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Citation: Young, Robert, McKelvey, Kathryn and MacLarty, Liz (2009) The Design Postgraduate Journeyman: Mapping the relationship between design thinking and doing with skills acquisition for skilful practice. In: International Association of Societies of Design Research 2009 Conference, 18-22 October 2009, Seoul, Republic of Korea.

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The Design Postgraduate Journeyman

Mapping the Relationship between Design Thinking and Doing with Skills Acquisition for Skilful Practice.

Abstract: The relationship between knowing, doing and skillful practice resonate in industry and design education. The connection between creativity, design and successful innovation practices in industry has been debated much recently, heightened by realization in academe and governments that we need ‘different ways of thinking and doing if we are to live well, prosper and safeguard the future’.

This paper addresses the question; how to understand more about the relationship of design thinking and doing with learning. It describes research to correlate design knowledge and skill with the pedagogy of skilful practice, thereby supporting pedagogical theory for the design practitioner learner. The research correlates Sennett’s review of craftsmanship as skilful thinking and doing, with Dreyfus & Dreyfus’s model of mental activities in the transition from novice to masterful states of skilful practice. It concludes by illustrating the critical transition points to inform educational practice.

Key words: Design Thinking, Craftsmanship, Skilful Practice, Pedagogy

1. Introduction

“The modern era is often described as a skills economy, but what exactly is a skill? The generic answer is that skill is a trained practice. In this, skill contrasts to the *coup de foudre*, the sudden inspiration. The lure of inspiration lies in part in the conviction that raw talent can take the place of training... We should be suspicious of claims for innate, untrained talent.” [15]

The relationship between knowing and doing and skillful practice have resonated as issues in industry and design education since the time of Wedgwood and the industrial revolution. The connected values of creativity, design and innovation and the relationship with successful product and service innovation practices in industry has been the subject of much debate in countries throughout the Western and Eastern hemispheres in recent years, heightened by the increasing realization of academe and governments that we need ‘different ways of thinking, being and doing if we are to live well, prosper and safeguard the future’ [10] and enter a new era of creativity and growth.

The Cox report [4] in the UK restated the connections and led to government initiatives to promote design-led innovation in industry and multidisciplinary learning in UK university departments between design, business and technology. While Cox conducted his review of creativity in industry Leitch [13] was also commissioned by the UK government to identify the optimal skills mix in 2020 to maximise economic growth, productivity and social justice, and to consider the policy implications of achieving the level of change required. His report, in 2006,

included the consideration; how to better integrate employment and skills services at a local level. He observed that some problems are attitudinal such as embedding lifelong learning and accepting shared responsibilities. He recommended setting up a new employer-led commission for employment and skills, which has translated quickly into various schemes to promote ‘employer engagement’ and work-based learning. Economic recession has further emphasized the need for better ways of thinking, and doing.

The UK Design Council has also been working with the sector skills council for the creative industries to set up a ‘Design Skills Alliance’ between design employers and educators to address the question; do we have the right skills to help the economy stay competitive into the future [5]. The ‘European Design Training Incubator’ (EDTI) is an EU network project focused on professional practice in design [8]. It seeks to benchmark design education and training in the context of lifelong learning. EDTI is running an online questionnaire to look at the domains in which designers are active. At the time of writing this IASDR paper, EDTI claim that two interesting highlights have already emerged: one designer out of three does not have a degree and although there appears to be a demand for a more multidisciplinary approach, designers seem to be moving towards greater specialisation.

However, the purpose of this paper is not to focus on the development of the right design skills or how they are benchmarked in relation to lifelong learning but to address a more fundamental question; how to understand more about the relationship of design thinking and doing with learning. The paper describes research conducted to correlate design knowledge and skill with the pedagogy of skilful practice, thereby supporting pedagogical theory for the design practitioner learner. Concepts of knowledge and skillful practice exemplified by Sennett’s [15] review of skilful thinking and doing, are contrasted with pedagogic theory, drawn from Dreyfus & Dreyfus’s model of the mental activities in the transition from novice to masterful states of skilful practice. It concludes by presenting a ladder of the critical transition points drawn from this contrasting theory, to inform educational practice.

The research methods used to develop this paper are based on the triangulation of three perspectives and associated methods by the three authors. X has adopted a design thinking perspective that combines literature review and philosophical debate of design knowledge and practice issues leading to sense making constructs to stimulate academic development. Y uses a design management perspective based on a design craft practice background and an academic role that seeks to develop an optimal, germane, contemporary postgraduate learning framework in the context of knowledge based learning and viable resources. Z adopts a design pedagogy perspective based on her research in the field of fashion design practice, where tacit knowledge and skills are acquired by osmosis and as a dialogue around practice [16,17] and her challenge is to convert these into explicit materials suitable for pedagogic reference. Together these perspectives and methods have been interwoven in this research to integrate the design; thinking, management and pedagogy perspectives with knowledge, skill and practice. The common concern is to develop design practice knowledge.

2. A Review of Concepts of Skill in; ‘The Craftsman’, by Richard Sennett

Richard Sennett’s seminal work on skills in society is an authoritative to this research [15]. This book asks two key questions: What are skills and what are the ways in which skills improve?

He shows that there are three issues at the heart of what is involved in becoming a craftsman (someone who

posses skills) today. That the concept of the craftsman has moved far from the worlds of material practices. Nowadays it includes computer programmers but there is continuity between those who worked with their hands in the physical world in the past to those who work in, for example the virtual world today! He argues skills are talked about and understood in a very narrow way and there is a limited sense of what we mean by being skilled.

Sennett referred to Diderot's philosophy [15] that mankind shares skills that grow from prosaic activities, there is high skill even in simplistic activities with a high degree of content. Diderot thought you could be competent only if you were the master of a craft! This led to the revolutionary idea of developing skills in everyone to help them do well in society. There are three issues still relevant to these ideas now:

- 1) The concept of making things concrete. Conventional wisdom concedes that it takes 10,000 hours to become proficient, i.e. get skilled through repetition and routine. You have to go over things again and again to generate a deeper level of knowledge. This acquisition of knowledge and skill allows us to vary our practice, obvious in the context of extemporisation by a musician. Therefore, skills have a narrative, a virtual quality of the everyday. They are something to be shaped and demand the questions: How to control or change them, or how to change circumstances to become more proficient. However, the problem nowadays is that the skills economy does not allow for this. The context prevents this concept of proficiency. People on short contracts cannot do this. Contractors live in a skills world without a narrative. Skills have become superficial and based on 'making do'. How then can we challenge institutions to confront this problem and how do we deepen skills through the narrative of work?
- 2) The second issue concerns reflecting on qualities. It was originally identified by Wedgwood then adopted by Diderot, that is; problem solving and problem finding. How to work out the logic of the job? The idea was based on the belief that as we get better at problem solving through skill, we get better at problem finding! In MIT in the USA higher levels of work are just as much interested in wrong answers (things that don't work) as right answers! Wrong answers lead to the question; if this is wrong, what is false? This approach understands the procedure of asking questions to improve knowledge and understanding! Yet theoretical education is organised against this. It only asks for right answers. You can't write a wrong answer on an exam paper. This problem exists in all educational regimes where belief is based on how to do something rather than how to investigate something. We ask people to say what they are doing rather than show/prove why it is right! Chris Rust found in his review of practice led art, design and architecture research [14], that research through practice is better at exploring the right questions to ask of a problem rather than to solve a specific question about the problem. Intrinsic problem solving and problem finding goes against the grain in most educational institutions, perhaps with the exception of art and design schools where this is valued as a practice, albeit implicitly.
- 3) The third issue concerns how we become more competent? What is the equilibrium in doing good work! Sennett revoked interest in Ruskin's concept of 'calm surrender' [15] to the object /process. This also follows Diderot's belief that in order to stay in control we need to embrace the phenomenon of surrender. Another way to look at this is to consider, when is it as good as it can get? To feel that we can't work on

something any more otherwise it will deteriorate. Sennett states that the kinds of people who never let go are those who end up degrading labour! He describes two different concepts for standards of skill; the ideal (destructive way) and the humane or best possible (equilibrium way), which connects to the concept of mentoring. Sennett suggests that in UK society we don't understand how to mentor, that is, how to help someone become better at a skill and we have problems arising from linking qualifications and skills. Having qualifications that are suitable to rigorous application of skills in a trade is very useful. The gap between qualification and skills equals the gap between craft and art: Art Schools look at the way to do things that can't be formulated! However, to do this we need to separate the world of qualifications from the process of presenting a skill, which involves showing rather than telling.

3. A review of pedagogical theory with respect to design practice

“Most students learn through doing, but others learn from exposure; a few learn from hearing or reading about design. There are even students who learn by imitating the work of other designers. All students learn by a combination of methods”. [12].

Kelly was a pioneer of graphic design education who firmly believed that effective teaching was about understanding what students gained by undertaking design problems and used ‘content, process and criteria directed toward learning’.

Marshall Gregory's writing on: ‘Curriculum, Pedagogy and Teacherly Ethos’ considered that practice had to be governed by two mental activities: firstly by criticism and secondly by imagination, the ability to visualise the performance or the skill not as it might be done now but in the future, differently and better after more practice.

“...while teachers feel pressed to cover more and more material in their discipline, what students need is time to make mistakes, to correct them, to fail and to try again... and they need teachers to help them view each failure as merely interim, not as a terminal judgement on their abilities.” [11]

As we saw above, Sennett takes a positive view of the repetition of learned actions. He pointed out that going over an action again and again, by contrast, enables self-criticism. However he believes that modern education fears repetitive learning as mind numbing. At primary and secondary levels it is afraid of boring children, preferring to present ever-different stimulation, thus depriving children of the experience of studying their own ingrained practice and modulating it from within [15,p38].

Ramsden [1] discusses three theories of teaching in higher education. He describes them as: Theory 1 – teaching as telling or transmitting. Theory 2 - teaching as organising student activity; Theory 3 – teaching as making learning possible. He advocates Theory 3 believing that we need to move towards student-centred approaches if we are to prepare students for a complex and rapidly changing world. Ramsden interprets theory 3 as ‘project based learning’, which is the theory that is broadly applied in the UK design education system and many other design education systems across the world. It is a reverse educational model compared to the majority of other professional disciplines where pure theory moves to applied theory and then on to practical application (Schon) and instead begins with practical problem solving, allowing a student to practice with ‘real-life’ scenarios, behaving as a traditional apprentice in learning a craft before being allowed to act independently. Such learning

allows the application of knowledge to the problem and the student to understand complexity of the problem through that application [1].

In UK higher education, pre-unitisation/modularisation allowed for a system where design subjects were taught in a way that allowed ‘repetition’ in project based learning – experience could be built upon by undertaking similar sequential design projects set by a practicing design lecturer, offering constructive feedback. It can be argued that this is still the case, but the modular system requires less academic staff input and the isolation of subject matter in modules, causing less continuity of progressive feedback from one module to another, not only in the same level but also from level to level.

Taking curricula in the School of Design at ‘A’ University as an example, the current ladders and critical transition points in design pedagogy are at the end of the levels 4, 5 and 6 in undergraduate programmes, where ‘levelness’ is pre-ordained in Programme Specification Documents. For example, the three undergraduate ‘levels’ for BA (Hons) Interactive Media Design are described briefly as:

1. Level 4 is initially diagnostic, consisting of basics of the subject, the design process, technical skills, design practice and thinking and progresses to learning and exploring the language and content of visual design elements – academic foundations.
2. Level 5 extends this knowledge into more complex processes and reasoning by analysing design directions through research and written comprehension. The student needs to be more experimental whilst developing skills by building on knowledge and skills gained in Level 4 – purposeful learning.
3. Level 6 culminates in professional practice modules, including reviewing future developments, concluding with the student’s own personal subject development and project realisation, which demands an understanding of the holistic nature of designing, demonstrating originality, individuality and capability - autonomous learning.

Within each level ‘Learning Outcomes’ are applied and used to measure the students’ attainment by the phrase ‘On completion of this level the successful student will be able to...’. Success must be measured by the student that passes the level with an average attainment of 40% or above and shows synthesis of all of the skills. This means that a very broad ‘range’ of skill acquisition and attainment is possible by students within any level. The skills being measured in the Learning Outcomes consist of ‘Knowledge and Understanding’, ‘Intellectual Skills’, ‘Practical Skills’ and ‘Transferable Skills’. Learning Outcomes are applied to modules and these modules culminate in assessment.

Perhaps the most useful model to help us link concepts of levels of study with stages of progression of mental activity commensurate with skill acquisition is that of Dreyfus and Dreyfus [6]. Their ‘Five Stage Model of the Mental Activities involved in Directed Skill Acquisition’ is built using the key elements; skill, cognition and situation understanding. They maintain that in acquiring a skill by means of instruction and experience, the student normally passes through five developmental stages which they designated; novice, competence, proficiency, expertise and mastery. They argue, based on analysis of careful descriptions of skill acquisition, that as students become skilled they depend less on abstract principles and more on concrete experiences. They

systematised and illustrated the progressive changes in a performer's ways of seeing his task environment and concluded that any skill training procedure must be based on some model of skill acquisition, so that it can address, at each stage, the appropriate issues involved in facilitating advancement.

Dreyfus and Dreyfus' approach was to take reliance on everyday familiarity in problem solving not as an anomaly, but as a pervasive essential feature of human intelligent behaviour. Therefore in their account of skill acquisition, rather than adopting the Piagetian [6] view that proficiency increases as one moves from the concrete to the abstract, they contended that concrete experience plays a paramount role and that skill at a basic level is produced by following abstract formal rules and that only experience with concrete cases can account for higher levels of performance. Their logical conclusion was that if concrete experience is necessary and sufficient for proficiency, then one has the option of dispensing with formal information processing explanations of skill acquisition for skilful behaviour. A detailed understanding of the stages through which skilful performance develops is essential to design training programmes and materials to facilitate high-order skill acquisition. The five skill acquisition stages are:

1. Novice: the skill performer initially learns to recognise objective facts and features, relevant to the skill without the benefit of experience and then given *rules* for determining an action on the basis of these features. To improve the novice needs monitoring to bring his behaviour into conformity with the rules.
2. Competence: the performer only becomes competent after considerable experience actually coping with real situations. Competent students understand their environment, are able to identify recurrent situational patterns and develop guidelines.
3. Proficiency: the proficient performer has increased practise of a wide variety of whole situations and determines situational patterns and their meaning in relation to the achievement of a long-term goal.
4. Expertise: previously the performer needed some sort of analytical principle to connect their grasp of the general situation to a specific action. The expert performer has a vast repertoire of experienced situations and each situation they encounter immediately dictates an intuitively appropriate action or fluid performance where all elements are involved in a single interdependent transaction. This is similar to the concept of 'Flow' proposed by Csikszentmihalyi [2,3] and the description of the nature and levels of skill in 'craftsmanship' by Sennet [15].
5. Mastery: is associated with intense absorption and takes place when the expert, who no longer needs principles, can cease to pay conscious attention to his performance and can let all the mental energy previously used in monitoring his performance go into producing almost instantaneously the appropriate perspective and its associated action' [6 p14].

Dreyfus & Dreyfus's five stage model can be mapped out as follows: The Novice must progress through prerequisites levels to higher levels. At the level of Expertise – actions and decisions are made without conscious reference to specific learning – and the state of intuition allows the fluid combination of actions in response to

different contexts.

Table 1

Mastery
Expertise - INTUITIVE
Proficiency
Competence
Novice

However, is it possible to relate Dreyfus and Dreyfus' levels of skill acquisition to the practice of designing?

4. A Practitioner's Journey - Design thinking and doing at postgraduate level.

Accepting Sennett's review of craftsmanship as skilful thinking and doing and Dreyfus & Dreyfus's model of mental activities in the transition from novice to masterful states of skilful practice, the authors correlated explanations of skills acquisition for design practice students by presenting a ladder of the critical transition points to inform educational practice. Reference was made to teaching approaches at undergraduate and postgraduate levels of study. The latter is based on a reflection of 2 years postgraduate study development at 'A' University, including reflection on work with students coming to the UK for study and the skills base they bring with them and how to attract graduates with highly proficient design skills to stay on for postgraduate study? The challenge is how do we educate and facilitate both groups to become the innovators and change agents of the future? This overarching issue is; how can we understand points of transition between undergraduate, postgraduate and continuing professional development to enable us to act as custodians of the knowledge and skill transition stages and provide gateways to access design practice knowledge.

Sennett described the workings of the Guild system and how historically the Guilds provided their member craftsmen with an infrastructure for the growth of individuals, but also crafted and grew the future of the guild, protecting its role in society and hence its succession. The role of the Master entailed not only being an expert and good at his trade but also responsible for the growth and morals of the Guild and its members. The progression from Apprentice –Journeyman – Master, as explored by Sennett has some correlation to the stages of making matters concrete, becoming problem attuned and expanding the senses. The authors have used this structure to explore and explain the transition point from apprentice to journeyman and map these against characteristics and requirements for postgraduate study.

According to Sennett once the apprenticeship was complete – the apprentice moved status to journeyman. At this stage the journeyman traveled around the country to get experience of his trade in context, and an understanding of his relationship to other communities of craftspeople. The journeyman status entailed; 'a larger understanding of how to use what one knows', and, of the relationship and responsibility to the community of craftsmen and to society generally. The journeyman travelled to foreign cities, acquiring the knowledge and skills, managerial talents and moral behavior to prove to master craftsman in other cities that he is 'one of them'. Sennett identifies a shift from imitation of procedure through repetition to managerial competence, the journeyman develops the necessary skills for future leadership, trust and worthiness, thereby demonstrating transference of skills from imitation and ritual to authority. This transition represents a process which is analogous to 'postgraduateness' and

illustrates related skill acquisition. Sennett explains the journeyman is training to respond to opportunities and has equivalence today with the modern professional migrant. The importance of the traveling nature of the journeyman is that ‘sedentary guilds became inert and corrupt, whereas, ‘the good master presides over a traveling house’.

The paradox is that once expertise is gained in the apprentice’s chosen field or craft – s/he returns to novice level at the next stage of journeyman. This time the apprentice is on a journey to understand what s/he knows in the broader context, but is armed with the knowledge of how to learn through doing. This paper suggests that a correlation can be drawn between the journeyman and the postgraduate student. International students arriving in the UK for a Masters education fit the definition of modern professional migrants; well-travelled, global, speaking several languages and in many cases well established as craftspeople with a wealth of experience. UK postgraduate students have high quality visible skills acquired through the UK undergraduate education system, but by staying at home within a known and tested environment, in terms of tacit, non visible global skills they lag behind their international counterparts. For the postgraduate design student, and journeyman, it is a time for understanding ‘what you know’ within a broader context. To have value in the real world of global professional practice, the student must understand the value of his/her skills to a broader community, whilst crafting new ones.

Traditionally, designers undertaking projects within an organization work at a tactical level. However, the journeyman status relates to both tactical and strategic levels – where an understanding of the business, its overall strategy, ethics, well being and growth are part of the context of operation. Outputs must have value in the world beyond the organization. Consequently success depends on working in multidisciplinary teams where communication of value is essential. The journeyman student also has responsibility to understand the managerial context to enable her/him to negotiate their case to experts and others. These are essential tacit knowledge and skills for innovators and change agents, which, are needed to have authority but cannot easily be described. They are nevertheless recognizable to masters in our community of experts.

The postgraduate student must have established proficiency before embarking on a Masters education. A craftsman within their own professional practice established through learning by doing and repetition of learned actions. Three steps to the growth of the craftsman can be related to Sennett’s issues above:.

- Step one: Making matters concrete. Through a process of doing and reflection and a cycle of repetition. The Craftsman Guild system this was equivalent to an apprenticeship.
- Step two: Reflecting on qualities. Through reflection and deeper understanding of the context the craftsman becomes problem attuned, better able to define the problem space and solution space. Producing clarity from obscurity and reformatting established skills. Sennett observed that hinking and crafting at this level can lead to domain shifts in practice!
- Step three: Knowing when to stop and expanding the senses.

These can be mapped as follows:

Table 2

Expanding the senses Knowing when to stop	Master	
Reflecting on qualities Problem attuned/finding/solving INTUITIVE Domain shift	Journeyman Context/leadership Comparison global value/markets	Understanding what you know
Making matters concrete/process/reflective cycle, time based - 10,000 hours to become proficient	Apprentice	

The table above maps the stages of Apprentice, Journeyman and Master and suggests that Sennett's categorizing of 'making matters concrete', to become proficient in a craft, has equivalency to the apprenticeship/undergraduate stage. The higher-level skills attained through reflection and intuition 'to understand what you know' can be mapped against the journeyman/postgraduate stage, which is achieved through reflective practice and 'intuition' as described by Sennett and correlates to the skill acquisition stage defined by Dreyfus & Dreyfus. Intuition as Dreyfus and Dreyfus explain happens at the expertise level, where a fluid combination or synthesis of knowledge of both physical and cerebral reactions can take place in response to given situations. Sennett defines how this happens, giving some explanation from the craftsman's practice of this pivotal non-visible shift which leads to new design thinking. He suggests that it is the willingness and know how to be able to explore if a tool or practice can be changed in use, which allows the craftsman to be comfortable with and make sense of ambiguity. The designer is working from obscurity to distil clarity from complex situations. His framework of how this happens involves: reformatting/adjacency, imaginative leap, tacit knowledge – surprise, recognition, insights - problem solving and problem finding.

The craftsman/designer, trained by doing, through repetition of learned actions, learns how to make mistakes and recover, how to dwell temporarily in the mess of 'wrong moves, false starts and dead ends'. He/she actively creates this situation as a means of understanding working procedures [15 p161] This ability to reformat existing skills, leads to adjacency– two unlike domains are brought close together which can provide new and unforeseen options. 'In the third stage you begin dredging up tacit knowledge into consciousness to do the comparing and you become surprised. Surprise is telling yourself that something you know can be other than you assumed'. This leads to insights, problem solving and problem finding and can also lead to domain shift in practice, and permits the designer to transfer his/her thinking and apply it where opportunities exist, to different domains. For the postgraduate student this is the transitional shift that defines postgraduateness and begins a new journey of higher skill acquisition. In higher stages of skill, there is a constant interplay between tacit knowledge and self conscious awareness, the tacit knowledge serving as an anchor, the explicit awareness as critique and corrective. Craft quality emerges from this higher stage, in judgments made on tacit habits and suppositions. [15 p47]

Table 3

Dreyfus & Dreyfus	Dreyfus & Dreyfus	Sennett	Sennett	Correlation with levels of design practice education
Mastery	Intense absorption Unconscious performance	Master	Expanding the senses Knowing when to stop	
Expertise	Intuitive responses Fluid performance	Journeyman	Reflecting on qualities Problem-attuned- finding-solving INTUITION Domain shift	Postgraduate; UNDERSTANDING WHAT YOU KNOW Reflective practice

			Reformatting/adjacency, imaginative leap, tacit knowledge – surprise, recognition, insights	Intuition – to take advantage of and create possibilities and opportunities
Proficiency	Determines and understands situational patterns	Apprentice	Making matters concrete Iteration of process/reflective cycle Time based 10,000 hours to become proficient	Undergraduate Level 6 Understanding holistic design Demonstrating originality, individuality and capability
Competence	Coping with real situations			Undergraduate Level 5 Experimentation and development Analysis and reasoning
Novice	Recognising facts and features Repetition Using rules			Undergraduate Level 4 Learning the basics Diagnostic

Understanding what you know using reflective practice at postgraduate level is a pivotal focus at Northumbria University to develop the practitioner's ability on two levels. According to Schon [16,17] professional education should be centred on enhancing the practitioner's ability to reflect before taking action. This is important to the designer for two reasons. The first of these concerns real world professional situations, which are rarely clear and lack 'right answers'. The successful professional requires the ability to learn by doing in order to handle complex and unpredictable problems with confidence. The second concerns the nature of the of the designer's relationship with design problems themselves. The designer's exploration of his/her own awareness develops in parallel with the problem definition [7].

5. Conclusions

The paper began by discussing the relationship between knowing and doing and skillful practice as issues for both industry and education and went on to correlate different concepts of skills. The research confirmed that we can't expand skills without doing. Proficiency requires lots of time and this is increasingly problematic these days. That finding relationships between problem solving and problem finding is in contrast to general education, which disables the procedure and the process of exploration, except perhaps in Design. If this correlation has relevance to education, it should also map onto the needs of industry and future related demands of employability and economic prosperity.

The issue of design skills and professional development needs in the creative industries was the focus of a recent edition of Design Week [9] and views on the kind of designers and skills needed for 'the difficult years ahead' included.

- Being good at the craft of design, strong specialists capable of producing high standards of work on their own. But they also needed an instinctive grasp of the business they were working in and good judgment about how to apply their skills for the overall good of the project.
- They had to be open-minded and capable of working in teams, not just with designers but with other specialists, because most projects quickly take on a complexity that meant relying on other experts.
- Finally, it helps if designers are never satisfied with their own work, and know when to listen to new arguments and ideas and stand up for what they believe in.
- Less tangible skills emerge as the most desirable collateral we can offer our clients. The three main skills to develop are creativity, market and cultural awareness.

These skills map onto the notion of the postgraduate/journeyman: strong specialists also with less tangible skills.

And this is the challenge for postgraduate design education. The important skills students are developing are tacit and fundamentally invisible. They must return to novice status to start a new journeyman stage, leaving their comfort zone behind to attain them but this is part of their journey to become skillful designers of the future.

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