences in context, three types of roles, identified by Goldschmidt et al**.** (2010) as 'tutor profiles' - based on their literature review of tutoring in the design studio context - were used to organize the different types of conversational exchanges identified in the design reviews inspected here. They are presented, organized in the same way, in sections 3.2-3.5. The three profiles are: tutor as source of expertise

or authority; as coach or facilitator; and as 'buddy' – one who provides encouragement and 'helps in socialization into the professional community' (op.cit.: pp. 286-287). The descriptions below are a result of identifying the role the tutor assumes from moment to moment in the conversations and then closer inspection of how each role is manifested. This reveals a range of conversational strategies at play and fluid movement between roles during each design review. Section 3 below sets out the results of examining the conversation in the design reviews. Since the broader motivation for the work is to explore how working on design projects serves to develop novice designers' proficiency, and this entails a designer self-consciously developing their own 'stance in relationship to that which is being designed', the concept of designs functioning as *rhetorical instruments* was overlaid on the material analysed. This allowed the construction of an account of the tutor-student interactions in terms of how the design proposals the students were supported in developing were being made to serve as instruments for *design reasoning* through the conversational interventions of the tutor. This account is presented in section 4.

2. The design reviews in context

2.1 Constraints of place and time

The design reviews take place in work-rooms where other students and staff are present. The environment is noisy: there is background disturbance from others' conversations and comings and goings through the space. The tables where sketches, images on computer screens, or 3-D models are discussed are cramped and cluttered by other objects. The video is recorded by a researcher who is present during the recording, usually filming from a static position, but occasionally moving round the tutor and the student while their conversation takes place. Despite the apparent shortcomings of the immediate environment, the interlocutors do seem to be able to focus on the matters they are discussing, rarely indicating awareness of either the video-recoding taking place, or the surrounding activities.

Whilst the locations are places in which the students do some of their work, there is not a sense of their ownership of the space: we are not seeing the students being visited by the tutor at their 'own' desks in a dedicated workspace. The design reviews do not occur in what is conventionally understood as a studio setting that has territorial connotations (cf. reference to

'guests' quoted below). What is in common with the 'studio' experience is that the students are independently developing designs to address a brief. A second distinction is apparent between one to one crits in the 'studio' and the design review data examined. Here, students meet with their tutor only at key milestones in their design process - outlined below. The tutor reminds the students of the purposes of each meeting and what progression outcomes are necessary. So, whilst the meetings help students to shape their ideas (formatively), they also play a summative role, not as formal assessment points per se, but to mark critical transitions between phases of the design process the students are following. That design process is now briefly described, drawing on the characterization supplied with the dataset (Adams, 2013: pp. 26-30) supplemented by evidence from the explicit references to tasks made by the tutor, Gary, during the meetings themselves.

2.2 Prescribed elements of the design process

The students are working on this design project in parallel with pursuing other components of their formal education. They have a design brief from external clients who design, manufacture and retail office furniture. The students have examined the company's current office furnishings ranges and 'what the competition is doing'. They are tasked with preparing a set of ideas to discuss with their tutor in a first (1:1) design review (1-ID-jr) with him. In this session they review their initial ideas with the specific goal of identifying five concepts for further development. During these meetings the tutor accomplishes a number of things including prescribing how to go about the next task. He tells them to spend two hours on each idea, to develop each as much as possible, to think about seating ergonomics (so function) at the scale required for accommodating a sitting person, and so on. He tells them to have a 'hard stop' after working for two hours on each concept.

The purpose of the second set of review meetings (2-ID-jr) is to select three from the five developed concepts through discussion with the tutor. These three alternatives are to form the basis of short, 'elevator pitch' presentations to a small group of client stakeholders. These 5-minute presentations and resulting questions and discussions (3-ID-jr) make use of slide presentations, foam prototypes and story-boards developed for this purpose by each student. These presentations are followed by production of full-scale mock-ups and/or models to develop

the students' designs further (the milestone related to this activity is dubbed the 'look-like' desk review (4-ID-jr) - 1:1 with the tutor). Following this students prepare and present (5-ID-jr) their final design proposals at the client premises to an audience comprising the tutor, client stakeholders and their student peers.

The stages in the design process are unambiguously prescribed for the students with the five reviews above situated at key transitions in the focus of attention. The process they follow fits the engineering design process model attributed to Cross (2000) reproduced in Figure 1 on the left, annotated on the right to show how the main tasks for this project map onto it. The particular instructions leading up to and following on from I-ID-jr, 2-ID-jr and 3-ID-jr (tasks during and goals between) are the instantiation of the model's feedback loop.

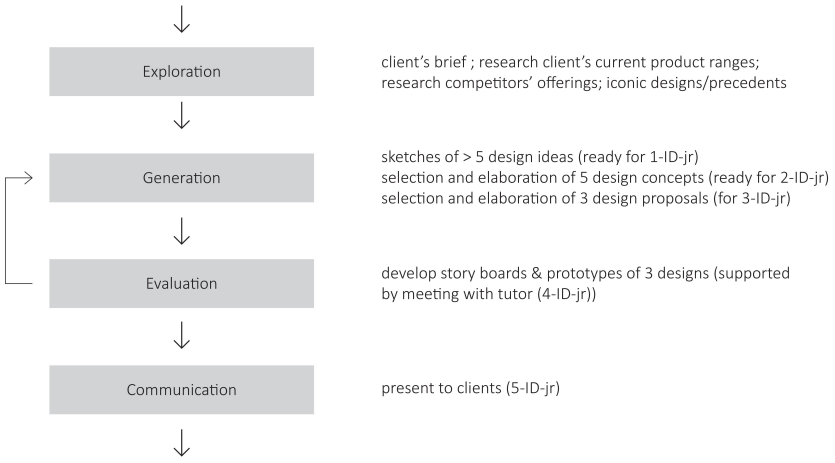

Figure 1. Underlying design process with annotations for the ID-jr design project (flow at left from Dubberley (2004: p.30) attributed to Cross (2000))

3. An examination of the design review conversations

This section characterizes the discourse between the tutor and his students by paying attention to the roles the tutor performs conversationally. (A larger collection of examples for each of the conversational strategies drawn out in each sub-section below can be accessed in McDonnell, 2014). Section 3.1 briefly indicates what the tutor does to set the agenda for each review and

place it in the context of the project as a whole. He moves between telling students how to proceed and encouraging them to develop their design concepts and make choices. The prior categorization of teaching roles/profiles introduced in section 1.2 is then used to characterize how the tutor engages with the students during the design reviews. In the literature on tutor profiling there is usually some hedging about pigeon-holing individuals, Goldschmidt et al. phrase it thus, 'No design teacher has traits of a single profile only, but the classification is viable on the basis of the teacher's predominant traits.' (op.cit.: p. 287). Looking at the video-recordings of the tutor in action with these profiles as sensitivities, we see that he moves proficiently among all these three types of engagement, nurturing the novice designers' development across several fronts seamlessly.

Overall it is noticeable that the tutor's engagement with different students and their design ideas has a consistency about it, some key messages are put across but it is striking that he brings these into play for each student opportunistically – at moments when their enactment as design strategies will make a material difference to what they do. This suggests that critiquing concrete design proposals can simultaneously offer a way forward with a particular design short-coming or stumbling block and present an occasion to learn about professional norms more generally. There are parallels here with the research of others for example the exploration of critique in architectural design in which analogies have been identified as supporting both the solving of problems with tentative design solutions and the invitation to see what the design task might be differently – so serving problem setting (an aspect of the designer's stance) as well as problem solving (what is being designed) (Murphy, Ivarsson & Lymer, 2012). In making this observation and drawing parallels with others' work about the dual roles of some of the tutor's interventions it is not claimed that pre-meditation is at work. The descriptive exploration below can be read as an account of the tutor's display of skills based on tacit understanding of both how to tutor effectively and what professional design practice entails.

3.1 Prescribing activities and goals while also encouraging design reasoning

Close scrutiny of the talk between the tutor and his students shows a distinct contrast between doing and thinking, or put another way between processes and ideas. Gary often gives precise instruction about what to do: *you've got five concepts, try to give yourself at least two hours for*

development … in terms of height … whatever you think is with the requirements of the design brief, spend a couple hours on that and exhaust every single possibility and then stop and then go and look at this one work for two hours … then work on another one [R2:16]. This contrasts markedly with how he deals with students design ideas and the choices they need to make about how to select alternatives for development, and how that development emerges.

The tutor pushes each student to make decisions, guiding them in how to arrive at a point where they can do this when necessary. He does not tell them what to think, even when asked to do so explicitly. Here is one example, Sheryl asks: *So of these two which one do you think they would prefer to see?* [Gary responds:] *Well I don't, I don't wanna, you're the designer, which do you think? I mean there's some great simplicity here. This is, this is intriguing, ah but what I would do is I would maybe, this is gonna change because you gotta change some of your dimensions. See what it looks like … develop that far enough to where if you start losing the essence of what you consider a strong visual design* [R5:04]. We notice he not only says explicitly: *you are the designer what do you think?* but also more subtly suggest that the decisions rest with Sheryl and are hers to make – he refers to *your dimensions* (subjective) rather than 'the dimensions' (objective) and then he tells her what to do to arrive at a point where *she* can make a judgment, using 'you' twice to convey agency: *develop that far enough … if you start losing the essence of what you consider a strong visual design*.

During each meeting, the tutor explicitly reminds each student of its purpose and the tasks ahead. This is usually early on in the conversation but may be mentioned more than once to introduce or repeat instructions: *our job is for you to have five concepts, directions that you want to go in today* [R2:00]; [after considerable elaboration] *so maybe what you do is you develop those two, and then where the time lands will help you decide whether you wanna* [develop /pursue other concepts] [R3:13]; *again the purpose of this* [selection of three concepts] *is to show'em* [the clients] *and get their feedback the concepts* [R4:06]; *you gotta narrow this down to ah your final three* [R5:01].

As part of this explicit rehearsal of what the process is, and where the meetings fit within it, the tutor reminds students what they have done so far - where they have come from in the design process - perhaps by alluding to the brief, the competitor products they have researched, or what

is the context and intention of the brief: *they're looking for something new and exciting* [R1:04]. He also reminds them where they are going next in the process, referring to what needs to be done with the selected design ideas to take them to the next stage (cf. Figure 1). In effect, by these means, he acts as project manager and inculcates them as to what a systematic design process entails for a designer.

The three following sub-sections enumerate some of the conversational strategies the tutor uses to perform three types of role in his meetings with students. In each case examples from the transcripts are given to illustrate the strategy identified. Seen in combination, what the tutor does is revealed as using a rich variety of means to achieve a balance between directing, informing and encouraging. This, in turn, places the onus on the student to make choices, develop their own stance, and assume responsibility for the choices they make. He, thus, supports them in developing their own judgment and in becoming self-aware that this is what they are doing.

3.2 A source of expertise and authority

The design reviews take place within the prescribed series of activities depicted in Figure 1. The activities and what to do to accomplish them, come as explicit instructions from the tutor (as illustrated above). He presents himself as an authority on the design process and what to do to develop students' design proposals through conversational turns that are instructional in form and tone.

Beyond the advice about how to proceed and what will happen next, the tutor positions himself as an authority over a whole range of technical matters related to the design brief, the clients, and the design of furniture. These include what the clients' expectations are, to Lynn: *why their product ranges have the properties they do: if you saw what N……* [the client company] *was like, it's very, very simple and the reason for that is that it's capital investment … these offices can be very expensive … and so they wanna get several years out of these office expensive systems … so they typically pick up kinda safe and neutral colors* [R2:01].

He 'transmits knowledge and know-how' (Goldschmidt's terms, op.cit.: p.286) including technical information about materials: *a lot of upholstery of a lot of, you know, comfortable chairs and what they'll do in a minimum of two different densities of foam … so you have one*

which is a heavier density which keeps your, that's your ergonomics, then you do something lighter that's gotta be, it's gotta be resilient enough to actually fill your form out [R2:20]; about furniture construction: *this form will probably be something made out of plywood, too, which we'll upholster that sorta thing … but you can on the inside here, potentially, do a veneer if you wanted to* [R2:13]; and similarly about manufacturing processes and their costs (and hence viability).

In contrast to the way the tutor avoids questions about what to think (examples in 3.1 above), he does answer technical questions, e.g. when Alice asks about the thickness of a cross-sectional element, with: *an inch?,* he responds definitively: *ah, it's gotta be more than that, I mean you might be able to get by with like a plywood and then you still got put foam. Give yourself at least two inches* [R4:19-20]. With Adam, he is equally forthcoming, Adam: *Do you think the base this way would be too unstable?* Gary responds: *um, this is , this is better… I would probably make 'em the same. Try to come up with the symmetry* [R3:02].

References to precedents are made, always in the context of drawing a student's attention to some feature that resonates with an idea the student is developing currently. These include reference to Herman Miller's spun chair, to encourage Todd to consider how people sit in 'fun' chairs [at R1:03], *I think with what you're doing like you could get some inspiration from it* at [R1:15]; the tutor refers to other features of the same chair in the context of a discussion with Adam to reassure him over his seat height [R3:01]; he alludes to Ron Arad's use of color to play up negative space in a way he is encouraging Lynn to consider [R2:03]; and refers to seating constructed entirely in cork, held in a museum collection when Adam is talking about using cork for one of his proposals [R4:10]. These references are examples of within-domain analogies, a well-studied source of object references during designing, which are often seen to be cued to structural relationships between the design at hand and the object drawn in as analogy (see for example Stacey, Eckert & Earl, 2009: p.369).

3.3 Coaching and facilitating

A distinction has already been made between how the tutor deals with what to do and what to think. He instructs on the former, he acts as coach and facilitator with respect to the latter using a number of conversational strategies. To encourage students' exploration in depth of their initial

design concepts he uses a variety of means to open up the proposals for further development including asking questions: *are these all fixed together?* [R1:00]; *and this, and this, this is part of the stacking thing here?* [R1:06]; *this one would be x number of pieces then all layered together or what?* [R1:08]; *what could you do to this to offer just another function?* [R4:00]; *well is there anything you could do in this area here minimally between this surface and that surface, maybe, to create a shelf?* [R4:01]. He offers suggestions which are hedged by indirection (e.g. 'maybe'), often by suggesting what *he* would do, rather than instructing the students' to take the action he introduces: *and I, I would develop an in-, independent piece, too, just as a pure form exercise* [R4:14].

When the tutor makes positive appraisals of proposals he draws attention to attractive features, inviting students to notice these and to consider how to work to build upon them: *this is really fascinating too 'cos again it becomes a, a design element on its own, a, when you're not using it* [R2:11]; *it's almost a visual kinetic, if I would sit on it, all of a sudden it changes the whole palette, like that's really cool* [R2:21]; *I saw that neat little tension, it creates tension which is kind of neat … you know? and so which offers, and then you could have different materials and colors* [R1:06]; *visually it's really attractive ... two people could be sitting here and just bring this around and throw, or they could just pull'em out and then sit back of each other* [R1:11]; *both these are really fun, both of 'em have great merit. This, um, you could play around with the height on this thing and your proportions* [R4:20].

The tutor avoids explicit negative appraisals, rather he makes these in an indirect way, again by drawing students' attention to features they should focus on: *this is really, really nice ... this is gonna be your biggest challenge is trying to get your geometry right* [R2:09]; *I don't wanna influence you on the curvilinear thing you got going on and an organic shape, but like once you start laying this out scale-wise then you might find out that maybe some of your proportions, some of these may not work for you* [R2:16]; *you got this energy, this dynamic opening in this really cool form. But if we work on the dimensions on that part, but like you still gotta have your cushions on the outside. It could, still could be minimal on the inside, in terms of upholstered. But I mean at least you gotta have some, some dimensions* [R4:09]. And here two more examples, first positive qualities then the cause of the negative, and finally a lot of hedging: *let me tell you what's really, what I like about this is it, everything but base. We based for the price*

to get this nice curvilinear biomorphic sort of flowing shape. And this, ah, I don't know it kinda puts in on a little, it creates to me, it creates a little design tension, a little bit, personally [R3:07]; *this one's got a really nice organic, ah, you're kind of drawn to it 'cos of the coolness of the form, and, and the fact that you can nest it. Um, but that's gonna take some time to get that … in the way you want to* [R3:12].

3.4 Being a 'buddy'

The tutor does not manifest as a buddy conversationally in direct ways. For example, he doesn't imply a shared set of issues to be addressed together by using the collective pronoun 'we'. He does use 'you' to instruct (3.2) and in coaching, and hedges advice to render it more coaching in tone using 'I' for suggestions he directs apparently at himself: *I like this element and that, that could be pretty cool as one, I probably would do two, I'd figure as a designer, pick one* [R1:17]. He does make explicit reference to what a designer has to do when he is putting the onus on the student to make choices, and particularly when he is avoiding invitations to chose for them he separates himself from them with phrases like 'you're the designer', these are not buddying conversational tactics. He does hint, by little indications, that he understands their plight, but again indirectly. Here is an example: *So, well that's the curse of being a designer, you have to sometimes stop and figure out what you wanna do* [R3:03]. He does occasionally make himself a fellow (designer) traveller by referring to his own experience, but not often.

Indirectly, the tutor sets himself on a par with the students by giving positive appraisals that are not justified. (So here we are contrasting this conversational behavior with the positive appraisals referred to above in section 3.3 where reasons are proffered to coach students on what needs their attention.) There are numerous examples: here are two to give the flavor. In response to one of Lynn's ideas, Gary responds with: *no, that's great*, followed by Lynn's; *and can sit here or you can sit here*, and Gary again responds further: *no, that's exciting, that's fun* [R2:06]; a similar series of uncritical positive responses comes with Todd's presentation of his initial ideas, Gary's turns at talk include: *I like that* [R1:00]; *that's ok that would be good* [R1:10]; *it's kind of fun* [R1:12]. However, since the majority of unjustified positive appraisals occur in the context of students showing their work and explaining their ideas they might equally be interpreted as serving to encourage students to elaborate what they propose prior to guidance – whether

instructional or coaching in form. Other researchers who have examined the ID-jr data have also concluded by different analytical means that Gary rarely performs the 'buddy' role (Goldschmidt, Casakin, Avidan & Ronen, 2015) overtly.

We should note here, however, that the students collectively are aware of Gary's credentials as a furniture designer. He has participated as a designer-tutor on their programme in the past; he has a web presence for his professional practice that includes examples of his furniture designs, client history, and so on. These professional credentials arereinforced for the students individually through his interaction with them in the role of design expert and domain authority (as we have seen in section 3.2). So, in some sense we can see that 'being a buddy' pervades all that he does with the students from the point of view that in the field of professional behavior, in the professional behavior he tutors them in, he is a 'kindred spirit and 'on their side' – as designers doing a job for a client.

Having examined how the tutor-student relationship is performed in the design review sessions we now draw attention to how what is going on can be seen as invitation to practice two inter-related forms of designer behavior. Both allow the student as novice designer to develop a sense and command of their design concepts and through this to explore, assert and assess their own design sensibilities. We focus particularly on the notion that emerging design proposals serve as resources for each other, and that, suitably juxtaposed, they can serve to draw attention to distinct qualities and features of design alternatives. As such, design proposals support design(er's own) reasoning and serve as resources for justifying designs to others and are a key element in designerly reasoning.

4. Reasoning with and through design proposals

The central role of the studio, of design reviews, and of many varieties of crits (peer and tutor) in design education is an acknowledgement of the fundamental role of critique in the practice of designing; in these settings 'individuals learn to think and act in a context of design judgment and situation appropriateness to develop and defend solutions (Gray, 2013: p.8). In this section attention is drawn to how the tutor presents students with the opportunity to see their designs as rhetorical instruments that can serve design reasoning. The motivation is to explore further what opportunities the practicing designer tutor's

engagement with design projects may be offering novice designers. 'The skillful practice of design involves a skillful practice of rhetoric, not only in formulating the thought or plan of a product, through all of the activities of verbal invention and persuasion that go on between designers, managers, and so forth, but also in persuasively presenting and declaring that thought in products.' (Buchanan, 1989: p.109) Buchanan, here, is drawing attention particularly to the rhetorical properties of *designed artifacts*, here we aim to reveal how the tutor exposes his students to the practices of skilled designers of making use of the same rhetorical properties of *design proposals* both during the design process (section 4.1) and in presenting (the case for) design possibilities to others (section 4.2). We can only suggest that what is presented below are opportunities for experiential learning, we have no means to assess whether any particular practice advocated by the tutor is put into effect nor whether there are measurable, longer term changes in the range of possible behaviours of any of the students.

4.1 Reasoning privately: design thinking

The tutor frequently directs the students what to do, indicating that the proposed actions will lead to productive movement through the design process through the insights that will arise from taking action. For example, he directs students to consider what the imposition of hard constraints (on the comfortable height range for seating) will do to the forms they have sketched out: *ok I would, again, now I would develop these in terms of scale … in fact I wouldn't mind seeing a scaled elevation front and a side view and a top view I mean, I'm talking about just taking a, a piece of paper and creating a, a grid on a piece of paper over it. Just, just, I just wanna make sure that you, you, you're going down that route to where you, you evaluate in terms of the, of real scale* [R1:19-20]; *you have to make your dimensions back scale to two and a half inches to get that, that scale to where now all of a sudden, 'cos if it's twenty inches high, it needs to be a certain amount deep and a certain amount wide, that sorta thing* [R4:14]. He proposes that resolving difficulties with how to handle aspects of a concept may be achieved by moving between design representations e.g. from 2-D to 3-D, advising building a foam model to test *the reality of dimensions* [R3:03], or advising using modeling clay to resolve how to progress with developing part of a form. Lynn says: *yeah but I don't know how to do the top part because it's kind of not a flat part, so how to sit on it*, Gary advises her what to do to resolve this *for*

herself by responding: *well maybe you wanna get some modeling clay* – perhaps Lynn was hoping for a solution rather that a route to find her own as she responds with surprise: *oh*, leading Gary to elaborate: *you wanna mess with* [the modeling clay] *I mean it, does, that's really something to think about, we're looking at a two-dimensional drawing. So you'd model a Hershey Kiss, and then you'd figure out you're gonna have to do a, I'm not gonna draw it, but you're gonna have to do something which* [he draws something] *you're still, depending on what your shape is, maybe your Hershey Kiss from the, from the front has a little bit more curvature, you know* [R2:18-19]. It is interesting just to note here that the tutor's suggestions to students that they shift between modes of representation and types of activity to make progress is a consistent feature of better quality design processes and frequent moves such as these are a distinguishing feature of expert performance in design (Cross, 2007: p.111-112). Frequent transitions cannot be learned as practice in the abstract; Gary gives his advice very concretely tied into some real dilemma a student is currently facing with a project. There is then also the opportunity for a student to learn a more general lesson here if s/he is able to step back and critically examine what has taken place.

As the tutor advises his students about what to do to develop their design concepts and choose between them, he creates opportunities for them to develop their own understanding of a number of things: that their own preferences are legitimate criteria for selecting in favor of one move over another; that their evaluation of the outcomes of moves may legitimately lead them to revise their own preferences and goals; and that meeting hard constraints such as seat height, stability requirements, the practicalities of physical construction and materials' qualities (e.g. strength, flexibility) and production costs may undermine the essential features of a concept they have in mind. Here are examples of Gary presenting these learning opportunities. Firstly, here is Gary advising Todd: *what I would do is I would do the, the easy simple form ones first, and the more complex ones later, and that way – 'cos you're gonna find out on your forms whether or not it's something you wanna work with* [R1:13], and a couple of minutes later: *and some you may find out you just got along you've gotta change it, which may lead even lead you to a better solution or you may say, listen now, this is wonderful thoroughbred , you know horse I had designed, now it probably looks like a mule and a goat* [R1:16], and then again: *now I would develop these in terms of scale ah, and, and you may find out that it may force you into some other forms you like even better* [R1:19]. We see the same pattern in conversation with Adam, Gary tells Adam to

work with a foam model and indicates what might happen: *and then when you do your foam model that'll be what you do before you design, well, you may discover another proportion or something, another element which you might wanna incorporate back into your line drawings* [R3: 03-04]. With Alice, discussing adding function to a bench form she likes, Gary asks about the potential for incorporating something between two surfaces. Alice expresses concern not to loose qualities she sees in the form, saying: *I just feel like it kind of ruins the form … 'cos this profile I really like the profile like this. I feel like if I add more material on there, it's just gonna ruin the relationship* [R4:01-02]. Gary offers practical information about what to do (*draw quarter inch elevations*) and about construction techniques that will be an acceptable cost: *to keep it less expensive and it's upholstered piece so they'll probably use plywood ribs, that sorta thing and then they'll skin in with a real thin wood veneer that they'll plump that up with upholstery* [R4:02]. This is followed immediately with advice: *that's the part I would work on, you wanna keep this design essence but now you have, you've gotta translate it into a buildable materials* [R4:02].

In all of the examples of the tutor's instructing to which we draw attention he is making allusions to the experience of designing. What he says renders acceptable the feeling of surprise at the 'talk-back' from a developing design, and legitimates allowing oneself, as a designer, to respond to this by shifting ambitions and expectations about what a design can, and cannot achieve, and what qualities it can have. The actions he instructs the students to take present them with opportunities to move their designs on, and at the same time encourage them to develop a designerly disposition to what emerges. By making them aware of what may happen he legitimates what they will experience and also *draws attention to it* (brings it to their consciousness). If this is effective, the students will learn to make use of their own evaluation of emerging designs not only to move on with the immediate task but as a resource for justification of the choices they have made (and the ensuing effects on the design) to themselves and to others. Once design proposals are appreciated as rhetorical resources it becomes possible to see how some of them may even serve this instrumental purpose as their raison d'etre – to be conjectures in the service of the generation of other design proposals, to be retained or discarded once they have served a purpose.

4.2 Reasoning publicly: design justification

The tutor gives the students the opportunity to develop their understanding not only of what constitutes, for them, the essence of a particular design concept but also how a design proposal constitutes an argument that can serve a persuasive function. He shows them that the presentation of choices to clients can serve as resources for authentic engagement that is aimed at helping the clients realize *their* goals; as means for them to come to appreciate the qualities of a designers' proposals. Beyond the rhetoric of words lies a rhetoric of things (Buchanan, 1989, p.105); a design concept functions, as does a designed object, as a practical demonstration of what might be, or what is the case. 'The designed object declares that it is fit for use … yet it is only an assertion; users may then begin their own deliberations about whether to buy it and how to use it in their lives' (ibid.). Gary shows students how to use their design proposals to serve persuasive purposes. Here are two moments that make his position on this clear. First, towards the end of the first review meeting with Lynn: *I would have something really simple 'cos it's, I call it the illusion of choice ... it's safe ... sometimes it's good for them* [clients] *to have something safe to compare it to* [R2:23]. The second, early on in the first review with Todd, is when Gary advises: *Always do something safe. Um, 'cos sometimes you never know how, what people are, how, who you present to, but there's a good reason for the safe too, is what it does if you don't have the option, I call it the illusion of choice. If you don't have that option they see all you're really extreme, they, they don't have anything that's gonna ground 'em to, to why, ah, why they like what you like* [R1:04].

The practice Gary advocates is to present clients with three choices: *what I always like to do is I like to have, you know, safe, medium and extreme to some degree. That's, that's, kinda it helps them* [R4:07]. He dismisses the giving of too many options as unhelpful and confusing, but he does advocate conveying openness about design variations within each distinct proposal to encourage the clients to see possibilities beyond rigid adoption of what is formally presented: *the purpose is to show 'em the concept, get their feedback, ah, and they can, they could say, 'well we think this is doable', whatever 'but may want to make this modification'* [R4:06]. He makes it clear that it is important to differentiate between alternative design concepts - the safe, the medium, and the extreme - and the potential for introducing variations that do not critically undermine the *essential* concept. This is a subtle matter that novice designers grapple to master.

Gary says to Alice: *they're hiring you for your vision, so you as a designer, when you look out against, and again, the landscape of all the competitors, where's the next step up? Again they* [the clients] *can … be 'me too', but they hired you to say 'okay let's be bold and these are the reasons why and this is, this is the essence of what I want to do', and be passionate about it, again you're the designer, lead 'em, and baby steps* [R4:07]. Two minutes later he advises Alice again, when she is expressing concern about the possible functions, beyond the 'first function', of one of her design concepts. Alice says: *I like that one* [concept] *too … the only thing with that it didn't have a* [second] *function* … Gary counters with advice: *if you run across a form which is, it has a lotta strength, as a designer, don't worry about the additional function* … [he praises its qualities] … *but the neat thing about that once you have talked to the* [client] *designers … you can say …'well you know I can make this functional by running some metal rods across here to add another material just if you feel like you need to do that, and it might give some additional support'. But be thinking about those things so you can say 'well this and this is what I was also thinking' … so somehow you need to channel them into an area which you think is your best design* [R4:08-09].

Gary recommends courses of action to his students that will generate what they need to make persuasive arguments about their design proposals. Playing off the different qualities and features of design proposals, one against the other, is a significant aspect of design justification. The idea of the 'safe' option serves an explanatory function. Explanations presuppose a question; they function to avert misunderstanding (Wittgenstein, 1953: §87). Professional designers know how to anticipate what their audiences will raise questions about and will often use an expected, but for some reasonable infeasible or dis-preferred design, to rehearse the arguments against an obvious, or routine, design response. The designs they use in this way serve as rhetorical devices, supporting persuasion - away from the described design as a feasible option in its own right - towards the qualities of preferred options by drawing attention, through comparison, to particular properties or qualities. Developing a sensitivity as to what needs to be justified about a design proposal and what can be left unsaid is a professional skill that requires an understanding of audiences: what their norms and values are, and their expectations and aspirations. Here, Gary reminds his students about the brief and the background of product ranges against which they are developing something novel and complementary. Against this backdrop, the case for a proposal is made by successful appeal to the audience. Gary directly guides his students in learning to do

this through explicit advice. However, he also helps them to acquire the material for persuasive arguments implicitly by the way he councils them to proceed with developing and responding to their design concepts in ways that invite them to become more self-aware of their own design thinking; specifically how they are generating ideas and evaluating them, or as Schön would have it: their framing, moving and reflecting.

5. Reasoning competently

Designers have to come to understand what can be called into question (Lawson, 1990: p.134); they have to establish the scope of their design intervention – what parts they have control over. The central activity of designing is 'understanding the field of the context and inventing a form to fit it', these concerns ' are really two aspects of the same process' (Alexander, 1964: p.21); Alexander's notion of fit and misfit embrace the idea that as an evolving design is evaluated, the designer understands better the qualities and short-comings of his/her design whilst *simultaneously* developing his/her understanding of the context. This is what is meant by the observed practice that trained designers focus on solution testing in order to better understand the situation their design is intended to address. Misfit is a relationship between a design proposal and the problem framed *by the designer*. So a designer's understanding of both - namely that which is designed and that for which it is designed - change as the design proceeds. Misfits claim attention – the tutor, in the meetings studied, is inviting his students to see that both shortcomings and novel aspects of a design, which come to light as a proposal is evaluated, serve equally as useful information that may help them, as designers, to proceed.

In the practice of design, insights about how a design brief might be addressed which come about through working on a particular line of enquiry (such as developing a particular design concept) do of-course influence the conception of, and response to the task as a whole. Noticing something in the evaluation of an idea may prompt or modify another avenue of development. In Schön's terms, this is reflection-*in*-action. Educating the reflective practitioner involves providing the occasions to learn to reflect-*on*-action. Gary's talk encourages reflection-*on*-action. This is a pedagogic strategy. Experiences like the ID-jr project are necessary to move towards competence as a designer – what we see here are suitable pedagogic interventions for the current levels of experience of these novice

designers. Using terms from the writings of Nelson and Stolterman (2012: pp233-234), these students have some *capacity* (facts and skills at their disposal); they are still developing *confidence* to take action, as they become more *capable* in producing designs.

Studies of design and other kinds of creative practice have revealed that some ideas serve entirely as resources to make others possible and may be discarded once that purpose has been served. Studies of architectural practice (Lawson, 2007: pp.65-66), poets' writing practices (Beatty and Ball, 2010), collaborative Fine Art practice (McDonnell, 2011), and text typeface design (Harkins, forthcoming) show that some practitioners are able to articulate their own strategies for scaffolding their creative practice with different sorts of devices. A variety of rhetorical mechanisms, like the often-referenced primary generator (Darke, 1979) serve creative purposes before being discarded once that function has been fulfilled. Making designs serve as sacrificial in pursuit of some (other) design outcome is a subtle aspect of professional practice.

Whilst the tutor's advice to students about evolving their design proposals does not explicitly advocate that specific designs be treated wholesale as sacrificial, he does invite the students to see that pushing through with detailed design for some design ideas - such as considering seat heights, strength of materials, and so on - can serve other ends. These include another subtle aspect of becoming a professional: namely developing a sense of what it *is* about the 'design concept' that is non-negotiable, from the point of view of the designer; what will irrevocably compromise the design, and what remains negotiable (McDonnell & Lloyd, 2014: pp. 349-350). Here, again drawing in the language of Nelson and Stolterman, we begin to stray into the territories of *competence* and of *courage* (op.cit.). And, in passing, we note again here (as in section 4.1 above) that the tutor's suggestions about action resonate with another characteristic of expert performance, namely alternation between working in depth and in breadth (Cross, 2007: pp.110-113). We can see him advocate pushing a bit deeper to explore some ideas to arrive at sufficient understanding to make a confident decision about whether, as well as how, to proceed with a particular line of development. Again, he does this by giving concrete advice to address a very particular circumstance at a specific moment in a student's work. We are not able to

say, on the basis of the data available, whether or not the student learns something transferrable to other contexts from this experience.

Individual professional designers rarely work in isolation and rarely design for themselves. A designer's need to explain his reasoning and to justify decisions, to communicate and co-operate with others, is an integral part of the practice of his/her profession. In moving from novice designers to competent ones designers become answerable for the choices they make (Dreyfus, 2001: p.36). This implies a certain level of awareness of what they have done and the decisions they have made and an ability to communicate this. Close examination of how Gary instructs his students shows us a highly skilled, nuanced set of activities which help to demystify how 'knowing how' is nurtured through careful navigation between modes of instruction using a rich variety of conversational strategies.

In section 3 a set of roles drawn from prior studies of practitioner designers critique of novice designers' work was used as a device for examining a tutor's conversational strategies in 1:1 design reviews with several of his students. Paying close attention to apparently unremarkable, everyday *academic practices* draws to notice phenomena that otherwise might be undervalued or overlooked. In this work, after drawing out the roles the tutor plays during the design reviews examined we have focused on how the tutor points to means for students to progress their designs and how he shows them that they can use their emerging designs as resources for their own design thinking, and, if they are sufficiently self-aware of their own reasoning, how this same reasoning, evidenced in design proposals, can be used to draw others' attention to qualities in their designs. These practices are characteristic of *professional behavior*. The professional designer tutor, operating within and across the two fields of action (Gray, 2014), offers his students opportunities to develop a critical awareness of what are the reasons for the choices they make and indicates to them how their own impositions - preferences, priorities, and so on - must play a part in driving their designs to a conclusion. By these means he plays some part in both their inculcation into the design profession and their exploration of what are to become their own design sensibilities.

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