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Editorial

Design Learning for Tomorrow
— Design Education from Kindergarten to PhD

This issue of FORM*akademisk* is built upon papers from the DRS//CUMULUS Oslo 2013 conference — *2nd International Conference for Design Education Researchers* — at Oslo and Akershus University College of Applied Sciences (HIOA) 14-17 May 2013 in Oslo. The conference was a cooperative event between the Design Research Society (DRS) and the International Association of Universities and Schools of Design, Art and Media (CUMULUS), and hosted by the Faculty of Technology, Art and Design at HIOA. The theme for the conference was *Design Learning for Tomorrow — Design Education from Kindergarten to PhD*. The conference received an overwhelming response both ahead of the conference, with 225 admitted papers, and during the conference with 280 delegates from 43 countries listening to 165 presentations and having a good time in Oslo. The last day of the conference was the 17th of May, Norway National Day, with traditional songs and a children's parade in the centre of Oslo.

We see this positive response to the conference as a growing awareness of perceiving design in a broad interdisciplinary perspective in support for a *better tomorrow*. For years the *Design Literacy Research Group,* with a base at HIOA in Oslo, has promoted the idea that sustainable design solutions should include more than 'professional' designers; they should also include the general public as 'conscious' consumers and decision makers with responsibility for quality and longevity, as opposed to a 'throw-away' society.

This is also the reason why the conference focused on design education from Kindergarten to PhD. This perspective was put forward as a contrast to most design education conferences where there is either a focus on design education for professionals or general education for children and non-designers. In the call for conference papers, we argued for a longitudinal perspective on design education where the education of professional designers is seen in *relation* to the general education of the public. This is becoming increasingly relevant as more decisions are being made on the basis of visual representations. We regard education at many different levels as important in securing a sustainable future for the design of everyday life solutions. For that, we need qualified and reflective decision makers with a consciousness for quality of design and solutions.

Why have these issues of concern been so important for Norwegian researchers within this field? The answer goes back to the 1960 National Curriculum for primary and lower secondary schools in Norway, when art and crafts were merged into *one* subject. Currently, this subject includes art, architecture, design and visual communication. No other Nordic—or European—country seems to have developed a model similar to this. Today, we see the benefit of this merger where design is at the core of the subject for youngsters—building upon the best from art and the best from craft to become creative problem solvers and critical consumers. Hopefully we will soon see UNESCO or other organizations with responsibility for funding research recognize that we need more research and knowledge on what impacts design education from Kindergarten to PhD have on consumer habits and sustainable development at large. We hope that such projects are not far off. Politicians have for too long been told that advanced mathematics is the main way to stimulate youngsters to abstract thinking. The designerly way of solving problems can be even more suitable in training abstract thinking, and it will also include ethical aspects of sustainable development and ecology. A design literate general public would therefore be a step forward in supporting the statement of com-

mitment for sustainable development by the members of CUMULUS—the 'Kyoto Design Declaration 2008' (Cumulus, 2008).

In the conference proceedings the conference chair professor Liv Merete Nielsen wrote:

> We hope, as the organizers, that the conference will promote design and design education as a field of practice and inquiry. We hope that it will create a fertile context for establishing new networks of future cooperation, nationally and internationally, and that design education research in its broad context will be recognized both inside and outside the design research community. The general public's interest for design and quality is developed from the kindergarten, through primary and secondary education and the public's attitude is central for professional activities and a broad democratic design participation (Nielsen, 2013, p. iii).

Now, in 2015, we can see that this conference has been a further step to international collaboration in design education research. Guest researchers have visited HIOA and a new international research consortium has been created. Other academic journals have followed up the conference theme with special issues, such as *Art, Design & Communication in Higher Education*, *TechneA*, *Design and Technology Education* and *Studies in Material Thinking*. The role of these journals is essential for the advancement of knowledge production within the design education field. This issue of FORM*akademisk* contains articles developed on the basis of the conference. They represent a wide perspective on design education at different levels.

Articles in this Issue

Pino Trogu, professor at San Francisco State University, discusses in the article *Working memory and background knowledge: Cognitive science in the design classroom* two universal principles from cognitive psychology and proposes some ways in which those principles relate to graphic design. The two most important principles are first, the strict constraints of working memory, a function that persists for only a few seconds, and second, the finding that perceptions and meanings are mediated by the cultural knowledge of viewers, including their knowledge of design conventions and genre. Better designs are likely to emerge from the designer's familiarity with these psychological and cultural principles. Visual examples, including maps and student projects, illustrate how the two principles are useful for classroom instruction.

Eva Lutnæs, postdoc at the Oslo and Akershus University College of Applied Sciences explores in her article *Imagining the unknown. Responsible creativity for a better tomorrow* the scientific discourse on creativity in the field of design education. She draws upon 165 papers presented at the DRS//CUMULUS Oslo 2013 conference. The review shows creativity to be a key concept in scientific discourse and identifies five storylines that conceptualise creativity as a generic human capacity for which the field of design education eagerly claims responsibility. In scientific discourse, the fostering of creativity is a leading motive when articulating reasons for design to gain terrain in general education. A multifaceted repertoire of strategies to solve design problems can drive new ideas or artefacts that contribute to both environmental protection and degradation, human aid or human-made disasters. How to frame the relevant educational content of creativity as part of a general education that empowers citizens to promote sustainability and meet global challenges ahead is discussed.

Joanna Boehnert, visiting research fellow at the University of Colorado and director of EcoLabs, develops in her article *Ecological literacy in design education: A theoretical introduction* theoretical aspects on ecological literacy for design education. Ecological literacy is a concept developed by sustainability educators that provides a basis for learners to

understand the nature of environmental problems and to develop new capacities and critical skills to respond effectively. The article gives a philosophical overview of why ecological literacy is necessary, describes ecological principles with associated design concepts and explains why critical ecological literacy is necessary to make the work of transforming unsustainable conditions and designing sustainable ways of living possible.

Robert Harland, lecturer at Loughborough University, asks in his article *Testing keywords internationally to define and apply undergraduate assessment standards in art and design*: What language should be featured in assessment standards for international students? Have universities adjusted their assessment methods sufficiently to match the increased demand for studying abroad? How might art and design benefit from a more stable definition of standards? Language use is at the heart of this issue, yet it is generally overlooked as an essential tool that links assessment, feedback and action planning for international students. The paper reveals existing and new data that build on research since 2009, aimed at improving students' assessment literacy. Recommendations are offered to stimulate local and global discussion about keyword use for defining undergraduate assessment standards in art and design.

Aysar Ghassan, senior lecturer at Coventry University, and ***Erik Bohemia***, senior lecturer at Loughborough University, present in the article *The Global Studio: Incorporating peer learning into the design curriculum,* research on a specific learning environment named the Global Studio. The Global Studio aims to provide students with peer-learning experiences, conducted through complex project situations. The Global Studio makes use of a blended learning approach, a combination of online learning and face-to-face teaching. The learning environment of The Global Studio is described as operationally different from tutor-led design education as lecturers are more 'distant' in teaching and learning activities. In recognition of the benefits of peer learning, the authors have designed explicit opportunities for peer tutoring to take place within Global Studio Projects. The authors conclude by arguing that in order to maximise the benefits of student-led projects featuring peer tutoring, activities that facilitate student-led learning, need to be scaffolded into design programmes.

Matthew Watkins, PhD and senior lecturer at Nottingham Trent University, presents in the article *An audio visual approach to the teaching of the social aspects of sustainable product design* research on approaches that enhance understanding on the complexity of the social aspects in sustainable design. The study indicates that audio visual introductions in combination with collaborative learning are beneficial to foster learning among students from what is described to be the Net Generation. The workshops in this study aimed to enable students to grasp the complexity of the social aspects of sustainable design in a short space of time and to encourage personal responses and creative problem solving through an exploration of design-thinking solutions.

Meryem Yalcin, assistant professor at TOBB University of Economics and Technology in Ankara, Turkey, discusses in the article *Progressive development of creative design skills from kindergarten education* how early childhood is a beneficial period for development of creative-thinking skills and how this development may be facilitated in kindergarten. Yalcin argues that kindergarten environments where children imagine, create, practice, modify, recognise, manipulate and share knowledge, experiences and objects through play are ideal for facilitating learning on creative-thinking skills. These basic skills, which children develop in kindergarten, should be further developed through the entire education.

Astrid Skjerven, PhD and professor at the Oslo and Akershus University College of Applied Sciences, presents in her article *Vernacular traditions in Norwegian jewellery design: Past, present, future* how the capability of communicating identity has become of greater importance. The paper sheds light on the relation between Norway's role in the global scene and the use of the vernacular tradition in the development of jewellery design in

general. It consists of a historical exploration that leads to a discussion of the present and future situation. Today there is a cleft between consumer behaviour and avant-garde practice. In accordance with the global situation and Norway's geopolitical position in the outskirts of political and economic decisions, the setting is characterized by a variety of practices and by a slow acceptance of the vernacular values in a world of avant-garde practitioners.

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References

Cumulus. (2008). *Kyoto Design Declaration 2008*, Kyoto. http://cumulusassociation.org/images/stories/Current_affairs_files/kyoto_design_declaration2008.pdf

Nielsen, Liv Merete. (2013). Design Learning for Tomorrow. Design Education from Kindergarten to PhD. In Janne Beate Reitan, Peter Lloyd, Erik Bohemia, Liv Merete Nielsen, Ingvild Digranes & Eva Lutnæs (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers, 14-17 May 2013* (Vol. 1, pp. i-iii). Oslo: ABM-media.

Links for more information on the DRS//CUMULUS Oslo 2013 conference

Official webpage for the DRS//CUMULUS Oslo 2013 conference
http://www.hioa.no/DRScumulus

Reviews from the conference
http://www.cumulusassociation.org/component/content/1486-drscumulus-oslo-2013-2nd-international-conference-for-design-education-researchers/152

http://www.hioa.no/eng/Aktuelle-saker/Successful-DRS-CUMULUS-conference

Pictures from the conference
http://www.hioa.no/eng/About-HiOA/Faculty-of-Technology-Art-and-Design/DRS-CUMULUS-Oslo-2013/Pictures-from-the-DRS-CUMULUS-Oslo-2013-Conference

Book of abstracts
http://issuu.com/erik.bohemia/docs/book_of_abstract_drs_cumulus_oslo_2

Conference proceedings
Volume 1
http://www.academia.edu/8995210/Design_Education_from_Kindergarten_to_PhD_Design_Learning_for_Tomorrow_Proceedings_of_the_2nd_International_Conference_for_Design_Education_Researchers_Vol._1_

Volume 2
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Volume 3
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Volume 4
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Pino Trogu

Working memory and background knowledge

Cognitive science in the design classroom

Abstract

This article discusses two universal principles from cognitive psychology, and proposes some ways in which those principles relate to graphic design. The two most important principles are first, the strict constraints of working memory, a function which persists for only a few seconds, and second, the finding that perceptions and meanings are mediated by the cultural knowledge of viewers, including their knowledge of design conventions and genre. Better designs are likely to emerge from the designer's familiarity with these psychological and cultural principles. Visual examples, including maps and student projects, illustrate how the two principles are useful for classroom instruction.

Keywords: working memory, context, background knowledge, visual narrative, teaching

Introduction

Much exciting research has been conducted in cognitive science since George Miller (1956) published his path-breaking article, 'The magical number seven, plus or minus two: Some limits on our capacity for processing information'. Building on Miller's observations, Alan Baddeley (2014) has developed a robust model of working memory — or 'temporary storage system' — that aims to explain such memory processes.[1]

Some art-theorists, especially the great art historian Ernst Gombrich (1960), have invoked the findings of psychology in analysing the effects of art, but his insights came a few decades too early to invoke the powerful limitations of working memory. These developments in cognitive science, which validate Gombrich's historical perspective, have largely been missing in graphic design teaching, which is still dependent on theories of structuralism and semiotics that were pervasive in the 1970s and 1980s.

Structuralism and semiotics, founded on the ideas of the brilliant Swiss linguist Ferdinand de Saussure (1959), have since gone out of fashion, except perhaps in graphic design. In *Semiology of Graphics*, the imposing book on maps, networks and diagrams by the French cartographer Jacques Bertin (2011, p. 419), 'graphics' is dogmatically presented as a 'monosemic' system (one sign = one meaning) in a synoptic table that includes other systems, such as music and mathematics. The recently published comprehensive textbook, *Graphic Design Theory*, by the respected author Meredith Davis (2012), includes many visual examples explicated in the tradition of structuralism and semiotics.

This article, through maps, diagrams and visualizations, attempts to broaden the aim of design teaching in the classroom to include principles of cognitive science, especially those related to working memory. The article will also describe design strategies aimed at mitigating the strict time limitations of this universal memory bottleneck, which lasts only a few seconds.

Can a graphic be universal?

Are there universal principles that determine good graphics? If the question is taken as meaning 'Is there a universal practical recipe for creating good graphics?' the answer is 'no' because of the cultural contingency of any given graphic with respect to any given viewer. The visual form of an image is contingent upon its meaning as interpreted by an audience, as the great iconologists Panofsky (1962) and Gombrich (1960) have shown. Background knowledge is always required to make sense of even purely formal inputs. The false belief in

universal trans-historical forms is called 'The Myth of the Given' (Sellars, 1956). The given is a myth because every form we perceive is 'post-interpretatum' (Cleveland & McGill, 1984; Casner & Larkin, 1989; Carpenter & Shah, 1998; Cook, 2006; Canham & Hegarty, 2010; Hinze et al., 2013).

Ernst Gombrich rejected as groundless the idea that certain concrete design elements will appeal to all audiences at all times and places; the very form of the design element is never a brute given, never unambiguously *there*, but rather a psychological construct, that is, something co-constructed by viewers from their prior knowledge and expectations. Gombrich made the point very succinctly in explaining the naiveté of scientists who placed a graphic design in the Pioneer Spacecraft, which was meant to communicate something about human civilization for the benefit of beings in outer space, who undoubtedly would lack knowledge not only of the represented objects but also of our conventions of representation (Gombrich, 1982, p. 150-151). For instance, the right side of the woman's face is narrower than her left (Figure 1). What sort of lopsided creature is that?

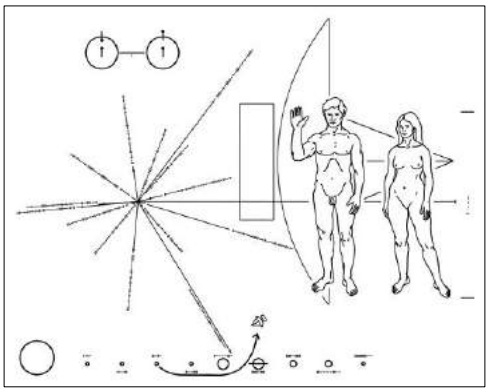

Figure 1. A golden plate with this design was included in the Pioneer 10 Spacecraft launched by NASA in 1972. Design by Carl Sagan, Frank Drake, and Linda Salzman Sagan. Dim. 23 x 15 cm (9 x 6 inches) Wikimedia Commons, public domain, 2013.

However, if one asks the more modest question 'Are there universal principles that determine good, culturally contingent graphics?', then recent cognitive psychology has much to tell us.

In describing their work, graphic design students and professionals use form, texture, colour and so on to combine functionality with aesthetics. A graphic design work — 'graphic' for short — is successful when it achieves both its communication goal and a certain aesthetic level. Although beauty and functionality are both important, graphic design students are taught that functionality comes first. The main function of graphic design is to communicate, and we cannot escape the old dictum that form follows function. In addition to the formal elements of layout, typography, colour, and so on, which are the core of both teaching and practice, what psychological principles enable a graphic to communicate successfully? Recent studies in cognitive psychology indicated that universal principles are indeed involved in the perception of a graphic and that these are always at work in both successful and unsuccessful communications. The principles hold for both verbal and visual experiences, that is, for a book, a poster or a webpage. Proper knowledge of these cognitive principles can help the designer to construct successful visual solutions.

Cognition (1): The time constraint of working memory

In the interaction between the graphic and the viewer, a very important psychological principle is the time limitation set by working memory, which lasts only a few seconds. 'Working

memory' is the name given by cognitivists to the short time span during which the human mind can put experiences together to form a meaning that is lodged in long-term memory. Understanding this very stringent limitation or bottleneck of the mind is one of the greatest insights of psychology since 1956, when Miller published his famous article on the 'magical number seven'. The current view sees the limitation as mainly a time constraint, a window of just a few seconds. Within those first few seconds, if the viewer is not able to 'construct' the various elements into a broader meaningful whole that is sent to long-term memory, then some will quickly drop from working memory, and little that is meaningful will survive.

Because of this limitation of working memory, a good designer tries to reduce the viewer's processing time. Within the window of the viewer's working memory, a meaningful whole must emerge from the various elements. The viewer can repeat the process for various subgroups of elements, but in every case has to reach meaningful closure. A similar sub-process takes place in language, where the clause, which is considered the primary unit of speech, is a universal feature of all languages (Hirsch, 1977, p. 108-109). However, unlike in a written text, in a graphic, the primary units need not be perceived in a fixed, specific sequence. For example, a good transportation map works well as a meaningful overall image, but its more practical use is in obtaining local, detailed step-by-step instructions that are related to some sub-portion of the whole, such as a specific route or a specific neighbourhood.

Thus, in order for the viewer to be able to reach fast closure within a few seconds, the designer has to make the elements of the graphic work quickly in concert. However, this time limitation need not apply to the whole graphic at the same time. As a good book, or a beautiful speech, can successfully communicate to the reader or listener through a succession of well-defined primary units, such as clauses and other sub-units, a good graphic can be comprehended as a series of meaningful visual units that have reached 'closure', each of which is comprised of several smaller component elements.

However, despite the universality and transcultural character of these psychological constraints and because of the various settings in which graphics can be used in a practical way, individual graphic design problems require individual, ad-hoc solutions. Thus, a theory of graphic design is not a fixed set of universal *formal* principles, but instead must be the flexible adaptation of cultural and psychological constraints — especially the universal limitation of human working memory.

Chunking

The concept of closure is closely tied to that of 'chunking'. Miller found that a chunk can be as discrete as a single digit, but it can also collapse multiple items into a single new item (Miller, 1956). He explained that although one can never keep more than about seven 'chunks' of information in immediate memory at the same time, if one can chunk the items, such as the digits in one's social security number (i.e., the tax number in the United States) then one can remember that number more readily. Hence, social security numbers are written in chunked groups, such as 434-65-9623. This example has nine digits but only three chunks, making the number much easier to handle and recall than 4-3-4-6-5-9-6-2-3. These simple chunks can represent extremely complex meanings. An explicit concept, such as a word, a name or a phrase, always represents a much larger set of implicit meanings with which the reader may be more or less familiar, such as the name James Bond (Hirsch, 1977, p. 124).

Cognition (2): The verbal, visual and spatial components of working memory

Almost twenty years after Miller's 'magical number seven', Baddeley and Hitch (1974) proposed the multi-component model of working memory. The model has undergone many refinements since 1974 but it remains the standard reference in cognitive psychology on working memory (Baddeley, 2014).

Baddeley's model of working memory includes two important components. One is the articulatory or *phonological loop*, which provides temporary verbal storage, even in the case of visually presented materials. He found that we unconsciously name objects as they are presented to us, in a process called 'sub-vocalization', which is a kind of inner speech (Baddeley 2014, p. 49-66). Since the 1970s, it has been known that we subvocalize when viewing pictures (Noizet & Pynte, 1976). Such naming plays a strong role for gaining rapid closure in the successful perception of a visual organization, just as it does in the understanding of a verbal organization (Logie, 1996).

Another component of the model is the *visuo-spatial sketchpad*, which is involved in the temporary retention of visual and spatial information. According to Logie (1996, p. 53), 'As the phonological loop has been linked to the speech system, the visuo-spatial sketchpad has been linked to the control and production of physical movement'.

The tight visual-verbal interaction that takes place in the process of working memory suggests that the effort is distributed among all the components of the system, especially between the phonological loop and the visuo-spatial sketchpad. Therein lies a key point for designers: either with or without text in the design, the role of the verbal seems just as important as the visual in processing visual information! Moreover, the *quick recognition of representations is connected with the quick naming of them,* which can be reinforced by the extensive use of text in graphic design. Designers should be aware of the universality of subvocalization. The silent act of looking at pictures is accompanied by the activity of inner speech, just as silent reading is (Baddeley, 2014).

Cognition (3): Background knowledge and familiarity

Until the viewer interprets the graphic, it has no meaning. The formal features of any design do not precede but follow the interpretation of that form. In the interpretation process, the viewer brings to bear a complex system of expectations comprised of prior experiences. Hence, the second universal principle is that the viewer constructs meaning based on external stimuli that are made meaningful by prior experience. Modern psychology holds that perceiving and remembering are both productive acts based on previous experience — an important insight that psychology has reconfirmed many times since the path-breaking book by F. C. Bartlett: *Remembering: a study in experimental and social psychology* (1932). Bartlett included the idea of socially shared expectations as part of the remembered event. The art of creating an effective graphic involves the designer's successful social prediction of the kind of response a typical viewer will probably construct. Memory is not the passive reproduction of past events but is an active productive process. Similarly, the experience of the graphic is not passive but a productive activity that is based on the viewer's relevant experiences.

The two principles of working memory and the collaborative co-construction of meaning always interact. In communication, if the viewer is familiar with the subject matter, closure will occur much faster. Therefore, it is important for the designer to include in the graphic the most appropriate and relevant information, instead of assuming that the viewer already has this information. The limitations of working memory can be reduced greatly if the background knowledge of the viewer is both highly familiar and relevant to the subject matter at hand.

Words, not just pictures

Although the temporal limitation of working memory cannot be influenced directly, the designer can provide the necessary 'scaffolding' — an array of visual and verbal aids — for the viewer to build on her or his existing knowledge. Graphics seldom consist of only text or pictures although the latter are more likely to need words than vice versa. It is often true that a

picture is worth a thousand words, but sometimes a graphic that does not provide enough textual support runs the risk of being misunderstood and misinterpreted. In the interplay between the image and the text in a graphic, this task of providing enough textual information is often neglected, although the addition of text to the visual elements can make the graphic truly informative. Amanda Cox, graphics editor of *The New York Times*, stresses the importance of the 'annotation layer' — the written text — in successful data visualization. She stated, 'We learn by connecting to what we already know' (Cox, 2012). She proved her point with a simple exercise performed on the front page of *The New York Times* (paper edition), in which she highlighted things that she did not already know. The extent of facts unknown by her amounted to only about 10 per cent per day, during a typical week (Figure 2).

Figure 2. Front page of *The New York Times* from 18 September 2012, detail. The highlighting shows new knowledge acquired that day. Replica of original exercise presented by Amanda Cox. Author's collection.

Most graphic constructions, however sophisticated, are therefore dependent and highly influenced by the relevant background knowledge of the viewer. New knowledge is best communicated by a graphic that combines new elements with familiar elements of the past. Brief notes, legends and captions are thus an excellent way to provide the viewer with background knowledge upon which new knowledge can be built.

This annotation technique was shown to work effectively in a student graphic about gas prices (Figure 3), which was inspired by an article in *The New York Times* about the changing price of crude oil (Mouahad, Cox, & Nguyen, 2008). The graphic depicts the fluctuation of gas prices (vertical axis) as well as total consumption (horizontal axis) in the United States between 1979 and 2012. In the graphic, a line connects various dots representing the years from 1979 to 2012. The position of each dot plots the price per gallon and total consumption for that year. The line appears to move backwards when consumption dropped after 1979, 1988, and 2007.

Various points on the line are annotated with small chunks of text. The economy of means of this graph — clean lines and legible typography, combined with concise and clear text — make for a well-sequenced and informative piece. All visual and verbal elements provide for fast closure, and although the data are relatively complex, the viewer is able to absorb the parts and quickly move from the overview to the detailed description.

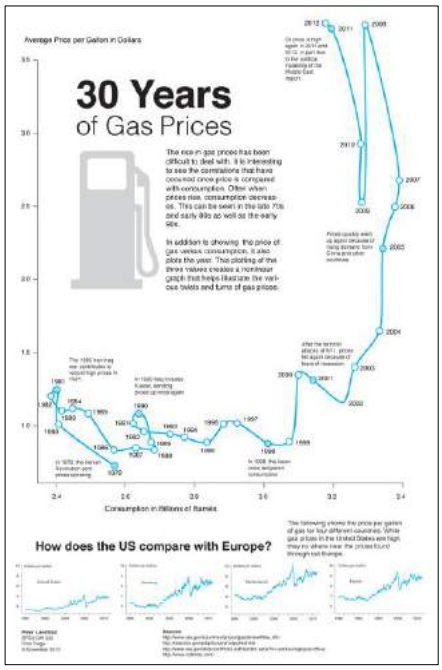

Figure 3. Thirty years of gas prices. Poster size: 11 x 17 inches. Source: Student work by P. L., 2013.

Conventions, context and genre

Design conventions play a critical role in the exchange between the designer and the viewer. Similar to the set of conventions in spoken and written languages, design has a set of visual conventions. It is a mistake to assume that the viewer will be automatically familiar with the design conventions that the designer employs. However, because all verbal and visual communication is based on prior agreement with a set of conventions, an effective designer works within the constraints of the conventions that are familiar in a given cultural moment. A visual element that might mean one thing in Europe might mean something completely different in Australia.

Anthropology has shown that although black may have a negative value and white a positive one in one tribe, the reverse may be the case in another tribe; the same may hold for numerous design elements. No doubt, some elements are trans-cultural, such as the female body and an infant's face, but the safest course is to assume that all design elements are dependent for their effectiveness on the culturally constituted assumptions and expectations of the viewers.

As Bartlett pointed out, the act of remembering, as well as perceiving, is not the mere reproduction of a previous experience, but instead a re-construction based on typical features of other events of the same type experienced over time. When looking at the front page of a newspaper, for example (Figure 4), we prepare to read it based on how we read it in previous instances. We expect to see titles at the top and text immediately below them. We expect all the columns of text under a title to belong to the same article, and so on. These expectations, if properly fulfilled, contribute to the re-construction of the object, 'newspaper', as we know it. We recognize the object newspaper as belonging to a similar type, or 'genre', as we have experienced it in the past. The recognition of genre takes place within the narrow window of working memory lasting just a few seconds, and the positive feedback regarding an object that matches our previous experience of similar objects, enables us to move forward to read the articles in the paper.

Imagine a situation in which the visual elements and the typographic conventions of titles, subtitles and so on were disrupted or omitted. Imagine that the articles have no titles.

Looking at this unfamiliar object, the typical reader of *The New York Times* would be puzzled and wonder if he or she were holding a real copy of the paper or a fake one. He or she would not recognize the paper, based on prior experiences. The genre and type would not be determined within the first few seconds, and communication therefore would be compromised. Genre and type are not absolutes, however, but function within the social conventions of a given cultural time. This is the social dimension and perception pointed out by Bartlett: the viewer must share in the system of values and conventions within the specific historical context if he or she is to understand the specific genre and types presented at that given moment.


The New York Times

Figure 4. Front page of *The New York Times*, detail. California edition, 28 November 2013. Author's collection.

One of the first readers of *The New York Times*, which started publication on 18 September 1851, might be forgiven for feeling disoriented if he or she travelled forward in time more than 150 years and were given a copy of the same paper in 2015. What would he or she make of the extensive use of relatively large titles, subtitles, and above all, coloured pictures? He or she would have been familiar with newspapers that densely pack text, use minimal titles and display no pictures at all. The first issue of the paper (Figure 5), which was originally named *New York Daily Times*, employed exactly these graphic conventions, which were typical of the genre of newspaper publishing at the time of its debut in the middle of nineteenth-century America.


New-York Daily Times.

Figure 5. Front page of the *New York Daily Times,* detail. Later renamed *The New York Times*. First issue, 18 September 1851. Wikimedia Commons, public domain, 2015.

The example of *The New York Times* demonstrates that one of the most important tasks for the graphic designer is to make sure to include the elements that help a viewer quickly place the object in the right context, that is, to identify immediately the correct genre or type. Only after the type or genre is identified can the reader start making meaningful constructions and making sense of the whole. What type of graphic are we looking at? If this question is not answered within the first few seconds of the interaction, the viewer will have trouble focusing his or her attention on the piece. That window sometimes can be reopened and the viewer will need to 'restart', but more often than not, he or she will become frustrated and refocus his or her attention on something else. The designer needs to not only provide the elements necessary for correctly identifying the genre but also *exclude* elements that might be misleading and steer the viewer in the wrong direction. Because visual elements and verbal text are not absolutes but vary in the meanings they convey and therefore are ambiguous, the designer must eliminate this ambiguity immediately at the high level of titles, subtitles and large images. Effective titles and other means of quick orientation to type or genre are necessary in any graphic, in order to keep the reader's attention. Proper initial orientation — quickly identifying the genre — is akin to the role played in a good map by the You-Are-Here mark, which helps in pointing out one's position on the map. The mark quickly establishes the spatial relation of the viewer to his surroundings. In a graphic, the elements that properly identify the type or genre help the viewer to place quickly that graphic into the larger, correct social context.

Within the very first few seconds, proper orientation is central to further understanding, but this orientation and further understanding are dependent both on the time limitations of working memory as well as existing background knowledge. One way to help the viewer 'keep up' is to include in the graphic many elements that are already familiar to the viewer, elements that are part of the viewer's existing background knowledge.

A beautiful design that did not work

How does the duality of working memory and background knowledge affect a graphic? When the New York City Transit Authority introduced it in 1972, the striking map of the subway system shown in Figure 6 was radically different from previous ones. Maybe too different! Just seven years later, after complaints from confused subway riders, it was discontinued and a new map issued, with a more traditional design that has survived to the present day virtually unchanged (Lloyd & Ovenden, 2012).

Figure 6. New York City subway map, detail, 1972. Massimo Vignelli, designer. Revised: February 1978. Dim: 45 x 56 cm (18 x 22 inches), MTA, 1978. Author's collection.

Despite its beauty, the discontinued map — by the late Italian designer Massimo Vignelli — was very problematic for the average user. In a case of false parallelism between simplicity of form and simplicity of communication, the arbitrary geometry of its square format actually works against the physical observations of the subway rider who could not easily match the stretched distances and distorted proportions of the map with the reality and the precise topography of the city above the ground.

By contrast here (Figure 7) is its more complex replacement, which, with modest changes, has satisfied subway riders for the past 36 years:

Figure 7. New York City subway map, 1979. Michael Hertz, designer. Revised: Summer 1985. Dim: 58 x 71 cm (23 x 28 inches), MTA, 1985. Author's collection.

Today's New York subway map is the fruit of many refinements, but the underlying structure has remained intact since the 1979 edition (Figure 7). It is an analogical representation of the network of train lines superimposed upon the familiar structure of New York's streets, parks and rivers. Vignelli's map (Figure 6) showed few details beyond those pertaining to the subway system. However, the replacement map includes all kinds of information: above-ground train lines, tunnels, parks, streets, airports, cemeteries — things belonging to the real world, which the average user is trying to navigate. Complexity of representation translates into simplicity of communication, while Vignelli's simplifications translated into psychological super-complexity that exceeded the limitations of working memory.

However, ask a three-year-old from a small rural town which of these two pictures she prefers, and the answer might well be the abstract Vignelli — depending on whether she likes straight lines rather than curves.

There is a further subtlety: there is no principled reason why a schematic representation that was executed sensitively could not have worked. One could very well make one's way in New York using a schematic map, just as one does in London, where the Underground has a similar schematic, which like Vignelli's map, emphasizes the rail system rather than the underlying topography (Figure 8).

Figure 8. London Underground tube map, detail. Transport for London, 2007. Author's collection.

The London map, which essentially reproduces Harry Beck's original design of 1931 (Wikipedia, 2015), has endured for 84 years and is still in use today. Why then did the abstract schematic in London succeed, whereas Vignelli's failed? We know that a schematic, topographically incorrect map has continued to work for tens of millions of passengers in London. Why did Vignelli's map not work? A reasonable explanation is that because London is a river city surrounded by land, one needs only a schematic representation of the defining river to achieve orientation in real space. If the land area depicted is lengthened or fore-shortened here and there to magnify the busy centre, as in Vignelli's map, the schematic of the river still enables one's orientation in space.

The myth of simultaneity

Another example of misguided parallelism with geographic maps is graphics that mimic traditional road maps in order to show relationships within an abstract system. However, while traditional maps bear a direct, natural connection to the physical objects that they represent, such as roads, cities, rivers and so on, in these diagrams the subject matter is often a set of abstract concepts that lack a given natural arrangement. The 'mind map' or 'concept map', popularized by Joseph Novak and Bob Gowin (1984) in their book *Learning how to learn,* is thus analogous to a road map. However, in a road map, the amount of information is usually not a factor, whereas in concept maps, the absolute limit of the number of items on which one can focus at any given time (Miller, 1956), as well as the stringent time limitation of working memory, play against the insights gained by a simultaneous spatial arrangement. Instead of remembering and retrieving the concepts, the viewer tends to retain only the visual abstract image, without retaining the concepts or the main content.

Concept maps also exhibit another crucial defect, which was first pointed out by Ferdinand de Saussure — the confusion between *langue* and *parole* (Saussure, 1959). *Parole* refers to the actual utterances we make, such as sentences with (explicit or implied) subjects and predicates. *Langue* is the entire shared mental convention system of a speech community at any point in time, which enables *parole* to be spoken, written and understood. His distinction between *langue* and *parole* was path breaking and illuminating: *langue* is a system of possibilities, and *parole* is the realization of some of these possibilities in actual usage. Most concept maps miss or ignore Saussure's epochal distinction: sentences, not individual words, are the basic building blocks of speech. In these concept maps, we are left with a vague visual representation of *langue*, but no *parole*, that is, no real speech. We are given individual words, similar to those in one of those magnetic poetry sets, but the words alone simply do not communicate. The connections supposedly afforded by the spatial arrangement

of concept maps, that is, the various possible *paroles* (many possible paths) remain in the abstract area of shared possibilities, that is, all *langue* and no *parole*, all commercials and no programme.

The sceptical reader might try to learn and remember the content of Figure 9, which shows a typical concept map produced by a student for an information design exercise now discontinued.

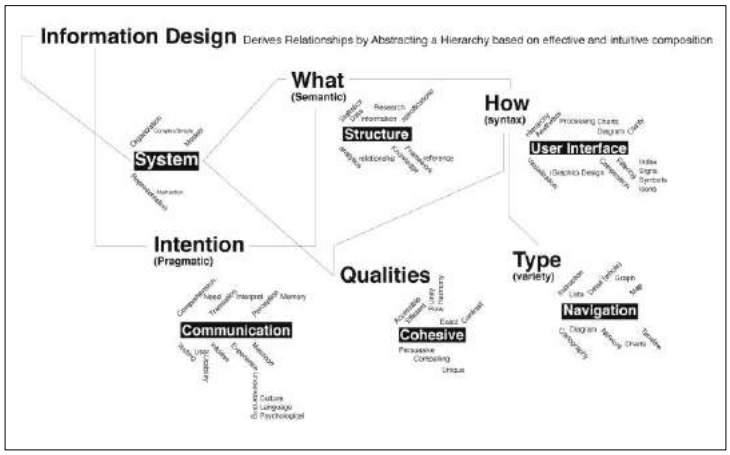

Figure 9. A concept map of key elements in information design. Source: Student work by K. K., 2009.

The road map model was adopted in a recent typographic illustration in Time magazine showing the 2012 London Olympics (Cooke et al., 2012). In this example (Figure 10), there is no attempt to assign specific meaning to the colourful lines containing the text. The lines are simply there to evoke the lines of the London underground map, if one has seen it before. It is up to the reader to read all the zigzagging text crammed inside the coloured lines, without getting a stiff neck.

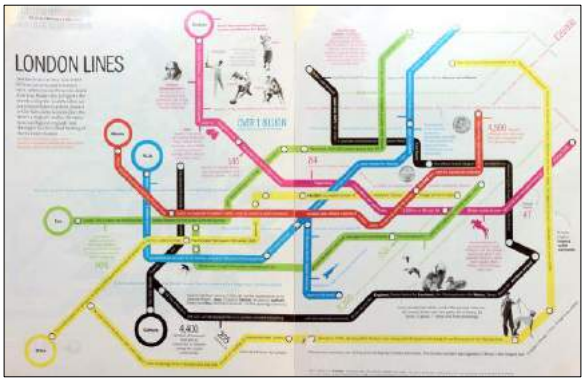

Figure 10. London lines. Article and infographic on the 2012 London Olympics. Time magazine, 30 July 2012. Spread size: 16 x 10.5 inches. Author's collection.

In the same issue, another illustration of Olympic trivia (Adams et al., 2012), while still rather crowded, manages to do a much better job of breaking down the information into smaller, finite chunks of text that can be read more easily and sequentially (Figure 11).

Figure 11. Trivia games. Article and graphic in Time magazine, 30 July 2012. Spread size: 16 x 10.5 inches. Author's collection.

Cognition in the design classroom

The current explosion in the use of infographics and data visualization tools has had a strong effect on today's students of design, but how does one distinguish good infographics from bad? For example, which of the two representations of quantity shown in Fig. 12 would be processed faster by the viewer?

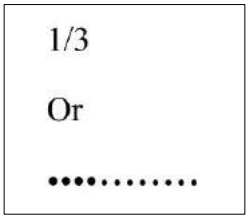

Figure 12. Which symbol better represents 'one third'? A numerical fraction or a series of dots?

Today, many popular infographics use the repetition of little dots or icons to represent numbers, which is an unfortunate distortion of the isotype system developed by the Austrian polymath Otto Neurath (2010) and his associates. However, George Miller's fundamental insight was that the limitations of working memory could be overcome by chunking, in which several things are unified into a single thing, thus reducing the number of elements the mind has to deal with at the same time. Hence, as shown in Figure 12, 1/3 is a chunked version of the little dots **.....** . Although brilliant, Neurath's isotype system is not always optimal. When used with discretion, it need not crowd out working memory, and it may work well. If Neurath, who was highly alert to the trends of philosophy and psychology, had lived in the era of cognitive psychology, he would have surely accommodated his ideas to it.

The little dots in effect unchunk the fraction. Some designers, who misapprehend that dots, because they are visual, are processed simultaneously, show an unfortunate tendency to reverse Miller's insight and unchunk a unitary idea into multiple elements, thereby increasing processing time.

The two examples shown in Figure 13 are details from student work that was influenced by the Neurath-derived trend of using little people and little squares to represent quantities, and worse, proportions. However, we no longer use pebbles to count. It is much better to write out the number or to visualize it using a single solid area, as in a simple bar chart or pie chart, instead of many tiny areas in repeated little rows.

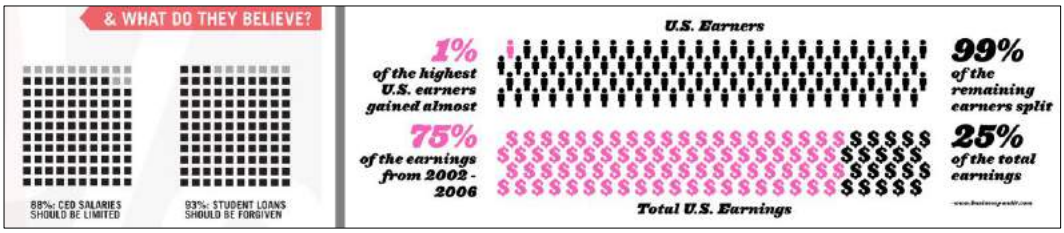

Figure 13. Representations of quantitative data that use repeated little people or dots invert Miller's principle of 'chunking', thereby increasing the cognitive load on the viewer. Source: Student work by J. L. and T. B., 2011.

A comparison of two posters: baseball and skyscrapers

Two posters by students in my information design class will help to clarify Miller's principle of 'chunking'. The first poster (poster #1, Figure 14) addresses the topic of team payrolls in major league baseball in the United States. The second poster (poster #2, Figure 15) represents the topic of the world's tallest buildings.

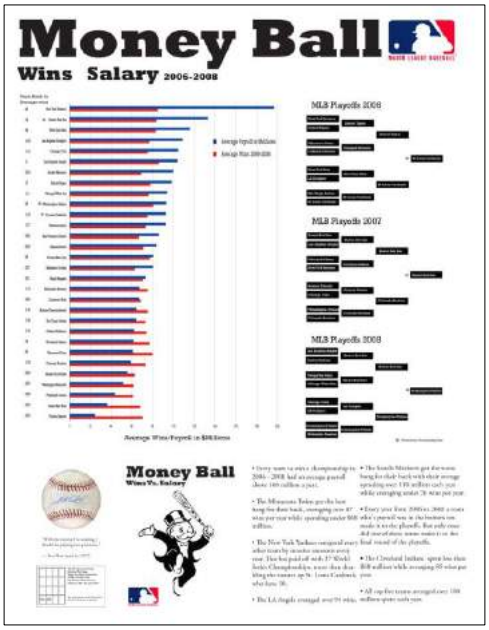

Figure 14. Student poster #1 on the relationship between payroll and performance of teams in major league baseball from 2006 to 2008. Poster size: 34 x 44 inches. Source: Student work by A. N., 2010.

Poster #1, like poster #2, starts with a big title at the top, but the title in poster #1 requires more background knowledge than the title in poster #2 does. 'Money Ball' refers to a book and the movie by the same title, which are about the Oakland Athletics, a team that advanced to the playoffs and almost made it to the World Series, despite its minimal payroll budget. However, viewers who are not familiar with the book or the movie are unlikely to make that connection. In poster #2, the title means exactly what it says. If the viewer of poster #1 is not familiar with the baseball world, then the title is an obstacle to the viewer's apprehension.

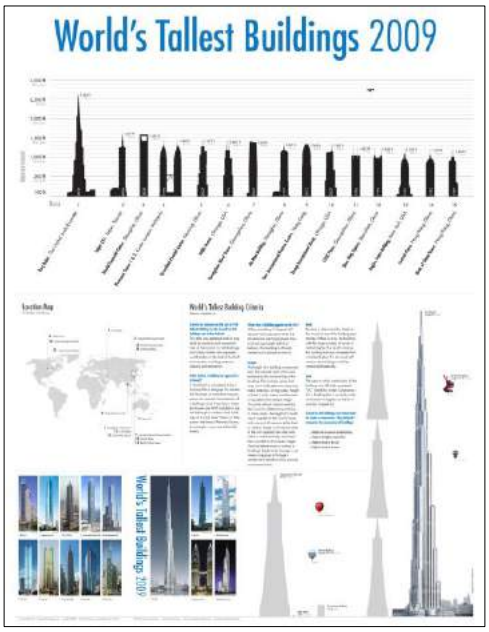

Figure 15. Student poster #2 on the world's tallest buildings in 2009. Poster size: 34 x 44 inches. Source: Student work by M. L., 2010.

Below the title, both posters present large graphics, one depicting the relative salaries and performance of baseball teams, from 2006 to 2008, and the other showing the 15 tallest buildings in the world in 2009. Poster #1 also includes playoff brackets from 2006 to 2008. Additional pictures and text are included in the lower portion of both posters. As usual, in these examples, the viewer needs to assess quickly the genre if his or her attention is to be retained long enough to proceed to the smaller, localized elements of images, text, maps, graphs, photos and so on.

However, the viewer of poster #1 will be off to a very slow start, for the majority of the poster's layout consists of two separate, visually very active graphs, only one of which provides directly relevant information. The bar chart disproportionately occupies most of the space although it provides limited information. The graphic brackets showing the playoff pairings offer no information about payroll or performance. The bar chart on the left does include relevant data, but the display is too busy because of the colour vibration, and thus poster #1 struggles to convey its message by failing to provide easily 'chunkable' groups.

In contrast, the layout of poster #2 provides a series of well-defined chunks. First is the clear, descriptive title. Next is the large graphic showing a pictorial bar chart of skyscrapers with detailed information about height, rank and so on. The world map then shows the location of each building. In the middle of the poster, the explanatory text offers a short but detailed introduction to the material, and below that is a diagram of the tallest building compared to another smaller, well-known building, which indicates the huge scale involved. Finally, the photographs of the buildings provide the most direct visual presentation of the material.

In short, every element, especially the title and the large graphic, contributes to capturing and focusing the viewer's attention and retaining it in the precious initial seconds allowed by working memory. All the elements fulfil the expectations of the viewer by adhering to the visual schemes experienced earlier. The large graphic resembles a giant bar chart, the world map is clear, and the text is well arranged, with clear subtitles and concise paragraphs. The diagram with the stacked skyscrapers follows a familiar comparison device, and the familiar display of photos and captions completes this informative piece.

Poster #2 then seems to satisfy the constraints of working memory by giving a quick snapshot of the topic, then by guiding the viewer through the smaller visual units or chunks.

Conclusion

The visual is temporal. A common mistake in graphic design is to assume that the visual elements of a graphic are atemporal and that the design problem is solved with a handsome arrangement and clear elements. From the viewer's standpoint, however, the visual design is a time-dependent interpretive problem to be solved within the constraints of working memory. It is not an immediate experience. It is mediated, and its elements are likely to be unclear unless great care has been taken to enable closure to occur rapidly, causing the present perceptual experience to be transferred to the permanent storage of long-term memory, which is the repository of all successful communication.

In order to insure rapid closure within the time limitation of working memory, each graphic must employ visual conventions that are accepted in a specific culture at a specific time. It must also assume a certain amount of background knowledge on the part of the viewer, or conversely, it must work to compensate the lack of background knowledge. Erring on the side of the latter, that is, providing extra knowledge regardless, is generally a common-sensical approach to design that shows editorial respect for the reader.

Design as it is currently taught relies chiefly on a visual framework that includes typography, layout and colour, in addition to gestalt psychology. This article suggests that the attention of instructors and designers also should be focused on the psychological principles that are at play in all graphics. While fundamentals, such as typography, layout and colour, are always the proper elements of good design pedagogy, they alone are not adequate to solve communicative problems that are never purely formal or purely visual, but depend on the limits of the viewer's working memory, relevant knowledge and values. Hence, every design problem is highly contextualized, specific, ad hoc and resistant to a formulaic approach.

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References

Adams, W. L., Cooke, S. V., Gibson, M., Paramaguru, K., Welikala, J. & Jones, H. (2012, July 30). Trivia games (graphics). *Time*, 94-95.

Baddeley, A. D. (2014). *Essentials of human memory.* Hove, U.K.: Psychology Press Classic Editions.

Baddeley, A. D. & Hitch, G. J. (1974). Working memory. *The psychology of learning and motivation: Advances in research and theory*, *8*, 47-89. doi: 10.1016/S0079-7421(08)60452-1

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology.* Cambridge: Cambridge University Press.

Bertin, J. (2011). *Semiology of graphics: Diagrams Networks Maps.* Translated by William J. Berg. Redlands, CA: Esri Press.

Canham, M. & Hegarty, M. (2010). Effects of knowledge and display design on comprehension of complex graphics. *Learning and Instruction, 20*(2), 155–166. doi: 10.1016/j.learninstruc.2009.02.014

Carpenter, P. A. & Shah, P. (1998). A model of the perceptual and conceptual processes in graph comprehension. *Journal of Experimental Psychology: Applied, 4*(2), 75–100. doi: 10.1037/1076-898X.4.2.75

Casner, S. M. & Larkin, H. (1989). Cognitive efficiency considerations for good graphic design. *Proceedings of the Eleventh Annual Meeting of the Cognitive Science Society* (pp. 275-282). Hillsdale: Lawrence Erlbaum Associates.

Cleveland, W. S. & McGill, R. (1984). Graphical perception: Theory, experimentation, and application to the development of graphical methods. *Journal of the American Statistical Association, 79*(387), 531–554. doi: 10.1080/01621459.1984.10478080

Cook, M. P. (2006). Visual representations in science education: The influence of prior knowledge and cognitive load theory on instructional design principles. *Science Education, 90*(6), 1073–1091. doi: 10.1002/sce.20164

Cooke, S. v., Gibson, M., Paramaguru, K., Welikala, J., & Jones H. (graphics) (2012, July 30). London Lines. *Time*, 26-27.

Cox, A. (2012, July 10). *Eyeo2012 - Amanda Cox*. Retrieved September 15, 2012, from https://vimeo.com/45537437

Davis, M. (2012). *Graphic design theory*. New York: Thames & Hudson.

Gombrich, E. H. (1960). Art and illusion: A study in the psychology of pictorial representation. Princeton: Princeton University Press.

Gombrich, E. H. (1982). *The image and the eye: Further studies in the psychology of pictorial representation.* Oxford: Phaidon.

Hinze, S. R., Rappa, D. N., Williamson, V. M., Shultz, M. J., Deslongchamps, G. & Williamson, K. C. (2013). Beyond ball-and-stick: Students' processing of novel STEM visualizations. *Learning and Instruction*, *26*, 12–21. doi: 10.1016/j.learninstruc.2012.12.002

Hirsch, Jr., E. D. (1977). *The philosophy of composition.* Chicago, IL: The University of Chicago Press.

Lloyd, P. B. & Ovenden, M. (2012), *Vignelli transit maps*. Rochester, New York: RIT Cary Graphic Arts Press.

Logie, R. H. (1996). The seven ages of working memory. In J. T. Richardson, L. H. Robert, E. R. Stoltzfus, L. Hasher, R. T. Zacks, & R. W. Engle, *Working memory and human cognition* (31-65). New York: Oxford University Press. doi: 10.1093/acprof:oso/9780195100990.003.0002

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review, 63*(2), 81–97. doi: 10.1037/h0043158

Mouahad, J., Cox, A. & Nguyen, V. (2008, February 19). *Oil Prices Reach a Symbolic Mark*. Retrieved September 30, 2013, from The New York Times - Breaking News, World News & Multimedia: http://www.nytimes.com/interactive/2008/02/19/business/20080220_CENTURY_GRAPHIC.html

Neurath, O. (2010). *From hieroglyphics to isotype: A visual autobiography.* (M. Eve, & C. Burke, Eds.) London: Hyphen Press.

Noizet, G. & Pynte, J. (1976). Implicit labelling and readiness for pronunciation during the perceptual process. *Perception, 5*(2), 217–223. doi: 10.1068/p050217

Novak, J. D. & Gowin, D. B. (1984). *Learning how to learn.* Cambridge, England: Cambridge University Press. doi: 10.1017/CBO9781139173469

Panofsky, E. (1962). *Studies in iconology: Humanistic themes in the art of the renaissance.* New York: Harper & Row.

Saussure, F. de (1959). *Course in general linguistics.* (W. Baskin, Trans.) New York, New York: Philosophical Library.

Sellars, W. (1956). Empiricism and the philosophy of mind. In E. Feigl, & M. Scriven (Eds.), *Minnesota Studies in the Philosophy of Science, Volume I: The Foundations of Science and the Concepts of Psychology and Psychoanalysis* (253–329). Minneapolis, MN: University of Minnesota Press.

Wikipedia, (2015, May 12), *Harry Beck*. Retrieved May 26, 2015 from http://en.wikipedia.org/wiki/Harry_Beck

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Eva Lutnæs

Imagining the unknown

Responsible creativity for a better tomorrow

Abstract

This paper explores the scientific discourse on creativity in the field of design education, drawing upon 165 papers presented at the DRS//CUMULUS Oslo 2013 conference. The review shows creativity to be a key concept in the scientific discourse and identifies five storylines that conceptualise creativity as a generic human capacity for which the field of design education eagerly claims responsibility. In the scientific discourse, the fostering of creativity is a leading motive when articulating reasons for design to gain terrain in general education. A multifaceted repertoire of strategies to solve design problems can drive new ideas or artefacts that contribute to both environmental protection and degradation, human aid or human-made disasters. I discuss how to frame the relevant educational content of creativity as part of a general education that empowers citizens to promote sustainability and meet global challenges ahead.

Keywords: responsible creativity, design education, creative, assessment repertoire, general education.

Imagining the unknown

Despite a growing number of climate-change mitigation policies, the annual emissions of greenhouse gases grew more quickly from 2000 to 2010 than in the three previous decades (IPCC, 2014, p. 6). The global mean temperature might rise to levels that cause a social and ecological collapse and we have not yet been up for the task of large-scale changes in our unsustainable ways of living. General education prepares students to step into the making and problem solving of tomorrow. David Orr (1992) describes the prerequisites to ecological literacy: "the study of environmental problems is an exercise in despair unless it is regarded as only a preface to the study, design and implementations of solutions" (Orr, 1992, p. 94). In order to act as responsible citizens, awareness of unsustainable consumerism and severe climate changes is crucial, but to evoke empowerment, students need to recognise their capacity to transform that reality. The declarative logic of natural science and the normative logic of design complement each other. Concerned with how things are, the natural sciences contribute to students' awareness of environmental problems, but the capacity to transcend the known is the expertise of design. Design is concerned with how things ought to be (Simon, 1969). To create the sustainable future that does not yet exist, creative strategies that enable students to construct alternative modes of production, trade and consumption – to imagine the unknown – are a vital part of general education.

The *DRS//CUMULUS Oslo 2013 2nd International Conference for Design Education Researchers* aimed to explore the idea of design education as important for all citizens, a core component in general education to promote sustainability and meet global challenges for the future (Oslo and Akershus University College of Applied Sciences, 2012). The Chair of the conference, Liv Merete Nielsen, addressed the importance of a design-literate general public in the introduction of the conference proceedings:

> For years we have promoted the idea that sustainable design solutions should include more than 'professional' designers; they should also include a general public as 'conscious' consumers and decision makers with responsibility for quality and longevity, as opposed to a "throw-away" society (Nielsen, 2013, p. i)

Nielsen promotes design education for all as a game changer for consumerism, enabling a bottom-up citizenry to be knowledgeable consumers demanding sustainable design solutions. Designers, policy makers, investors and consumers all make choices that will influence our future visual and material culture – the mitigation or continual growth of pollution and over-consumption. The results of human creativity take shape as both weapons and midwifery kits, machinery for rapid deforestation and plans to save imperilled bees. Creativity as a skill does not intrinsically imply support for the "*better tomorrow*" that Nielsen (2013, p. i) recommends as achievable by a design-literate general public. In this article, I draw upon 165 papers presented at the DRS//CUMULUS conference as samples to explore the scientific discourse in the field of design education in relation to the concept of creativity. The review situates creativity as a key concept in the scientific discourse of design education and identifies five different storylines about creativity. The second part of the article addresses the good practice challenges that Arts and Crafts teachers face when assessing creativity in the works of their students. The final section discusses how to frame the relevant educational content of creativity as part of a general education that empowers citizens to promote sustainability and meet the global challenges ahead.

Design education and creativity – a concept analysis on papers from DRS//CUMULUS

With the strap line "Design Education from Kindergarten to PhD", the conference gathered 278 delegates from 43 countries to explore the idea of design education as important for all. The organisers of the conference received 225 full papers. After a double-blind peer-review process, 165 papers were selected and included in the conference proceedings (Reitan et al., 2013). The papers total 2,330 pages and provide a vast database to explore the scientific discourses of design education in a transdisciplinary and international context anno 2013. I have conducted a brief concept analysis of how the field of design education frames 'creativity/creative' by exploring the diverse meanings applied to the concepts within the sample of 165 DRS//CUMULUS papers. The concept analysis derives from Soini and Birkeland's (2014) approach when investigating the scientific discourse on the concept of 'cultural sustainability'. They use storylines (Hajer, 1995, p. 56) as a semiotic tool to identify generative narratives used to give meaning to specific physical or social phenomena within a discourse (Hajer, 1995, p. 44). The discourse in my case refers to ideas, concepts and categorisations that are produced, reproduced and transformed in the practice of writing papers for a conference through which meaning is given to physical and social realities within the field of design education. Soini and Birkeland (2014, p. 215) describe storylines as a mechanism for creating and maintaining meaning that speaks to particular ways of constructing a problem. Given the broad scope of the conference, the DRS//CUMULUS papers use the concepts 'creativity/creative' in a wide variety of contexts and the authors put numerous different agendas in play. As an approach, storylines encompass the complexity of the scientific discourse on 'creativity/creative' and provide a semiotic tool to voice different narratives in the discourse.

The first phase of the concept analysis was a thorough word search on 'creativ' across the conference proceedings, designed to investigate how frequently the concepts 'creative' and 'creativity' appeared in the papers. I used Adobe Reader, searched through the 2,330 pages with the keyword 'creativ', and registered all the papers that make use of the concepts 'creativity' and/or 'creative' in the text and title in every session. The term 'text' here refers to the abstract and/or main body. I have not included the concepts if present in the acknowledgements or bibliographies of the 165 papers. The conference proceedings divide into four volumes and ten different sessions. Table 1, below, displays the results:

DRS//CUMULUS SESSION	PAPERS IN SESSION	CREATIVITY and/or CREATIVE IN TEXT	CREATIVITY and/or CREATIVE IN TITLE	VOLUME/PAGES
Introductions	3	3	0	Introductions/p. i-viii
Design Curriculum	19	17	0	Vol. 1/p. 2-250
Assessment	8	6	3	Vol. 1/p. 252-355
Internationalisation of design education	5	4	1	Vol. 1/p. 357-427
Philosophy of design education	18	15	1	Vol. 1, 2/p. 431-665
Design knowledge	17	10		Vol. 2/p. 667-905
Research informed design education – Design education informing research	18	14	1	Vol. 2,3/p. 907-1155
Multidisciplinary design education	18	14	2	Vol. 3/p. 1157-1418
Challenges in design education methods	31	24	2	Vol. 3, 4/p. 1420-1864
Design education for non-designers	26	22	6	Vol. 4/p. 1867-2248
E-learning	5	2	0	Vol. 4/p. 2250-2330
TOTAL	165	128	16	2330

Table 1. The use of the words 'creativity' and/or 'creative' across the 165 papers of the DRS//CUMULUS Oslo 2013 conference proceedings.

Conducting the word search on 'creativ', I found that ¾ of the DRS//CUMULUS papers contained the concepts 'creativity' and/or 'creative' and that they appeared in 10% of the titles. The frequent use of the concepts 'creativity' and 'creative' within the DRS//CUMULUS papers situates creativity as a key aspect in the scientific discourses of design education. The terms 'creativity' and/or 'creative' feature in all the three texts in the introductions to the conference proceedings. In some papers, the concepts are keywords, extensively defined and used on nearly every page of the paper; in others, the concepts appear once. However modest the discussion is, the authors have contributed to the discourse on creativity in the context of design education. In the second phase of the concept analysis, I reviewed the scientific discourse sampled by the conference proceedings, searching for generative narratives – storylines – on what creativity is in the context of design education. Given the vast amount of text, the abstracts have been key to navigating through the proceedings and I have primarily focused my analysis on the papers in which creativity is a key aspect of the discussion. A more detailed analysis of all 128 papers that include the concepts 'creativity' and/or 'creative' could yield additional storylines and further nuances to those I have identified in this study.

Storylines on creativity identified in the DRS//CUMULUS conference proceedings:

1. **Creativity is the core of design as a discipline**. This storyline is a statement by the authors Pillan, Maiocchi, & Radeta (2013, p. 618). Their statement gains strong support from the frequent use of the concepts 'creativity' and/or 'creative' that I found across the conference proceedings. In his introduction to the conference proceedings, Michael Tovey (2013), convenor of the DSR Design Pedagogy Special Interest Group, upholds creativity as the most fundamental quality that design students need in order to enter the community of practice of professional design.
2. **Creativity is not an ability exclusively for the field of design or design education.** Raffaella Perrone (2013, p. 1684) quotes Boden's definition of the concept: "Creativity is the

ability to come up with ideas or artefacts that are new, surprising and valuable" (Boden, 2004, p. 1). Boden understands creativity as an aspect of human intelligence in general that enters virtually every aspect of life. Grace Schlitt (2013) further explicates the broad application of creativity: "By definition, creativity is the ability to transcend traditional ideas, rules, patterns and relationships, and to make meaningful new ideas, forms, methods, and interpretations" (Schlitt, 2013, p. 1356).

3. **Creativity means newness and expediency.** Perrone (2013) and Schlitt (2013) stress that the new idea or artefact must be meaningful or valuable. Innovative design is a unique solution that creatively satisfies a problem (Vande Zande, 2013, p. 2187). The newness derives from transcending the traditional or conventional in a surprising way; knowledge of prior solutions is deemed vital. Creativity is based on knowledge of previous work and the ability to see connections and relationships where others have not (Zhang, 2013, p. 418).
4. **Creativity is as a skill that people can learn.** Several papers explore how design education might cultivate creativity by describing exercises, activities and techniques across a span of education contexts, from kindergarten to design students (Zhang, 2013; Pillan, Maiocchi, & Radeta, 2013; Schlitt 2013; Kwon & Yang, 2013; Perrone, 2013; Taboada & Coombs, 2013; Yalcin, 2013; Canina, Coccioni, Anselmi, & Palmieri, 2013; Ingalls Vanada, 2013; Rinnert & Coorey, 2013; Seevinck & Lenigas, 2013; Vande Zande, 2013). A shared storyline across the interdisciplinary papers addresses creativity as learnable, and the idea that design education provides specific methods of generic value to adopt that cultivate creativity across sectors.
5. **Creativity advances economic competitiveness.** Several papers identify learning and managing creativity techniques as a prerequisite to innovation. Zhang (2013) describes a method to improve Chinese design students' creativity as a means to change the current situation of 'Made in China' to 'Created in China'. Canina and her co-authors (2013, p. 1909) suggest a creativity-training plan for companies as a key to succeed in the market. Preparing students for success in the globalised world economy is a goal of the *Partnership for 21st Century Skills* (2015). Several papers discuss the value of design education for enhancing creativity as a key 21st-century skill (Kim, Kwek, Meltzer, & Wong, 2013, p. 86; Rinnert & Coorey, 2013, p. 2135; Vande Zande, 2013, p. 2186; Wright, Wrigley, & Bucolo, 2013, p. 2217; Wright, Davis, & Bucolo 2013, p. 2231).

The five storylines situate creativity as a generic human capacity for which the field of design education eagerly claims responsibility. Across the interdisciplinary papers from the DRS//CUMULUS conference, creativity is embraced as a skill to learn and several papers promote the value of techniques derived from the design process of problem solving as generic methods to cultivate creativity. In the initial word search, I found that the session "Design education for non-designers" had the most frequent use of 'creativity/creative' in titles: authors of six papers (out of 26) regard 'creativity/creative' to be such an important aspect of their discussion that they included it in the title. The concepts appeared in 22 of the papers in the session. Given the title of the session, the frequency indicates that creativity constructs a widespread narrative in the scientific discourse when legitimising the value of design education to non-designers. Vande Zande's (2013) paper in that session offers a significant example because it concludes thus: "one of the most effective ways to get support is to educate business leaders that creativity and innovation are important aspects of design education and it is giving them what they ask for in our society and future workforce" (Vande Zande, 2013, p. 2193). The fostering of creativity surfaces as a leading motive in the scientific discourse when articulating reasons for design to gain terrain in general education. The fostering of creativity necessitates learning, but in my paper for the DRS//CUMULUS conference (Lutnæs, 2013) I described an alarming lacuna in the assessment repertoire of Norwegian Art and Crafts teachers; one of the subject's main concepts, creativity, is only weakly linked between learning and assessment. The teachers struggle to find words to describe what makes students' design creative. There is nothing to the concept when I dig beneath the surface and it ends up being an inherent ability that the subject allows students to

make use of, not something specific to learn and expand through Art and Crafts classes. In order to claim responsibility for this generic human capacity in general education, the Art and Crafts teachers' educational deficit with regard to creativity makes it an area to advance substantially.

Teachers' educational criticism – the public face of connoisseurship

The assessment of students' work is an act of connoisseurship and educational criticism, qualities that Elliot Eisner (2002) distinguishes between in his book *The Arts and the Creation of Mind*. Connoisseurship is a process that can be carried out in solitude and without uttering a word. Educational criticism is the task of making public what one has experienced as a connoisseur and requires words (Eisner, 2002, p. 187). As the silent act of connoisseurship can be elusive as empirical material, I have studied the "public face" (Eisner, 1991, p. 85) of connoisseurship, educational criticism. More specifically, I observed teachers when negotiating students' final grades and interviewed them regarding their assessment practice. I chose to do fieldwork amongst two teams of good practice Art and Crafts teachers. The concept of 'good practice' refers to profiled, educated, experienced and admired teachers. My agenda as a researcher was to explore what teachers valued after ten years of compulsory education in the subject Art and Crafts and to discuss the content that their assessment practice facilitated.

The grade given in the subject Art and Crafts equates with grades given in subjects such as English, Science and Norwegian in the certificate awarded to all students when they leave their ten-year compulsory schooling. The grades that the teachers make use of range from 1 to 6, with 1 the lowest grade and 6 the highest. The current curriculum, "Knowledge promotion" (Kunnskapsdepartementet, 2006), provides learning objectives but does not state expected levels of achievement, as is done, for example, in Sweden and England. The development of assessment criteria that echo the complexity of the main subject areas of visual communication, design, art and architecture is part of each teacher's professional responsibility. The fieldwork was limited to the negotiation of the final grade, summing up the students' achievements after ten years of compulsory education in the subject Art and Crafts. I was in the midst of the teachers' assessment practice for nearly two months, attending their meetings, listening to their negotiations, conducting interviews and collecting the assessment tools they used. This combination of methodology was chosen to document thoroughly the challenges and dilemmas of assessment in the subject, and the vocabulary and strategies teachers draw on to solve them.

Negation of meaning

I analysed the teachers' assessment repertoire as locally negotiated regimes of competence, drawing upon Etienne Wenger's (1998) theory on the negotiation of meaning. Wenger makes a distinction between the repertoire the members of a community of practice have produced and the repertoire they have adopted (Wenger, 1998, p. 83). When assessing the work of their students, the teachers can draw upon the history of their profession, and thereby adopt earlier solution strategies and concepts used as descriptors of quality. They also have their own history of negotiations to reuse as a repertoire when they face similar dilemmas of assessment (e.g. what grade should they give products they suspect to be finished by a parent or to products half-finished because of a long period of truancy?). These histories of interpretation create shared points of reference, but, as Wenger states, "they do not impose meaning" (Wenger, 1998, p. 83). As a resource for the negotiation of meaning, the repertoire remains inherently ambiguous; ambiguity is a condition of negotiability. The teachers negotiate which part of history to make "newly meaningful" (Wenger, 1998, p. 137) when assessing students' work within their local school context and current national curricula. By choosing a good practice approach, I conducted my fieldwork amongst the connoisseurs, educated art and

crafts teachers who know the repertoire. Their way of solving dilemmas of assessment document the profession's capability, because the locally negotiated regime of competence reflects the repertoire available for adoption. In this paper, I revisit the fieldwork with the scope limited to the assessment of creativity.

Assessment of creativity in the subject Art and Crafts

When they negotiated the students' final grades in the subject Art and Crafts, all the teachers valued craftsmanship. They expected the technical conventions explained in class to be repeated in the objects made by their students. However, it was not sufficient to demonstrate excellent craftsmanship by copying an idea of the teacher or fellow students. In order to achieve the highest grades, the students were expected to develop their own, original designs, to add their own creative twist to the objects in question. As I analysed the teachers' assessment repertoire, a distinction became apparent. They all had a well-functioning linguistic repertoire related to the assessment of technical performance but struggled to find words to describe what made students' designs original or creative. Their struggle is an indicator of an assessment repertoire that can cause the teacher problems when providing criticism. How can the teachers promote creativity if they lack words to identify achievements? Creativity and originality surface as assessment criteria in both the assignments and the rubrics used by the teachers to document their assessment of students' work. These concepts appear as a prioritised aspect of students' work in the subject Art and Crafts. In the following sections, I will describe two cases from the fieldwork and discuss the challenges good practice teachers face.

School B - Creativity as the unpredictable element of surprise

In a group interview, a team of three teachers started an extensive discussion when I asked them to describe what they put value on concerning the assessment criteria for creativity in their assignment on contemporary art. The teacher who first answered linked the assessment of creativity to the subjective preferences of each teacher. Creativity depended on what the teachers liked, identified as "exciting and resilient" (Lutnæs, 2011, p. 186). This descriptor makes quite an unpredictable compass for the students and I continued by asking the teachers how they explain the assessment of creativity to their students. Another teacher stated that creativity is about creating the new, to create something that is new to you. With this approach, creativity depends on the students' earlier achievements. Two seemingly identical works would be given different grades, a low score to the student who just replicated a previous success and a high score to the student who freshly unpacked the same concept.

My next step as a moderator of the discussion was to reactivate the teachers' preferences as a compass when assessing creativity by asking what would happen if a student made something "new to him or her" and the teacher did not like the design. The third of the teachers participating in the group interview replied, "You do not even need to like it, but you could be surprised" (Lutnæs, 2011, p. 187). The moment of surprise as an important aspect of creativity was supported by another teacher, who gave examples from art history of works that had surprised in their time. He explained that new, surprising artworks arise as a result of previous artworks; it is a twist, a response to history. He continued by saying, "If you have that skill, then you are creative" (Lutnæs 2011, p. 188). I remarked that it is demanding for students in tenth grade to reach this level of performance. The teachers agreed and returned to their "creative for you as an individual" path, but as their discussion evolved, they ended up downplaying this as relevant assessment evidence; they claimed to assess the students' products as they are, and not by comparing them to the students' previous design processes.

In summary, creativity emerges as a volatile concept in their assessment repertoire, an unpredictable element of surprise. The teachers were not able to identify a robust set of de-

scriptors they could agree upon related to creativity in their joint assignment on contemporary art. Given this absence, creativity seems more like a buzzword, an ornament on the subject's public façade rather than the public face of Art and Crafts teachers' connoisseurship.

School A - Originality in works of students

At the other school I visited as a researcher, a teacher used the word 'originality' when assessing objects in wood. In an individual interview, she told me that assessment of originality is limited to the varieties within the class and the school, not the whole world. It is not regarded as original if students copy an idea they have seen in the previous year's exhibition or one of the teacher's examples. To assess whether students' works are original or not, one needs in-depth knowledge about what happened during a project. This criterion makes the students' teacher the sole connoisseur. The teacher is the only one who knows what design solutions she or he made available in class as examples, not to speak of which one of the students originated an idea first.

One need not be an Art and Crafts teacher for long to discover how ideas percolate amongst a group of students, especially the ideas that are appraised by a teacher in class. Sharing ideas could be seen as a sign of a sound and dynamic setting for learning, but, because the impending assessment values unique and independent ideas as proof of originality, it could be recognised as a problem. The students tend to hide their sketches or to make sure that the teachers keep track of whom to reward as the originator and whom to mark down as the copycats. The teacher revealed doubts about the relevance of assessing originality in students' work; when she appraises an idea of a student, it usually turns out that the student has seen a similar object elsewhere. Then, she said, the idea is not as original as first anticipated, and continued, "Maybe it is stupid to put as much value on originality as we do. Most things are already thought of … What is the good in always expecting works to be original? Maybe we should return to the practice where students replicated the teacher's models?" (Lutnæs 2011, p. 197). The teacher drew my attention to the students' works on the wall behind us and stated that all of them were slight variations of the same design – a design developed by the teacher. The students had redesigned the teacher's model and her doubts about expectations of originality were most reasonable.

A weak link between learning an assessment.

The assessment of creativity in the teachers' assessment repertoire is linked to the assessment of the final object. In the interviews, the words 'creativity' and 'originality' are used interchangeably, directed towards the *outcome of making*, not the *process of innovative problem solving*. Seemingly, they look at an object made by a student and ask, "Is this creative? Does this object convey proof of an independent design solution?" Michl (2002) challenges the idea amongst design students that it is best not to be inspired by others:

> It is a fact that all designers, the outstanding ones as much as the mediocre or inferior ones, always build on, modify and continue the work of other designers, and that no one can avoid doing precisely this. (Michl, 2002, p. 12)

Michl presents 'redesign' as a more appropriate notion for the practice of designing to underline the collective and evolutionary dimensions of designing. Originality is a utopian aim for students at lower secondary school, who are most likely making a first attempt to create within whatever specific field of art and design the teacher has introduced them to. Still, what concerns me more is that the striving for originality obscures what students could learn by exploring prior objects and professional art and design practices. The ideal to create a product

uninfluenced by others is counterproductive to learning. Michl illustrates this by a striking example:

> If a student makes his own originality his goal, he will try, logically and naturally enough, to defend his own individual artistic "innocence" against what he sees as harmful external influence. This leads to a fundamental hostility to learning – because learning always implies being influenced by others and acquiring other people's solutions and approaches (Michl, 2002, p. 12).

Michl (2002) shows how the ideal of originality makes teachers' instruction difficult. In my fieldwork amongst Art and Crafts teachers, I found that the period of awaiting assessment further restrains teachers in the first phase of a project. With assessment criteria such as originality and creativity, the teachers find themselves caught in an educational trap: If they aid the students, they could end up assessing their own ideas. Without help, some of the students would not proceed from the drawing board to the making of objects. This dilemma is acknowledged by the teachers in my fieldwork as part of their daily life. True to a tradition that the initial idea should come from the students, their strategy is to keep back and try to get students started by asking questions. If they have to provide ideas and a student makes a product based on exactly the same idea, the consequences take the form of a lower grade. It is regarded as unfair to assess such a product, based on the idea of a teacher, on the same level as a product based on an idea developed exclusively by a student. In the first phase of a project, the teachers are sidelined, patiently waiting for original ideas to pop up amongst the students. Then they can re-enter the scene and aid the students in the realisation of their ideas. As mentioned earlier, when it comes to craftsmanship, in a narrow understanding, as skills to make ideas real, the students are expected to reuse the technical conventions developed by earlier generations of makers. Strategies of construction and the use of tools to manipulate and transform materials into the intended object are free to copy. The ideal of originality is preserved in form and content. Originality is the assessment evidence of creativity, and seems to be something that just happens or does not. Some students come up with spontaneous and unique design solutions that fit the teacher's specifications; others remain frustrated and have to ask for the teacher's help, which, from previous experience, they know will lower their grade.

This approach makes creativity something you possess, an inherent ability the subject allows you to make use of, not something to learn and expand through Art and Crafts classes. The assessment evidence, which the teacher values as creativity, is not a continuum of a learning process planned by the teacher. Framing creativity as independent ideas produces a weak link between learning and assessment. The teachers wait for unique ideas to surface in the students' sketches, while the students, caught in a culture that disparages sharing, protect their ideas and their artistic innocence from the repertoire of generations of makers within the fields of art and design. The assessment evidence, independence, is counterproductive to learning and reveals an urgent need for reframing the concept of creativity. A catalyst for change would be a shift from the emphasis on the *outcome of making*, framed as "unique" design solutions, to the emphasis on the actual act of making, *the process of innovative problem solving*. In my view, a multifaceted repertoire of strategies to solve design problems is the relevant educational content of creativity. These repertoires do not evolve from teachers handing out white sheets of paper and a strategy of patient waiting for "original" ideas; it requires teachers that claim an active role as cultivators of creativity – teachers who teach specific tools to adopt in the act of making. The focal point in the subsequent assessment would be on how the students utilise the learned repertoire in the process of problem solving.

Repertoires available for adoption

The assessment repertoire of teachers sets the direction for desired learning outcomes and paves the way for the skills, identity and ambitions that general education seeks on behalf of future generations. The DRS//CUMULUS-paper "Wicked Futures" (Hooper, Welch, & Wright, 2013) addresses how an educational environment that requires considerable amounts of assessment tends to favour convergent thinking over creativity, and divergence as creativity is difficult to assess fairly. The assessment repertoire of good practice art and crafts teachers in my study confirms this distinction. In terms of creativity as an unpredictable element of surprise, the students at School B hardly got a fair assessment, but expectations of craftsmanship were well defined and subject to clear rules, framed as 'tame' problems (Coyne, 2005). Hooper, Welch, & Wright (2013) argue that the big issues that will dominate students' adult lives are "wicked problems", like the complex problem of refuturing our world (Fry, 2009). To face what Hooper, Welch, & Wright (2013) refer to as the "perfect storm" of climate change, the development of a repertoire that assesses creativity fairly is a leverage point (Meadows & Wright, 2008). The assessment repertoire makes a vast footprint on the education of future citizens, and makes it an area to cultivate accordingly.

Locally negotiated regimes of competence reflect the repertoire available for adoption, and the development of a repertoire to teach and assess creativity implies the joint responsibility of both classroom teachers and researchers. The Swedish professor Lars Lindström (2006) approaches the challenge of assessing creativity in an exemplary manner by the questions he asks in the article "Creativity: What Is It? Can You Assess It? Can It Be Taught?" The article is based on a research project (Lindström, 1999) that identified four dimensions of creative ability, and developed and tested a rubric describing levels of performance related to four process criteria: investigative work, inventiveness, the ability to use models and the capacity for self-assessment. In the article, Lindström takes the research project one step further by giving advice on how the four dimensions of creative ability can be taught, thus making the crucial link between learning and assessment that is weak when it comes to creativity, as seen in my studies (Lutnæs, 2011, 2013). Further links are made by other research projects (Gardner, 1996; Atkinson, 2001; Kimbell, 2005; Lindström, 2005; Borg, 2008; Kreitler & Casakin, 2009). A multifaceted repertoire of strategies to solve design problems can drive new ideas or artefacts that contribute to both environmental protection and degradation, human aid or human-made disasters. Considering the socio-ecological transition ahead, what would make a relevant framing of creativity as part of a general education that empowers citizens to promote sustainability and meet global challenges for the future?

Framing creativity as part of general education

Comprising the scientific discourse in the DRS//CUMULUS conference proceedings, creativity is defined as the ability to make valuable and meaningful new ideas based on knowledge of previous work. Still, what makes an idea valuable and to whom is it meaningful? In the second phase of the concept analysis, I identified five different storylines in the scientific discourse on creativity in the field of design education. Storyline 5, "Creativity advances economic competitiveness", relies on a recognition of creativity as one of the main driving forces of economic development. New ideas, forms and methods are judged meaningful in terms of business. In this, creativity strengthens just one out of three mutually reinforcing pillars of sustainable development (United Nations, 2002), namely, economic development, at the expense of social development and environmental protection. The creativity of designers has to pair up with other concepts to transform conditions of unsustainability. In the final phase of the concept analysis, I searched the DRS//CUMULUS papers for options.

Wright, Davis and Bucolo (2013) pair 'creative' with the concept 'citizen' in their paper on the value of design education in the knowledge economy. The authors do not define

the idea of 'creative citizen', however. In the introduction to the paper, the concept of 'citizen' is linked to the *Partnership for 21st Century Skills* and the ability to thrive in the global skills race to ensure economic competitiveness. In response to the motivation of the research study, one of the survey respondents voiced concern about prioritising the economy as a goal of design education given the compelling need to change our thinking fundamentally, at both a local and global level. "The Earth is finite yet we continue to plunder and trash it at an increasing rate" (Wright, Davis, & Bucolo, 2013, p. 2238). The survey respondent sees design thinking as a key to changing our worldviews and mitigating ecological change, not as a way to sell more stuff. When the authors propose recommendations for the future development of design education programs in Queensland, the focus is on design's value in building innovative, adaptive and resilient communities. Their creative citizen remains an agent for economic competiveness, however, because concerns for the environment and social inequities are not made explicit.

Boehnert (2013) stresses the link between ecological literacy and design as she upholds systemic understanding, ecological knowledge and critical skills as foundations of responsible design. Mateus-Berr and her co-authors (2013) address responsible design in their paper on the social responsibility of designers and criticise the way that established design strategies reinforce global capitalist desires and create desire for new products. The authors argue that designers have played a considerable role in shaping today's consumerist culture by providing their skills and talents (Mateus-Berr et al., 2013, p. 433), and they call for a shift of focus in which design does not refer to the shaping of consumable items but to the creation of structures that aim at improving quality of life. Sevaldson (2013) describes systems-oriented design as an approach to deal with complexity as a designer to reach solutions that combine ethical issues with sustainability, economy, new technology and social and cultural considerations. Ingalls Vanada (2013) makes big picture thinking a central issue in her paper on how to educate tomorrow's change makers and problem solvers. With a view towards fostering deep, connected, and independent thinkers, she balances creativity with practical wisdom and the ability to think critically.

Boehnert, Mateus-Berr, Sevaldson and Ingalls Vanada's shared agenda is to make responsibility for and concern about the wider social and environmental impacts of design solutions an imperative when judging new ideas as meaningful or valuable. Drawing upon Vande Zande's (2013) conceptualisation of innovative design as unique solutions that creatively satisfy a problem, the ethics of designers derive from the problems they choose to solve. Cultivating creativity as part of general education can empower destruction just as much as transitions towards more sustainable modes of production, trade and consumption. In *Creativity in Schools: Tensions and Dilemmas,* Craft (2005) states that, "Promoting children's creativity in the context of wider ethical dimensions of our existence is not an optional extra" (Craft, 2005, p. 149). She refers to the alarming findings of the GoodWork project (Fischmann, 2004) on how young workers assert themselves as the ultimate judges of the ethics of their work and espouse a dubious brand of moral freedom. The interconnectedness to the natural world and other humans is lost when individual aspirations determine the appropriateness of ideas and actions.

Cultivating responsible creativity

Craft (2005, p. 150) makes use of the notion of 'responsible creativity' in describing the GoodWork project's concern with human creativity and its agenda of supporting the evolution of thoughtful, responsible creativity among aspiring young people. Craft argues that the fostering of creativity in its ethical context is applicable to all young people if we are to expect of them responsible actions as citizens, both at home and at work. Adopting Craft's notion of responsible creativity as part of a general education that empowers citizens to promote sus-

tainability and meet global challenges yields implications for both teaching and the subsequent assessment of students' process of innovative problem solving. In cultivating responsible creativity, teachers have to consider the ethical potential when choosing the problems for students to solve. It makes a vast difference whether students are asked to design desirable products to increase sales or to design useful, lasting products to improve quality of life or to mitigate pollution. In class, a core part of the teacher's role would be to draw the students' attention to the wider social and environmental impacts of design and engage them in critical scrutiny of their own and their classmates' ideas. The teacher should expect the students to connect to the world beyond their white sheets of paper and explore new modes of production, trade and consumption, based on real-world knowledge. The key to assessing their design process as valuable and meaningful is how the alternatives they propose satisfy real-world problems responsibly and towards a better tomorrow.

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References

Atkinson, D. (2001). Assessment in Educational Practice: Forming Pedagogised Identities in the Art Curriculum. *International Journal of Art & Design Education 20*(1), 96-108. doi: 10.1111/1468-5949.00254

Boden, M. A. (2004). *The creative mind. Myths and mechanism*. 2nd edition. London and New York: Routledge.

Boehnert, J. (2013). Ecological Literacy in Design Education: A Foundation for Sustainable Design. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1.* (pp. 442-457). Oslo: ABM-media

Borg, K. (2008). Kreativitet eller problemlösning – vad bedömer vi i slöjden?. In *Slöjda för livet om pedagogisk slöjd*, edited by Kajsa Borg, and Lars Lindström, 199–210. Stockholm: Lärarförbundets förlag.

Canina, M., Coccioni, E., Anselmi, L. & Palmieri, S. (2013). Designing a creativity training plan for companies. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4. (pp. 1907-1923). Oslo: ABM-media.

Coyne, R. (2005). Wicked problems revisited. *Design Studies, 26*(1), 5–17. doi: 10.1016/j.destud.2004.06.005

Craft, A. (2005). *Creativity in Schools. Tensions and Dilemmas.* London: Routledge. doi: 10.4324/9780203357965

Eisner, E. W. (1991). The Enlightened Eye: Qualitative Inquiry and the Enhancement of Educational Practice. New York, N.Y.: Macmillan Publ. Co.

Eisner, E. W. (2002). *The Arts and the Creation of Mind*. New Haven: Yale University Press.

Fischmann, W., B. Solomon, D. Greenspan, H. Gardner. (2004). *Making Good. How Young People Cope with Moral Dilemmas at Work.* Cambridge: Harvard University Press.

Fry, T. (2009). *Design futuring: sustainability, ethics and new practice*. Sydney: UNSW Press.

Gardner, H. (1996). The Assessment of Student Learning in the Arts. In D. Boughton, E. W. Eisner, and J. Ligtvoet (Eds.), *Evaluating and Assessing the Visual Arts in Education: International Perspectives*, (p.131-155). New York: Teachers College Press.

Hajer, M. (1995). *The Politics of Environmental Discourse*. Oxford: Oxford University Press.

Hooper, L., S. F. Welch & N. Wright. (2013). Wicked Futures: metadesign, resilience and transformative classrooms. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds*.), Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 3.* (pp. 1269-1281). Oslo: ABM-media.

Ingalls Vanada, D. (2013). Practically Creative: The Role of Design Thinking as an Improved Paradigm for 21st Century Art Education. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 2048-2063). Oslo: ABM-media.

IPCC, (2014). Climate Change 2014. Mitigation of Climate Change. Summary for Policymakers. Retrived January 15, 2015, from http://mitigation2014.org/report/summary-for-policy-makers

Kim, J., S. H. D. Kwek, C. Meltzer, P. Wong. (2013). Classroom Architect: Integrating Design Thinking and Math. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol.1*. (pp. 1282-1297). Oslo: ABM-media.

Kimbell, R. (2005). Assessing Design Innovation. In L. Lindström (ed.), *Technology Education in New Perspectives: Research, Assessment and Curriculum Development*, (p. 17-35). Stockholm: Stockholm Institute of Education Press (HLS).

Kreitler, S. & Casakin, H. (2009). Self-perceived Creativity. The Perspective of Design. *European Journal of Psychological Assessment, 25*(3), 194-203. doi: 10.1027/1015-5759.25.3.194

Kunnskapsdepartementet. (2006). *Læreplanverket for Kunnskapsløftet*. Midlertidig utg. juni 2006. Oslo: Utdanningsdirektoratet.

Kwon, D. E., & S. H. Yang. (2013). An effect of multidisciplinary design education: creative problem solving in collaborative design process. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 3.* (pp. 85-100). Oslo: ABM-media.

Lindström, L., Ulriksson, L. & Elsner, C. (1999). Portföljvärdering av elevers skapande i bild, Utvärdering av skolan 1998 avseende läroplanernas mål. Stockholm: Skolverket.

Lindström, L. (2005). Novice or Expert? Conceptions of Competence in Metalwork. In L. Lindström (ed.) *Technology Education in New Perspectives: Research, Assessment and Curriculum Development,* (p. 61-83). Stockholm: Stockholm Institute of Education Press (HLS).

Lindström, L. (2006). Creativity: What Is It? Can You Assess It? Can It Be Taught?. *The International Journal of Art & Design Education, 25*(1), 53-66. doi: 10.1111/j.1476-8070.2006.00468.x

Lutnæs, E. (2011). Standpunktvurdering i grunnskolefaget Kunst og håndverk. Læreres forhandlingsrepertoar. CON-TEXT, Avhandling; 52. Arkitektur- og designhøgskolen i Oslo.

Lutnæs, E. (2013). Creativity in the subject Art and Crafts: the weak link between learning and assessment. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1.* (pp. 317-329). Oslo: ABM-media.

Nielsen, L. M. (2013). Design Learning for Tomorrow – Design Education from Kindergarten to PhD. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1-4.* (pp. i-iii). Oslo: ABM-media.

Mateus-Berr, R., Boukhari N., Burger, F., Finckenstein, A., Gesell, T., Gomez, M. … Verocai, J. (2013). Social Design. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1.* (pp. 431-441). Oslo: ABM-media.

Meadows, D. H. & Wright, D. (2008). *Thinking in systems: a primer*. White River Junction, Vermont: Chelsea Green Publishing.

Michl, J. (2002). "On Seeing Design as Redesign: An Exploration of a Neglected Problem in Design Education". *Scandinavian Journal of Design History, 12*(1), 7-23.

Oslo and Akershus University College of Applied Sciences. (2012). *DRS // CUMULUS Oslo 2013*

The 2nd International Conference for Design Education Researchers. Retrieved Mar 3, 2015, from http://www.hioa.no/eng/Om-HiOA/Fakultet-for-teknologi-kunst-og-design-TKD/DRS-CUMULUS-Oslo-2013

Orr, D. W. (1992). Ecological literacy: education and the transition to a postmodern world. Albany: State University of New York Press

Partnership for 21st Century Skills. (2015). *From Aspiration to Alarm Bell.* Retrived April 20, 2015, from http://www.p21.org/about-us/our-history

Perrone, R. (2013). Relating creativity, fantasy, invention and imagination: studying collective models of creative collaboration from Kindergarten to University Degrees. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 3.* (pp. 1680-1693). Oslo: ABM-media.

Pillan, M., Maiocchi, M., & Radetatovey, M. (2013). Teaching Constraints, Learning Creativity: Leveraging the Guided Distractions. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 2.* (pp. 607-620). Oslo: ABM-media.

Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.). (2013). *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1-4.* Oslo: ABM-media.

Rinnert, G. C. & Coorey, J. (2013). Introducing high school students to design and creative thinking in a teaching lab environment. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 2134-2144). Oslo: ABM-media.

Schlitt, G. (2013). Cultivating creativity: documenting the journey. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 3.* (pp. 1354-1368). Oslo: ABM-media.

Seevinck, J. & Lenigas, T. (2013). Rock Paper Scissors: Reflective Practices for design process in the landscape architecture novice. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 2145-2159). Oslo: ABM-media

Sevaldson, B. (2013). Systems Oriented Design: The emergence and development of a designerly approach to address complexity. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 1765-1786). Oslo: ABM-media.

Simon, H. A. (1969). *The sciences of the artificial* (Vol. 136). Cambridge, Mass: M.I.T

Soini, K. & Birkeland, I. (2014). Exploring the scientific discourse on cultural sustainability. *Geoforum*, 51, 213-223. doi: 10.1016/j.geoforum.2013.12.001

Taboada, M. & Coombs, G. (2013). Liminal moments: designing, thinking and learning. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 1806-1818). Oslo: ABM-media.

Tovey, M. (2013). Design Pedagogy Special Interest Group of DRS. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1-4.* (pp. iv-vi). Oslo: ABM-media.

United Nations. (2002). *The Johannesburg Declaration on Sustainable Development, 4 September 2002*. Retrieved February 18, 2015, from http://www.un-documents.net/jburgdec.htm

Vande Zande, R. (2013). K-12 Design Education, Creativity, and The Corporate World. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 2185-2195). Oslo: ABM-media.

Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511803932

Wright, N. Davis, R. & Bucolo, S. (2013). The creative citizen: Understanding the value of design education programs in the knowledge economy. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 2230-2248). Oslo: ABM-media.

Wright, N. Wrigley, C. & Bucolo, S. (2013). A methodological approach to modelling design led innovation across secondary education: An Australian case study. In In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 2212-2229). Oslo: ABM-media.

Yalkin, M. (2013). Constructing design knowledge built up on the kindergarten education. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 4.* (pp. 1856-1864). Oslo: ABM-media.

Zhang, Y. (2013). A New Way To Improve Design Students' Creativity - Based on Thinking Style. In Reitan, J. B., Lloyd, P., Bohemia, E., Nielsen, L. M., Digranes, I. & Lutnæs, E. (Eds.), *Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1*. (pp. 417-427). Oslo: ABM-media.

Joanna Boehnert

Ecological Literacy in Design Education
A Theoretical Introduction

Abstract
Sustainability educators developed the concept of ecological literacy *to provide a basis for understanding environmental problems and developing new capacities and critical skills to respond effectively. This paper presents a theoretical introduction to ecological literacy for design education. It starts with a philosophical overview of why ecological literacy is necessary, including details of some of the planet's vital signs. The paper then describes six ecological principles (networks, nested systems, cycles, flows, development and dynamic balance) along with associated design concepts (resilience, epistemological awareness, a circular economy, energy literacy, emergence and the ecological footprint). The final section explains why critical ecological literacy is necessary to make the work of transforming unsustainable conditions and designing sustainable ways of living possible.*

Keywords: design education, sustainability, ecological literacy, environment, systems design

In an era of risk associated with environmental problems, the design disciplines have an important role to play in the creation of sustainable ways of living. Ecological knowledge is a foundation for informed decision-making. The concept of *ecological literacy* was coined by Professor of Environmental Studies and Politics David Orr in 1992 and has since been developed by sustainability educators such as Fritjof Capra (2009, 2005, 2003, 1997), Stephen Sterling (2003, 2001), Richard Kahn (2010) and others. Ecological literacy is relevant across all disciplines but is especially important in design, since design is a practice that is engaged with creating new ways of living. Ecologically literate education is a basis for responsible practice across design disciplines. This goal remains a significant challenge in design education. Ecological and sustainability literacy cannot be developed in a token "green week" fashion. Nor is it adequate for ecological literacy to be an elective that staff and students can decide to ignore. Part of the reason why the challenge of ecological learning is so severe is that it is not simply a collection of facts to be added onto what we already know, but rather it is a kind of learning that requires an interrogation of many basic premises. For example, in light of the recognition of humankind's interdependence with our environment, what right does anyone have to make pollution that will destroy the well-being of others — now and in the future? Partially due to the profoundly difficult nature of this type of question, ecological literacy remains marginal in education and in practice. Since ecological learning disrupts and challenges educational cultures and assumptions about what constitutes good design, there has been institutional resistance to the idea. Nevertheless, it is no exaggeration to say that the future of humanity rests on our capacity to become ecologically literate and to design ecologically sustainable ways of living. There will be no long-term future unless this goal becomes possible. For this reason, ecological literacy is a comprehensive program of learning that requires its own curriculum and research culture in design education.

Ecological Theory

The ambitious aim of ecological literacy is to create a frame of mind that recognizes relations and interdependency with the natural world and supports the development of new capacities to create sustainable ways of living. Ecological literacy is a kind of learning that understands the environment as the material basis for prosperity, and adjusts cultural priorities appropriately. David Orr coined the concept of ecological literacy in his seminal book *Ecological*

Literacy. Orr proposed a need for education to impart an understanding of the interdependence between natural processes and human ways of living. He stressed that ecological understanding must become a pedagogic priority across all disciplinary traditions, although the book often focuses on design education. Ecological literacy demands a type of education that nurtures the capacity to think broadly: a skill that has been "lost in an era of specialization" (1992, p. 87). In an industrially advanced society, understanding the ecological impacts of our actions is imperative for informed citizenship and the design of sustainable ways of living. Ecological literacy explores the "roots of our problems, not just the symptoms" (Orr, 1992, p. 88) and, in the words of the environmentalist pioneer Aldo Leopold, helps learners move from an attitude of "conqueror of the land community to plain member and citizen of it" (Leopold, quoted in Orr, 1992, p. 90). Acknowledging geophysical relationships, and the consequences of these relations, is a foundational step toward transforming learning and cultural priorities.

Ecological literacy responds to severe environmental problems and offers the potential for addressing these problems based on ecological knowledge. Scientists warn that we are now exiting the relatively stable Holocene age in which civilization developed and entering a new geological epoch, that of the Anthropocene (Zalasiewicz, Williams, Haywood & Ellis, 2011). Humankind is responsible for altering the functioning of ecological systems with dramatic consequences. While science has given us power over nature, this technological innovation has not been accompanied by the foresight to use industrial capacities wisely; as a result, we will leave our descendants highly degraded ecological systems. Since 1970, the Living Planet Index (LPI; an indicator of the state of biodiversity) has fallen by 52 percent (WWF-I, 2014, p. 12). What this means is that in "less than two human generations, population sizes of vertebrate species have dropped by half" (WWF-I, 2014, p. 4). At a global level, the yearly ecological footprint takes 1.5 years of regenerative capacity to replace (WWF-I, 2014, p. 9). Thus biocapacity continues to shrink while consumption rates continue to grow. Even the most basic analysis indicates the danger of this situation. The vital signs of the planet are included here as they are the basic background knowledge necessary for responsible design education. Even if we have no concern for the non-human natural world for its own sake, the degradation and destabilization of global ecological systems (especially the climate system) creates grave risks for humanity (Rockström et al., 2009).

Ecological theorists suggest that humankind's current environmental problems result from a highly reductive way of knowing and an intellectual tradition characterized by atomism, mechanism, anthropocentrism, rationalism, individualism and a dualistic tradition that pits humanity versus the non-human natural world. This radical discontinuity with nature constitutes an error in understanding. This epistemological error (Bateson, 1972) is currently reproduced across disciplines and in design theory and practice, resulting in deeply unsustainable ways of living. Society's tendency toward fragmentation makes sustainability an impossible achievement when approached through reductive modes of analysis and the ensuing focus on highly individualistic consumer choices. Ecological literacy addresses these fundamental philosophic errors. Epistemological error determines that humankind is incapable of perceiving systemic interconnections and is ill-prepared to deal with the complexity presented by converging ecological, social and economic crises. It is not that we cannot deal with interconnectedness and interdependence, but that this reality is effectively hidden by the complexity of contemporary conditions and inadequate and erroneous epistemological tradition. Ecological literacy addresses these philosophical problems.

Ecologically Literate Design Education

Ecological literacy implies a radical rethinking of many basic philosophical premises in design education. Design education must broaden its inquiry to build capacity for designers to

understand the social and ecological consequences of the objects, spaces and communication processes they create. As a starting point, Orr describes four prerequisites for ecological literacy:

- to know that "our health, well-being and ultimately survival depends on working with, not against, natural forces";
- to have an understanding of the scope and speed of the current crisis and a familiarity with "the vital signs of the planet and its ecosystems";
- to have a historical understanding of how we have become so destructive;
- to take a practical and participatory approach: "the study of environmental problems is an exercise in despair unless it is regarded as only a preface to the study, design and implementation of solutions" (Orr, 1992, pp. 93-94).

These four building blocks of ecological literacy are the beginning of a much longer learning curve required as a basis for sustainable design. Educational theorist Stephen Sterling describes the learning necessary for sustainable education as "third order learning," i.e. learning that emphasizes capacity-building, enactment and transformative practice (2001, p.78). These prerequisites build capacities for learners to become able to influence industry to create genuinely sustainable solutions — and not simply quick fixes or "greenwashing". While there is no guarantee that ecological literacy will motivate learners to create sustainable options, without ecological knowledge there are no possibilities for sustainable alternatives. The next section will examine ecological principles for design.

Ecological Principles for Design

Ecological theorists describe patterns and processes in natural systems as providing time-tested models for the design of sustainable ways of living. The physicist and ecological literacy advocate Fritjof Capra explains that learners must "understand the principles of organization, common to all living systems, that ecosystems have evolved to sustain the web of life" (2003, p. 201). The "Nature's Patterns and Processes" concept developed by Capra and the Center of Ecological Literacy (CEL) in Berkeley, California, defines six principles in ecological systems: *networks*, *nested systems*, *cycles*, *flows*, *development* and *dynamic balance*. In the following section each of these principles will be linked to a concept in design. This theoretical framework serves as a guide to putting the principles into practice. It should not be considered absolute, since many concepts are relevant for different principles. The design concepts are *resilience*, *epistemological awareness*, a *circular economy*, *energy literacy*, *emergence* and the *ecological footprint*. Linking each principle to a concept informing design strategies, this section explores how ecological principles can inform ecologically literate design education. Each of the following sections begins with a relevant quote from the CEL.

Networks + Resilience

"All living things in an ecosystem are interconnected through networks of relationship" (CEL, 2015).

Network science has provided new understanding of the structure, properties, patterns and organizing dynamics of complex systems. Ecosystems are characterized by robust networks with many interconnections. Highly interconnected complex networks are resilient to shocks and failure because there are a diversity of means for achieving systemic goals. If one node is destroyed, other nodes and links can replace its function. The network theorist Albert-László Barabasi explains:

> Natural systems have a unique ability to survive in a wide range of conditions. Although internal failure can affect their behaviour, they often sustain their basic functions under very high error rates. This is in stark contrast to most products of human design, in which the breakdown of a single component often handicaps the whole device. (2003, p.111).

Nature's designs are *resilient*. This resiliency is different from design in industrial systems, which is typically optimized for maximum efficiency and short-term profitability. Designing for resilience is fundamentally different than designing for efficiency. According to Orr, the basic design principles of resilient systems consist of small units dispersed in space that are designed for redundancy, diversity, decentralized control, quick feedback, self-reliance and at an appropriate scale (2002, pp.114-117). Designing for resilience is a strategy of sustainable design informed by ecological literacy.

Nested Systems + Epistemic Awareness

"Nature is made up of systems that are nested within systems. Each individual system is an integrated whole and — at the same time — part of larger systems" (CEL, 2015).

The term *nested systems* refers to the relationship between systems. The concept is important because systemic dysfunction arises when the relationships between nested systems break down. Ecological economists describe unsustainable development as being caused by a dysfunctional relationship between the economic, social and ecological systems. The economic system has not been "designed" as a subsystem of the larger ecological system in which it is embedded (Daly, 2008). The economic system does not respond adequately to feedback from the ecological system. Humankind has thereby created conditions of deep unsustainability. The implications of dysfunction in nested systems can be dramatic: a subsystem will behave as a parasitic growth that destroys the system in which it is embedded when it does not acknowledge itself as interdependent with its context. Systems design requires conceptual awareness of embeddedness and the ability to distinguish between different types of premises for different levels of embedded systems. For example, the reductive logic that works within economic processes is not the same as the logic that "works" within ecological processes. Epistemological flexibility enables "conscious movement between different levels of abstraction" (Ison, 2008, p. 147). Sustainable design depends on such new capacities for systems thinking, such as epistemic awareness and flexibility across different levels in embedded systems.

Cycles + A Circular Economy

"Members of an ecological community depend on the exchange of resources in continual cycles" (CEL, 2015).

Cycles are perhaps the most obvious pattern in nature (e.g., days, years, the water cycle or the carbon cycle). There is no waste in nature's cycles as all elements are endlessly re-used. These natural cycles are again very different from current industrial production processes where an estimated 99 percent of materials extracted from the Earth become "waste" in just six months (Lovins, Lovins & Hawkins, 1999, p. 81). Our economy is dependent upon a continuous flow of natural resources that are extracted from the Earth and then move through industrial processes, resulting in various types of pollution. Economic growth has material demands. The need for more resources and energy continues to grow as does pollution and the consequences of pollution (e.g., climate change, toxins in the food chain or water scarcity). Designers must learn how we can support the development and design of a circular economy in order to eliminate the concept of waste. The "cradle-to-cradle" method imitates "nature's highly effecttive cradle-to-cradle system of nutrient flow and metabolism in which the very concept of waste does not exist" (Braungart & McDonough, 2002, pp.103-104). The

imitation of natural processes (i.e. biomimicry) is another strategy for sustainable design. Both biomimicry and cradle-to-cradle methods hold enormous promise *if* they are used as part of a larger strategy of economic, social and cultural transformation for sustainability.

Flows + Energy Literacy

"Each organism needs a continual flow of energy to stay alive. The constant flow of energy from the sun to Earth sustains life and drives most ecological cycles" (CEL, 2015).

Flows of energy and natural resources provide living systems with essential energy and materials. Flows, feedbacks, stocks and delays describe a wide variety of ecological processes and are also basic concepts of systems thinking. The availability (i.e. flow) of natural resources will become increasingly important for designers in an age of increasing resource scarcity. One of the most important flows is that of energy. Energy literacy is increasingly important for designers. The flow of conventional fossil fuels is declining due to the increasing scarcity of easy to access reserves. Unconventional fossil fuels are now being extracted with even more severe ecological consequences than conventional fossil fuels (Kitchen, 2014). Meanwhile, global demand escalates as developing nations follow prodigiously wasteful Western models of unsustainable development. While pathways to wean Western economies off of fossil fuels have been developed—for example, the Centre of Alternative Technologies' *Zero Carbon Britain* (Kemp & Wexler, 2010) — there are no current energy sources that can provide energy in such abundance and as cheaply as fossil fuels have in the past (Trainer, 2007). The challenge of meeting energy needs with significantly less fossil fuels leads to the concept of *energy descent*, which refers to "the continual decline in net energy supply supporting humanity" (Hopkins, 2008, p. 53). Energy descent is a central idea in permaculture and the Transition movement due to both the scarcity of easily accessible fossil fuel resources and climate change. Energy literacy includes an awareness of concepts such as embedded energy, energy return on investment (EROI) and the rebound effect, along with knowledge about pathways for carbon reduction. These are all elements of ecological literacy and should be part of sustainable design education.

Development + Emergence

"All life — from individual organisms to species to ecosystems — changes over time. Individuals develop and learn, species adapt and evolve, and organisms in ecosystems coevolve" (CEL, 2015).

As complex living systems develop, they exhibit self-organizing properties. Development is a learning process in which "individuals and environments adapt to one another" (Capra, 2005, p. 27). *Emergence* is a process of self-organization of complex adaptive dynamic systems that results in the creation of entirely new properties. Emergence appears as the result of relationships wherein the whole is greater than the parts. The phenomenon of emergence is significant for sustainability because it implies that systems will exhibit unpredictable behavior. Emergent properties can have positive or negative implications, but one key insight is that the behavior of complex systems is never completely predictable. Increasing relational thinking is an emergent process of reflexive self-organization as humankind responds to environment problems. Thus ecological literacy itself is an emergent phenomenon. The emergent order of reflective ecological awareness supports new cognitive and social capacities that could potentially facilitate the creation of more resilient and sustainable futures. As individuals develop relational understanding of networks and complex levels of causality, our collective capacity to attend to sustainability challenges is enhanced. Ecological learning allows us to use these new capacities to respond to environmental problems. New cognitive

capacities for systemic thought support the design of sustainable ways of living — but emergence will always remain unpredictable. For this reason, reductive and purely instrumental approaches to design and sustainability have limited capacity to address environmental problems.

Dynamic Balance + the Ecological Footprint

"Ecological communities act as feedback loops, so that the community maintains a relatively steady state that also has continual fluctuations. This dynamic balance provides resiliency in the face of ecosystem change" (CEL, 2015).

Dynamic balance is created as systems organize themselves in response to feedback from subsystems and meta-systems. Ecological systems maintain their processes through feedback loops that allow nested systems to self-regulate within tolerance limits (Capra, 2005, p. 28). These limits can be described in various ways using ecological assessment tools such as the ecological footprint. According to the Global Footprint Network (GFN), the ecological footprint is a metric that calculates human pressure on the planet by measuring how much:

> . . . land and water area a human population requires to produce the resources it consumes and to absorb its carbon dioxide emissions, using prevailing technology. (GFN, 2011).

Ecological accounting tools determine the area of productive land required for services and consumption patterns. Tolerance levels are determined by how much stress an ecological system is under due to resource extraction, pollution and other human activities. One key point is that if ecosystems are damaged beyond critical thresholds, dramatic change and even collapse can occur on various scales. The Stockholm Resilience Centre developed the concept of "planetary boundaries" as a framework that establishes boundary conditions and tolerance limits of various Earth systems (Rockström et al., 2009). Rockström and colleagues' research describes four planetary boundaries as having already been transgressed: climate change, biosphere integrity, biogeochemical flows and land-system change. Two of these — climate change and biosphere integrity — have the potential to drive the Earth into a new state (Steffen et al., 2015). While this work has received widespread critical attention within scientific communities, it is still far from being integrated into the design disciplines that will be required to respond by addressing these severe problems. Ecological footprints and planetary boundaries are elements of an ecologically literate design education curriculum.

The ecological principles described above (networks, nested systems, cycles, flows, development and dynamic balance) describe key features of ecological processes. Each of these principles is linked to a concept in design (resilience, epistemological awareness, a circular economy, energy literacy, emergence and ecological footprints) to illustrate how these ideas can inform the design of sustainable ways of living. Nature's processes and patterns are a basis for ecologically informed design. Patterns in the non-human natural world are characterized by interconnectivity. This interconnectivity suggests that reductive modes of analysis will not work to make sustainability possible. Instead, sustainability must be viewed as a collective condition of a culture. Capra explains that "sustainability is not an individual property, but a property of an entire network" (2005, p. 23). Ultimately, sustainability can only be achieved through systemic understanding and collaboration between all elements of a network, since it is the *collective impact* on the ecological system that will determine future conditions.

While these ecological principles are a foundation for responsible design, transforming unsustainable systems requires not only ecological knowledge, but also critical skills in order to analyze the political problems and societal dynamics that keep sustainable practices marginal. Transforming conditions of unsustainability requires practical ways of

working to avoid reproducing current problems. The next section will briefly review the politics and practice of ecological design.

Critical Ecological Literacy

Within a highly unsustainable world, design must be critically informed about the relationships between power and knowledge in order to challenge the interests that support business as usual or some slight variation thereof. While some new design approaches are systemic, many continue to lack a critical approach to issues of power. This lack of criticality results in a tendency for design to continue to prioritize profitable activities over those that are ecologically sustainable. Institutions and corporations maintain their legitimacy by publicizing green credentials, but are often far less likely to do the much harder work of building capacities to address environmental problems effectively. Ultimately, ecologically literate design must confront the cultural traditions, development frameworks and powerful interests that determine the systemic priorities of the design industry (Boehnert, 2014). A critical orientation to issues of sustainability in design is necessary to critique and transform design practice in the context of a deeply unsustainable culture.

The concept of sustainability itself is highly contested. Although sustainability can be measured using various environmental assessment processes, the lack of rigorous standards — combined with the failure to adjust boundaries of concern widely enough to include the full impact of products and the industrial systems that support our ways of living — results in rampant misuse of the term. Frameworks for making ecological assessment legally binding or holding corporations morally and legally accountable for the ecological damage of industrial practices are often weak or non-existent. Thus sustainability continues to be an elusive goal. While individual products proudly proclaim their green credentials, the overall impact of consumer lifestyles continues to accelerate the degradation of natural systems — the most dramatic of which is climate change.

To many of those who notice the larger context and dynamics of escalating ecological crises, *sustainability* is a term that is often associated with greenwashing. Since marketing a product or process as sustainable is easier than actually creating sustainable ways of living, greenwashing is plentiful. Brands have an interest in projecting a green image, and so the idea of sustainability is typically used to reassure consumers that unsustainable consumption is morally acceptable, contrary to the fact that current ways of living are causing climate change (IPCC, 2013) and severely degrading other Earth systems (Rockström et al., 2009). For many sustainability theorists the economic model itself is recognized as a primary cause of unsustainable ways of living.

The contradiction of infinite economic growth within the context of a planet with finite ecological resources is increasingly recognized as a root cause of ecological crisis conditions. In 2008, the UK Sustainable Development Commission published *Prosperity Without Growth?* (Jackson, 2009). This report analyzed how quantitative market growth now threatens not only social well-being and ecological sustainability but also economic prosperity. Author Tim Jackson maintains that neither decoupling nor technological fixes can deliver sustainability in a market economy dedicated to quantitative growth due to the ever-increasing need for natural resources and the resulting pollution. Quantitative economic growth demands a constant increase in the flow of ecological resources, as mechanical engineering professor Roderick Smith warned in a speech at the UK Royal Academy of Engineering:

> . . . relatively modest annual percentage growth rates lead to surprisingly short doubling times. Thus, a 3 percent growth rate, which is typical of the rate of a developed economy, leads to a doubling time of just over 23 years. The 10 percent rates of rapidly developing economies double the size of the economy in just under 7 years. These figures come as a

> surprise to many people, but the real surprise is that each successive doubling period consumes as much resource as all the previous doubling periods combined. This little appreciated fact lies at the heart of why our current economic model is unsustainable. (2007, p.17)

Ecological economist Herman Daly describes the need for "a system that permits qualitative development but not aggregate quantitative growth" (Daly, 2008, p. 1). Fritjof Capra and Hazel Henderson's report *Qualitative Growth* explains the difference between good and bad growth:

> . . . good growth is growth of more efficient production processes and services which fully internalise costs that involve renewable energies, zero emissions, continual recycling of natural resources and restoration of the Earth's ecosystems. (2009, p. 9)

Quantitative economic growth demands an ever-increasing flow of energy and natural resources that are extracted from the Earth, moved through the economic system and generally returned to the ecological system as waste. This paper has already described the central role of flow of resources in our economic system and the associated problems with resource scarcity and pollution; the latter includes the flow of carbon dioxide waste into the atmosphere, which subsequently leads to climate change.

"Sustainability" has been associated with "development" since the 1987 Brundtland Commission report. This dual role for sustainability (simultaneously meaning "ecological care" and "development") has been critiqued from its beginning. Wolfgang Sachs describes sustainable development as "conservation of development, not for the conservation of nature" (1999, p. 34). Similarly, the late David Orton claimed: "with sustainable development there are no limits to growth. Greens and environmentalists who today still use this concept display ecological illiteracy" (Orton, 1989, unpaginated). Sustaining or increasing levels of consumption on the diminishing resource base, with more people wanting "better" lifestyles (i.e. more consumption — thus requiring more resources) increases ecological harm in the current development model.

Researchers have proposed terms that reflect critical awareness of inherent shortcomings in the concept of sustainability. *Just sustainability*, *sustainment* and *scarcity* are three concepts that challenge the hegemony of sustainability. Julian Agyeman, a professor of urban and environmental policy and planning, coined the term *just sustainability* to prioritize justice and to "ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (Agyeman et al., 2003, p. 5). The philosopher and design theorist Tony Fry uses the concept of *sustainment* as an alternative to the "defuturing condition of unsustainability" (Fry, 2009, p. 1). Fry writes, "myopically, the guiding forces of the status quo continue to sacrifice the future to sustain the excesses of the present" (2009, p. 2). A discourse on scarcity reflects, according to the architect and educator Jeremy Till: "a condition defined by insufficiency of resources" (2011, p. 1) and the contradiction between unlimited human "needs" and the limits of natural resources. This concept has its own set of problems, as constructed scarcities can be made to seem natural, thereby justifying austerity measures and punishing the poor for the rampant consumption of the rich.

Despite the justified cynicism caused by the abuse of the word "sustainability," it remains the dominant term used to describe the idea of meeting the needs of the present without compromising the ability of future generations to meet their own needs. Ecological literacy informs the debate on sustainability by revealing that, ultimately, sustainability is not a feature of a particular product but rather is the condition of a culture relative to its gross impact on ecological systems. Since the cumulative impact of consumer lifestyles, or the

ecological footprint of consumption, in the United Kingdom is 4.71 gha and 7.19 gha in the United States (WWF-I, 2012, pp.144-145), these two nations have cumulative ways of living that are not sustainable. (The *global hectare* is a measurement unit for quantifying both the ecological footprint and biocapacity). While the behavior of certain individuals is below the threshold (i.e. they personally use fewer resources and create less pollution), the gross impact of the collective system is the indicator that matters, as it is the collective effect that causes total ecological harm. Ecological literacy emphasizes the contextual and relational characteristics of ecological well-being and learning as being central to the pursuit of sustainability.

Conclusion

This paper has described a philosophical foundation of ecological literacy as well as six ecological principles, and it has briefly introduced critical ecological literacy. The work of advancing new values that prioritize environmental and social sustainability in design education remains a formidable challenge. Despite the best intentions of many designers and educators, over two decades after the introduction of the term *ecological literacy*, it remains an elusive goal. Since ecological literacy remains marginal in design education, design practice and in society at large, unsustainable conditions continue to be reproduced by design. The struggle to embed ecological literacy into professional design practice is situated most intensely at universities. Educational establishments have a responsibility to ensure that students graduate with an understanding of the consequences of unsustainable design and the skills to do something about it. The various design disciplines all have important roles to play in the design of sustainable futures. Designers are among the key professionals responsible for the design of future sustainable ways of living. This task will only be possible when supported by ecological literacy.

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References

Agyeman, J., Bullard, R. D. & Evans, B. (2003). *Just sustainabilities: Development in an unequal world*. London: Earthscan.

Bateson, G. (1972). *Steps to an ecology of mind.* Chicago: University of Chicago Press.

Barabasi, A-L. (2003). *Linked.* London: Plume.

Boehnert, J. (2011). Transformative learning in sustainable education. Design Research Society: Experiential Knowledge Special Interest Group: SkinDeep '11. Farnham, UK.

Boehnert, J. (2014). Design vs. the design industry. *Design Philosophy Papers*. *12*(2), 119-136. doi: 10.2752/144871314X14159818597513

Capra, F. (1997). *The web of life*. London: Harper Collins.

Capra, F. (2003). *The hidden connections.* London: Flamingo.

Capra, F. (2005). Speaking nature's language: Principles of sustainability. In Z. Barlow and M. K. Stone (Eds.) *Ecological literacy*. San Francisco: Sierra Club Books.

Capra, F. & Henderson, H. (2009). *Qualitative growth*. London: The Institute of Chartered Accountants in England and Wales.

Center for Ecoliteracy (CEL). (2012). *Explore: Ecological principles*. Retrieved May 30, 2012, from http://www.ecoliteracy.org/nature-our-teacher/ecological-principles

Daly, H. (2008). *A steady-state economy.* London: Sustainable Development Commission.

Ehrlich, P. R. & Ehrlich, A. H. (2013). Can a collapse of global civilization be avoided? *Proceedings of the Royal Society B* 280: 20122845. doi: 10.1098/rspb.2012.2845

Fry, T. (2009). *Design futuring.* Oxford, UK: Berg.

Global Footprint Network. (2011*). Global Footprint Network: Footprint basics — Over*view. Retrieved September 30 from http://www.footprint network.org/en/index.php/gfn/page/footprint_basics_overview

Hopkins, R. (2008). *The transition handbook: From oil dependency to local resilience*. Dartington, UK: Green Books.

International Panel on Climate Change (IPCC). (2013). *IPCC fifth assessment report: Climate change 2007.* Geneva: IPCC

Ison, R. (2008). Systems thinking and practice for action research. In P. Reason and H. Bradbury (Eds.), *Sage handbook for action research*. London: Sage. doi: 10.4135/9781848607934.n15

Jackson, T. (2009). *Prosperity without growth?* London: Sustainable Development Commission.

Kahn, R. (2010). *Critical pedagogy, ecological literacy, and planetary crisis.* New York: Peter Lang.

Kemp, M. & Wexler, J. (2010). *Zero carbon Britain*. Llwyngwern, Machynlleth, Powys, UK: The Centre for Alternative Technology, CAT Publications.

Kitchen, C. (2014). *To the ends of the Earth*. London: Corporate Watch.

Lovins, A, Lovins, H. & Hawken, P. (1999). *Natural capitalism: Creating the next Industrial Revolution*. Boston: Little Brown.

Meadows, D. & Wright, D. (Ed.). (2008). *Thinking in systems*. London: Earthscan.

Orr, D. (1992). *Ecological literacy*. Albany: State University of New York Press.

Orr, D. (2002). *The nature of design*. Oxford: Oxford University Press.

Orton, D. (1989). Sustainable development or perpetual motion? *The New Catalyst*, 23, Spring 1989.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, III, F.S., Lambin, E. T. M. . . . Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society*, *14*(2): 32.

Sachs, W. (1999). *Planet dialectics: Explorations in the environment and development*. London: Zed Books.

Smith, R. (2007). *Carpe diem: The dangers of risk aversion*. Lloyd's Register Educational Trust Lecture, Royal Academy of Engineering, May 29, 2007.

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. W. . . . Sörlin, S.. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347* (6223), doi: 10.1126/science.1259855

Sterling, S. (2001). *Sustainable education — Re-visioning learning and change*. Schumacher Briefing No.6. Dartington, UK: Schumacher Society/Green Books.

Sterling, S. (2003). *Whole systems thinking as a basis for paradigm change in education*. (Doctoral dissertation). University of Bath, Bath, United Kingdom.

Till, J. (2011). *Constructed scarcity*. Working paper no. 1 for SCRIBE. Retrieved October 30, 2012, from http://www.scibe.eu/wp content/uploads/2010/11/01-JT.pdf

Trainer, T. (2007). *Renewable energy cannot sustain a consumer society*. London: Springer.

World Wide Fund for Nature International. (2012). *Living planet report 2012*. Gland, Switzerland: WWF-International.

World Wide Fund for Nature International (2014). *Living planet report 2014.* Gland, Switzerland: WWF-International.

Zalasiewicz, J, Williams, M., Haywood, A. & Ellis, M. (2011). The Anthropocene: A new epoch of geological time? *The Royal Society Philosophical Transactions*. Royal Society A 2011 369, 835-841.

Robert Harland

Testing keywords internationally to define and apply undergraduate assessment standards in art and design

Abstract

What language should be featured in assessment standards for international students? Have universities adjusted their assessment methods sufficiently to match the increased demand for studying abroad? How might art and design benefit from a more stable definition of standards? These are some questions this paper seeks to address by reporting the results of recent pedagogic research at the School of the Arts, Loughborough University, in the United Kingdom. Language use is at the heart of this issue, yet it is generally overlooked as an essential tool that links assessment, feedback and action planning for international students. The paper reveals existing and new data that builds on research since 2009, aimed at improving students' assessment literacy. Recommendations are offered to stimulate local and global discussion about keyword use for defining undergraduate assessment standards in art and design.

Keywords: assessment standards, internationalisation, art and design, keywords

Introduction

Students repeatedly say they want more meaningful and constructive feedback (Rae & Cochrane, 2008, p. 145) and they have difficulty learning from feedback (Orsmond et al., 2013, p. 241). As for students who study in a second language, what chance do they have of connecting assessment criteria, standards, feedback, reflection and action planning as parts of an assessment cycle? Unsurprisingly, the link between reflection and action planning is little understood by students (Parkin et al., 2012, p. 969). This paper weaves together issues that illuminate aspects of this problem by reporting the results of action research at Loughborough University in the United Kingdom (UK). This study is set in the context of an emerging "re-internationalisation" agenda in the UK since the early 1990s, driven by economic growth. It challenges the author's previously held assumptions about keyword use in the application of assessment criteria for an international audience. The findings reported in this article raise important questions about how to relate verbal descriptors to class and grade indicators in assessment. Furthermore, different approaches to assessment level indicators at national and international levels are revealed to show considerable variations among universities.

The paper includes a review of recent focus group activities on developing and testing a keyword strategy for assessment standards to support written criteria statements that help guide tutors and tutees towards a collective understanding about levels of achievement. Focus groups have been undertaken in the UK, the Netherlands and Norway, bringing an international dimension to what began in 2009 as an internal evaluation exercise. This research is set in the context of the development of internationalisation, emphasising the need for language use to be more carefully considered and explained as an enabler of learning by international students.

Art and design (a conjoined phrase used here) provides the backdrop for the research. The formative and summative assessment in art and design differs from the "stereotypical" view of assessment that limits the dialogue between the student and the assessor to the student's response to the assessment task (Price et al., 2012, p. 19). Art and design student outputs in the UK are mainly coursework related; it is common for the student and the tutor to hold discussions through critique sessions and informal studio settings. At anytime, the tutor may offer a verbal commentary on the development of a student project, often in the form of

qualitative judgement statements that a student may interpret as an indication of progress and standards. Coursework output in art and design tends to be "divergent" and allows students to demonstrate what Sadler refers to as "sophisticated cognitive abilities, integration of knowledge, complex problem solving, critical opinion, lateral thinking and innovative action" (2009, p. 160). The resulting "artwork" may be assessed in a studio setting through a discussion among lecturers "situated within its disciplinary context", looking for anticipated and unanticipated creative solutions (Orr, 2007). Implicit in this work is the "wow" factor, something difficult to define in assessment criteria but is said to include "creativity, originality, inventiveness, inspiration, ingenuity, freshness and vision" (Gordon, 2004, as cited in Orr, 2007).

Aims of the paper

Letters, numbers, symbols and words are used to code, order and communicate grades in marking systems (Schünemann et al., 2003, p. 677). In assessment criteria, grades align with and are supported by descriptors that characterise levels of achievement. The descriptor provides some explanation and guidance to the student and the tutor about what must be evidenced for attaining the level. This method places high importance on consistent language use if students are to understand assessment criteria, tutors are to use assessment criteria when marking student work and providing feedback, and then students are to develop action plans. In support of this approach, Woolf regards language as central to "a higher level of shared understanding" among "students, tutors and other stakeholders" to fulfil the "educational value" of assessment criteria (2004, p. 479).

The desire for consistent language use becomes more complicated in terms of the aspiration for internationalisation and the need for universities to attract students from abroad. This paper reports on attempts to develop assessment standards that support the links among marking, feedback and action planning for national and international students. The aim is to highlight how keywords used in assessment discourse can assist in the process but at the same time, present problems when applied internationally. Some recommendations are made about how keywords might be used to indicate standards and link assessment criteria, feedback and student response. One intention is to stimulate discussion within art and design about the use of keywords in assessment "rubrics", acknowledging that words such as "qualities", "criteria" and "standards" are used interchangeably (Sadler, 2009, p. 163) to reflect comparative judgement about the work being assessed. In this paper, the term "criteria" means a fixed set of statements within a rubric about knowledge and understanding, subject-specific cognitive skills, subject-specific practical skills and key/transferable skills. "Standards" indicate the level of achievement matched against these criteria. "Qualities" refer to the comparative level of distinction or excellence.

Methods

The research builds on previous work (Harland & Sawdon, 2012) and resembles action research. It utilises "evaluative procedures" in a desire to improve the criteria-based assessment methodology through "continuing professional development" and "behaviour modification" (Cohen et al., 2007). As well as content analysis, focus group activities tested keyword use in the application of assessment criteria in national and international contexts. The focus group method uses "stimuli" (topics and visual aids) provided by the researcher (Silverman, 2005, p. 378) to generate probability samples for making generalisations. The findings reported here are drawn from a simple random data set (Cohen et al., 2007, p. 110–111).

Ways to indicate standards in assessment

As students move from one assessment regime to another, their understanding of assessment must also change. Pass or fail is the simplest way to indicate the outcome of an assessment. A classification, verbal descriptor or literal grade generally confers more detailed attainment levels. Numerals or letters usually indicate class and grade, whereas the nomenclature of "good", "very good", "excellent" or "outstanding" distinguishes among "levels of competence" (Davies, 2012, p. 2). The correlations among class, verbal descriptor and literal grade indicate the way these different codes communicate similar levels of achievement. Table 1 shows how a 2:1 undergraduate degree classification may be the equivalent of the literal grade of A–. Both may be described as "very good". In the same grouping, levels of attainment are indicated by as few as six (class) or as many as 13 (literal grade) options, with verbal descriptors registering seven divisions.

Class	Verbal descriptor	Literal Grade
1	excellent	A+
		A
2:1	very good	A–
		B+
2:2	good	B
		B–
		C+
3	moderate	C
		C–
P	marginal	D+
	pass	D
		D–
F	fail	E

Table 1. Comparison of class, verbal description and literal grade indicators (Brown, 1997, p. 75).

These indicators offer three ways to communicate the achievement level but there are more. Collins (2004, p. 24) identifies five approaches:

> 1) pass or fail (commonly used in competency-based testing),
> 2) letter grades (e.g., A, B, C, D, etc. with and without plus and minus variations),
> 3) numerical grades (e.g., 1 = excellent, 2 = very good, etc.),
> 4) numerical scores (e.g., an achieved score out of a predetermined whole – 12 out of 20) and
> 5) percentage point marks.

In an international review of assessment conventions, Collins discusses regional and national differences. For example, in the UK assessment, conventions are split into "full range percentage marks, grade based marks and what one might call hybrid grade percentage systems" (Collins, 2004, p. 27). The pass threshold is generally set at 40% for undergraduate and 50% for postgraduate studies. Beyond the UK, most European practice is said to be grade based. An exception is Germany where the predominant system is numerical, from 1 (high) to 5 (low), with an accompanying three subdivisions for each number for greater accuracy. Hungary, Sweden and Switzerland have similar systems but in the reverse rank order from 1 (low) to 5 (high). In the European Community, attempts have been made to translate these different approaches by introducing a European Credit Transfer and Accumulation System (ECTS) for Erasmus students wishing to study abroad (European Commission, 2009). The system proposes a five-segment grading scale (top 10%, next 25%, next 30%, next 25% and lowest 10%, corresponding to A, B, C, D and E, respectively), which does not indicate fail or

pass thresholds. Further afield, the United States of America (USA) seemingly favours letter grades, setting the pass threshold at 60% (higher than that of the UK). Specifically, Collins reports that York University in the USA employs a 10-grade letter scale with descriptors (2004, p. 30). At the median, Canada and Australia set the pass threshold at 50%, with the exception of The University of Calgary, The Royal Melbourne Institute of Technology, The University of Technology Sydney, University of New South Wales and the University of South Australia.

These sources suggest at least seven scales for registering achievement levels, as summarised in Table 2. There are more levels if the various configurations of the percentage scale are considered, broken into as little as five divisions to match degree classifications in the UK (e.g., 0–39, 40–49, 50–59, 60–69 and 70–100) and as many as 16 (e.g., 1–19, 20–29, 30–39, 40 pass, 41–43, 44–46, 47–49, 50–53, 54–56, 57–59, 60–63, 64–66, 67–69, 70–71, 72–74 and 75+) reported by Collins (2004, p. 48). Levels range from 5, 6, 10, 13 to 17, with pass thresholds usually just below the mid-point, exceptionally in the middle or slightly above. Some systems are used in combination. For example, percentage scaling may also align with verbal descriptors, classification bands or a points gauge; literal indicators may accompany verbal descriptors or a points gauge. The verbal description is of primary interest in this paper because it is language based and therefore most closely related to what can be read as assessment criteria.

Type	*Indicator*	*Division*
Verbal	| Excellent | Very Good **|** Good **|** Moderate **|** Marginal Pass **|** Fail **|**	6
Class	| 1 **|** 2:1 **|** 2:2 | 3 | P | F |	6
Literal	| A+ **|** A | A– | B+ | B | B– | C+ | C | C– | D+ | D | D– | E |	13
Percentage	**|** 100 **|** 90 **|** 80 **|** 70 **|** 60 **|** 50 **|** 40 **|** 30 **|** 20 **|** 10 **|** 0 |	10
Point	**|** 16 **|** 15 **|** 14 **|** 13 **|** 12 **|** 11 **|** 10 **|** 9 **|** 8 **|** 7 **|** 6 **|** 5 **|** 4 **|** 3 **|** 2 **|** 1 **|** 0 **|**	17
Fraction	**|** 1 **|** 1.3 **|** 1.7 **|** 2 **|** 2.3 **|** 2.7 **|** 3 **|** 3.3 **|** 3.7 **|** 4 **|** 4.3 **|** 4.7 **|** 5 |	13
Numerical	**|** 17–20 **|** 13–16 **|** 9–12 **|** 5–8 **|** 0–4 |	5
Combined	**|** 90–100% (A) **|** 65–89% (B) **|** 35–64% (C) **|** 10–34% (D) **|** 0–9% (E) |	5
	High . . . . . Low	

Table 2. Examples of scales for representing achievement levels in assessment.

Alignment of verbal descriptors with percentage levels of achievement

Table 1 shows how "good" corresponds to a 2:2 degree classification or a B literal indicator, but what does this mean to a student? The answers to this question depend on the context and a range of adjectives and synonyms to help clarify the meaning. To a craftsperson, "good" may suggest skilled, a priest may interpret it as virtuous and to a parent, obedient comes to mind. However, the meaning of individual words is less of a concern in this paper. Of more interest are the relationships among words in a hierarchy of standards. What terms help substantiate a word such as "good" when aligned with assessment criteria, regardless of the typology being used to register a mark? The various scaling options available mean that six descriptors – excellent, very good, good, moderate, marginal pass and fail – comprise an insufficient, coarse scale. A finer-grained version is needed to cope with art and design assessment, which may require what Hornby describes as "matters of judgement and interpretation" (2003, p. 439).

Reflecting on establishing a keyword approach to applying assessment criteria

Recent work at Loughborough University School of the Arts extended the range of verbal descriptors in Table 1 – excellent, very good, good, moderate, marginal, pass and fail – by assigning equal percentage divisions, from 0 to 100%, to 10 words. Some of the reasons for this method relate to undergraduate external examiner comments that the full range of marks is under utilised, a common criticism in qualitative assessment using "high validity/low reliability instruments" (Hornby, 2003, p. 439). By establishing 10 words, the intention was also to encourage more consistent use of formative and assessment feedback language among marking tutors (Harland & Sawdon, 2012). This approach meant introducing additional words to further differentiate among underused grade bands in the first class (70% and above) and fail (below 40%) brackets used in UK assessment matrices, representing more than two-thirds of available marks. A working group of six academic staff members developed a set of generic verbal descriptors for marking both written (e.g., essay) and practical (e.g., artefact) outputs by art and design students. As part of the development process, an informal consultation with the staff and the students took place in a small focus group to provide quick feedback. The outcome supported the word recommendations corresponding to a hierarchy of numerical grading. See Table 3. Word options were sourced to support the writing and presentation of generic assessment standards in student handbooks as a guide for the application of assessment criteria across four headings commonly used in the UK: knowledge and understanding, subject-specific cognitive skills, subject-specific practical skills and key/transferable skills. For example, applying assessment criteria for knowledge and understanding in the 60–69% bracket is supported by the statement, "Very good acquisition of knowledge and understanding, with an appropriately critical and controlled approach to your chosen subject".

90–100	Outstanding
80–89	Excellent
70–79	Rigorous
60–69	Very Good
50–59	Good
40–49	Satisfactory
30–39	Marginal
20–29	Insubstantial
10–19	Insufficient
0–9	Deficient

Table 3. A hierarchy of key terms representing 10 percentage divisions (Harland & Sawdon, 2012, p. 79).

A similar approach was adopted after a content analysis review of language use in the art and design assessment criteria at nine universities in the UK. The data contained familiar words (e.g., excellent) and some that could be interpreted as metaphorical (e.g., sound). See Table 4.

	A	B	C	D	E
90–100	Extensive In-depth Coherent Detailed Theoretical	Extensive Deep Excellent Inventive Ambitious	Outstandingly high quality Originality	A Outstanding High Quality Originality Excellent Technical competence and innovation	Outstanding Original Complex Rigorous New Insights
80–89	Intellectual	Exceptional Highly fexible			Publishable Extensive Effective
70–79	Comprehensive Coherent Wide-ranging Specialist techniques Systematic		Exceptional Distinguished Authoritative Methodical Critical Skilled	A Excellent Exceptional Distinguished Very good quality	Confident Appropriate Organised Structured
60–69	Thorough In-depth Advanced Critical Creative	Sound Very good High level Inventive Strong Quite flexible	Very good Greater insight Good qiality Sound Ordering Appropriate	B Greater insight and originality Good quality	Very good Analytical Critical
50–59	Sound Focused	Sound Good Thorough Competent	Insight Satisfactory Relevance Standard Accurate	Sound quality	Satisfactory
40–49	Adequate	Acceptable Competent Moderate Sometimes flexible	Satisfactory Reasonable Competent Familiarity Derivative	D Satisfactory Standard	D Satisfactory Standard
30–39	Limited Unfocused Inadequate Little or no coherence	Limited Partial Basic Unconvincing Limited flexibility	Misinterpreted Misdirected Misunderstood Poor	F Fail	Incomplete Deficient Inadequate
20–29		Insufficient Unacceptable Too narrow Poor Inflexible	Little engagement Irrelevancies Minimal evidence	Clear fail	Misunderstanding Lacks coherence
10–19			Poor quality Minimal effort Little relevance	Very poor fail	
0–9			Virtually nothing of relevance, depth or merit		

Table 4. (Part 1) Assessment criteria keyword analysis from nine higher educational institutions (Harland & Sawdon, 2012, p. 74).

	F	G	H	I
90–100	Significant Original Transcend Transform	Outstanding Exceptionally high standard Trivial defects	Unfamiliar conceptual territories Unified Discernment Technical/craft	High order Appropriate Developed capacity Very high standard
80–89	Flair Thorough	Excellent Very minor defects	Persuasive Compelling Responsibility Well informed Wide ranging Accurate	Rigorous High quality
70–79	Challenging Exceptional Evaluative	Very good Few minor defects	Extensive Risk taking Selective Organised Reflective	Originality
60–69	Coherent Familiarity Evaluation Clarity	Very good – minor defects Generally very good Notable defects	Professional Accurate Checking Testing Finishing	Above average Synthesis Sound
50–59	Satisfactory	Good Creditable Generally sound Number of shortcomings	Good judgement Reflection Adequate References Familiar ideas	Average Clear
40–49	Some knowledge Limited Reiteration Descriptive	Fair Shortcomings Satisfactory On borderline	Awareness Collaborative Independent	Limited Adequate
30–39	 Compensated pass Weaknesses	Unsatisfactory Significant shortcomings	Insufficient Rudimentary Limited knowledge Little judgement Lack clarity Sporadic	Inadequate Very limited Poor
20–29	Confused Inadequate	Very poor Exceedingly poor	Little evidence Poor judgement Very limited Ineffective	
10–19	 Incomplete Inaccurate		No awareness	
0–9	Incomplete Fragmentary Zero response			

Table 4. (Part 2) Assessment criteria keyword analysis from nine higher educational institutions (Harland & Sawdon, 2012, p. 74).

The staff and the students contributed to selecting 10 keywords for use in the application of assessment criteria. The initial process consisted of academic staff who taught practical, historical and theoretical classes, forming a working group from within a larger learning and teaching committee. The group aimed to review the language used in assessment criteria across 9 UK universities, extract useful words, dismiss others and introduce new ones to fit a 10-part percentage division matrix. A mix of familiarity, habit and proposition informed the creation of a new list (with some words in reserve) that could then be shared more widely. The new list, as shown in Table 3, was then tested at a staff-student focus group whose attendees had not previously contributed to the process. Using visual stimuli, the facilitators presented the focus group participants with the new list, which was randomly assembled. See Figure 1. The participants were then asked to rank the words in order from 1 (low) to 10 (high). The outcome of the exercise, whilst using a small sample size, provided quick feedback to the working group, enough for publication in student handbooks as part of a

revised set of assessment standards. (For further reading, see Harland & Sawdon, 2012). However, this initiative provided very limited endorsement of working group recommenddations. Consequently, since then, the same basic exercise had been repeated in three focus groups with national and international audiences. The following section summarises the results.

Figure 1. Random keywords for assessment ranking (Harland & Sawdon, 2012).

Testing keywords in national and international contexts

The first focus group was held at the Group for Learning in Art and Design (GLAD) 2012 conference at Kingston University in the UK, with 11 academic staff members as participants. No prior explanation of what the words meant was provided and the participants were left alone to use their own interpretation as they performed the exercise individually. The results showed that most words were ranked one level from the predetermined position, some occasionally higher by two levels. The most consistently misplaced words were "insubstantial" and "insufficient", the former being accurately matched in only four out of 11 responses.

A second focus group was conducted with 45 undergraduate and postgraduate students and five academic staff members at the St Joost Academy of Art in Breda, the Netherlands, in February 2012. The results from the Dutch event presented a more varied data set from respondents who did not speak English as their first language, some of whom were from outside the Netherlands (e.g., Russia). The exact breakdown by nationality is unknown but the majority of the participants were Dutch. The St Joost results revealed a less reliable match between percentage and grade among international participants. This finding was further emphasised by anecdotal feedback during the focus group when some students claimed that certain words do not translate well between assessment cultures. For example, a Russian student confessed that the word "outstanding" may be difficult for Russian speakers as it suggests that the work being assessed stands physically (not intellectually) apart from the rest of the assignments and therefore may not be assessed. The academic staff participants also debated whether the idea of "rigorous" has a Dutch equivalent since it seems to lack a direct translation. This issue clearly suggests potential problems associated with a keyword approach to assessment criteria for international staff and students.

The data from St Joost revealed that building a hierarchy of words with less than 20% variability is difficult in an international context. In fact, there can be as much as 70% difference in the hierarchical placement of words within the predetermined set. The degree of accuracy proved to be very low, compared to the recommendations made by the Loughborough working group. A lack of fluency in English is a possible explanation for this discrepancy. However, it can be assumed that some words (e.g., excellent) are generally understood by most individuals with a basic understanding of English. The reliability of "blindly" ranking

keywords is shown in Table 5; the degree of accuracy varies between the least reliable score of 30% for the word "rigorous" and the most reliable score of 74% for the word "satisfactory". The variability in matching keywords to their respective predetermined rankings cast doubt on the relationship between keywords and the achievement levels they represent, especially for international students who may have limited initial understanding of the application of assessment criteria.

Rank	**Verbal descriptor**	**Reliability**
10	outstanding	60%
9	excellent	58%
8	rigorous	30%
7	very good	40%
6	good	62%
5	satisfactory	74%
4	marginal	64%
3	insubstantial	46%
2	insuffiicient	58%
1	deficient	62&

Table 5. Variability of "blindly" ranking keywords according to a predetermined order in an international context.

Most recently, the same keywords were tested with a focus group at a Design Research Society/Cumulus conference "workshop" in Oslo in May 2013. A call for participation attracted seven participants from Australia, Austria, China, England, Iran, Mexico and Venezuela. The results by nationality are shown in Table 6. This micro-sample revealed that "excellent" is most consistently placed in the top two positions, with "outstanding" nearly as recognisable in terms of high attainment levels. "Very good" is similarly ranked one or two levels below the top two words, with "good" or "rigorous" consistently positioned in sixth, seventh or eighth, with the exception of the Iranian participant, who also ranked "outstanding" as a mid-level achievement. "Satisfactory" is consistent in five responses but "marginal", "insubstantial", "insufficient" and "deficient" are the most randomly positioned words. There is less variability here than in that of the St Joost sample, especially with the higher-level keywords, although more so than those in the initial focus group at Loughborough and at the GLAD conference.

Rank	**Australia**	**Austria**	**China**	**England**	**Iran**	**Mexico**	**Venezuela**
10	Outstanding	Outstanding	Excellent	Outstanding*	Excellent	Excellent	Outstanding
9	Excellent	Excellent	Outstanding	Excellent*	Very good	Outstanding	Excellent
8	Rigorous	Very good	Rigorous	Very good*	Good	Very good	Rigorous
7	Very good	Good	Very good	Good	Satisfactory	Good	Very good
6	Good	Rigorous	Good	Insubstantial	Outstanding	Rigorous	Good
5	Satisfactory	Satisfactory	Satisfactory	Deficient	Deficient	Satisfactory	Satisfactory
4	Marginal	Marginal	Insufficient	Insufficient	Rigorous	Marginal	Insubstantial
3	Deficient	Insubstantial	Insubstantial	Marginal	Insubstantial	Insubstantial	Insufficient
2	Insubstantial	Deficient	Marginal		Marginal	Insufficient	Deficient
1	Insufficient	Insufficient	Deficient	Satisfactory	Insufficient	Deficient	Marginal

Table 6. Keyword ranking responses from seven focus group participants. *Outstanding, excellent and very good were all considered rigorous.

The focus group participants acknowledged the difficulty in establishing 10 keywords that can universally represent standards. Furthermore, they collaborated in small groups to generate alternatives, using the data in Table 4 as reference. Two approaches emerged, one as a direct 10-part alternative and another as keyword combinations across five levels of achievement. See Table 7. The latter approach points in the direction of keyword sets that provide a greater scope to define characteristics associated with a particular level. It may be argued that "very good" and "good" are insufficiently differentiated and may easily stand for the same meaning in everyday language. The respective additions of "rigorous" and "competent" support further differentiation and are arguably better alternatives. The 10-part division situates some words that could be interpreted as synonymous, such as "deficient" and "limited", the former being considered a mid-level achievement.

10-part hierarchy	*5-part hierarchy*
Exceptional	Excellent/outstanding
Outstanding	Very good/rigorous
Excellent	Good/competent
Appropriate	Satisfactory/pass
Competent	Fail/insufficient
Deficient	
Limited	
Inadequate	
Insubstantial	
Nil	

Table 7. Two suggestions for a keyword hierarchy in assessment criteria.

Clearly, ranking keywords for easy recall by the staff and the students is difficult to achieve with any degree of accuracy. Perhaps this case is truer in art and design due to the nature of "studio and design productions" and "specialised artefacts" that tend to be immeasurable and "open" (Sadler, 2009, p. 160), meaning that limitless possibilities exist. The same can be said for historical, critical and theoretical essays that students may write. However, we should consider matters carefully before dismissing such approaches, especially when keywords are incorporated into a criterion-referenced assessment grid. Students welcome such tools as a "good idea", despite acknowledging that "terminology is open to multiple interpretations by individual staff and students" (Price et al., 2012, p. 32). Moreover, these tools can inspire others to create their own hierarchies. For example, previous work by the author (see Harland & Sawdon, 2012) motivated a colleague to create an alternative version in 2012 for use in a dissertation module by utilising the 10-part division and replacing a previous 20-part standards hierarchy (Barnard, unpublished). With a focus on the acquisition of knowledge and understanding, this revision is shown in Table 8. It incorporates "rigorous" as a property of "excellent", the basic level of achievement for a first-class degree in the UK. It also eradicates potential problems in an international context. Barnard also lifts "good" and "satisfactory" up a band, dispensing with "very good" as an apathetic representation of something better than "good". Furthermore, "adequate" represents the band immediately above the pass threshold, implying something passable but less than the "satisfactory" required for a 2:2 degree.

Classification	Percentage	Keyword criteria statement
1	90–100%	**Exceptional** acquisition of knowledge and understanding: originality of topic and argument; of publishable standard; a model/ideal essay.
	80–89%	**Outstanding** acquisition of knowledge and understanding: demonstrating independent thought and exemplary development of topic.
	70–79%	**Excellent** acquisition of knowledge and understanding: critical; showing rigorously organised argument and well-selected evidence.
2:1	60–69%	**Good** acquisition of knowledge and understanding: convincing display of analytical and reasoning skills; well written.
2:2	50–59%	**Satisfactory** acquisition of knowledge and understanding: some analytical content and argument supported with evidence.
3	40–49%	**Adequate** levels of knowledge and understanding: largely descriptive or narrative; little use of argument, analysis or evidence; adequate use of written English and scholarly apparatus.
Fail	30–39%	**Inadequate** levels of knowledge and understanding: little attention paid to brief or no appropriate topic; descriptive; no reasoned selection and organisation of material.
	20–29%	**Poor** levels of knowledge and understanding: minimal use of argument, evidence or analysis.
	10–19%	**Insufficient** levels of knowledge and understanding: does not answer the question, no use of argument, no evidence collected or used.
	1–9%	**Nil response**: effectively no evidence of knowledge or understanding: irrelevant material; no attempt to answer question; no organisation of material; no structure to writing.

Table 8. Criteria statements for assessing knowledge and understanding in written dissertations (Barnard, unpublished).

Criterion-referenced assessment grids are not new. In the late 1990s, Price and colleagues (2012, p. 29) created one for undergraduate use in the Business School at Oxford Brookes University, which is still employed today. Their grid does not attempt to include verbal descriptors that rank achievement levels, such as "good", but provides "both students and assessors with information about standards applied for each criterion" (2012, p. 29). Some of the values associated with each level of achievement are listed in Table 9. At the lower end of the spectrum, the text tends to resort to partial evidence of higher qualities, specifically the repetition of some words such as "coherent" and "incoherent", or partial demonstration of organisation or logicality. Words such as "inadequate" and "insufficient" do the same in Barnard's (unpublished) text. In Table 9 as well, a common grading scheme introduced at the Robert Gordon University, combining the grade definition and the descriptor, relies similarly on variations on words such as "good", "competent", "satisfactory" and "fail" to differentiate among levels (Hornby, 2003, p. 442–443).

Grade	Keywords
A	Polished, imaginative, comprehensive, confident, challenging, reflective, independent, proactive
B+	Careful, logical, coherent, evaluative, challenging, developmental, autonomous
B	Organised, coherent, logical, focused, dependent
C	Partly organised, logical, focused, dependent, directed, guided
Refer/Fail	Disorganised, incoherent, failing, unable, dependent

(Price et al., 2012, p. 29)

Grade	Keywords
6	Excellent: outstanding performance
5	Commendable/very good: meritorious performance
4	Good: highly competent performance
3	Satisfactory: competent performance
2	Borderline fail: failure, open to compensation
1	Unsatisfactory: fail
0	Very unsatisfactory: abject fail

(Hornby, 2003, p. 442–443)

Table 9. Two examples of values associated with standards of achievement.

Similarly, Sadler's (2005, p. 180) simpler interpretation of words corresponding to letter grades for "objective-based" grading defines the differences among A, B, C and D as clear, substantial, sound or some attainment of course objectives, respectively. Further qualifying terms regarding understanding are differentiated as complete and comprehensive, high-level understanding, mostly understood and basic. There is very limited logic to these words in supporting hierarchies of language use.

The potential for ambiguity associated with the articulation of achievement levels in assessment criteria for "open" outputs clearly represents a challenge for staff and students alike. We may all be familiar with "excellent" but in the UK, this may be used to represent as much as a third of the marking spectrum. As Price and colleagues point out, this issue is further complicated by an international dimension (2012, p. 17). Let us therefore briefly consider internationalisation as a phenomenon in higher education.

Interpretations of Internationalisation

Internationalisation and higher education have been directly linked through the development of research among scholars throughout the history of universities. More recently, the alignment of academic standards for research and teaching is cited as an increasingly important factor (Institutional Management in Higher Education [IMHE], 1999, p. 19) as universities perceive internationalisation as "the concept and the process of integrating an international dimension into the teaching, research and service functions" through "quality assessment and assurance" matters (IMHE, 1999, p. 3). "Globalisation" is therefore an influential factor in the present-day understanding of internationalisation, the incentives being "commercial advantage, knowledge and language acquisition, enhancing the curriculum with international content, and many others" (Altbach & Knight, 2007, p. 290).

Internationalisation has been a priority in Europe since the early 1990s but the contrast between its historical and contemporary interpretation has led some scholars to rename it "re-internationalisation" (Teichler, 2004, p. 6–9). Alternatively, some researchers distinguish between "cooperative internationalisation" and "commercial internationalisation" (Beelen & de Wit, 2012, p. 1), acknowledging increased competition. In the UK, funding for university

education has shifted from the public to the private sector through gradual increases in tuition fees, compensating for the stagnation and recent reduction of government funding. A consequence of this situation has been to seek out more international students willing to pay tuition fees higher than the amounts typically charged for UK-based students of the past. This change has resulted in the need to examine how the curricula are suited to students from overseas and must include assessment and feedback processes; as studies have shown, these assessment and feedback systems differ significantly among institutions in the UK and beyond. Despite the reinterpretation of internationalisation in the guise of economic development, little research appears to have been published on issues that link internationalisation to assessment criteria in art and design.

Discussion and Recommendations

There are numerous methods to indicate achievement levels in assessment through letters, numbers, symbols and words. However, "marks and grades do not in themselves have absolute meaning in the sense that a single isolated result can stand alone as an achievement measurement or indicator that has a universal interpretation" (Sadler, 2005, p. 177). For example, it is hard to communicate "excellence" because of various national and international definitions (Price et al., 2012, p. 17). "Excellence" defines the highest levels of achievement but it is unclear how it can be differentiated from "outstanding" or "exceptional" as definitions are mutually acknowledging. "Excellence" constitutes the first-class band of an undergraduate degree, which in the UK covers as much as 30% of the available marks, difficult to define in terms of standards. Yet "there needs to be a higher level of shared understanding than currently exists (among students, tutors and other stakeholders) of the language in which criteria are couched and the ways in which criteria are applied" (Woolf, 2004, p. 479). The alignment of verbal descriptors with grade indicators seems scarcely considered, especially with international students in mind. This may be due to the fact that the grading schemes have only been established in higher education since the late 1980s (Sadler, 2009, p. 159), which parallels the growth in internationalisation (Teichler, 2004, p. 6–9). When verbal descriptors are used, typically they range from as few as five to not more than 10 keywords. Three sets of keywords have been introduced earlier, as shown in Table 10. Those identified by Collins offer a limited scope of adjectives, heavily relying on too few keywords such as "good", "competent" and "passing", with further qualifying statements. Harland and Sawdon's (2012) hierarchy similarly relies on close similarity words in the distinction between "good" and "very good", as well as incorporates difficult words such as "rigorous" internationally. Barnard's (unpublished) version attempts to define each level independently, drawing on the distinction between "adequate" and "inadequate" at the pass threshold. He also lowers "excellent" but raises "good" and "satisfactory". The single keyword that seems inappropriate is "nil response", which means zero and clearly does not match a mark of 1–9%.

Exceptional	Outstanding	Exceptional
Excellent	Excellent	Outstanding
Very good	Rigorous	Excellent
Good	Very good	Good
Competent	Good	Satisfactory
Fairly competent	Satisfactory (P)	Adequate (P)
Passing	Marginal	Inadequate
Barely passing	Insubstantial	Poor
Marginally passing (P)	Insufficient	Insufficient
Failing	Deficient	Nil response
(Collins, 2004)	(Harland & Sawdon, 2012)	(Barnard, unpublished)

Table 10. Hierarchies of keywords for assessment criteria.

Taking all factors into account, standards in assessment criteria may be represented by a hierarchy of keywords that provide the stimulus for further justification through additional words, phrases and supporting statements. Building on Barnard's (unpublished) developments, based on the earlier work of Harland and Sawdon (2012), Table 11 presents a recommendation of how 10 keywords and secondary qualifiers might function to guide the writing of assessment criteria that make standards explicit. If a student output is considered excellent, why is it so and what further explanation can support it? If rigour and criticality are considered essential for excellence, these words may form the basis of feedback to students and will be determined by the disciplinary perspective. Rigour and criticality may differ for a Fine Art or Textiles undergraduate degree, but each term must define how to ensure that students of both programmes are judged by using the same criteria and standards but in different contexts. One benefit of incorporating keywords is to support (through consistent language) a link between the criteria, written and verbal feedback from tutors, on one hand, and the reflection and action by students as they progress, on the other hand. Clearly, this approach must be inclusive and motivate local and international students to learn equally well. Keywords and supporting statements provide an opportunity to enhance understanding.

Exceptional / Original / Comprehensive
Outstanding / Imaginative / Independent
Excellent / Critical / Rigorous
Good / Focused / Logical
Satisfactory / Organised / Reasoned
Adequate (P) / Predictable / Passable
Marginal / Incomplete / Inadequate
Insubstantial / Vague / Inaccurate
Insufficient / Feeble / Poor
Deficient / Inept / Scant
(P) = pass

Table 11. Hierarchy of keywords and qualifying terms for assessment standards.

The increasing internationalisation agenda in the UK, larger numbers of international students and overseas expansion mean that many more students who use English as a second language are exposed to assessment criteria that are rarely tested in global contexts. The variety of systems used internationally suggests that student migration has not been a major consideration for universities. Nonetheless, a more fundamental issue has been neglected in the litera-

ture on assessment, concerning what international students do with feedback. It is unclear what assessment means to students beyond an indicator of progress. What do students do once they receive their marks? How do they interpret feedback? Assessment and feedback are known to be under-researched topics (Cramp, 2011; Rae & Cochrane, 2008). However, interest is growing (Pitts, 2005) and although research into feedback dates back to the late 1970s (Pokorny & Pickford, 2010), considerable blind spots remain. For example, virtually no studies have been undertaken about first-year undergraduates (Cramp, 2011, p. 114).

Conclusion

The "relational dynamic" between staff and staff, staff and student, student and student (Price et al., 2012, p. 17) and perhaps increasingly, student and parent, allows assessment to be effectual. A consistent and disciplined use of language that defines grades in art and design may help counteract the diverse, often ambiguous range of assessed outputs that display the kind of "tacit knowledge and experience that does not easily lend itself to articulation and explanation" (Price et al., 2012, p. 33). For international students, this approach may be more significant if they are to grasp new assessment systems and align criteria with standards through reflection. This paper shows that although consistent language use may be desirable, it is unlikely. Keywords that clearly differentiate among levels of achievement appear to have been an overlooked aspect, considering the number of times words such as "very", "highly", "mostly" and "partly" are used to substantiate definitions. After testing assumptions that emerged from working group activities in international contexts and reviewing the literature about assessment criteria and standards, the study found some consensus about keywords to define grades. These supplement letters, numbers and symbols and link with descriptions of grades to enhance understanding. In art and design, where students may also experience levels of dyslexia higher than those of other academic disciplines, the recommendations offer a starting point for broader discourse that may extend across universities as well as different levels of education. As students migrate between countries and experience various interpretations of "good", they also mature and have to adapt their notion of "good" as they advance through progressive stages of their education.

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References

Altbach, P. G. & Knight, J. (2007). The internationalization of higher education: Motivations and realities. *Journal of Studies in International Education, 11*(3–4), 290–305. doi: 10.1177/1028315307303542

Beelen, J. & de Wit, H. (2012). Internationalization revisited: New dimensions in the internationalization of higher education. Amsterdam: Centre for Applied Research on Economics and Management (CAREM), Hogeschool van Amsterdam, 1–3.

Brown, G., Bull, J. & Pendlebury, M. (1997). *Assessing student learning in higher education*/*George Brown with Joanna Bull and Malcolm Pendlebury*. London: Routledge.

Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education*. Abingdon: Routledge.

Collins, P. (2004). *Expressing and reporting the results of assessing in grades and percentages*. Nottingham: Nottingham Trent University Centre for Academic Practice.

Cramp, A. (2011). Developing first-year engagement with written feedback. *Active Learning in Higher Education, 12*, 113–124. doi: 10.1177/1469787411402484

Davies, A. (2012). Learning outcomes and assessment criteria in art and design. What's the recurring problem? *Networks, 18*, 1–8.

European Commission. (2009). *ECTS users' guide.* Luxembourg: Office for Official Publications of the European Communities. Retrieved July 21, 2014, from http://ec.europa.eu/education/tools/ects_en.htm

Harland, R. & Sawdon, P. (2012). From fail to first: Revising assessment criteria in art and design. *Art, Design & Communication in Higher Education, 10*(1), 67–88. doi: 10.1386/adch.10.1.67_1

Hornby, W. (2003). Assessing using grade-related criteria: A single currency for universities. *Assessment & Evaluation in Higher Education, 24*(8), 435–454. doi: 10.1080/0260293032000066254

Institutional Management in Higher Education. (1999). *Quality and internationalization in higher education*. Paris: Organisation for Economic Co-operation and Development.

Orr, S. (2007). Assessment practices in art and design. *Art, Design & Communication in Higher Education, 5*(2), 79–151. doi: 10.1386/adch.5.2.79_2

Orsmond, P., Maw, S. J., Park, J. R., Gomez, S. & Crook, A. C. (2013). Moving feedback forward: Theory to practice. *Assessment & Evaluation in Higher Education, 38*(2), 240–252. doi: 10.1080/02602938.2011.625472

Parkin, H. J., Hepplestone, S., Holden, G., Irwin, B. & Thorpe, L. (2012). A role for technology in enhancing students' engagement with feedback. *Assessment & Evaluation in Higher Education, 37*(8), 963–973. doi: 10.1080/02602938.2011.592934

Pitts, S. E. (2005). "Testing, testing...": How do students use written feedback? *Active Learning in Higher Education, 6*(3), 218–29. doi: 10.1177/1469787405057663

Pokorny, H. & Pickford, P. (2010). Complexity, cues and relationships: Student perceptions of feedback. *Active Learning in Higher Education, 11*. 21–30. doi: 10.1177/1469787409355872

Price, M., Rust, C., O'Donovan, B. & Handley, K. (2012). *Assessment literacy: The foundation for improving student learning*. Oxford: The Oxford Centre for Staff and Learning Development, Oxford Brookes University.

Rae, A. M. & Cochrane, D. K. (2008). Listening to students: How to make written assessment feedback useful. *Active Learning in Higher Education, 9*, 217–230. doi: 10.1177/1469787408095847

Sadler, D. R. (2005). Interpretations of criteria-based assessment and grading in higher education. *Assessment & Evaluation in Higher Education, 30*(2), 175–194. doi: 10.1080/0260293042000264262

Sadler, D. R. (2009). Indeterminacy in the use of preset criteria for assessment and grading. *Assessment & Evaluation in Higher Education, 34*(2), 159–179. doi: 10.1080/02602930801956059Schünemann, H. J., Best, D., Vist, G. & Oxman, A. D. (2003). Letters, numbers, symbols and words: How to communicate grades of evidence and recommendations. *Canadian Medical Association Journal, 169*(7), 677–680.

Silverman, D. (2005). *Doing qualitative research*. London: SAGE Publications Ltd.

Teichler, U. (2004). The changing debate on internationalization of higher education.

Higher Education, 48(1), 5–26. doi: 10.1023/B:HIGH.0000033771.69078.41

Woolf, H. (2004). Assessment criteria: Reflections on current practices. *Assessment & Evaluation in Higher Education, 29*(4), 479–493. doi: 10.1080/02602930310001689046

Aysar Ghassan and Erik Bohemia

The Global Studio

Incorporating Peer-Learning into the Design Curriculum

Abstract

In 'tutor-led' design education, lecturers reside at the centre of teaching & learning activities. We argue that tutor-led design education does not prepare graduates sufficiently for working in highly complex professional capacities. We outline an alternative learning environment named the Global Studio in which lecturers are more 'distant' in pedagogical activities. This 'distance' opens up learning spaces which expose students to complex project situations in preparation for professional working life. Global Studio projects are 'student-led' and contain explicit opportunities for peer tutoring to ensue. Feedback indicates that learners benefitted from engaging in peer tutoring. However, many students struggled with making important decisions when operating outside of the tutor-led learning environment. To maximise their benefit, we argue that student-led projects featuring peer-tutoring should be scaffolded throughout design programmes to provide students with a sufficient level of exposure to this mode of learning.

Keywords: peer tutoring, peer learning, learning to deal with complexity, tutor-led learning, student-led learning

Introduction

The 'tutor-led' model has a long history in design education. It can be traced back at least as far as the Staatliches Bauhaus. In characterising the tutor-led system, Walter Gropius (1919, p. 1), the founder of this highly influential institution, stated that the educator "instruct[s]" the novice. Gropius (1919, p. 3) reaffirmed the top-down nature of the schema by pointing out that "the instruction of the individual is left to the discretion of each master".

As the design profession is perceived as being practice-led, an important attribute for tutors remains their ability to 'pass on' practical skills to students. Talented, experienced and passionate educators continue to aid students to understand and hone a plethora of skills intrinsic to life as a design professional. Indeed, the attainment of many practical skills seems difficult to envisage without educators' continued dedication to the tutor-led system.

The authors have both benefitted from being educated via the tutor-led model. We fully understand and appreciate its positive attributes. However, criticism has been levied at this system. Below we reflect on criticisms associated with the tutor-led model.

The Tutor-Led Model

It is perhaps only natural for educators to take an interest in the direction universities are heading. Not all are content with the track higher education is pursuing. For example, John Danvers (2003, p. 53) argues that education is becoming 'increasingly determinist' and is promoting "linear systematic processes [which] lead to predictable [student] outcomes". However, for Danvers (2003), practice-led training of artists and designers appears to differ in its approach to the other sections of the higher education fraternity. Danvers (2003, p. 54) claims a dialogical approach is the norm in art & design education as "there is an expectation that received opinions, dogmas and assumptions will be challenged by students and staff". In art and design higher education Danvers suggests that:

> ...students are encouraged to take as little as possible as 'given', and to develop a critical stance in relation to the orthodoxies of practice, matters of taste, style and aesthetic codifi-

> cation, and to recognise and question ideological positions wherever possible (Danvers, 2003, p. 54; original emphasis).

Danvers' experiences of design education appear different to those of some other academics. Alain Findeli (2001) argues that problem solving through linear, causal means remains the most widely utilised method of processing seen in design teaching. Rather than facilitating the continued development of 'voice' in learners, researchers have argued design educators speak more than their students during studio teaching sessions and are at the centre of learning activities (see Davies and Reid (2000)). Perhaps more ominously, Cameron Tonskinwise (2011, p. 452) argues "design education is exemplarily Bourdieusian" in that tutors' values dictate outcomes delivered by students. Rather than being involved in a perspectivist dialogue with students, Jorge Frascara states:

> I have seen [design] instructors judge the quality of their students' work by saying: "This one is too busy" or "This is better, it is simpler." They suggest that "busy" is bad and "simpler" is better in every situation (Frascara, 2007, p. 64; original emphasis).

The behaviourist system described above is surely of some concern as it does not provide optimal conditions for creating mature relationships between students and tutors in the classroom (Baxter Magolda, 2009). For Jorge Frascara (2007) this approach leads to curtailing of students' development evidenced through their delivery of unimaginative forms. Controlling students' outputs can add little to preparing them for life as a professional which demands graduates to be flexible, adaptable and to rely on their own initiative (see Barnett, 2000). Brigitte Borja de Mozota (2010, p. 98) questions whether design education enables designers to operate optimally in current professional climates. For her the problem is that even though designers "have this potential to work at higher strategic levels...they are not trained to do so". This, she claims, "is a challenge for design education." (Borja de Mozota, 2010, p. 98).

The educational theorist Ronald Barnett (2000, p. 262) proposes that graduates are entering "a world that exhibits global features of challenge, uncertainty, turbulence, unquantifiable able risk, contestability and unpredictability". For Barnett, contemporary existence seems to have become messy – for he argues we currently reside in:

> …a *supercomplex* world […] in which the very frameworks by which we orient ourselves to the world are themselves contested. It is a world where nothing can be taken for granted, where no frame of understanding or of action can be entertained with any security. It is a world in which we are conceptually challenged, and continually so. (Barnett 2000, p. 257; original emphasis)

Seemingly in agreement, the sociologist and cultural theorist Scott Lash (2003, p. 53) argues that in late modernity "totally normal chaos is regulated by non-linear systems". We argue *tutor-led* design education does not optimally prepare students for processing complex problems. As such, it may not aid learners prepare to negotiate *normal chaos* as graduates.

For Derek Miller (2010, p. 5), Senior Fellow at the United Nations Institute for Disarmament Research, professionals should be involved in a process of "figur[ing] out what is wrong with their own ideas, and not what is right about them." However, Miller argues:

> Designers are worryingly not involved in that process. Design is trying to prove itself, rather than disprove itself. It is the latter, though, that will serve the social good. (Miller, 2010, p. 5)

Perhaps the lack of exposing design students to complex challenges contributes to the situation described by Miller (2010, p. 5). We attempt to introduce students to the demands of 'normal chaos' that are a feature of the contemporary era via running projects through the *Global Studio*. The Global Studio primarily centres on students taking responsibility for their own decisions through peer-tutoring and peer engagement. We construct this approach to give learners the opportunity of *dealing with uncertainty*. We term the approach used in the Global Studio 'Student-Led' Design Education.

The Global Studio

In the contemporary world of professional industrial design practice, it is not unusual for teams located in different geographic locations and from different cultural backgrounds to collaborate in order to deliver interventions (Wang et al., 2002; Gupta et al., 2009). The list of professionals in such operations is formidable: clients, designers, researchers, engineers, suppliers and manufacturers. It is important to remember that each team contains a workforce made up of *human beings*. Richard Thaler and Cass Sunstein argue individuals from this species are not as infallible as they are sometimes made out to be:

> If you look as economics textbooks, you will learn that homo economicus can think like Albert Einstein, store as much memory as IBM's Big Blue, and exercise the willpower of Mahatma Gandhi. Really. But the folks we know are not like that. Real people have trouble with long division if they don't have a calculator, sometimes forget their spouse's birthday, and have a hangover on New Year's Day (Thaler and Sunstein, 2009, p. 7).

Add to this other requirements (for example negotiating differences in time zones, issues with spoken or written language as well as differences in cultural norms and practices) and one can imagine the likelihood of '"normal chaos' ensuing in professional design practice. Through enabling cross-institutional collaboration conducted between a university based in England, industry partners and international universities, the Global Studio responds to shifting trends taking place in design practice with regards the emergence of globally networked organisations and the inherent shift in ways of working (e.g. Hoppe, 2005; Horváth, Duhovnik, and Xirouchakis, 2003; Asokan and Payne, 2008). Harrison and Peacock claim this presents:

> …home students with [an opportunity to develop] a portfolio of globally relevant skills and knowledge without them leaving their home country (Harrison and Peacock, 2010, p. 878).

The organisation of Global Studio learning activities aims to equip students with an appreciation of cross-cultural and distance communication and consequently strives to allow them an opportunity to experience 'normal chaos'. Our approach thus concurs with Ben Johnson's claim that education should prepare learners:

> …for uncertainty by helping them feel comfortable in postulating, guessing, hypothesizing, conjecturing, and testing their theories (Johnson, 2011, unpaged).

Our approach in turn aims to address the already cited criticisms of design made by Miller (2011).

The Global Studio follows in the tradition of the Design Studio, with its emphasis on project-based learning and learning in & through "doing" (Schön, 1985). Concentration on project-based learning in the Global Studio is claimed to help embed established design practices into students' repertoires (Bohemia and Harman, 2008). The Global Studio makes use of a blended learning approach—a combination of online learning and face-to-face teaching. In order to facilitate cross-cultural collaborative learning, Web 2.0 technologies are

used to enable communication between distributed student design teams. According to Harrison and Peacock (2010, p. 878) these technologies help individuals "transcend national boundaries and the constraints of distance educational opportunities".

In the Global Studio all participating students are allocated an online project site which provides a common interface and 'space' for learners, academic staff, and industry partners to collaborate on a given assignment. The use of such technology has led to the production of learner-authored content and has facilitating the development of a student-centred teaching & learning approach (Bohemia, Harman and McDowell, 2009). The shared sites also provide students with an opportunity to learn from and with peers from their own and participating universities and manage their own time frames in order to simulate a 'real world design studio' scenario.

We claim the Global Studio is structured in such a way as to deliver students the opportunity to experience the educationally valid phenomenon of 'normal chaos' through enabling learners to negotiate and construct conversations and design outcomes with peers. Consequently, in focusing on student-led learning, the Global Studio makes use of peer-tutoring. We move on to discuss peer-tutoring with respect to the two Global Studio projects the authors have conceived and collaborated on.

Peer Tutoring in the Global Studio

Peer tutoring is defined as teaching which is facilitated by individuals who are not professional tutors (Topping, 1996). Falchikov and Goldfinch (2000) claim peer learning enables students to take a leading role in learning and to develop autonomy and independence. Moreover, Wong et al. (2003, p. 417) propose that students "interacting with a more knowledgeable peer can learn to become as knowledgeable as the peer". The concept of peer tutoring has its origins in face-to-face environments (De Wever et al. 2010). Pertinent to the Global Studio, De Wever et al. (2010, p, 355) argue peer tutoring can also be seen to occur in an online environment where it improves students' "knowledge construction". Specifically pertinent to both Global Studio projects to be outlined here, cross-institutional educational endeavours conducted through ICT have been argued to precipitate increased levels of peer learning among students (OECD-CERI, 2005). Elsewhere, we have suggested that peer tutoring is a feature of the Global Studio (Bohemia and Ghassan, 2012; Ghassan and Bohemia, 2011).

The subject of *knowledge construction* is of great interest to this paper. The tutor-led model propagates a top-down knowledge system in which professional educators orchestrate the learning experience for students. Rather than this, through developing a model where "collaborating students are co-dependent on one another's inputs" (Bohemia and Ghassan, 2012, p. 113), the authors have attempted to propagate a method which recognises that knowledge is socially constructed. This is not to say that an air of neutrality and egalitarianism exists between peers—indeed elsewhere we have suggested that this is not the case (Bohemia and Ghassan, 2012). However, we argue that learners share more in terms of status with peers than they do with professional academics. As such, there exists more opportunity for design outcomes to be precipitated via a process of conversation and negotiation. Below, we move on to discuss the *explicit* opportunities for peer tutoring which have been purposefully designed into the two projects the authors have worked together on.

Explicit Opportunities for Peer Tutoring: Gifts & Festivals

The two Global Studio projects outlined in this section each involved more than two hundred students from universities around the world. That said, at a micro level, the projects were run via teams of three to five students from one university (Team A) collaborating with an equivalent group from another participating institution (Team B). Collaborating teams are

provided with their own WordPress project sites through which they communicate. Students are also free to choose to communicate via other Web 2.0 technologies such as Skype or Facebook. Academic staff, other participating learners and industrial collaborators were also encouraged to provide feedback to students via the project sites.

Global Studio projects advance through pairs of teams adopting *Client–Designer relationships*. As in professional design practice, the Client delivers a brief and a set of parameters for the Designer. Ultimately, the Designer's task is to respond with a design intervention. In the Global Studio, Client briefs and eventual Design outcomes must exist within an overarching *project theme* provided by the project coordinators. This theme contains a set of deliverables as well as deadlines. It is important to note that when a team acts as Client, their brief contains instructions to design products or services that are to be relevant to an aspect of the culture in which they are 'home students'— this notion will be expanded on below. Each team within the pairing performs both the Client role and the Designer role. Thus, Team A is the Client for Team B. At the same time, Team B must write a brief and expects appropriate design interventions from Team A.

The premise that teams of students are reliant upon input from one another introduces a sense of *risk* to the Global Studio. John Earwaker (1992) suggests that for growth to occur amongst students, risk should be inherent to the experience of higher education. Of importance to the focus of this paper, the notion that collaborating teams are co-dependent facilitates an explicit opportunity for peer tutoring to take place.

The first Global Studio project outlined here was named *The Gift*. The project was inspired by the anthropologist Marcel Mauss' seminal book of the same name (Mauss 1950, 1990). The sociologist Pierre Bourdieu (1998, p. 94) claims "Mauss described the exchange of gifts as a discontinuous succession of generous acts". Mauss claims that *giving*, *receiving* and *reciprocation* are the central tenets of human interaction.

Whilst undertaking the role of Designer, students were asked to create gift artefact(s) and/or service(s) which were specific to cultural practices experienced by their collaborators. A central premise of the project revolved around the notion that relevant information on these cultural practices—as well as iterative feedback on the appropriateness of design solutions—was to be supplied by the collaborating teams in their role as Clients. This presented an explicit opportunity for peer tutoring to take place.

Over 200 students participated in the second project entitled *Festivals, Fairytales and Myths*. This collaboration reflected the notion that currently in developed markets, where consumers can get hold of seemingly limitless quantities of fungible commodities, there is a yearning for *authenticity* (Arnould and Price, 1993). This helps explain the expansion of the *Slow Movement* (Pietrykowski, 2004) and the growth of music festivals (Stone, 2009). The project also attempted to underscore the importance of *context* and *meaning* to design students. Kopytoff (1986, p. 68) argues that artefacts exist as "culturally constructed entit[ies]" which are "endowed with culturally specific meanings". The notion that designers should be able to understand contemporary or historical movements is highlighted by Paul du Gay et al. (1997, p. 5) who state that designers "play a pivotal role in articulating production with consumption by attempting to associate goods and services with particular cultural meanings" and are pivotal in presenting "these values to prospective buyers". Consequently designers are termed **"**cultural intermediaries" (du Gay et al., 1997, p. 62).

Whilst undertaking the role of Designer, students were asked to create solutions pertinent to festivals, fairytales or myths which were intrinsic to the cultural experiences of their collaborators. As with the previous project, the collaborators were required to communicate relevant information to the design team. Elsewhere we have termed this process the communication of "local knowledge" (Ghassan and Bohemia, 2013). In their role as Clients,

the collaborators were also asked to provide regular feedback on design interventions. Consequently, this project offered an opportunity for peer tutoring to ensue.

Students' Reflection and Discussion on Peer Learning in the Global Studio

Individual feedback from participating students was collected at the mid-point and the end of the two projects. This paper will focus on end-of-project qualitative feedback kindly provided by home students at the UK institution. We have only included end-of-project feedback as this data was collected following reflection on the whole learning experience provided by the Global Studio.

Through their feedback, many learners indicated that working in a student-led manner through the Global Studio has been a beneficial learning experience. For example one student stated that collaborating with a "complete group of strangers from another country" helped him improve his confidence. This student felt this experience was:

> …beneficial […] for future situations where I'll need to present to companies or group of people I've never met before.

Another learner stated working with people with cultural backgrounds which differed from her own was a "challenging and interesting" experience. This student felt the project:

> …was all about learning about a new culture, having to both understand and respond to new, and different cultural cues.

Another student reiterated the value of the learning experience stating working via the Global Studio:

> …gave each individual an experience and a learning curve at the same time.

Students also seemed to suggest that working in this manner may have been good preparation for professional practice. One student informed us that "collaborating with students where the distance was to the extreme" would prepare him for professional:

> …design collaborations across distance, whether it be again somewhere as far as Japan or on the other hand a company (person) based in [elsewhere in] the UK.

Another learner believed "society and culture" to be the "main driver for products". Consequently, she felt that:

> …the ability to fully encompass a knowledge for someone else's culture will make you a well-rounded, better designer who creates more effective designs that have an impact on peoples lives.

Pertinent to the focus of this paper, feedback presented by many students indicated that they had benefitted from tutoring delivered by their collaborators in international settings. Students stated they had gained an appreciation of *local knowledge* (Bohemia and Ghassan, 2012) specific to their collaborators. For example, one student stated he had "learnt about the Nebuta festival" and felt it was "good to learn a bit about their own culture too." In relaying relayed local knowledge that his peers had taught him, another student stated:

> Apparently it is the craziest thing you will ever see in Japan; it is a huge fight amongst the villagers to ignite a wooden shrine by swatting their pine branch torches, which acts as a offering to the gods.

Peer tutoring also enabled students to critically evaluate cultural stereotypes. Feedback from the following student illustrates the importance of this:

> Seeing/observing what the overseas team had found on our own culture (or my own) demonstrating what the cultural stereotypes were. What the overseas team found was not necessarily appropriate to our culture or reflected our culture, but based on these cultural stereotypes and clichés.

Another student relayed the idea that, as with members of his own team, his collaborators had also begun the project armed with culture stereotypes. This learner stated he had gained an appreciation of "how wrong are some stereotypes could be from both parties".

As well as this, information gained through peer tutoring prompted students to reflect upon their own cultural practices:

> England never hosts any festivals similar to this, partly due to fire hazards and the British Standards Institute.

As noted, the Global Studio peer learning environment means that in order to deliver a successful outcome, teams must rely on a student-led learning. As such, students who felt they had benefitted from the experience noted they had learnt to rely on developing their own problem-solving strategies. For one student this meant leaving the confines of the studio and "go[ing] outside and experience[ing] [the] world." Another student suggested she had to learn how to self-evaluate her design work:

> We then had to go ahead and use our own judgment, as designers to decide as to what concept would work the best.

Another student felt that working via the Global Studio meant negotiating "several challenges that needed to be addressed without input from lecturers". In tackling these issues, this participant had to work in a student-led manner:

> This definitely formed an environment that felt greatly independent of University even though the project was undergone there.

As educators, we are heartened to learn that students feel they have gained value from our innovations in teaching & learning. However, some participants informed us of the difficulties they had experienced negotiating the deliverables associated with *The Gift* and the *Festivals, Fairytales & Myths* projects. Such difficulties appeared to centre round a perceived lack of input from tutors. For example one learner stated:

> It would have been beneficial to the process if we could have had some input from the lecturers with regards to the actual designs too, perhaps resulting in some less dubious outcomes or smoother transitions between iterations.

Moreover, some students felt they were in need of more "interim presentations with lecturers present" or practice runs prior to the final crit: "it would have been good had we had two or three presentations to the other university".

As design education employs a tutor-led model, students develop their understanding of design through processes set by professional educators. In other words, as the tutor-led model is the prevailing norm, it is usual for students to understand that learning is to take place via interventions from tutors. One student described feeling "really […] stuck" for his team "couldn't progress an inch without the feedback" from his counterparts. This meant his team:

> …had to take it to the tutors to set things in motion, eventually things started moving again.

Similarly, the following student expressed feelings of discomfort precipitated by a perceived lack of involvement from tutors:

> Our partners didn't act upon the initial concept feedback we gave them and therefore didn't upload any developed concepts. This caused us to panic.

Another student stated the project was "very difficult" as he had trouble "managing time and keeping up with the deadlines proved difficult to handle".

As noted earlier, the authors purposefully attempted to remain relatively distant in the Global Studio system. This is not to say that tutors were in any way neglectful. Projects which are run through the Global Studio are operationally different from those facilitated via the tutor-led model. The student quoted below articulated how projects that learners are normally asked to work on are administered by tutors—and how this impacts on the course projects takes:

> I have learnt an incredible amount from this project and they are things that I would never have experienced from the in-house projects at university, the projects we get from the university are regulated often by your tutors but it is so different when it is done by fellow students. Evidently our tutors are our clients and it's so easy to gain feedback and direction as they are there with you in your classroom however when working with international 'clients' it is clear to me how important communication is, how important leadership is and how communication your ideas in the right way can stop allot of confusion and misunderstanding.

As noted, there are tangible benefits to peer tutoring. We argue the top-down behaviourist approach common in design education can serve to reduce the opportunities for student-led peer tutoring to occur. Because of the scarcity of student-led education in design, we argue that it may take several iterations for individual students to become more accustomed to such operations and consequently to grow comfortable with the notion that learning from one's peers is both a legitimate and worthy process.

Conclusion

In this paper we have argued that tutor-led design education may not be ideally suited in preparing students for complexity and associated the *normal chaos* which defines contemporary times. The Global Studio attempts to enable design students to experience normal chaos and deal with uncertainty. In so doing we aim to help prepare students for this *supercomplex* era.

This paper has also illustrated our two-fold strategy for providing learning activities which prepare students for complex working environments. Firstly, tutors purposefully refrained from providing feedback to students on evaluations which were meant to be provided by their peers (i.e. Clients). In instigating this practice, we aimed to address Baxter Magola's (2009) call for tutors to create classroom relationships with students which differ from the ones primarily practiced by design educators. In this way we attempted to overcome some of the limitations of the dominant design education model outlined by Frascara (2007), namely

tutor-led design education's propensity to curtail students' development and dictate learners' outputs. Thus, in comparison to tutor-led design studio teaching & learning activities, the tutors remained relatively 'distant' and less directing in the two Global Studio projects described in this paper. Secondly, submissions were strategically timed throughout the project so that students were required to communicate and negotiate with their peers and acquire what we term *local knowledge* from them. In recognising that knowledge is socially constructed, we have aimed to facilitate peer-tutoring amongst participants.

Qualitative feedback informed us that many students gained valuable learning experiences from working in a student-led manner. This feedback also suggested that peer tutoring had helped improve participants' learning experiences. However, student feedback also suggested that learners struggled with making design decisions during both Global Studio projects. We suggest one factor for this may be the difference in pedagogical approach between Global Studio teaching & learning philosophy and that of tutor-led design education. The latter is the dominant approach in the design curriculum. Given the contemporary cultural and professional climate, we argue that peer learning needs to be introduced and scaffolding throughout the learning journey of design students in order for students to become versed with making decisions for themselves and their peers. That way, students can have the opportunity to maximise the benefit of working via a student-led, peer-tutored environment.

We began this paper by noting the long history of the tutor-led model in design education. We then acknowledged its continued importance in ensuring that vital practical skills continue to be 'passed on' to design students. We do not call for the removal of the tutor-led model from higher education classrooms. The tutor-led approach certainly has its place. But so too does a student-led system which presents explicit opportunities for students to benefit from learning from their peers. We call for further research into a balanced and holistic approach to design education which will best enable students to prepare for professional life in the 21st Century.

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References

Arnould, E. J. and Price, L. L. (1993). River Magic: Extraordinary Experience and the Extended Service Encounter. *Journal of Consumer Research* no. *20*(1), 24–45.

Asokan, A. and Payne M. J. (2008). Local Cultures and Global Corporations. *Design Management Journal* no. *3*(2), 9–20.

Barnett, R. (2000). Supercomplexity and the Curriculum. *Studies in Higher Education* no. *25*(3), 255–265. doi: 10.1080/713696156.

Baxter Magolda, M. B. (2009). Educating for self-authorship: Learning partnerships to achieve complex outcomes. In *The University and Its Disciplines: Teaching and Learning Within and Beyond Disciplinary Boundaries*, edited by Carolin Kreber, 143–156. Oxford: Routledge.

Bohemia, E. and Ghassan, A. (2012). Globally Networked Collaborative Learning In Industrial Design. *American Journal of Distance Education* no. *26*(2), 110-125. doi: 10.1080/08923647.2012.663678

Bohemia, E. and Harman, K. (2008). Globalization and Product Design Education: The Global Studio. *Design Management Journal*, no. *3*(2), 53–68. doi: 10.1111/j.1948-7177.2008.tb00014.x

Bohemia, E., Harman, K. and McDowell, L (2009). Intersections: The utility of an 'Assessment for Learning' discourse for Design educators. *Art, Design and Communication in Higher Education* no. *8*(2), 123–134. doi: 10.1386/adch.8.2.123/1.

Borja de Mozota, B. (2010). Design Management as Core Competency: From "Design You Can See" to "Design You Can't See". The Journal of Design Strategies, no. *4*(1), 91-98.

Bourdieu, P (1998). Practical Reason. Stanford, California: Stanford University Press.

Cassidy, S. (2006). Developing employability skills: peer assessment in higher education. Education and Training, no. *48*(7), 508–517. doi: 10.1108/00400910610705890.

Danvers, J. (2003). Towards a Radical Pedagogy: Provisional Notes on Learning and Teaching in Art & Design. *International Journal of Art & Design Education*, no. *22*(1), 47–57. doi: 10.1111/1468-5949.00338.

Davies, A. and Reid. A. (2000). Uncovering problematics in design education - learning and the design entity. In *International Conference on Design Education: Re-inventing Design Education in the University*, edited by Cal Swann and Ellen Young, 178–184. Curtin University of Technology, Perth, WA, Australia: Curtin Print & Design.

De Wever, B., van Keer, H., Schellens, T. and Valcke, M. (2010). Structuring asynchronous discussion groups: Comparing scripting by assigning roles with regulation by cross-age peer tutors. *Learning and Instruction 5*, 349–360.

du Gay, P., Hall, S. Janes, L. Mackay, H. and Negus, K. (1997). *Doing Cultural Studies: The Story of the Sony Walkman*. London, Great Britain: Sage Publications.

Earwaker, J. (1992). *Helping and Supporting Students: Rethinking the Issues*. Bristol, PA: Open University Press.

Falchikov, N. and Goldfinch, J. (2000). Student peer assessment in higher education: a meta-analysis comparing peer and teacher marks. *Review of Educational Research*, No. *70*(3), 287-322.

Findeli, A. (2001). Rethinking Design Education for the 21st Century: Theoretical, Methodological, and Ethical Discussion. *Design Issues, 17*(1), 6–17.

Frascara, J. (2007). Hiding Lack of Knowledge: Bad Words in Design Education. *Design Issues* no. *23*(4), 62–68.

Ghassan, A. and Bohemia, E. (2013). From Tutor-led to Student-led design education: the Global Studio. In Beate Reitan, J., Lloyd, P., Bohemia, E., Merete Nielsen, L., Digranes, I. and Lutnæs, E. *Proceedings of the DRS//Cumulus 2nd International Conference for Design Education Researchers, volume 1*, 'Design Learning for Tomorrow – Design Education from Kindergarten to PhD'. Held 14-17 May 2013 in Oslo, Norway, 524-536.

Ghassan, A. and Bohemia, E. (2011). Notions of Self: Becoming a 'Successful' Design Graduate. In Roozenburg, N.F.M., Chen, L.L., and Stappers, P.J. *Diversity and Unity: Proceedings of IASDR, the 4th World conference on Design Research*, 'IASDR'. Held 31 Oct–04 Nov 2011 in Delft, the Netherlands.

Gropius, W. (1919). *The Bauhaus Manifesto and Program*. Retrieved from http://www.thelearninglab.nl/resources/Bauhaus-manifesto.pdf

Gupta, A., Mattarelli, E., Seshasai, S. and Broschak, J. (2009). Use of collaborative technologies and knowledge sharing in co-located and distributed teams: Towards the 24-hr knowledge factory. *The Journal of Strategic Information Systems* no. *18*(3), 147–161. doi: 10.1016/j.jsis.2009.07.001.

Harrison, N. and Peacock, N. (2010). Cultural distance, mindfulness and passive xenophobia: using Integrated Threat Theory to explore home higher education student's perspectives on "internalisation at home". *British Journal of Educational Technology* no. *36*(6), 877–902. doi: 10.1080/01411920903191047.

Hoppe, R. (2005). The Global Toothbrush: International Division of Labor. *Spiegel: Special International Edition, The New World*, 130–135.

Horváth, I., Duhovnik, J. and Xirouchakis, P. (2003). Learning the methods and the skills of global product realization in an academic virtual enterprise. *European Journal of Engineering Education*, no. *28*(1), 83–102. doi: 10.1080/0304379021000056839.

Johnson, B. (2013). *Helping Students Deal with Uncertainty in the Classroom* 2011. Retrieved 20th January 2013 from http://www.edutopia.org/blog/dealing-with-uncertainty-classroom-students-ben-johnson

Kopytoff, I. (1986). The Cultural Biography of Things: Commoditization as Process, in Arjun Appadurai (ed.) The Social Life of Things: Commodities in Cultural Perspective, New York: Cambridge University Press. doi: 10.1017/CBO9780511819582.004

Lash, S. (2003). Reflexivity as Non-Linearity. *Theory, Culture & Society*, no. *20*(2), 49–57. doi: 10.1177/0263276403020002003.

Mauss, M. (1990 [1950]). *The Gift*, Translated by W. D. Halls. Suffolk, UK: Routledge. Original edition, Essai sur le don.

Miller, D. B. (2011). *Design Ethics for International Peace and Security*. The United Nations Institute for Disarmament Research (UNIDIR) 2010. Retrieved 20th May 2011 from http://www.unidir.ch/unidir-views/pdf/pdf-uv-28-31.pdf

OECD-CERI. (2005). E-Learning in Tertiary Education: Where do we stand? : OECD. Perraton, H., Creed, C., & Robinson, B. (2002). Teacher Education Guidelines: Using Open and Distance Learning: UNESCO

Pietrykowski, B. (2004). You Are What You Eat: The Social Economy of the Slow Food Movement. *Review of Social Economy* no. *62*(3), 307–321. doi: 10.1080/0034676042000253927.

Stone, C. (2009). The British Pop Music Festival Phenomenon. In Ali-Knight, J. ed. International Perspectives of Festivals and Events: Paradigms of Analysis, 205-224. Oxford: Elsevier.

Thaler, R. H. and Sunstein, C.R. (2009). *Nudge: Improving decisions about health, wealth and happiness.* London: Penguin.

Tonkinwise, C. (2011). A taste for practices: Unrepressing style in design thinking. *Design Studies*, no. *32*(6), 533–545. doi: 10.1016/j.destud.2011.07.001.

Topping, K. J. (1996). Effective peer tutoring in further and higher education: a typology and review of the literature. *Higher Education, no. 32,* 321-325.

Wang, L, Shen W, Xie, H, Neelamkavil, J. and Pardasani,. A. (2002). Collaborative conceptual design—state of the art and future trends. *Computer-Aided Design*, *34*(13), 981–996. doi: 10.1016/S0010-4485(01)00157-9.

Wong, W. K., T. W. Chan, C. Y. Chou, J. S. Heh, and S. H. Tung. (2003). Reciprocal tutoring using cognitive tools. *Journal of Computer Assisted Learning*, *19*, 416–428.

Matthew Watkins

An Audio-visual Approach to Teaching the Social Aspects of Sustainable Product Design

Abstract

This paper considers the impact of audio-visual resources in enabling students to develop an understanding of the social aspects of sustainable product design. Building on literature concerning the learning preferences of 'Net Generation' learners, three audio-visual workshops were developed to introduce students to the wider social aspects of sustainability and encourage students to reflect upon the impact of their practice. The workshops were delivered in five universities in Britain and Ireland among undergraduate and postgraduate students. They were designed to encourage students to reflect upon carefully designed audio-visual materials in a group-based environment, seeking to foster the preferences of Net Generation learners through collaborative learning and learning through discovery. It also sought to address the perceived weaknesses of this generation of learners by encouraging critical reflection. The workshops proved to be popular with students and were successful in enabling them to grasp the complexity of the social aspects of sustainable design in a short span of time, as well as in encouraging personal responses and creative problem solving through an exploration of design thinking solutions.

Keywords: Audio-visual resources, design education, product design, social sustainability

Introduction

Sustainability as described by the triple bottom line (Elkington, 1998) considers three pillars: economic, environmental and social concerns – considering all three aspects to be of equal value. While sustainable design education has emphasised and made inroads into addressing the environmental considerations and impact related to products and services, it has neglected the social considerations, particularly social wellbeing (Griffiths & O'Rafferty, 2010). A review of literature uncovered a distinct lack of sources addressing social equity within sustainable product design, corresponding with findings by Vezzoli (2006) who calls the social-ethical dimension of sustainable design a new research frontier, describing the field as relatively unexplored, with a lack of teaching proposals.

Prior to the undertaking of the research outlined in this paper, a set of criteria were defined and developed to guide the content of the 'Rethinking Design' workshops in respect to the social dimension of Sustainable Product Design (SPD) (Watkins, 2013). In addition, prior research conducted within the doctoral study (Watkins, 2014a) also sought input from leading academics in SPD within the UK and these findings informed the direction of the research presented in this paper.

This research conducted among academics concerned the difficulties that they encounter in teaching the social dimension of sustainable design and findings from these academic interviews suggest that students and lecturers often find it easier to address the more tangible environmental concerns than the complex often intangible social issues (Watkins, 2014a).

Academics noted that addressing the social aspects of SPD requires a transformative holistic approach rather than the traditional transmission approach with measurable outcomes (Watkins, 2014a). Academics also noted that the social aspects of SPD are more suited to teaching or discussion in small groups within the context of a student's work in a studio or tutorial setting (Watkins, 2014a). This suggests that larger groups of students inhibit the ability to engage in discussion, with academics describing a tendency to revert to teaching solely the environmental aspects when larger groups were involved. These findings echo those de-

scribed by Ramirez (2007b) in his worldwide survey of sustainability in industrial design education, which found that while the teaching of environmental considerations of sustainable design is widespread, the additional social and ethical considerations are often neglected (Ramirez, 2007b).

These earlier findings were considered within the design and development of the 'Rethinking Design' workshops. The impact of these workshops is explored and evaluated through two separate publications. This paper presents the impact of the audio-visual approach using popular music and carefully selected photography to convey meaning and the breadth of social sustainability, while a previously published paper considers how deep learning was fostered in the workshops through reflection, relevance and group interaction (Watkins, 2014b).

One of the key considerations of the research outlined is this paper is to ensure that the format of learning resources is relevant to the students and takes account of their learning styles, to facilitate their learning in a manner that is accessible and effective. Therefore, the following two sections consider the students' preferences and modes for delivering the content.

Contemporary learners

There is a wealth of literature that specifically discusses the nature of the current cohort of students in higher education and the impact this has on higher education. The current generation of students are referred to in a number of ways with multiple terms being used within the literature including: 'Net-Generation' (Oblinger & Oblinger, 2005a; Tapscott, 1998), 'Millennials' (Holliday & Li, 2004; Howe & Strauss, 2003) and 'Digital Natives' (Palfrey & Gasser, 2008; Prensky, 2001). This generation of students are typically defined as individuals born from 1982 onwards (Howe & Strauss, 2003; Oblinger & Oblinger, 2005a). However, the differentiating factor for the 'Net Generation' may be their technological experience rather than just their age, as this generation of students would have all been typically using computers by time they were 16 to 18 years old (Oblinger & Oblinger, 2005b). The research presented in this paper commenced in 2010 at which point the oldest 'Net-Generation' learners would have been 28 years old; therefore, it is entirely appropriate that the research considers the needs of this generation considering that typical undergraduates would have been aged between 18 and 22 years. Therefore, the range of learners that could be considered 'Net Generation' learners could encompass the majority of the students involved in undergraduate and postgraduate study in the UK at the time (Watkins, 2014b).

The literature states that Net Generation learners learn in different ways and have differing learning preferences to the preceding generation (Barnes, Marateo, & Ferris, 2007). It is suggested that these differences are related to the pervasiveness of technology and digital media, with the emergence of the internet and social media as well as wider changes in the social climate (Tapscott, 2009) that they have grown up in. A fuller explanation of the 'Net Generation' is given in an earlier paper (Watkins, 2014b).

Learning preferences

A summary of the key considerations are summarised below, with a fuller explanation given in an earlier paper (Watkins, 2014b). 'Net Generation' learners in Higher Education prefer an autonomous style of learning with preferences for experiential learning (Barnes, Marateo & Ferris, 2007) and learning by doing (McNeely, 2005). Therefore students prefer a greater emphasis on exploratory learning by discovery, as individuals or in collaboration with their peers, to the more traditional lecture format where information is given to them (Oblinger & Oblinger, 2005b; Tapscott, 2009). Literature recognises that this exploratory style enhances

the way in which students retain information and are able to use it in more creative and meaningful ways (Tapscott, 1998).

Net Generation learners are socially orientated and are attracted to activities that foster social interaction through interactive learning (Barnes, Marateo & Ferris, 2007; Tapscott, 2009), peer to peer learning (Oblinger & Oblinger, 2005b) and group work (Howe & Strauss, 2003; Oblinger & Oblinger, 2005a; Barnes, Marateo & Ferris, 2007; Tapscott, 2009). An interesting consequence of this social nature is that the Net Generation typically dislikes online or distance learning environments (McNeely, 2005), despite the technological focus of such an approach, preferring instead the social interaction of a traditional learning environment. Tapscott (2009) describes how students can begin to internalise their learning through discussion in a group environment. Oblinger & Oblinger (2005b) further describe how a peer-to-peer approach is often seen more credible than a teacher-led approach among Net Generation learners.

Net Generation learners are visual learners who retain, on average, 30% of what they see but only 10% of what they read (Oblinger & Oblinger, 2005b); therefore, such students are more comfortable with image-rich environments than with text (Oblinger & Oblinger, 2005b; Tapscott, 2009; Windham, 2005). Net Generation learners have an enhanced visual literacy with the ability to read images and an innate ability to communicate through visual methods, combining images, text and sound seamlessly (Oblinger & Oblinger, 2005b). Their abilities have been widely demonstrated by the prevalence of amateur You Tube content.

Net Generation learners are also characterised by their ability to multitask (Barnes, Marateo & Ferris, 2007; Holliday & Li, 2004; Prensky, 2001), quickly shifting their attention from one task to another and are able work on multiple tasks simultaneously (Oblinger & Oblinger, 2005b). This also presents an ability to handle and process information in nonlinear ways (Oblinger & Oblinger, 2005b) and more quickly when compared to previous generations. However, crucially for educators this means that Net Generation learners expect rapid responses (Oblinger & Oblinger, 2005b). This ability to multitask and adopt a rapid pace, however, is cited as detrimental to the student's ability to reflect and adopt critical thinking skills and therefore could be considered a weakness of the Net Generation (Holliday & Li, 2004; Oblinger & Oblinger, 2005b; Prensky, 2001).

Audio-visual learning resources

Audio-visual learning resources are referred to in many different ways across disciplines. However, for the purposes of this paper the author is only concerned with the use of audio-visual resources in the physical classroom context, rather than a distance learning IT-based environment, as this doesn't suit the preferences of the 'Net Generation'. The use of audio-visual methods can take the form of either an alternative to, or an additional component to traditional classroom-based teaching and learning approaches. Therefore, throughout the study when the term 'audio-visual' is used it refers to the use of audio-visual content within a physical classroom environment that is delivered face to face with students, with the intention of enhancing teaching and learning.

Audio-visual learning approaches are being explored for numerous reasons including the recognition of a student preference for a visual format in the 'Net Generation' literature and the growing prevalence of an audio-visual culture through formats such as YouTube. Audio-visual learning approaches are also noted in Sustainable Design literature in respect to the teaching of ethics and responsible practice to engineering (Perdan, Azapagic & Clift, 2000) and design students (Griffith & Bamford, 2007). Griffith & Bamford (2007) cite the use of introductory audio-visual presentations as a means of promoting interest in responsible design among students, and supporting lecture content and stimulating discussion and activities in tutorials. However, very little detail is given on the development of choice for or

intent behind such audio-visual resources within these papers. Furthermore, there is a lack of literature in the design field discussing the use and benefits of an audio-visual teaching approach.

Therefore, this paper considers support for the use of audio-visual teaching methods from the field of sociology education, where the practice of using both visuals in the form of photographs and audio in the form of popular music is more established particularly in relation to teaching introductory sociology. Such literature is closely aligned with the requirements of the research presented, which is concerned with developing an introductory approach for teaching the social aspects of sustainability within product design.

Literature suggests that the use of an audio-visual approach can have reflective benefits for students (Albers & Bach, 2003; Hanson, 2002; Tan & Pearce, 2011), and foster critical thinking and reflection by encouraging discussion in a group context by creating a shared experience (Albers & Bach, 2003; Hanson, 2002; Hraba, Powers, Woodman & Miller, 1980). This is important as this addresses the key perceived weakness of Net Generation learners: the ability to critically reflect (Holliday & Li, 2004; Oblinger & Oblinger, 2005b). Additionally, the careful use of photographs suits the visual preferences of the Net Generation, while the additional use of music is also noted in the literature as beneficial to learning (Ahlkvist, 2001; Albers & Bach, 2003; Brkich, 2012).

Another benefit described in the literature is the use of audio-visual methods to address theory in the curriculum that involves difficult concepts (Hinds-Aldrich, 2012), which suits the complex nature of the social aspects of SPD.

Methodology

Workshops were conducted at 5 universities, 3 in England, 1 in Wales and 1 in Ireland, among undergraduate and postgraduate product design students. In total, 150 students took part in the workshops, which were conducted within modules that considered sustainable design.

Data collection consisted of a number of different formats to permit triangulation:

- Two student questionnaires were completed, one prior to students commencing the workshops and the other immediately after completion. The questionnaires were similar enabling the differences in individual students' understanding and attitudes to be measured.
- Audio recordings and photography were also used to record the students' interactions during the workshop sessions. The audio recordings were transcribed and analysed in conjunction with the images of the students mind maps and subsequent project work, using coding and clustering techniques.
- Students' reflective diaries that were maintained throughout the module were considered for references to the workshops and also analysed using coding and clustering techniques where applicable.

Coding and clustering was used to analyse these qualitative data sources because it permits the data obtained to be reviewed and dissected in a meaningful way while still keeping the relationships between the data intact (Miles & Huberman, 1994).

Three separate workshops were offered each considering a different aspect of social SPD and themes derived from earlier research (Watkins, 2013):

- The first workshop 'Step into my World' featured photographs of individuals from diverse backgrounds and differing abilities and ages and encouraged the students to explore user-centred design issues under the 'design for the other 90%' banner through the images and the use of a song that invited the listener to 'step into another's world'. The workshop was de-

signed to introduce themes such as inclusive design, design for true need, co-design, social design, design for the aged and design for disability.

- The second workshop 'Localisation, Reuse and Emotionally Durable Design' considered the narrative and product lifecycle of products and the users' relationship to the products, addressing issues such as localisation, end of life considerations, emotionally durable design, personal meaning, personalisation, product reuse, secondary product life, cultural identity and employment. Photographs, brief text-based statements and atmospheric music were used to convey the message.
- The third workshop called 'Exploitation' was more holistic and controversial than the first two and encouraged students to consider the wider ethical issues surrounding design such as consumerism, global inequality, social equity, social justice, ethical consumption, globalisation and design activism. Photographs were intertwined with news clippings and underlined by a piece of popular music that questioned the effects of consumerism and globalisation.

Each workshop consisted of two elements, a 3–5 minute audio-visual introduction that was shown at the beginning, followed by a 45-minute group-based workshop that sought to encourage students to respond to what they had seen. Four prompt questions were also provided to aid group discussion during the 45-minute workshop element and students were actively encouraged to record their own thoughts and group discussions in the form of a mind map.

The design of the workshops was supported by the literature, which suggested that the visual methods should increase the relevance of the activity to the highly visual 'Net Generation' learners (Oblinger & Oblinger, 2005b; Windham, 2005; Tapscott, 2009), while the use of carefully selected photographs could help foster indirect experiences with the content, enabling students to personalise aspects of sustainability (Murray, 2011). Furthermore, the opportunities for group work should appeal to the socially orientated nature of 'Net Gen' learners (Howe & Strauss, 2003; Oblinger & Oblinger, 2005b; Barnes, Marateo & Ferris, 2007; Tapscott, 2009). The workshop should also encourage and provide opportunity for discussion, debate and critical reflection as well as engagement (Huckle & Sterling, 1997; McNerney & Davis, 1996). Finally, brainstorming as a reflective technique is recognised as important to the design thinking process (Seidel & Fixson, 2013).

The audio-visual introductions were designed to be contemporary in style using photographs and popular music to capture the students' attention. This design deliberately mimicked 'You Tube' content style, where images or silent video are overlaid with a piece of popular music. Such a style is readily relevant and accessible to a 'Net Generation' audience, who are able to weave text, images and sound in a natural way (Oblinger & Oblinger, 2005b).

The photographs used were selected intentionally to portray a number of different aspects, so that each audio-visual introduction could introduce a much larger range of social issues than a traditional lecture format could accommodate, if only at a superficial level. The music selected was carefully considered to ensure that the lyrics or the tone of the music were related to the issues being portrayed.

Findings

The following section will describe how the students related to the audio-visual format and the effectiveness of the workshops, and will consider an example of how the workshops impacted the students' work.

Students cited the audio-visual introductions as effective and informative, describing how the format helped them to think and noted the emotive nature of the music. One student in particular cited the format as a video and noted that it helped memorise aspects more readily as a result: 'Video in 2nd activity & learning from, interesting could let me memorise things more easily.'

Students also discussed the effectiveness of the audio-visual introductions, responding positively to the style, citing the short length, simplicity, thought-provoking nature and ability to evoke discussion. The audio-visual introductions also provoked an emotional response among students who commented on how they found them 'powerful' and in the case of the final workshop 'Exploitation', the students found it 'shocking' and 'upsetting'.

Audio

The students commented positively on the inclusion of music, often commenting on the emotional nature of the music used and making links between the music and the visual content.

Students discussed the nature of the lyrics of the song used in the 'Step into my World' introduction. The song had the same title and described stepping into another person's world. The lyrics were effective in triggering discussion and led to a variety of user-centred empathic research approaches being suggested. Of note were empathic, co-design and ethnographic user-centred research and specifically relating such approaches to student group projects conducted at one of the universities. One student commented, 'Lyrics of the song – take a step in my world, this suggests living in one of these peoples shoes for a day.'

Visuals

The use of images and the visual nature of the audio-visual introductions were noted among students throughout the questionnaires, workshop sessions and reflective diaries, with students describing the 'striking' nature of the photographs and composition: 'It was the wonderful selection of photos that made me stop and think.'

The visual nature was found to be particularly memorable to the students, with them commenting on specific images and later describing specific individuals and objects portrayed in the audio-visual introductions in their diaries and mind maps. Students also began to relate to the examples given in the audio-visual introduction personally, contextualising aspects such as emotionally durable design, personal meaning and reuse by citing objects that they have an affinity with.

> When I saw the bit about the sentimental design so the guy with his first car it kind of reminded me of a project that I am working on at the moment restoring a 1962 Vespa which is almost finished now. It's kind of a piece of design that you relate to in a personal way (1st year BSc student).

Similarly, the images in the 'Exploitation' audio-visual introduction appeared to be particularly memorable and were cited by several students, with comments describing the cramped working conditions in particular. While it was typically photographs from the audio-visual introductions that were cited, a number of students at each institution also recalled text-based quotes from the materials, such as 'One man's waste is another man's treasure' in the 'Localisation and Emotionally Durable Design' introduction.

Effectiveness of the workshop style and format

Students cited the workshops as enjoyable and valuable, describing how the workshops helped them broaden their thinking and outlook in respect to their design solutions.

> Overall I thought the workshop was very beneficial as it opened my mind to looking beyond the obvious problem and look deeper into the situation to come up with a good solution (2nd year BSc student).

Students also cited the group work and group discussion aspect of the workshops, recognising benefits of group work such as the consideration of different opinions and viewpoints.

> We then broke off into groups and discussed what we thought of the videos. We had to group with people we don't normally group with which was quite good because we saw different opinions (2nd year BSc student).

Students reflected later in both their questionnaires and diaries on the conflicting views that arose from group discussion, especially in relation to the workshop 'Exploitation'. Students began to appreciate that there were often two equally valid points of view or arguments to a particular issue, grasping an important characteristic of the complexity of sustainability and demonstrating critical reflection.

> The other question is well you can say China and India are going through their Industrial Revolution, which we went through. Our industrial revolution, where we had child labour, child chimney sweeps and you go through that, so it's almost like a rite of passage to go through, but how long has that lasted though, we had ours. We endorse it yeah, but it doesn't make it right does it. Yeah because when we had it other people weren't paying them, we were paying them (2nd year BSc student).

Evidence of students applying learning from workshops

There was evidence at 3 universities of students relating the workshop content to design projects that they were currently undertaking both within the modules that hosted the workshops and other modules.

An example of such a project outcome arising from the workshops is given below. This particular group of students continued to explore the theme of intergenerational design that they arrived at during the 'Step into my World' workshop. During the workshop session, the group noted that the 5 pictures of people were actually 5 different stories relating to their individual lives and sought to link them. In particular, the group described the loneliness of an elderly lady and how the youth were portrayed as a possible result of broken families (Figure 1).

> Family the old lady doesn't have any and the guy with the hoody didn't look like he appreciated his family….. His angry because…….yeah that's true broken family….. There's five different stories in that presentation I mean….. maybe you can link them together (2nd year BSc student).

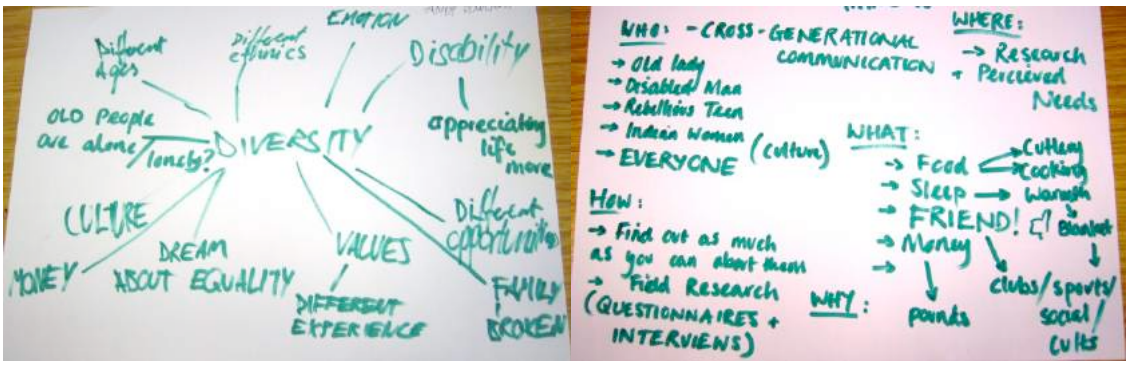

Figure 1. Mindmaps produced by the group in the 'Step into my World' workshop

The group then sought to produce a design that united different generations and produced a product design that served the needs of 3 generations, encouraging interaction and communi-

cation between the generations in the form of multifunctional public seating that attempted to address the importance of family.

As part of this process, the students undertook user-centred design research interviewing 3 generations of families: grandparents, parents and grandchildren. From this, they designed public seating to be placed within a park environment (Figure 2). The seating is adaptable to suit a number of different uses and age groups, suiting the intergenerational criteria. Additionally, the seat was linked to the students' reflections in the 'Step into my World' workshop of the elderly lady being stuck indoors. In their project outcome, there were clear references to their learning and reflections as a result of their involvement in the 'Step into my World' workshop, developing aspects from their initial workshop reflections concerning broken families, social deprivation and loneliness in elderly people.

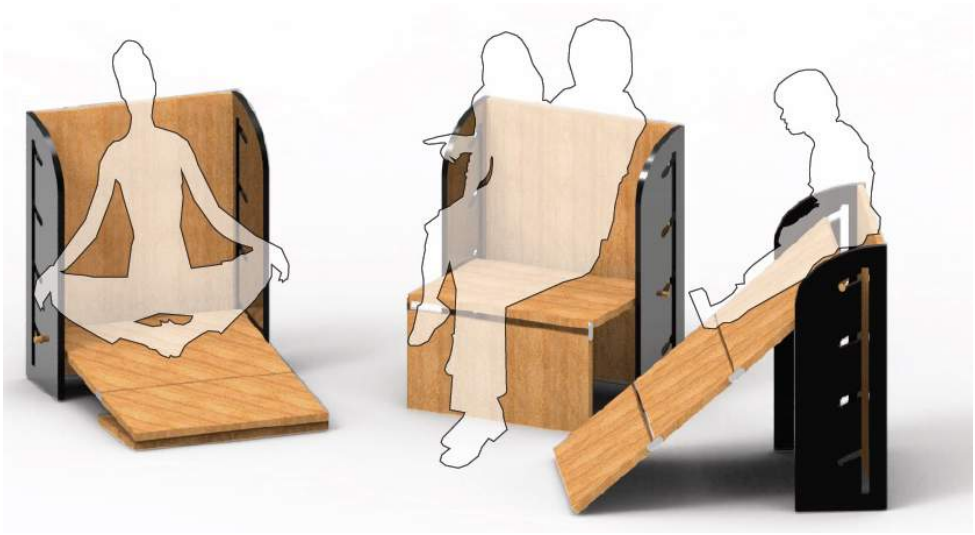

Figure 2. Design concept for intergenerational public seating

Discussions

Audio nature

Music was used in the audio-visual introductions for all three workshops, but the emotional nature of the music was only noted by students in response to two of the workshops, 'Step into my World' and 'Localisation and Emotionally Durable Design', recognising Crowther's (2012) view that music can evoke strong emotions.

All the students who commented on the inclusion of music were positive, suggesting that the music improved the presentation by providing additional meaning and understanding. Especially in the 'Step into my World' workshop, students elicited further meaning because of the addition of music.

The positive reaction and recognition that the music added to the learning experience in the 'Step into my World' workshop supports the literature findings (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995). Furthermore, the lyrics of the song which invited the listener to 'step into another's world' were effective in formulating discussion and thinking (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995) and led to the consideration of user-centred empathic research approaches including ethnography and co-design. The students considered how they could step into the world of the individuals portrayed in the audio-visual introduction by reflecting on the needs represented in the workshop when exposed to cultures outside of their own.

Such observations were made by students at all of the universities where the 'Step into my World' workshop was conducted suggesting that the connection was made universally. This suggests that the literature findings relating to the personalisation of sustainability through the creation of an indirect experience using visual methods (Murray, 2011) could be extended further to include music as a key element among the 'Net Generation' learners.

Visual nature

The use of carefully selected photographs within the audio-visual introductions helped to foster the indirect experiences that Murray (2011) describes as important for the personalisation of sustainability. The responses from the students suggested that the photographs used were particularly evocative and memorable, expressing emotion and stories that students could link to the individuals portrayed.

The students described how the portraits of the people in the 'Step into my World' introduction gave an insight into their lives, and students typically made generalisations from each of the photographs to describe the lifestyle or needs of the individual portrayed, interpreting the image and deducing the meaning as described by Perkins (1994). This filling in of the gaps is also acknowledged by Murray (2011) in relation to the use of imagery, but cited as a disadvantage as it leads to generalisations. However, for the purposes of these workshops it was beneficial as the students began to derive needs and design solutions from their interpretations. Students also in part recognised that they were making generalisations and therefore recognised the need for user-centred research in relation to the message portrayed from the music.

The evocative nature of the photographs and the length of time for which each photograph was shown caused students to remember the image long after it was displayed. This was an intentional aspect of the design of the introductions, to allow time for the students to process the image. This importance of time to reflect has been noted in the literature (Hanson, 2002; Perkins, 1994). The length of time the photographs were shown for was particularly noticeable in the 'Step into my World' workshop, to the extent that it was almost disconcerting to the viewer. However, this could have influenced the particularly memorable nature of each individual portrayed, as all groups at each university readily discussed each individual portrayed within the 'Step into my World' workshop.

Individual photographs were instrumental in fostering discussion and, in some cases, critical debate as proposed in the literature (Hanson, 2002; Schell, Ferguson, Hamoline, Shea & Thomas-Maclean, 2009), with multiple interpretations arising among the students. For example, students were divided in their opinions of the low-cost handmade artefacts featured in the 'Localisation and Emotionally Durable Design' audio-visual introduction. Some suggested that such reuse was letting companies off the hook when they should be ensuring recycling occurs at the end of life, while other students recognised the affordability and cultural relevance of reuse in developing countries.

Certain images led to in depth debate with students unravelling complex themes behind individual images, such as a simple 'Made in China' image. Students interpreted what this meant on multiple levels, reflecting on the effects of mass manufacture in the East, including labour issues, cost and the environmental effects of shipping. The discussion of labour issues during the 'Localisation and Emotionally Durable Design' workshop at one university was particularly interesting as the students involved at this institution had no prior exposure to the 'Exploitation' workshop materials but had effectively uncovered far wider reaching issues through the discussion of a single image.

This highlights the ability of students to draw multiple meanings through reflection on a single image. While the complete audio-visual introductions were intended to explore multiple aspects of social sustainability, it was interesting to note that this was also the case

with specific single photographs within the audio-visual introductions. A simple 'Made in China' image elicited reflection as did an image of a pallet chair, through which students recognised all three pillars of sustainability, the economic, environmental and social aspects, amid group-based discussion and reflection.

Despite the social SPD focus of the 'Rethinking Design Series' workshops, some students explored and discussed aspects relating to the wider context of Product Design such as the aesthetic value of the reused examples or whether the reused examples were indeed examples of industrial design because they weren't mass produced. This suggested that the workshops had encouraged them to consider the content in terms of their wider practice, helping them integrate social sustainability rather than compartmentalise it. This finding addresses a key issue found in literature in SPD education (Ramirez, 2007a).

From the 'Exploitation' introduction, students noted a range of images with many focussing on those that shocked them the most relating to the Chinese factory workers and child labour. However, the greatest impact from this introduction appeared to be related to the supporting text included with the images, with students recalling the facts and figures quoted in relation to the hours worked and wages paid to the Chinese factory workers. This suggests that while the highly visual nature of the images was effective throughout the workshops, the students also memorised the key facts and figures particularly well, which could indicate that the students preferred the exact information that these portrayed in respect to the subjective nature of photographs.

However, the length of these almost headline-like text-based quotes also appeared to have been a key factor in the ability to be memorable as the students didn't cite other information given in longer text-based quotes in the 'Exploitation' and 'Localisation and Emotionally Durable Design' audio-visual introductions. Nevertheless, it should be highlighted that while the short text-based quotes were memorable, they didn't elicit the same level of reflection among the students as the photographs. Therefore, the text-based material was merely useful to convey understanding and give detail required for understanding the images.

Conclusions

The audio-visual nature of the workshop introductions proved to be effective both in engaging the students as well as being memorable. This was demonstrated by students reciting exact quotes and accurately describing detail in images. Moreover the audio (in particular 'Step into my World') led students to a deeper exploration of the content to explore empathic design research approaches.

More importantly, the audio-visual introductions were engaging enough to foster group discussion and debate among the students. It was this discussion and debate in the workshops that was found to have instigated critical reflection that was initially absent in the students' individual responses.

The findings suggest that the visual imagery used within the audio-visual introductions was a highly effective way of portraying the content, and encouraged reflection among the learners, echoing the findings of both the audio-visual and 'Net Generation' literature. Furthermore, the use of audio added additional meaning for the students enhancing and adding to the literature on developing an indirect experience for personalising sustainability (Murray, 2011), which previously only considered visual resources through the use of photography.

The workshops also addressed a key issue described in the SPD education literature (Ramirez, 2007a) and academics in the earlier research interviews (Watkins, 2014a): the inability of students to apply their understanding of sustainability outside of a specialist module in their general practice. Instead, the workshops enabled students to draw links through discussion and reflection to other components of product design within the workshops and

applied their learning from the 'Step into my World' workshop as shown earlier. Further work, however, could consider the wider impact of such audio-visual workshops across their studies rather than in individual modules.

The approaches used in these workshops enabled students to explore multiple aspects of social sustainability within a short span of time, promoting peer learning and learning through discovery, preferences of 'Net Generation' learners. The workshops were successful in addressing a range of social sustainability criteria and encouraged students to consider such issues in respect to their discipline.

It was intended from the outset of the research that the simple design and format of these workshops could be replicated by other academics in similar contextual and environmental settings. However, the researcher recognised that constructing the workshops requires an innate ability to recognise appropriate images and music, skills that the researcher possessed as a photographer with a large personal music selection, but may prove limiting to others; therefore, guidance on sources of resources would be required.

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References

Ahlkvist, J. A. (2001). Sound and Vision: Using Progressive Rock to Teach Social Theory. *Teaching Sociology*, *29*(4), 471–482. doi: 10.2307/1318948

Albers, B. D. & Bach, R. (2003). Rockin' Soc: Using Popular Music to Introduce Sociological Concepts. *Teaching Sociology*, *31*(2), American Socio. doi: 10.2307/3211313

Barnes, K., Marateo, R. & Ferris, S. (2007). Teaching and Learning with the Net Generation. *Innovate*, *3*(4). Retrieved from http://innovateonline.info/pdf/vol3_issue4/Teaching_and_Learning_with_the_Net_Generation.pdf

Brkich, C. A. (2012). Music as a weapon: Using popular culture to combat social injustice. *The Georgia Social Studies Journal*, *2*(1), 1–9

Crowther, G. (2012). Using Science Songs to Enhance Learning: An Interdisciplinary Approach. *CBE-Life Sciences Education* , *11*(1), 26–30. doi: 10.1187/cbe.11-08-0068

Elkington, J. (1998). *Cannibals with forks: the triple bottom line of 21st century business*. Gabriola Island, BC: New Society Publishers

Griffith J., S. & Bamford, R. (2007). Embedding the principles of responsible design into student practice from 1st year. In *Connected 2007 International Conference on Design Education*. University of New South Wales, Sydney, Australia. Retrieved from http://www.connected2007.com.au/finalpapers/start.swf

Griffiths, R. & O'Rafferty, S. (2010). Sustainable social design. In F. Ceschin, C. Vezzoli, & J. Zhang (Eds.), *Sustainability in Design: NOW!* (pp. pp.944–951). Bangalore, India: LeNs. Retrieved from www.lens.polimi.it

Hanson, C. M. (2002). A Stop Sign at the Intersection of History and Biography: Illustrating Mills's Imagination with Depression-Era Photographs. *Teaching Sociology*, *30*(2), 235–242 American Socio. doi: 10.2307/3211385

Hinds-Aldrich, M. (2012). Teaching theory analogically: Using music to explain criminological theory. *Journal of Criminal Justice Education*, *23*(4), 481–499. doi: 10.1080/10511253.2012.665934

Holliday, W. & Li, Q. (2004). Understanding the millenials: Updating our knowledge about students. *Reference Services Review*, *32*(4), 356–366. doi: 10.1108/00907320410569707

Howe, N. & Strauss, W. (2003). *Millenials go to college: Strategies for a new generation on campus: Recruiting and admissions, campus life, and the classroom* (2nd ed., p. 100). American Association of Collegiate Registrars and Admissions Officers

Hraba, J., Powers, E., Woodman, W. & Miller, M. (1980). Social change through photographs and music: A qualitative method for teaching. *Qualitative Sociology*, *3*(2), 123–135. doi: 10.1007/BF00987267

Huckle, J. & Sterling, S. (1997). *Education for sustainability* (p. 233). London: Earthscan.

Martinez, T. A. (1995). Where popular culture meets deviant behavior: Classroom experiences with music. *Teaching Sociology*, *23*(4), 413–418 American Socio. doi: 10.2307/1319171

McNeely, B. (2005). *Educating the Net Generation - Using technology as a learning tool, not just the cool new thing*. EDUCAUSE. Retrieved from http://www.educause.edu/educatingthenetgen

McNerney, C. & Davis, N. D. (1996). *Education for Sustainability: An Agenda for Action*. Pennsylvania: Diane Publishing Company

Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis: An expanded sourcebook.* (2nd ed.). Thousand Oaks, CA: Sage

Murray, P. (2011). *The Sustainable Self: A Personal Approach to Sustainability Education* (p. 240). Earthscan

Oblinger, D. & Oblinger, J. (2005a). Educating the Net Generation. *EDUCAUSE*. Retrieved from http://www.educause.edu/educatingthenetgen

Oblinger, D. & Oblinger, J. (2005b). Educating the Net Generation - Is it age or IT: First steps toward understanding the net generation. *EDUCAUSE*. Retrieved from http://www.educause.edu/educatingthenetgen

Palfrey, J. & Gasser, U. (2008). *Born digital: Understanding the first generation of digital natives*. New York: Basic Books

Perdan, S., Azapagic, A. & Clift, R. (2000). Teaching sustainable development to engineering students. *International Journal of Sustainability in Higher Education*, *1*(3), 267 – 279. doi: 10.1108/14676370010378176

Perkins, D. N. (1994). *The Intelligent Eye: Learning to Think by Looking at Art* (p. 95). Los Angeles: Getty Publications

Prensky, M. (2001). Digital natives digital immigrants. *On the Horizon*, *9*(5). Retrieved from http://www.nnstoy.org/download/technology/Digital Natives - Digital Immigrants.pdf. doi: 10.1108/10748120110424816

Ramirez, M. (2007a). Promoting sustainability through industrial design studio projects. In *Connected 2007 International Conference on Design Education* (pp. 1–5). University of New South Wales, Sydney, Australia. Retrieved from http://www.fbe.unsw.edu.au/staff/mariano.ramirez/CONNECTED2007-promotingsustainability3r.pdf

Ramirez, M. (2007b). Sustainability integration in industrial design education: A worldwide survey. In *Connected 2007 International Conference on Design Education*. University of New South Wales, Sydney, Australia. Retrieved from http://www.fbe.unsw.edu.au/staff/mariano.ramirez/CONNECTED2007-idschoolsworldwide2r.pdf

Schell, K., Ferguson, A., Hamoline, R., Shea, J. & Thomas-Maclean, R. (2009). Photovoice as a teaching tool: Learning by doing with visual methods. *International Journal of Teaching and Learning in Higher Education*, *21*(3), 340–352

Seidel, V. P. & Fixson, S. K. (2013). Adopting "design thinking" in novice mulitdisciplinary teams: the application and linits of design methods and reflexive practices. *Journal of Product Innovation Management*, *30*(S1), 19–33. doi: 10.1111/jpim.12061

Tan, E. & Pearce, N. (2011). Open education videos in the classroom: Expolring the opportunities and barriers to the use of YouTube in teaching introductory sociology. *Research in Learning Technology*, *19*(1)

Tapscott, D. (1998). *Growing up digital: The rise of the net generation* (1st ed., p. 338). New York: McGraw Hill

Tapscott, D. (2009). *Grown up digital: How the net generation is changing your world* (1st ed., p. 384). New York: McGraw-Hill

Vezzoli, C. (2006). Design for sustainability: The new research frontiers. In *7th Brazilian Conference on Design*. Curitiba. Retrieved from http://www.design.ufpr.br/ped2006/apresentacoes/vezzoli.pdf

Watkins, M. A. (2013). Defining the social dimension of Sustainability in Product Design. *Key Engineering Materials*, *572*, 24 – 27. doi:10.4028/www.scientific.net/KEM.572.24. doi: 10.4028/www.scientific.net/KEM.572.24

Watkins, M. A. (2014a). *An investigation into effective methods for teaching social sustainability within product design in British and Irish Universities*. Loughborough University. Retrieved from https://dspace.lboro.ac.uk/2134/14155

Watkins, M. A. (2014b). Towards an Understanding of the Social Aspects of Sustainability in Product Design: Teaching HE students in the UK and Ireland through reflection and peer learning. *Design and Technology Education: An International Journal*, *19*(1), 40–47

Windham, C. (2005). *Educating the Net Generation - The student's perspective*. EDUCAUSE. Retrieved from http://www.educause.edu/educatingthenetgen

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Progressive Development of Creative Design Skills from Kindergarden Education

Abstract

This article offers an alternative view of design education, emphasising on its introduction in kindergarten and proposing a curriculum that covers design issues for introduction in kindergarten. This approach is suited to developing creative thinking skills. In an environment where children imagine, create, practice, modify, recognise, manipulate and share knowledge, experiences and objects are crucial in design education. Early childhood education should be advanced based on basic design issues—such as design principles, conceptualization, 2D/3D spatial allocation and composition—more comprehensively, which will enable children to construct perceptual, critical and analytic view points at an early age and develop these perspectives in the future. Based on this argument, the study model for design education in kindergarten, which will instil in children strong design knowledge, as well as stimulate their cognitive development.

Keywords: children-design relations, basic design, develop creative thinking

Introduction

Until the mid-1960s, children's drawings were one of the most popular themes in professional writing on creative education. Then, the topic virtually disappeared, not returning until the 1990s. The focus of curricula, teacher training and research shifted to picture analysis, popular forms of visual communication, and cultural studies (Ackermann, 2004; Lindström, 2006). One of the most important areas of child and educational psychology is the issue of creativity in children, the development of this creativity, and its significance to the general development and maturation of the child. It is important to enable and direct children correctly during the time period when they develop and learn quickly and construct their knowledge immediately (Florida, 2002; Vygotsky, 2004). All participants in this 'creative learning community' share principles and values based on the idea of children being competent and creative learners, which is articulated so well by the approach in design disciplines (Fawcett & Hay, 2004). The domain of child and youth study related to the visual arts includes much more than the study of children's drawings (Brosterman, 1997; Fulghum, 1986; Hirsh, Golinkoff & Eyer, 2003; Leinonen &Venninen, 2012; Sawyer, 2006). Moreover, at an age when they are very creative, they *imagine, create, practice, modify, discover, recognise, manipulate and share,* which is effective in design education but is not included professionally in the early childhood curriculum for design issues.

In agreement with this, it is known that advanced creative thinking skills are best achieved when children are encouraged during early childhood education. Artistic development occurs between 2 and 6 years of age more than at any other time during a child's development. During this four-year period, children progress from scribbles to representation, and from disorganised to organised representations. Drawings and modelling produced by children during these years are filled with a vitality and freshness that diminishes rapidly as they grow older (Lindström, 2011; Resnick, 1998; Rosario & Collazo, 1981; Thompson, 1995, 2007).

On the other hand, preschools are undergoing a dramatic change. For nearly 200 years since the first kindergarten opened in 1837, kindergarten has been a time for telling stories, building castles, drawing pictures and learning to share. However, this situation is starting to change. In essence, Froebel was designing for designers when he designed objects that ena-

bled children in his kindergarten to create their own designs. Froebel's work can be viewed as an early example of Seymour Papert's *constructionist* approach to education, which aims to engage learners in design experiences that have personal meaning. Froebel was limited by the materials available in the early 19th century when creating his Gifts. With today's advanced electronic and digital technologies, we can create new types of construction kits, expanding Froebel's kindergarten approach to older students working on more advanced projects and learning more developed ideas. With Mindstorms and Crickets, for example, children can create dynamic, interactive constructions, and in the process, learn concepts related to sensing, feedback and control (Dudek, 1996, 2000).

Creativity is at the root of a perceptual, critical and analytic point of view at a very early age to be developed in the future. Friedrich Froebel understood this idea when he opened the world's first kindergarten in 1837. Froebel filled his kindergarten with physical objects (such as blocks, beads and tiles) that children could use for building, designing and creating. These objects became known as Froebel's Gifts (Resnick, 1998). He found that interaction with the three-dimensional world was essential for meaning making. Through embodied interactions with the environment, people get know about its manifold properties, as well as about their own bodies and minds (Fredriksen, 2011). Moreover, providing knowledge, experiences and objects through play are crucial for design education. However, these issues must be professsionally processed and integrated more comprehensively in a curriculum with design principles, conceptualisation, 2D/3D spatial allocation, colour, texture and light composition.

Method and Research

The basis for this hypothetical study is the construction of practices of design education in preschool and continuing them in the future based on the empirical knowledge of its absence (Black, 2001; Oxman, 1999, 2001). With this as the argument, this review study (Torracco, 2005) aims to establish the foundation of child creativity on three main concerns: design education should be started in preschool education; this education has to be continuous and be handled pedagogically and professionally by design discipline; and a clear curriculum needs to be established (Ackermann, 2004; Fawcett & Hay, 2004; Fulghum, 1986; Rosario & Collazo, 1981; Sawyer, 2006). In addition, some findings from a questionare survey on interior architecture students from the Fine Arts, Design and Architecture Faculty, TOBB Economy and Technology, Ankara, Turkey, are also presented and discussed in light of the findings from this literature review. With these aims in mind, the background for the present research and the basis for this research argument are presented under the following headings: Creative Design Skills in the Preschool Curriculum: Educator-Designer Collaboration, Preschool Curriculum and Basic Design Education, and Creative Thinking Cycle in Preschool Education: A Proposal for a "Preschool Design Education Model." A review of the relevant literature indicated that a design education curriculum for preschools is either absent or, if present, is inadequate. Therefore, research on this topic was analysed (Maxwell & Cole, 1995; Niederhauser, Wetzel & Lindstrom, 2004; Torracco, 2005) and used to establish a preschool design education model, which has been proposed in this study. Finally, this model has been described and evaluated.

Creative design skills in the preschool curriculum: educator-designer collaboration

In recent studies, several factors related to artistic creativity were monitored in preschool children, such as sensitivity to problems, elaboration, flexibility, fluency, originality and redefinition. Teachers rarely give children the chance to present and apply their ideas. The themes that are offered frequently require children to simply make a representation of something that already exists rather than provide an incentive for children to think about what

different creations could look like. The foregoing approach has serious limitations. Children have no chance to express their own experiences, create unique forms, or improve their ability for observation. Creations that result from a lesson designed in this way often strongly resemble each other. In order for children to attain the goals of the curriculum, they should be gradually introduced to some features of the process of creative education (Batič, 2014). According to Ellis and Morrison (1998), the use of various materials allows children to explore freely, to test their ideas, and to solve design problems in a creative way, while at the same time provide flexibility for their personal expression and creativity. Indeed, Tomšicˇ Cerkez (2004) strongly recommends that teachers provide children with all the materials with which they are capable of working.

Figure 1. A four year old childs' 'structure design' made of blocks which represents structures built juxtaposition.

A multidimensional assessment gives students *feedback*, which helps them discover their strengths and identify areas of improvement. On the basis of these observations, Lindström (2006) proposed a four-step approach for schools to help children in creative education: *investigative work, inventiveness, ability to use models, and capacity for self-assessment.*

Educators can facilitate and support a child's depth of creative learning

- to develop reflective, creative early years;
- to work locally, and encourage regionally with regard to creations;
- to establish effective models and samples; and
- to document, evaluate and disseminate this progress and actively contribute to a growing body of practice.

Children should have the opportunity to gain meaningful creative experience through motion and through interaction with the real world or, when the latter is not possible, by means of modern teaching media. It is also important that preschools enable teachers to provide children with a suitable variety of creative materials that can facilitate the creation of a solution, as well as demonstrate how materials should be properly handled. The motif should be based on their own experience of the creations that they can elaborate in their imagination (Batič, 2014; Härkönen, 2002).

The information available about the current practices indicates that it does not foster children's creativity as effectively as possible. For instance, instead of making replicas of existing creations, the children may be given tasks based on familiar (real-world) tools, which

nevertheless enable them to experience them on their own, identify a problem, find original solutions and experiment with creative materials, as prescribed by the curriculum (Ackermann, 2004).

The experience allowed for collegiality and the varied contributions of designers, such as openness, quality of questioning, and different ways of responding to children, as might be expected. In addition, designers provide information about all kinds of interesting, aesthetically pleasing materials and their potential; how to make things; and other exciting new possibilities. The educators whereas add the drama and movement contributions with their own special perspectives and ways of thinking (Emilson & Johansson, 2009; Fawcett & Hay, 2004).

Circumstantial combination of two applied disciplines—pedagogy and design—can contribute to the improvement of the quality of basic design education with regard to designing objects; acquiring a sense of 2D/3D space allocation; and stimulating children to provoke questions, suggest answers, inspire action, and think of acquiring new skills. The challenge for design education in older students is developing an understanding of the build-up of creative skills in early childhood education and complementary construction in the future. In addition, children have a special way of looking at spaces and objects. Often, the tools with which children interact become objects with their own visual identity, different for each child, in which the tactile capabilities of children are also enhanced through education. Consequently, it is a controversial and complicated issue. Design knowledge during early childhood education has been examined in detail below.

Preschool curriculum and basic design education

Educational media for pre-school entities directly or indirectly affect systematic learning and formation of specific objectives. Consequently, children should be presented with these opportunities by allocating them in flexible and well-processed programs for providing unlimited freedom where they can experience themselves and develop skills. It is essential to direct children's unlimited imagination, creativity and curiosity corresponding to child development and to allow them to integrate broad-spanning opportunities. During this process, kindergarten students develop and refine their abilities as creative thinkers. They learn to develop their own ideas, try them out, test the boundaries, experiment with alternatives, get input from others, and—perhaps most significantly—generate new ideas based on their experiences. In reality, the steps in the process are not distinct or sequential. Imagining, creating, playing, sharing, and reflecting are mixed together in many different ways (Bryant & Hungerford, 1977; Fulghum, 1986; Göncu, Main & Abel, 2009; Thompson, 1995). However, the key elements are always present, in one form or another. Some of the most creative artists and inventors of the 20th century credit their kindergarten experiences with laying the foundation (Schön, 1987; Thompson, 1995) for their later success. They described their kindergarten experience in which children *imagine* what they want to do, *create* projects based on their ideas, *play* with their creations, *share* their ideas and creations with others, and *reflect* on their experiences—all of which lead them to *imagine* about new ideas and projects. The visual art curriculum for early childhood education is quite noncommittal. It emphasizes the necessity of experiencing art activities, self-expression, fun and satisfaction, and an opportunity for children to present their own points of view. It focuses on children depicting objects and events idiosyncratically, by using different media and techniques, and observing and describing their product. In an age in which art and scientific curiosity are not a prominent part of the education system and are deemed less important than acquiring competencies aimed at technological development, it is crucial to provide clear answers and solutions for developing children's creativity (Resnick, 1998).

For instance, a survey was conducted among the interior architecture students at the Department of Interior Arcitecture and Environmental Design, TOBB University of Economics and Technology, Ankara, Turkey. The respondents were randomly selected from among sophomore-, junior- and senior-level students. Out of the 110 students who participated in the research, 87.5 % had attended in kindergarten. The study augmented the idea that design education should begin in kindergarten and continue progressively, without interruption. Over half of the students stated that they have had none or inconsiderable design education since kindergarten; 31.3 % stated that their design education after kindergarten had progressed; and only 7.5 % of the students stated that their art, design and creativity education had been continued after kindergarten. It can be understood from the answers that the students who responded did not feel that they developed their creativity potentially during their art and design education after kindergarten. In this period, when the basic design knowledge from preschool education is supposed to be developed, it may be beneficial to address both design issues and corresponding pedagogical aspects.

As mentioned earlier, children younger than 6 years of age show many examples of aesthetic pleasure and creative approaches within the preschool educational activities. Accordingly, educators of young children provide material, motivation, structure and the psychological environment for the visual art education of their students. Interactions between preschool children and their educators have been studied by Rosario and Collazo (1981) and Thompson (1995), who found that the quality of art experiences of preschool or kindergarten children is particularly vulnerable to the expertise of the educators. However, younger children generally are unable to seek information from libraries or effectively discuss subject matters with peers, educators and parents. Therefore, they depend on educators to decide their creative activities and for feedback on their performance. In other words, children in preschool and/or kindergarten are totally dependent on educators to provide design materials and activities in the school setting.

Creative thinking cycle in preschool education: A proposal for a "preschool design education model"

Recently, design educators have started to explore the learning style characteristics of students that can be used for the enhancement of learning in design (Demirbas & Demirkan, 2003, 2007; Kvan &Yunyan, 2005; Uluoğlu, 2000). The literature suggests that design students should learn by experiencing, reflecting, thinking and acting in the process of finding solutions to the assigned design problems. Therefore, design education can be considered as being in accordance with Kolb's (1984) experiential learning theory (ELT). This study focuses on learning in design education by using Kolb's learning styles and explores the relationship between learning styles, gender and academic performance. The learning styles according to Kolb's ELT are described as the individual's intellectual approach to the processing of information (Chou & Wang, 2000; Kolb & Kolb, 2005). Consequently, each child has a preferred way of perceiving, organising and retaining that is distinctive and consistent.

On the contrary, iteration is at the heart of the creative process. As mentioned previously, the process of "imagine, create, play, share and reflect" inevitably leads to new ideas, which leads back to *imagine* and the beginning of a new cycle, within the process of constantly critiquing, adjusting, modifying and revising. This is imperative for becoming a creative thinker. Historically, kindergarten has provided a good foundation for creative thinking where the first creative thinking cycle takes place. Unfortunately, after leaving kindergarten, children usually do not have the opportunity to iterate on what they learned in kindergarten and to continue to develop as creative thinkers (Resnick, 1998). Extending the kindergarten approach and providing opportunities for learners of all ages to build on their experiences enables them to refine their abilities as creative thinkers by iteration throughout their future

academic life. The practices of design learning during early childhood education should be developed to facilitate the design process for what can be considered a crucial activity where educators and children share experiences. Participation also includes the participatory skills of negotiation and sharing (Göncu et al., 2009; Thomson, 2007), which according to educator descriptions, can help obtain results in common decision-making and shared planning together with educators and children. When design learning involves planning of educational practices beforehand (Härkönen, 2002), it could also involve planning of design learning practices. A child's age impacts the participatory practices available to them (Resnick, 1998).

In this context, the process of planning activities is an important process in design education. Educators and children should mutually participate in the creative thinking cycle. Enabling children to apply basic design principles, attitudes and manipulation of materials is essential for classroom activities at the kindergarten level, in which emphasis is placed on the developmental stages of design and how they are affected by the intellectual, physical, perceptual, aesthetic, creative, emotional and social growth of children (Berthelsen, Brownlee & Johansson, 2009; Brosterman, 1997). The design education of preschool children covers rather extensive and complicated issues such as those discussed before, which also apply to the present curriculum of creative and design activities. However, their relevancy and efficiency have been limited by the knowledge of the educator or equipment available in the preschool education centre. Therefore, this education should be both pedagogically and professionally assessed by an academic designer (Thompson, 1995; Schön, 1987). Table 1 illustrates the proposed model derived from these issues.

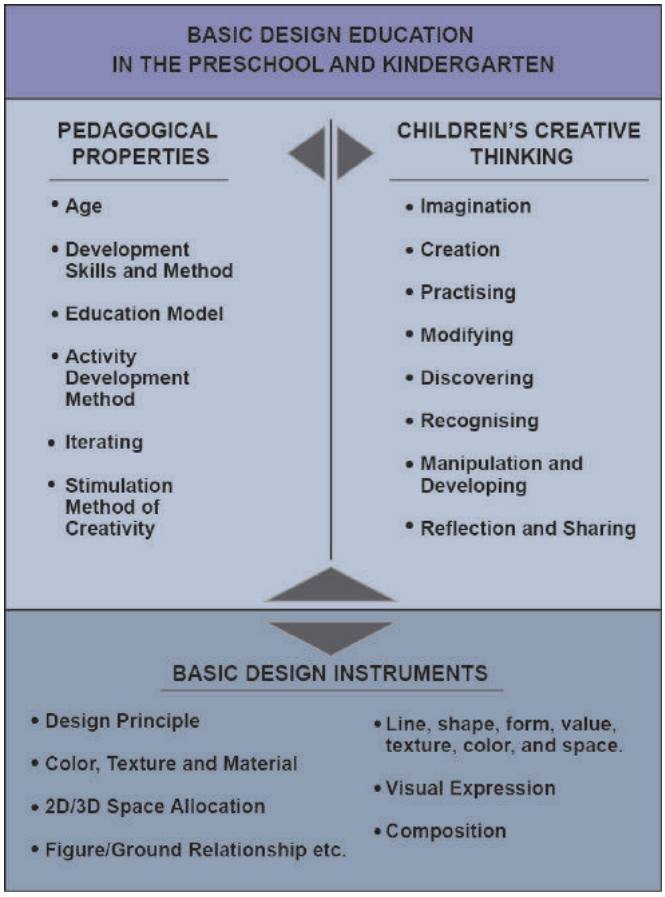

Table 1. Proposal for the "Basic Design Education in Preschool and Kindergarten" Model
Note: Pedagogical issues, children's creative thinking skills and basic design instruments are issues that are supposed to be evaluated as a whole

This model of components in design education in preschool and kindergarten summarises the creative thinking components, pedagogical issues and basic design instruments. The concepts of the creative thinking components are based on the studies of Sawyer (2006), Florida (2002), Brosterman (1997) and Fulghum (1986). The pedagogical issues are based on the studies of Sawyer (2006), Resnick (1998) and Schön (1987). The basic design instruments are based on the studies of Ackermann (2004), Demirbas and Demirkan (2003) and Florida (2002), which cover the dependent and independent variables of the 'Constructing design knowledge within kindergarten education' model: pedagogical issues, children's creative thinking approach and basic design elements. These three variables are described in detail below.

Pedagogical and design issues

Different socio-philosophical-pedagogical theories on the education models built for and around children led to the construction of our understanding of the current issues and curriculum of basic design during early childhood education. 'It was found that there were statistically significant differences between the performance scores of students having diverse learning styles at various stages of design process' (Demirbas & Demirkan, 2003, p. 437). The important point here is to provide various learning experiences and methods that emphasize different learning styles during the design process, since each design educator has his/her strategy in communicating with children.

As Schon (1987) proposed, the instructor should refer to all communication means as reflection-in-action. Furthermore, it is important to stimulate the diverging children to bring to the class their range of ideas and creative processes. The sensory, perceptual, motor, linguistic and intellectual abilities of young children have to be indicated in a harmonious and balanced manner while composing design facilities for appropriate age- and skill-related development. Moreover, application and iteration of flexible teaching methods will enhance children's motivation and stimulate their imagination; for example:

- The role of creativity in the learning of children;
- The developmental stages of children's basic design education;
- The philosophy, social context and attitudes of design education at the preschool level; and
- Knowledge of the curriculum (goals, organization, materials, and vocabulary) as it contributes to the growth of children.

Developing the creative thinking skills of children

There is growing emphasis on creativity, stimulating children's creativity, and improving the talent of preschool children from a very early age; the relations between these branches of design education with other school disciplines for creating an ensemble are important in developing children's personalities in the last years of education (Florida, 2002; Resnick, 1998; Sawyer, 2006).

Thus, children acquire an idea and begin to implement it. They know what equipment and materials they will need and obtain them. An educator is an enabler who offers children any materials that are unavailable but necessary. Such an idea often sparks other new ideas, and the original idea evolves during the process. The participation is seen in children who are excited and involved. The activity draws the attention of other children. All of them are sufficient for the creative process, which consists of imagining, creating, practicing, modifying, discovering, recognising, manipulating, developing, reflecting and sharing. As previously mentioned, these issues have been present in early childhood education and are relevant issues in the design process. However, children need to be stimulated and directed by professionals,

as well as need to construct the basis for a perceptual, critical and analytic point of view at a very early age, so that they will have the ability to develop it in the future.

Basic design instruments and preschool curriculum

Basic design principles are fundamental and important as media of instruction for children, such as play, storytelling, puzzles and cartoons, that could be turned into an experience of design (Dudek, 1996). Therefore, the curriculum could provide children with the opportunity to build a model that will guide them in understanding and applying the knowledge, skills, processes and theories of design and in providing a balanced synthesis between the conceptual and physiccal aspects of design:

- To acquire perceptual awareness by identifying and using the elements of design such as line, shape, form, value, texture, colour and space;
- To design concepts based on the elements of design and, in contrast, principles of 2D/3D space organization, e.g. balance, rhythm, emphasis and unity;
- To comprehend cultural heritage through the interaction of design and art in society;
- To utilize the processes and materials appropriate for preschool children;
- To understand self-expression through visual communication of ideas, experiences and feelings;
- To learn the vocabulary peculiar to design issues;
- To use natural and ecological materials allowing healthy growth of children and their awareness of basic design issues from the perspective of order, proportion, principles, etc.;
- To experiment with creative designs, and geometrical and structural forms with colour and texture, and to engage in imaginative and innovative technologies and materials; and
- To design spaces, perspectives and environments whose purpose is to enhance the intuition, imagination and creativity of children along with development of their aesthetic and scientific thoughts (Berthelsen et al., 2009; Demirbas & Demirkan, 2007; Uluoğlu, 2000).

Children's playful creativity in the preschool period can be regarded as artistic; they are capable of appreciating design and various activities or engaging in them. There can be different kinds of creative activity practices, which will support children's full development and personality during an age in which curiosity for art, design and science is created (Florida, 2002). Correspondingly, children somehow encounter creative activities within their pre-school education. Still, they are not professionally structured for design issues. Subsequently, they usually continue to have a traditional type of education, in which creativity is lacking or limited until they start an art or design undergraduate programme. However, students find it difficult to adapt to a very different way of thinking. Therefore, this part of the study attempted to determine whether the design student respondents within the study have had preschool education, the intention of creative activities between preschool and undergraduate academic life and, as a result, the students' performance with regard to basic design issues. Thus, the effects of continuous creative activities from kindergarten to an undergraduate programme on design education were examined.

Conclusion and Recommendations

The graduates of a design department are expected to be highly motivated, technically competent and mentally prepared to deal with ideas at a professional level (Demirbas & Demirkan,

2007). Achieving these outcomes with a four- or five-year education is complicated and discouraging for both student and instructor. This paper emphasises the accumulation of knowledge in design education; as in most other disciplines, the foundation of this knowledge must be founded and built up on during early childhood education. As mentioned above, in some nations, children lack the opportunity to develop their creativity after leaving kindergarten; they begin the traditional type of education, which creates a huge gap between kindergarten and undergraduate design education later on in their life. For this reason, especially in the beginning, students find it difficult to deal with design issues at the undergraduate level in the design departments due to absence or discontinuity of background knowledge, and experience creative issues.

Another offer of the study is a model for the basic construction of design education, which presents and identifies all the relevant independent and dependent variables in terms of pedagogical, creative, basic design issues. In this way, learning and teaching methods aim to balance the creative process with a critical awareness, considering methods and mediums in terms of the developmental aspects of children. Each design outcome tends to be unique, non-repetitive and immanent in its conception and development. During a design process, each child transforms a field of inquiry into a proposition or scheme. Children have a special point of view, but the learning process could be classified in terms of age and gender.

As a result, design has been integrated into almost all aspects of our lives, either practically or conceptually. The traditional kindergarten approach to learning is ideally suited to the needs of the 21st century (Resnick, 1998). In a society characterized by uncertainty and rapid change, the ability to think creatively is becoming the key to success and satisfaction, both professionally and personally (Florida, 2002). For today's children, nothing is more important than learning to think creatively—learning to come up with innovative solutions to unexpected situations that will continually emerge in their lives (Sawyer, 2006). For this reason, the traditional kindergarten approach has to be professionally reorganised in terms of contemporary design approach, materials and medium of education. The preschool curriculum should cover and comprise both pedagogy and design—multidisciplinary goals, contents and methods of preschool design education—and continue with imparting knowledge and skills in perceiving, planning, implementing, evaluating and developing design skills in their future academic and professional life.

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References

Ackermann, E. K. (2004). Constructing knowledge and transforming the world. In M. Tokoro & L. Steels (Eds.), *A learning zone of one's own: Sharing representations and flow in collaborative learning environments* (pp. 15–37). Amsterdam: IOS Press

Batič, J. (2014). Implementing change in architectural design in elementary school art education in Slovenia. *International Journal of Art and Design Education*, *33*(1), 130–140. doi: 10.1111/j.1476-8070.2014.01741.x

Berthelsen, D. C., Brownlee, J. M. & Johansson, E. (Eds.). (2009). *Participatory learning in the early years: Research and pedagogy* (pp. 185–202). New York and London: Routledge, Taylor & Frances Group

Black, A. L. (2001). Grappling with the realities of teaching: Artful representations as sense-making, meaning-making tools. In Singh, Parlo & McWilliam, E. (Eds.) *Designing Educational Research: Theories, Methods and Practices.* Post Pressed, Flaxton, Qld., pp. 59-70

Brosterman, N. (1997). *Inventing kindergarten*. New York: Harry N. Adams Inc

Bryant, C. K. & Hungerford, H. R. (1977). An analysis of strategies for teaching environmental concepts and values clarification in kindergarten. *The Journal of Environmental Education,9*(1), 44–49. doi: 10.1080/00958964.1977.9942015

Chou, H.-W. & Wang, T. (2000). The influence of learning style and training method on self-efficacy and learning performance in WWW homepage design training. *International Journal of Information Management*, *20*(6), 455–472. doi: 10.1016/S0268-4012(00)00040-2

Demirbas, O. O. & Demirkan, H. (2003). Focus on architectural design process through learning styles. *Design Studies*, *24*(5), 437–456. doi: 10.1016/S0142-694X(03)00013-9

Demirbas, O. O. & Demirkan, H. (2007). Learning styles of design students and the relationship of academic performance and gender in design education. *Learning and Instruction*, *17*(3), 345–359. doi: 10.1016/j.learninstruc.2007.02.007

Dudek, M. (1996). *Kindergarten architecture: Space for the imagination.* London: E. & F. N. Spon Press, p. 56

Dudek, M. (2000). *Kindergarten Architecture: Space for the Imagination.* Second edition. London, UK: Spon Press

Ellis, A. & Morrison, C. (1998). Real age-of-acquisition effects in lexical retrieval. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *24*, 515–523. doi: 10.1037/0278-7393.24.2.515

Emilson, A. & Johansson, E. (2009). The desirable toddler in preschool–values communicated in teacher and child interactions. In D. C. Berthelsen, J. M. Brownlee & E. Johansson (Eds.), *Participatory learning in the early years: Research and pedagogy* (pp. 61–77). New York and London: Routledge, Taylor & Frances Group

Fawcett, M. & Hay, P. (2004). 5x5x5 = creativity in the early years. *International Journal of Art and Design Education, 23*(3), 234–245. doi: 10.1111/j.1476-8070.2004.00403.x

Florida, R. (2002). *The rise of the creative class: And how it's transforming work, leisure, community and everyday life.* New York: Basic Books

Fredriksen, B. C. (2011). When past and new experience meet. Negotiating meaning with 3-D materials in the early childhood education. *FORMakademisk*, *4*(1), 65–80. doi: 10.7577/formakademisk.128

Fulghum, R. (1986). *All I really need to know I learned in kindergarten: Uncommon thoughts on common things.* New York: Ivy Books

Göncu, A., Main, C. & Abel, B. (2009). Fairness in participation in preschool. In D. Berthelsen, J. Brownlee & E. Johansson (Eds.), *Participatory learning in the early years: Research and pedagogy* (pp. 185–202). New York and London: Routledge, Taylor & Frances Group

Härkönen, U. (2002). *Esiopetus ja esiopetussuunnitelma varhaiskasvatuksen viitekehyksessä* (Pre-school and pre-school plan for early childhood education framework). Joensuun yliopisto Kasvatustieteiden tiedekunnan selosteita (University of Joensuu bulletins of the Faculty of Education) 84. (99 pp.). Retrieved from http://sokl.uef.fi/harkonen/verkot/esiopetus2002.pdf (in Finnish)

Hirsh-Pasek, K., Golinkoff, R. M. & Eyer, D. (2003). *Einstein never used flash cards: How our children really learn and why they need to play more and memorize less*. Emmaus, PA: Rodale Press

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall

Kolb, A. Y. & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education*, *4*(2), 193–212. doi: 10.5465/AMLE.2005.17268566

Kvan, T. & Yunyan J. (2005). Students' learning styles and their correlation with performance in architectural design studio. *Design Studies*, *26*(1), 19–34. doi: 10.1016/j.destud.2004.06.004

Leinonen, L. & Venninen, T. (2012). Designing learning experiences together with children. *Procedia Social and Behavioral Sciences*, *45*: 466–474. The 5th International Conference of Intercultural Arts Education 2012: Design Learning, University of Helsinki, Finland. doi: 10.1016/j.sbspro.2012.06.583

Lindström, L. (2006). Creativity: What is it? Can you assess it? Can it be taught? *International Journal of Art and Design Education*, *25*(1), 53–66. doi: 10.1111/j.1476-8070.2006.00468.x

Lindström, L. (2011). The multiple faces of visual arts education. *International Journal of Art and Design Education*, *30*(1), 7–17. doi: 10.1111/j.1476-8070.2011.01688.x

Maxwell, S. E. & Cole, D. A. (1995). Tips for writing (and reading) methodological articles. *Psychological Bulletin,118, 193–198*. doi: 10.1037/0033-2909.118.2.193

Niederhauser, D. S.**,** Wetzel, K. & Lindstrom, D. L. (2004). From manuscript to article: Publishing educational technology research. Contemporary Issues in Technology and Teacher Education, 4(2), 89-136

Oxman, R. E. (1999). Educating the designerly thinker, in W.M. McCracken, C.M. Eastman and W. Newsletter (eds.). Special Issue on Cognition in Design Education, Design Studies 20(2): 105-122

Oxman, R. (2001). "The Mind in Design - A Conceptual Framework for Cognition in Design Education" in C. Eastman, W.M. McCracken and W. Newsletter (Eds.) *Knowing and Learning to Design: Cognition in Design Education*, pp. 45-47, Elsevier, Oxford

Resnick, M. (1998). Technologies for lifelong kindergarten. *Educational Technology Research and Development*, *46*(4), 43–55. doi: 10.1007/BF02299672

Rosario, J. & Collazo, E. (1981). Aesthetic codes in context: An exploration in two preschool classrooms. *Journal of Aesthetic Education*, *15*(1), 71–82. doi: 10.2307/3332210

Sawyer, R. K. (2006). Educating for innovation. *Thinking Skills and Creativity*, *1*(1), 41–48. doi: 10.1016/j.tsc.2005.08.001

Schön, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco: Jossey-Bass Publishers

Thompson, C. M. (Ed.). (1995). *The visual arts and early childhood learning*. Reston, VA: The National Art Education Association

Thompson, C. M. (2007). The culture of childhood and the visual arts. In L. Bresler (Ed.), *International handbook of research in arts education* (pp. 15-28) Dordrecht, Germany: Springer. doi: 10.1007/978-1-4020-3052-9_61

Torracco, R. J. (2005). Writing integrative Literature reviews; Guidelines and examples. *Human Resources Development Review, 4, 356–367*. doi: 10.1177/1534484305278283

Tomšicˇ Cerhez, B. (2004). Likovni materiali in tridimenzionalne predstavitve prostora (Art materials and three-dimensional presentations of space). *Likovna Vzgoja*, *5/6*, pp.25–37

Uluoğlu, B. (2000). Design knowledge communicated in studio critiques. *Design Studies*, *21*(1), 35–58. doi: 10.1016/S0142-694X(99)00002-2

Vygotsky, L. S. (2004). Imagination and creativity in childhood. *Journal of Russian and East European Psychology, 42*(1), 7–97. Retrieved from http://masharpe.metapress.com/link.asp?id=265tnearjknc0220

Astrid Skjerven

Vernacular traditions in Norwegian jewelry design

Past, present, future

Abstract

Living in an era of globalization, the capability of communicating identity has become of greater importance than ever. This has increased our estimation of the vernacular, which represents an expression of a national or local identity. In Norway the vernacular tradition in silver jewelry is particularly strong. It has played an important role not only locally, but also in the constantly changing relation with the outside world, in accordance with the societal situation. It should therefore constitute a reliable indicator of how our country relates to the present process of globalization. The aim of the paper is to throw light on the relation between Norway's role on the global scene and the use of the vernacular tradition in the development of jewelry design in general. It consists of a historical exploration that leads up to a discussion the present and future situation. Today there is a cleft between consumer behavior and avant-garde practice. In accordance with the global situation and Norway's geopolitical situation of existing in the outskirts of political and economic decisions, the situation is characterized by a variety of practices, and by a slow acceptance of the vernacular values in the world of avant-garde practitioners.

Keywords: jewelry design, Norway, vernacular traditions, globalization, identity

Introduction

Contact with the outside world and foreign cultures have always constituted an important condition for the development and display of one's own. At the same time it has been a source of influence and innovation. In Norway international relations and cross fertilization, as well as displaying national identity, has played an important role in Norway. Its significance and meaning has changed through the ages according to the societal situation. As we are being constantly reminded of through media, we are now living in an era called globalization. By that is meant the process by which national economies, societies, and cultures have become integrated through a global network of political ideas through communication, transportation, and trade. It has led to a certain world-wide uniformity and sameness. At the same time it has created a contrary tendency, a cultivation of a regional, local or individual identity. In this way the phenomenon of globalization contains its own opposite force (Lash, 2010). This situation has crucial cultural implications. The capability of communicating these identities has become of great importance. This influences our estimation of the vernacular, which represents an expression of a national or regional identity. In Norway the vernacular tradition in silver jewelry is particularly strong. It should therefore constitute a reliable indicator of how our country relates to the process of globalization.

The aim of the paper is to throw light on the relation between Norway's role on the global scene and the use of the vernacular tradition in the development of jewelry design in general. It consists of a historical exploration that leads up to a discussion the present and future situation. Today there is a cleft between consumer behavior and avant-garde practice. In accordance with the global situation and Norway's geopolitical situation of existing in the outskirts of political and economic decisions, the situation is characterized by a variety of practices, and by a slow acceptance of the vernacular values in the world of avant-garde executants. In addition to published, archival and electronic sources, it is based on personal interviews.

The tradition and its development

Our tradition in jewelry design has a long history, with the Viking period as one of its early peaks. From medieval times jewelry constituted an important part of the rural costume (Figure 1).

Figure 1. Wedding dress from Sætesdalen, 19th century. Copyright: Berge, R. (1997). Norskt bondesylv. (Facsimile of 1st ed. 1925). Skien: Fylkesmuseet for Telemark og Grenland.

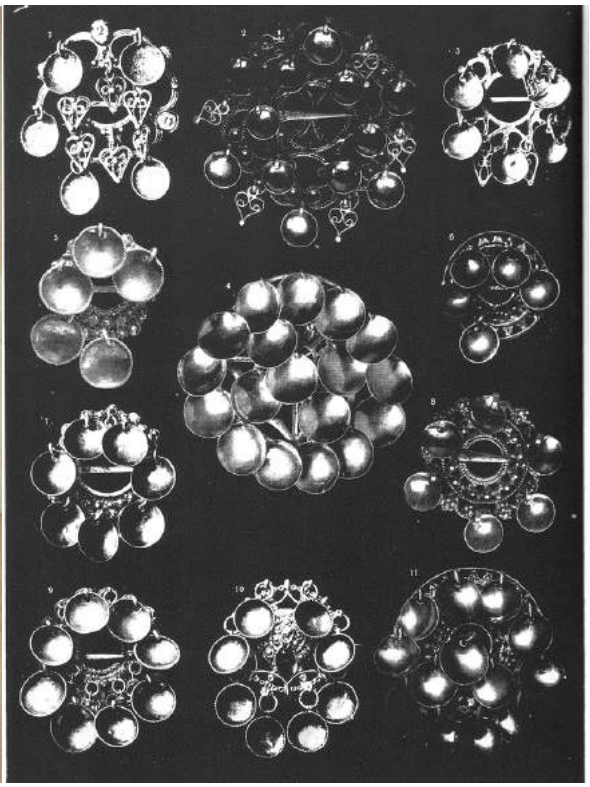

Figure 2. Rural jewelry. Brooches with hanging «leaves». Copyright: Berge, R. (1997). Norskt bondesylv. (Facsimile of 1st ed. 1925). Skien: Fylkesmuseet for Telemark og Grenland.

The reason was not only its beauty, but just as much its usefulness as economic security and expression of status and identity. In the 17th century the accessibility of local silver was growing, due to the development of a silver mining industry. This led to an increasing use (Berge, 1997). Rural silversmiths had existed since the middle ages. The technique of filigree was frequently used. During the next centuries contact with foreign travelling apprentices stimulated innovation. During the reign of the city based goldsmith firms the rural silversmiths continued their activity, and a certain interchange of goods and skills took place (Berge, 1997).

The innovation was particularly strong in the countryside of Mid and West Norway. The work of the local silversmiths mostly consisted of adornment for local costumes, especially bridal ware. Along with the bridal headdress the most important part of this adornment were the brooches. Their design was developed to a high level and in a way that is renowned as typical of Norway (Berge, 1997). In particular, the addition of "leaves" hanging from the plate of the brooch is regarded as typical of the country (Figure 2).

National Romanticism

During the era of nation building in the latter part of the nineteenth century there was a great need to find suitable symbols that could express national identity. In this matter the tradition of

rural jewelry constituted an ideal source of inspiration for the city goldsmith firms. Among these was Tostrup in Oslo, founded in 1832. Following the pattern of the highly esteemed firm Castellani in Rome, Italy, which applied traditions from Roman antiquity as well as rural filigree work to renew their work, Tostrup looked to the same traditions in their own country. Tostrup built up high competence in the filigree technique, and used rural jewelry as a source of inspiration, or even almost copying. It preferred young apprentices from the countryside.

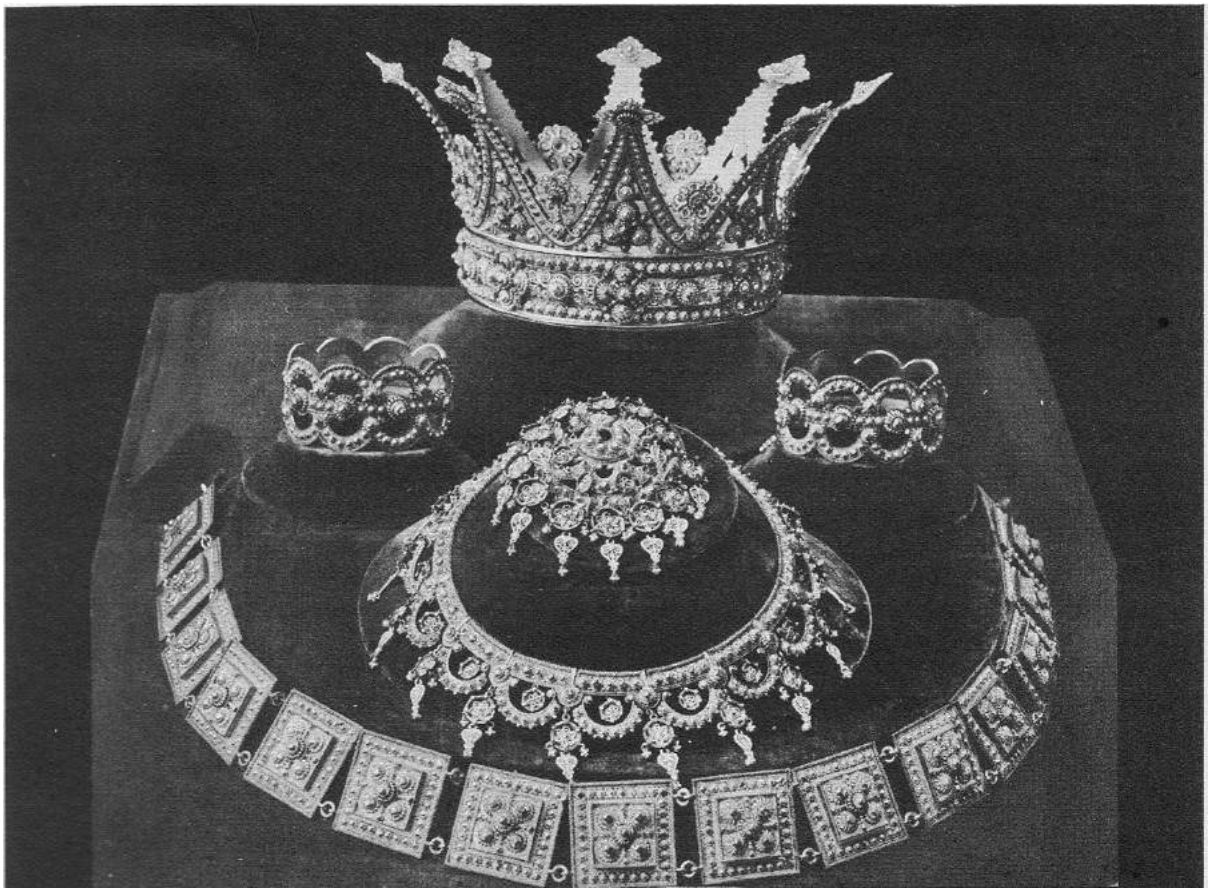

Figure 3. Norways' wedding gift to Crown Princess Victoria of Sweden in 1881. Copyright: Kielland, T. (1932). Om gullsmedkunst i hundre år: J. Tostrup 1832-1932. Oslo: Grøndahl.

They were believed to have an inherent talent for finer silversmith's work, whether they had any training in it or not (Kielland, 1932). This attitude and practice had been adopted from those of Castellani (Riisøen and Bøe, 1959). A result of this idiom is Norway's official gift for the wedding of Princess Victoria of Sweden in 1881, designed by the Director of the firm, Oluf Tostrup (1842-1882). It consists of a full bridal adornment in the style of rural bridal ware (Figure 3). The ornamentation was made in the filigree technique. Additionally, concavely shaped "leaves" constituted an important part of the ornamentation.

Brooches constituted a substantial part of the commercial market. Those made by the local silversmiths and those of Tostrup's own production were quite similar. They were sold to the same rural market all over the country as well as to the new segment of consumers, the tourists Kielland 1932). This practice also led to an innovation of Tostrup's production for its consumers of the urban bourgeoisie. Oluf Tostrup started to design modern jewelry in the filigree technique inspired by female rural adornment. Contrary to the rural costume it was to

be worn directly on the skin. It became an urban vogue to wear this kind of "national" jewelry. Similar examples can be found by many of the leading goldsmiths firms.

Modernism

The tradition played a small, but significant role during the idiom of Modernism. This was the case in the golden age of Scandinavian Design in the post war era. It was a period of internationalization and economic growth, and the export market was growing. As a welcome alternative to Modernism's emphasis on universalness and "machine aesthetics", Scandinavian design objects were particularly esteemed for their unique combination of modernity and regional traditions. National characteristics were vital to express each country's national profile within the common Scandinavian frame, as well as to create attention on the international arena (Skjerven, 2001).

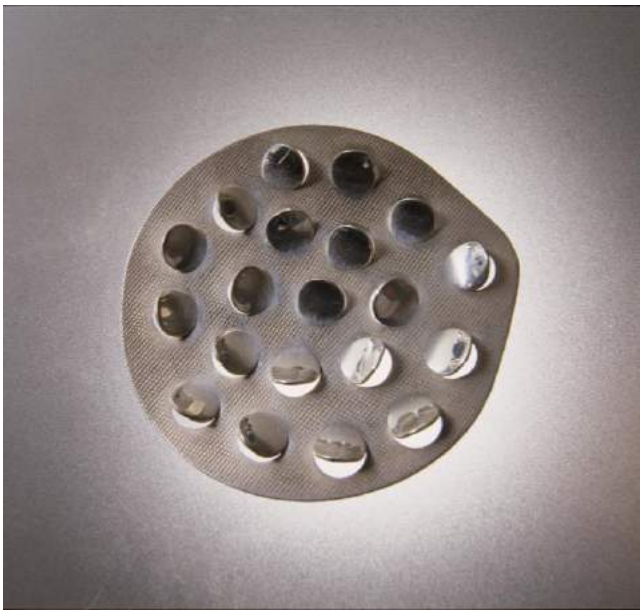

Figure 4. Designer Grete Prytz Kittelsen: «Med punkter» from 1952. Photo by Helga Bu. Copyright: Gilje, K., ed. Grete Prytz Kittelsen: Emalje og design. Oslo: Gyldendal, 2008. Photo: Helga Bu.

The jewelry designer Grete Prytz Kittelsen (1917-2010), representing the fifth generation of the family owned firm Tostrup, was one of Norway's pioneers in the field of Modernistic design. She contributed to the rejuvenation of Tostrup's collections and production methods after the war. She was occupied with making products that could be rationally produced and thereby available for most people, as well as fulfilling the expectations of the export market (Skjerven, 2001). The brooch "Med punkter" ("With dots") designed in 1951 and produced from 1952, was meant to be a "moderne sølje", a modern folk brooch, as she has stated herself (Skjerven, 2011) (Figure 4). Its design was based on the traditional "bolesølje", the main brooch of the rural adornment, but was made for modern times and an according lifestyle (Skjerven, 2008). It constitutes a Modernistic updating of the vernacular tradition. It was made of silver, had a circular form and a simple three dimensional pattern reminiscent of the "leaves" of the folk costume's brooches. In accordance with the ideal of Modernism it was made in a rational way. It was stamped out of thin silver plates in one piece and was produced in series. The "leaves" were parts of the same piece. They were stamped out half way and then slightly bended outwards. Instead of the labour consuming filigree technique the main form was ornamented with an engraved and oxidized pattern. This brought out the unornamented and polished "leaves". The expression and style of the brooch was highly modern and fit for an international

market. It could be placed anywhere on any outfit, but contrary to the rural brooch and according to the prevailing fashion it was always put on one side. It was perfectly fit for the emblematic outfit of the busy post war woman, the woolen tweed suit.

Prytz Kittelsen also made gilded and enameled versions, end even accompanying earrings and a bracelet, of which neither belonged to the tradition of the rural pieces. Her design was too avant-garde to be a commercial hit, but sold moderately through several decades to the élite segment of the market. It paved the way for a vogue of similar, more moderately designed enameled jewelry that became very popular.

Postmodernism

What happened after Modernism? Could inspiration from vernacular traditions survive not only Modernism, but also Postmodernism? Indeed it did, it actually had a flowering period, particularly in the style's flowering stages of the 1980s and 1990s. In accordance with this idiom's ironic play with the styles of previous times (Venturi, 1966), and utilizing them to create contemporary surroundings that often contained critical societal comments. Among some of the craft artists in Norway there was a trend of renewing folk tradition, although with an ironical distance, which was named Neotradition (Opstad, 1988).

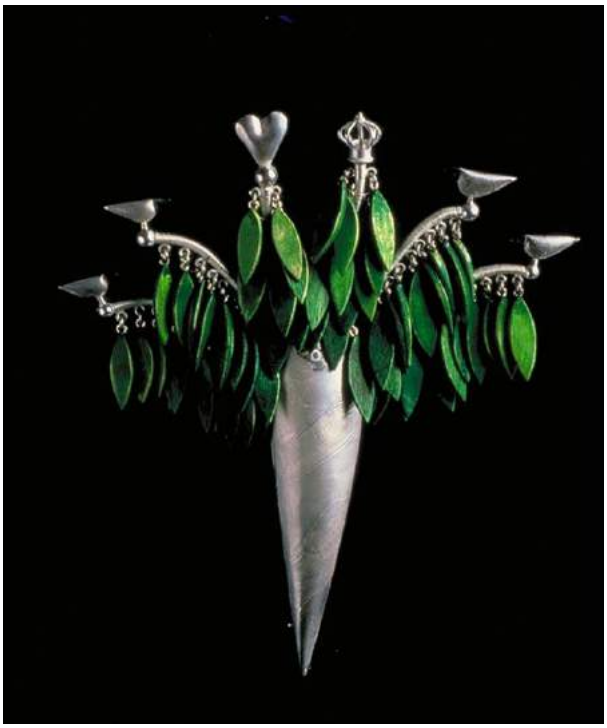

Figure 5. Konrad Mehus: «Gulrotsølje», 1991. Brooch with carrots. Copyright: Veiteberg, J., ed. (2012). Konrad Mehus: Form følgjer fiksjon: Smykke og objekt / Form follows fiction: Jewelry and objects. Stuttgart: Arnoldsche. Photo: Konrad Mehus.

One of the pioneers of Neotradition and an important exponent of the Postmodernistic idiom was Konrad Mehus (b. 1941). Initially trained as a goldsmith in Trondheim, he had learned the technique of filigree and to appreciate its qualities, particularly the works of the rural silversmiths. In the start of his career his ambition was to renew the technique with particular emphasis on the brooch Veiteberg (2012). After having been educated as a craft artist as well as a sculptor, his new artistic competence and interest for conceptualization, made that his interest took another turn. Rural jewelry has continuously been used as one of his means of

making comments on contemporary society, but he has never used the filigree technique. One of the most significant pieces is the "Carrot brooch" from 1991 (Figure 5).

Its shape was taken from a special category of heart shaped brooches, the "hjartesprette", also called Maria brooches, which were used as gifts of love or engagement and were decorated with symbols of love. Mehus' "Carrot brooches" were hand-made as unique pieces. They were made of silver, and some of the "leaves" of painted wood. The heart had been transformed into a carrot, which symbolizes the erotic side of love. The ornamental details consist of bird couples, a motive that was frequently used on the traditional brooches, but also trees and male elks. These new additions to the regular iconography refer to the eroticness of the forest and its potent king. It may also point to the awareness of nature and ecology in our own time. In this way it represented a provocative break with tradition. In this way the carrot brooch constitutes an ironic "anti folk brooch". It expresses his critical distance to traditions along with his deep admiration of them. Symbolically it expresses a critical comment on the explicit appetite for eroticism in our time as opposed to the appreciation of love and fertility of previous times. The "Carrot brooch" was well received in a small scale market. It is Mehus' greatest economic success (Veiteberg, 2012).

For Mehus the rural adornment is a recurrent motive and source of inspiration. He has made several brooches that are based on the "bolesølje", where filigree ornaments are substituted by imagery that associate to them, as well as "found objects" like buttons. He has also made crowns in various materials with motives that are expressing comments on contemporary society. Some of his brooches are based on the tradition of the "hengjepenning", which literally means coins that hang from the body of its wearer, with its origin in the old European tradition of "Agnus Dei" adornments.

Figure 6. Lars Sture: "Brudekrone". "Bridal crown", 1980s. Copyright: The National Museum of Art, Architecture and design, Oslo. Picture Archive.

Figure 7. Elsie Ann Hochlin: "Bursdagskroner". «Birthday crowns», 2005. Copyright: Elsie-Ann Hochlin.

Mehus' production demonstrates the strong and lasting symbolic inherent in the vernacular silver jewelry and its potentiality as a means of communication. His symbolic message is easily understandable and relevant both nationally and internationally, which might explain the great attention that has been paid to it.

For others, the bridal crown has been a specific source of inspiration. Lars Sture's (b. 1961) huge crown, made of anodized aluminium in 1991, is a delirious interpretation of a rural bridal crown (Figure 6). It displays the same playfulness as Konrad Mehus' "Carrot brooch", although without being any ironic "anti piece". It is an object of art in its own right, and is made as a unique piece. It is obviously not made for wearing or for storing at "kistebunnen", at the bottom of the chest in case of hard times, but for being exposed for the sake of its beauty per se.

His works from this time were called jewelry, but can just as well be categorized as body outfits. They consisted of waistcoats, collars, headdresses and hand bags with references to rural costume and its adornment (Sand, 1999). They constituted a colourful play with Norwegian vernacular traditions and contemporary fashion. It is also noteworthy that they were made at a period when Sture was working in London. The international metropolis, fashion center and at the time hot spot of avant-garde jewelry design probably made him get conscious of the value of national these traditions in a contemporary setting.

A more recent example of the interest in bridal crowns is Elsie Ann Hochlin's (b.1961) series of "Bursdagskroner" ("Birthday Crowns") from 2005 (Kunstnerforbundet, 2007) (Figure 7). Their shape is reminiscent of the rural bridal crown. They are made as unique pieces although the material is cheap aluminium, and decorated with representations of national cultural personalities with iconic status, as well as other motives taken from traditional national imagery. They constitute a contribution to that year's centenary celebration of Norway's existence as a nation in the form of a humorous and nonchalant comment on our traditions. They were made for an exhibition at Kunstnerforbundet in Oslo the same year and meant for the gallery audience and eventual museum purchases.

Early in the 21st century a few other jewelry artists used the same source of inspiration, but to a minor degree and only for decorative reasons and without symbolic references. The trend of Neotradition was only one among several directions. At a later stage of Postmodernism it almost disappeared.

Figure 8. Tone Vigeland: Installation. Source: Galleri Riis, Oslo, 2010. Copyright: Galleri Riis, Oslo.

In our present phase of Postmodernism, also called Post-Postmodernism Kirby (2006), the idiom is characterized by a lot of expressions and values existing parallelly. However, the main tendency in avant-garde jewelry in the late 20th and early 21st century has been to "liberate" oneself from the claim for practical function and serial production in crafts and design. The aim was to reach the sphere of pictorial and so called free art. This has led to a focus on artistic expression and the exploration of space. An example is the work of Norwegian jewelry art's Grande Dame, Tone Vigeland (b. 1938) Brundtland (2001). Her earliest work was based on the techniques and style of fine crafts of the 1950s, and was later inspired by armour from the Viking era. That is the case with some of her bracelets from the 1880s, made of iron and silver. After having explored the international trend Wearable Art, she started to work with large minimalistic installations in space. The exhibition at Galleri Riis in Oslo in 2010 demonstrates her mastering of the new dimensions of this kind of work (Figure 8).

The present situation

Today's art oriented jewelers have got their education at the art schools in an internationally oriented milieu with many foreign guest professors and fellow students. As professionals they are concerned with self-expression in a global setting. The arenas of presentation are mainly exhibitions in art galleries, and their audience consists of visitors to the exhibitions. There are many styles or idioms as well as highly individual approaches. Some of the exhibitions consist of temporary installations rather than fixed objects.

Figure 9. Anne Legér: "Secret garden", 2008. Copyright: Anne Legér, Oslo.

An alternative path is to stick to the making of jewelry as such, using traditional types like bracelets, brooches etc., but in the idiom of "storytelling" or "memory design". French-Norwegian Anne Léger (b. 1966), who has graduated from The National College of Arts in Oslo, is working with history in the form of associations or memories. The objects are made from an intricate combination of various materials and techniques (Jugendsenteret, 2012) (Figure 9). Besides nature she is using figurative motives reflecting dreams or vague personal memories in a most poetic language of expression. Due to their rich symbolic content and artistic originality, her laboriously made unique pieces are at the verge of transcending into pictorial art. Still they are highly wearable.

In her opinion the rural silversmiths' traditions represent labour intensive techniques and are attached to national folklore. She explains the popularity of these objects by their creation of recognition and their representation of national culture and history. As a foreigner she does not regard them as being part of her language of expression and therefore does not find it natural to use them (A. Legér, personal communication 7. August, 2013).

Figure 10. Norwegian family in national costumes with adornment. Copyright: Sptzbrgn, Trondheim. Photo: Jarle Hagen.

Figure 11. Sptzbrgn:«National costume tie» 2011.
Copyright: Sptzbrgn, Trondheim. Photo: Jarle Hagen.

This way of practice has led to a renewal in the field of artistic expression in jewelry, and has broadened its field into pictorial art. But it has happened at the cost of engagement in innovation of jewelry for the commercial market, where jewelry for national costume is in high demand. Norwegians are generally proud of their heritage within folk costume and jewelry. At special occasions people are often wearing national costume with full adornment, and they are willingly spending large amounts of money on such outfits (Figure 10). This lucrative market with its enthusiastic consumers has been left to other actors, like the many workshops offering copies of old pieces. Professionals in related fields such as costume design and other kinds of adornment have realized the potentialities of this market. One of them is the design team Sptzbrgn. In 2011 their "National costume tie" won one the award the Norwegian Design Council within the field of textile design (Figure 11).

Figure 12. Hilde Nødtvedt: Adornment for The East Telemark costume. Reconstruction. 2000s. Copyright: Hilde Nødtvedt. Photo: Eva Brænd.

Although the vernacular traditions in jewelry have been almost forgotten in the avant-garde and artistically oriented circles, the traditions are being painstakingly taken care of by a few other actors. One of them is Hilde Nødtvedt (b. 1954), who is educated both as a goldsmith and an ethnologist. She has been doing in thorough studies of old traditions, and is making pieces that are in accurate accordance with her findings and other historical research. Among her most extensive undertakings are her pieces for the East Telemark costume, based on a recently made reconstruction of the region's rural costumes of the1820s (Figure 12).

The low focus on Norwegian vernacular traditions has also comprised the world of higher education. At least that was the case until a few years ago. In 2005 The University of

Aust-Agder announced a brand new bachelor education in jewelry design to be situated in Valle in Setesdalen, one of the previous centers of folk jewelry. The still living traditions of the site were planned to constitute a basis for the education. However, because of few applicants as well as the university's prioritization of so called "basic" subjects, the education was announced once and never realized (T. Haugen, personal communication 2. April, 2013).

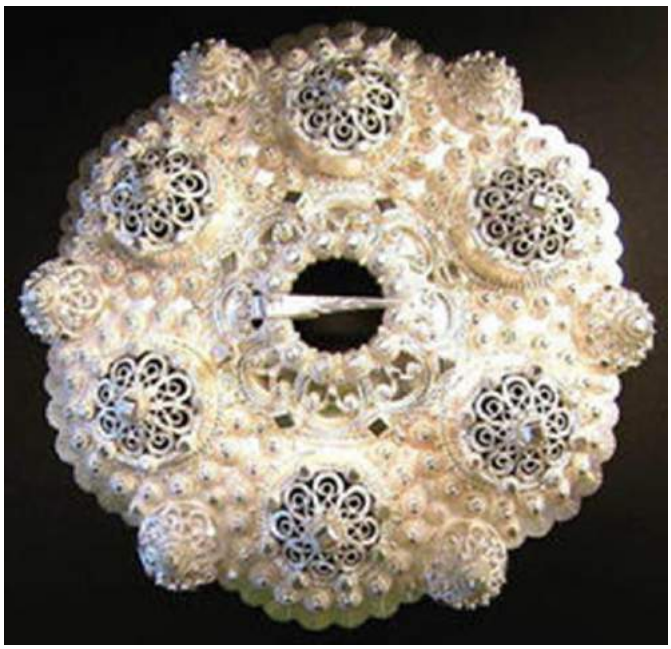

Figure 13. Telemark University College. Study of vernacular/folk art. Student's work. 2000. Copyright: Arne Magnus Johnsrød, Telemark University College

Recently, Telemark University College has taken up the challenge by establishing both a bachelor and a master degree in "Tradisjonskunst" (vernacular/folk art), and comprises the traditions of the rural silversmiths. This is the only higher education where these techniques are taught systematically and in-depth (Figure 13). There are many foreign students who are attracted by this unique opportunity of education in the field. The number of foreign applicants is increasing (A. Johnsrød, personal communication 6. June, 2013). The situation indicates that there is a growing interest in and conscience about the value of these traditions. One of its graduates, the locally born Linn Sigrid Bratland (b. 1978), is working full time as a jewelry designer. Her products represent a rejuvenation of the vernacular tradition. She believes that the techniques and their value generally are coming more and more into focus (L. Bratland, personal communication 8. August, 2013). Typically, these events have taken place at the university colleges. Nothing similar has yet happened at any of the art schools, where the traditions of fine art are still reigning.

An individual and different approach has been taken by the British-Norwegian designer Edward Longden (b. 1982). He moved to Norway a few years ago and has taken his master degree at Oslo and Akershus University College. With a foreigner's fresh eyes he has discovered stereotypes in Norwegian folk traditions (Longden, 2010). Based on subjective impressions from museums, supermarkets and everyday situations rather than historical re-search, he has created a concept and prototypes for a jewelry collection suited for young consumers (Figure 14). It supplies the wearer with a humorous yet appreciative attitude to regional belonging and traditions.

Figure 14. Edward Longden: Concept for jewelry design. MA project at University College of Oslo and Akershus. 2010. Copyright: Edward Longden.

In a broader perspective

In a global perspective vernacular traditions in jewelry design have for the last two decades been rejuvenated and used in art jewelry as well as in the world of fashion design. In Italy, where they in the 19th century were taken up by Castellani and became an inspiration source for the Norwegian firm Tostrup, something similar has been done by the high fashion brand Dolce & Gabbana. Ancient Sicilian jewelry, where the filigree technique and hanging coins are among the main ingredients, has been transformed into exclusive accessories. In spite of their striking likeness with the old pieces they are produced in series and represent the latest in fashion design. Even in the growing world power China there is the same tendency. Here the rich jewelry traditions of the Han dynasty have been used as an inspiration source for both art and fashion pieces Skjerven (2011). In other words, the general international situation is different from that in Norway, where the traditions are mainly used as they as adornments for national costumes.

What does this scenario tell us about Norway's relation to the globalization process of today and the jewelry designer's role in it? The country is situated in the periphery of power and events. Nevertheless, it has become increasingly involved in and dependent on interacting with the rest of the world. In the interchange of meanings and assets there is a growing demand for remedies to communicate national, group and individual identity. Vernacular traditions constitute an important means to be visible in in this communication process. The attitudes of the previously mentioned foreign designers Anne Legér and Edward Longden have demonstrated that the vernacular traditions in Norwegian jewelry design stand out as significant of the identity of the country and its citizens even to the outside world. This makes them an important means in the process.

At present there are only a few individuals with various backgrounds and some of those who have graduated from Telemark University College, who are working with our vernacular

traditions in an innovative way. Until recently they have generally been neglected by avant-garde jewelry designers and higher art education. Although working in a global context these professionals have focused on artistic self-expression rather than communication with any user, and the market has constituted of the global art scene and its audience. Consequently, communication in everyday life has got little attendance. As the world of art has lately become increasingly engaged in involving and interacting with the audience, this situation has started to change. The renewed evaluation of crafts as an artistic tool has also led to an evaluation of the qualities of vernacular traditions in the field (Adamson, 2007). As an avant-garde, meaning the troop that is walking in front to pave the way for a broader improvement, their contribution is highly needed.

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References

Adamson, G. (2007). *Thinking through craft.* Oxford: Berg.

Berge, R. (1997). *Norskt bondesylv.* (Facsimile of 1st ed. 1925). Skien: Fylkesmuseet for Telemark og Grenland.

Brundtland, C. M. (2003). *Tone Vigeland: Jewellery + sculpture: Movements in silver*. Stuttgart: Arnoldsche.

Cerval, M. de, ed. (1998). *Dictionnaire international du bijou*. Paris: Regard.

Jugendsenteret. (2012). *Antologi: Anne Léger – Smykker*. Ålesund: Jugendsenteret.

Kielland, T. (1932). *Om gullsmedkunst i hundre år: J. Tostrup 1832-1932*. Oslo: Grøndahl.

Kirby, A. (2006). The death of postmodernism and beyond. *Philosophy Now (58),* November/December.

Kunstnerforbundet. (2007). Elsie Ann Hochlin. from http://www.kunstnerforbundet.no/works/search?q=Elsie+Ann+Hochlin&category_id=

Lash, S. (2010). *Intensive culture: Social theory, religion and contemporary capitalism.* London: Sage.

Opstad, J.- L. (1988). *Neo-tradisjon: Norske Kunsthåndverkere i Midt-Norge*. Trondheim: Nordenfjeldske Kunstindustrimuseum.

Riisøen, T. and Bøe, A. (1959). *Om filigran: Katalog til en utstilling av filigran i norsk eie*. Bergen: Vestlandske Kunstindustrimuseum.

Sand, H. (1999, 02.11.). RAM GALLERI - 10 ÅR - GARDIN from http://www.ramgalleri.no/index_new.php/utstillinger/ram-galleri-10-ar-gardin-del-1

Skjerven, A. (2001). *Goodwill for Scandinavian design: Lunningprisen 1951-70.* Unpublished PhD thesis, Universitetet i Oslo.

Skjerven, A. (2003). Great expectations: The foundation of a design concept. Widar Halén and Kerstin Wickmann, eds., *Scandinavian design beyond the myth: Fifty years of design from the Nordic countries*, 27-31. Stockholm: Arvinius.

Skjerven, A. (2008.) Smykkekunstneren. Gilje, K., ed. *Grete Prytz Kittelsen: Emalje og design*. Oslo: Gyldendal, 2008, 173-211.

Skjerven, A. (2011). *What happened to vernacular traditions in Norwegian jewelry design?* Unpublished paper presented at research seminar at Kolding Designskole, Denmark.

Veiteberg, J., ed. (2012). *Konrad Mehus: Form følgjer fiksjon: Smykke og objekt / Form follows fiction: Jewelry and objects.* Stuttgart: Arnoldsche.

Venturi, R. (1966). *Complexity and contradiction in architecture.* N.Y.: Museum of Modern Art.