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Culture in Design, Technology, and Environment: Reflecting on Field Experiences

Kurt W Seemann

INTERNATIONAL TECHNOLOGY EDUCATION SERIES

Environment, Ethics and Cultures

Design and Technology Education's Contribution to Sustainable Global Futures

Kay Stables and Steve Keirl (Eds.)

SensePublishers

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This collection engages environmental, ethical and cultural values perspectives to show how Design and Technology (D&T) Education actively contributes to the significant educational goal of attaining sustainable global futures.

An international collection of authors representing all levels of education articulate how D&T research, curriculum theory, policy, and classroom practices can synergise to contribute positively to the education of children for sustainable global futures. The book offers a spectrum of theorised curriculum positions, political and policy analysis, and case studies of successful school practice.

A key word in the title is that of *contribution* which is construed in several senses: first, of D&T as a vehicle for understanding the range of political and social values that arise with such a major educational challenge; second, of D&T as an agent of critical and practical action for students as global citizens; third, by taking global and multiple perspectives (rather than, say, Western or mono-cultural positions); and, fourth, by demonstrating D&T's capacities for working in holistic and integrative cross-curricular ways.

The authors show how students can not only learn about their potential as humans-as-designers but can also develop designerly capacities that enable them to contribute meaningfully in practical ways to their communities and to wider society, that is, as global citizens who can apply design capability in ethical ways that are respectful of peoples, cultures and environments alike.

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INTERNATIONAL TECHNOLOGY EDUCATION STUDIES

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Scope
Technology Education has gone through a lot of changes in the past decades. It has developed from a craft oriented school subject to a learning area in which the meaning of technology as an important part of our contemporary culture is explored, both by the learning of theoretical concepts and through practical activities. This development has been accompanied by educational research. The output of research studies is published mostly as articles in scholarly Technology Education and Science Education journals. There is a need, however, for more than that. The field still lacks an international book series that is entirely dedicated to Technology Education. *The International Technology Education Studies* aim at providing the opportunity to publish more extensive texts than in journal articles, or to publish coherent collections of articles/chapters that focus on a certain theme. In this book series monographs and edited volumes will be published. The books will be peer reviewed in order to assure the quality of the texts.

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INTRODUCTION

Culture is a fuzzy kind of idea. We all point to it when we see it among others, but when asked to place a universal boundary around it to define it as framing much of what we do ourselves, we run into trouble. When we design and develop made worlds with, and for, other cultures, or when we think how we engage in the worlds made by others, the opportunity manifests itself to see how culture can be embedded not only in the choices made to create the artifacts, systems, or symbols but significantly in the socio-cultural and even natural resources that must have been evident to produce, maintain, and evolve them. In this sense, the made worlds we design and come to accommodate or curse, required both a community and an ecology a priori. Conversely, the designed world gives evidence of culture and community, and the presence of an ecology that offered up something to transform and consume: ipso facto an education in design and technology is an education in the dependencies that necessarily exist between humanity, the designed world, and the ecology. This is a big responsibility, as with such universal dependences that underpin all design choices and judgments, moral dilemmas abound. When we add the question of teaching to accommodate values and beliefs in the classroom, including the culture of shared values and ideologies of the State, multi-cultural diversity among pupils, staff, and parents, and values driving curriculum economics, it does not take much to concede that any simple web definition of culture in the design and technology education setting will prove inadequate, and that a more sophisticated respect for culture in design and technology studies is necessary. Culture in design and technology education and research, deserves much more serious attention than any handbook dictionary, web, or even an anthropological position could offer.

The array of sources that offer definitions of culture across the literature and web search engines range from the scholarly to the over simplified. Despite access to a plethora of helpful sources, there are times when it is more informing to use any number of contextually useful metaphors to describe culture than a definition. This chapter will offer some broad background ideas and unresolved questions about culture in design and technology studies and practice. I will be referring a deal to my own thirty-five years of working in cross-cultural design and technology education

K. Stables & S. Keirl (Eds.), Environment, Ethics and Cultures, 53–63.

and development settings. When working cross-culturally, especially across high-contrasting cultural and ecological domains, much is revealed about our own values assumptions as well as that of those one works with and for.

CULTURE AS BELIEFS AND VALUES THAT ALTER DESIGN AND TECHNOLOGY CHOICES

Being asked to write this chapter presented a genuine challenge. To write a broad-brush scene setter about culture for an audience of design and technology educators at first would not seem to be a complex task. After all, all undergraduate teacher education degrees would surely have included the study of culture, including the diversity of human beliefs and values in the classroom, the staffroom, and the hidden curriculum: the latter tapping into the political agenda of education regulators and providers. Culture presents as being obvious in its importance to pedagogy and pupil development, yet can also be seen as a background passive theme rather than playing an active part in a design brief, or a technical operational skill lesson. The sleeper in this challenge was to explore how culture did not just have optional links to how we go about our daily tasks as educators, but also whether culture held deep mutual transformation ties to our made and natural worlds that the idea of ignoring those ties would suggest a flaw in pedagogy.

Further we have the background issue of culture as an add-on content burden, or as something that must be necessarily embedded in the curriculum and assessment of all design and technology education. Is culture yet another layer that the busy teacher just has no time to weave into the DNA of all their design and technology strategies and assessments?

One metaphor. Culture can be envisaged like a real but edgeless mist transcending a forest forming shapes here and there; thick and obvious shapes at times, and at other times, thin and ethereal ones. We see it, it exists across the forest, and the forest draws important value from it that in turn makes the forest what it is. Without the regular mist, the forest would be very different, not just as being void of any mist, but that without the fine moisture and nutrients provided by it, the life ecology of that part of the woods would surely develop quite differently. The objects and ecology of the forest transform with the presence of the mist, and the mist transforms in density and shapes because of the form of the forest. Altering significantly either the form of the forest, or the presence of the mist, is all that is required for both to change. Imagining culture as an object with clear edges – here is culture, here is not culture – is a view that would surely be difficult to defend.

To consider the task of sketching out some universal and significant ideas on culture that both acted as a scene-setter, as well as connecting to design and technology educators dealing with the ambit of culture in the classroom, the staffroom, making things, engineering devices, using tools, its links to ecology, and visualizing ideas, all amounted to a challenge that seemed too wicked (for background information about wicked problems see (Balint et al. n.d.; Brown, Harris, & Russell, 2010; Ferlie, 2013;

Ritchey, 2010; Schultz, 2011)). But like the mist, culture is real, it changes things and it forms itself in response to the natural, social, and designed environments on which it depends. As both teachers and designers we hold in our strategies of action, the ability to form a culture in the design and technology staffroom, classroom, as well as around the topic and actions through which we scaffold our pupil's learning; whether or not we task those actions strategically to effect a planned transformation as a learning outcome.

DISCOVERING THE CULTURE OF YOUR OWN MAKING

All designers are socially and culturally situated. Ipso facto so are design and technology teachers, learners, and evaluators. While this proposition may be true, it's another thing altogether to figure out what one does with that insight as a teacher of design and technology. Moreover, how might it's importance be perceived in the minds of one's pupils and their readiness to accommodate beliefs and values in the task of investigating the basis of a successful design and its defence?

One fundamental motivation for designers to take seriously the task of understanding the shared beliefs and social bonding values of the initial end users of designed outcomes is that these represent deep broad behavioral patterns - patterns that may not reflect those held by the designer! If one of the criteria for producing designs for others is that others take it up and use it well, then the idea of ignoring a cultural dimension to the end user is rather wasted, and would be highlighted in a rigorous evaluation of a design defence. Fostering empathy for the end-users of an intended technology and design can offer a critical underpinning of good design, and so, good design education. The only note of caution here is the scenario where the designer believes that they are already at one with the end-user, that if the end-user of designs and technologies was either themselves or groups they believe they know intimately, or assume they do. In such settings, can design empathy for accommodating culture be too easily passed over?

From a pedagogy viewpoint, there is the question of maturity; a question linked also to prior life experiences and developmental expectations implied in the depth and complexity of a design and technology project set for pupils of different ages and circumstance. To the extent that developing a community sense of belonging with shared beliefs and values is something that one is acculturated into, usually from birth, life experiences play a powerful role in the ability of a pupil (and teacher), to infer and comprehend the subtle details that a design ought accommodate for its end-users. When we design for our first clients, for ourselves as the end-user, we have the opportunity to learn a little about how seeing our ideas manifest before us reflects the making of our values and beliefs.

When we design for others with whom we feel a good sense of empathy, two things are apparent: we might not feel the need to step out of, nor the need to highlight, our cultural frames to have some success with members of our fellowship community valuing our creations; and, the evaluation of those creations can appear

to get by rather well with not critiquing the cultural dimensions to our design and technology choices: after all, the designed objects and outcomes are products from, and evaluated by, those who identify as belonging to the same cultural fellowship. Assessment in such contexts can too easily turn more of its attention to the non-cultural concerns such as the technical and functional merits of the design. However, such domestication of design and technology education, production and assessment may also tend to avoid disruptive and necessary, culture-changing, innovation opportunities. Designing for the greater common good of a more just, tolerant, and sustainable shared future is one example where design ought not be caught short-sighted in its attention to culture change.

To guide teaching with sensitivity to culture, four key areas of material evidence can be used as key to design research, development, and production. These four areas are the systems, services, symbols and artifacts that human groups commonly build about them to manage their lives. Generically across these four areas, designers sensitive to culture and beliefs are interested in the way different human groups organize, solve problems, form relationships, develop beliefs about, and both make and respond to, the social and material world around them.

The evidence of what defines and drives us as social creatures is well embodied in the items, and the structures, we design and make. Archeology, considered in the North American tradition as a branch of anthropology, is entirely framed on the premise that how human groups developed responses to their world can be reconstructed from the material evidence in the systems, services, symbols and artifacts left behind. Designing that is active in considering the cultural dimension to the end-user context of their creations uses insights drawn from material culture from historically positioned ethnographic studies and field techniques, and applying that knowledge and set of adapted techniques to inform the process of designing and working technologically; in particular, to inform how different human groups respond to, and can co-develop ideas towards, new designs. Systems, symbols and all forms of artifacts are very common types of human material and digital 'products'. Many design educators who have already used or heard of methods such as co-design, or participatory design, have drawn upon long established ethnographic techniques.

MAKING IN SERVICE OF THE CULTURE OF OTHERS

Designing for others leads to a better chance of user acceptance if the designer understood well how their end-users are socially and culturally organized. We can learn a whole new way of growing design and technology knowledge by comparing what other cultures do, why they do it, how they socially sustain what they do, and what goes wrong when situations change.

> Informed by social scientific enquiry, design has the ability to engage with the visions of technologists to create ambient assisted living schemes that are not merely technically feasible, but also culturally desirable. (Roberts, 2011, p. 223)

What has made culture studies in design come to light in more recent years is a heightened appreciation of the emerging role that social dynamics plays in guiding the development of innovative new technologies, service, communication, and spatial and product designs. There are a few common ideas underpinning culture-based design research that very well overlap with design and technology subject matter. One method used to understand culture in design is where the designer collects tangible comparisons between groups of people. A key area that such methods examine is the way different groups of people create, use and are in turn socially influenced by the world that they 'made' in the situational context they live, work and socialize. Educationally and technically, the deliberate accommodation of culture in design and technology studies opens a rich opportunity to engage in a mutual transformation of both people and the physical (including digital) world. Harris (2007) and Nafus (2008) argue that when we engage with others that have a different way of knowing and doing in the process of transforming resources to achieve a goal, we cannot avoid experiencing a transformation, if not also an affirmation, of the knowledge and world views we hold. There is new insight that comes with working and learning across cultural domains.

> Working with difference, be it from within knowledge traditions of anthropology and design, or between the designer and user, also necessitates developing skills of engagement. Central to engaging with others is finding ways of imagining oneself into another person's world. This however does not mean individuals participating want to be the other. Rather they want to learn from each other's practices in order to build a closer relation between practices. We would argue that in building closer relations between using and producing, designing and using, people and things, a move is required away from a problem-orientated approach towards designing. (Gunn & Donovan, 2012, p. 1)

In 1983 I was asked to assist in redesigning a device called a pelton cup used in a micro-hydro electric power supply system being developed for the small and remote island village of Iriri in the Far North Western Province of the Solomon Islands (Seemann, 1986). It was also my role to undertake an analysis of the skills of villagers nearby to guide local capability strategies for maintaining and adapting the micro-hydro system years after our project team installed it. What I found is that technical skills were insufficient indicators for associating the project's functional success. While most of the 'technicality' of the technology design (such as its components as specified by engineers) added key functional requirements, this knowledge by no means was adequate for assuring that the overall technology choice and system design would lead to a good 'fit' for the end-users socio-cultural and ecological circumstances. Moreover, if the project ignored local social organisation (including shared values), and local technical knowledge, key design innovations that later were included to help assure the technical value of the project would not have been identified. To choose technologies and design the system so the project's overall purpose met the end-user's

local context was a key technological empowerment objective. Culturally, the Iriri people had a significant asset, they had already a well established and sophisticated shared belief in craftsmanship, and work structure organisation. Ecologically, they understood the tropical jungle resource and constraints. Indeed their deep knowledge of how to use and bind split vines to hold and suspend the penstock pipe tracing down the mountain from the small creek dam to the pelton turbine was instrumental in the design's technical and socially sustainable maintenance success. The knowledge and design behind the technology system and choices made was only able to be validated when assessed against the context in which the end-users and maintainers required it to function, including the key requirement that it 'worked' socially, technically, and ecologically and was locally maintainable. The technology design was successful, and validated for the engineers and end-users the many ideas developed. The design defence was robust, and as a result, new technical, social, and ecological context knowledge was produced transforming the lives and knowledge gained by engineers and end users alike.

The necessary ties between all that makes the people, the ecology, and the design and choice of the technologies used, was an inescapable system of dependencies that made the technology work in its context. This interlinked pattern appears to repeat itself: people, ecology and the context in which the purpose of design has to succeed cannot be extracted from the study and practice of design and technology.

In 1986, I was invited to up the scale of my previous project experiences in the Solomon Islands, and undertake a national research effort to examine the requirements for establishing the first national vocational qualification that would best fit the local circumstances of hundreds of small and remote Australian Aboriginal Communities located on their traditional desert lands across central and northern Australia. The goal was to enable these communities with a 'technical training qualification' that would help them maintain the plethora of transferred technologies into their lives.

The field projects noted above presented an insight about the ubiquitous social transformation power of technologies and design choices on people's lives. It was apparent that our educational and technology service institutions (known as the donors of aid) not only never questioned, first, if the technologies transferred were the best-fit for the socio-cultural and ecological circumstance of the end-users but also, second, that the transfer of them was both a conscious and compliant process to re-socialise people into an archetypal Western lifestyle. The choice and design of technologies and systems were part of a deliberate cultural assimilation strategy of government (Australia. Parliament. House of Representatives. Standing Committee on Aboriginal Affairs, 1987). The object was to use the power of structuring the material world of how people were to live so it would bring the world's oldest continuing culture into the economy and values of mainstream governance. 'Houses' were provided with layouts that assumed people formed a nuclear family structure (two parents, 1-3 children) despite the fact their 'family' was based around a more complex set of relationships extending often to 20 or 30 people seeking to live together. Houses and technologies such as public telephones and water-borne flush

toilets were also not designed with features and materials that offered any comfort or functional reliability in the extreme temperature conditions of the Australian desert: wind and bull-dust that affected both the technologies, and the health and wellbeing of the very young and old. The mismatch between the cultural and ecological lives of people and the assumed lifestyle represented by the design and technologies transferred into people's lives proved disastrous. Consequently, the Australian Government began investing in research, design, development and new education in Appropriate Technology and Environmental Health-hardware ideas since the late 1970s (Mayne, 2014). Underpinning much of this research was the concern for how the design and technology choices that were transferred into communities affected the fundamental social and cultural foundations of people, foundations critical to social cohesion and stability.

The systemic impact of poor technology choices did not stop with the house, but extended to the greater technological and design impact upon culture of the settlement system itself. Settlements were created that required a move away from a social organisation and values systems based on subsistence and an actively mobile lifestyle. Settlements represented a new set of value to accommodate where the mobile life was shifted in a 'boxed up' sedentary one that had to reconceptualise prior beliefs of shared ownership of made objects, and caretakers of open lands, to a new culture with notions of privatised property, fences, repair and maintenance tools and purchases using "cash technology", and the new governance structures that were also required to manage and fund the upkeep of this new made world called the settlement. Every layer of transferred technologies moved people closer to the cultural norm and technical education standards that those technologies required. With a settlement, came the new cash economy to manage technologies that did not exist before. A people that had control over the detail, choice, and designed of tools and shelters, were now 'rounded up' so that over time, they took on the life of a householder (Australian Race Discrimination Commissioner, 1994). In effect, the strategy may be summarized as a view that it was better to change the people into the ways of their new material worlds, and so alter their governance, than to enable people to continue their path and transfer technologies that have been chosen and developed to best fit with local values and social organisation. This was an awakening to the political and cultural face of design and technology.

Social, political and cultural dimensions to technology transfer projects have been well documented in case studies of community development and Appropriate Technology philosophy (for an insight into the philosophy of Appropriate Technology in community development see (Mayne, 2014; Schumacher, 1999; Walker & Seemann, 1988; Willoughby, 1990)). However, what these projects demonstrated was how the donors and end-users of technologies were both largely uninformed if not dismissive of the role culture and values played in the success of a design and technology build. When they were aware, there was a chasm with no theory or methods available to deliberately and assuredly guide design and technology development that could guide a 'best fit' for the end users needs and circumstances.

In contemporary Western government departments of education and curriculum, the lack of serious understandings about the design of our technological world remains at best problematic and at worse void of attention. It is part of the reason why our education systems can be described as sleepwalking society through the design and technology education they experience (Seemann, 2007). We are comfortable with a set-aside module of learning or objective about the social and ecological impact of technology. We can accommodate the idea that culture has some indirect, vague role in how these ideas shape our worlds. We can at times be almost dismissive of the idea that the made world acts upon our minds and behaviours where we largely capitulate to its rule as the easier path to take, and accept that our made world, over time and repetition, alters the values and ideas we come to accommodate as normal and so no longer at the forefront of any conscious design and technology deliberations. That is, much of our perceived will to make design and technology choices has already been conditioned at least in part, by the learned and shared values we have come to accommodate living over generations in the world we have created around us.

Our understanding of the dependent links between culture and technology in education are all still to mature. If we asked even the most experienced technology educators to articulate how, exactly, does one design and create things, systems, and services to best fit a cultural context, and how do we know if this fit is indeed 'best', we find our draw upon assured methods, theory, and research is rather thin. There is a lot of work to do in this space of educational research and practice.

What I have coined as the study of cross-cultural technology and design transfer and development has its success heavily grounded in a critical understanding of the culture that has made a technology possible. Culture was also essential in maintaining and innovating technology and design as circumstantial (contextual) changes emerged in communities over time. We sometimes see this idea written as humans adapting to change. We also see evidence where the common held and shared values and worldviews of people are so embedded and invested in the very world they have created that for the created world to change, people have to accept a change in the cultural world views they have so heavily and systemically accepted over time. Culture drives the acceptable uptake of design and technologies. However, the technology designs and choices placed in our worlds can only induce cultural change to the extend that the change required to successfully accommodate the introduced technologies do not require an excessive shift in existing shared world views, capabilities, and beliefs by those engaging with it. It is one reason why the appearance of disruptive technologies can, for some, be associated with a degree of anxiety or apprehension.

What has always struck me as conceptually significant in my efforts above, both as someone educated as a secondary teacher, as well as in the scholarship and practice of design and technology, is that the more I sought to help the communities learn and manage 'our' technologies, the more I found myself discovering the loaded values and worldview assumptions we have blindly embedded in the technologies we were donating. Indeed, it becomes more important to know what our "Western"

beliefs and social organisation assumptions were if I was to have any success in explaining to people the new technologies before them. The trade-offs such systems will introduce in their lives. The warning on the packet, along side the tangible benefits. Yet, still today, such a critical approach to the teaching and learning of design and technologies, at the tangible level of researching and making, remains largely silent if not disassociated in many mainstream school activities.

Over the 1990s and more so the last 14 years, these fundamental dependencies extended from what was initially a view of 'best engineering fit', to 'best socio-technical fit'. The move to a conceptual frame that acknowledges the necessary requirement of design and technology to fit in the intended end-users socio-technical circumstance, appears to take highest priority as indicators of longevity of the end–users capacity to benefit, control and alter the new technology in their lives. However, all the while, there have always been two more fundamental dimensions that design, technology, and education projects could not ignore. These were the end-users' natural and human made environmental circumstance, and the role that different belief systems played in the social management of all technologies, whether indigenous to the users, introduced, or 'hybridly' adapted: the latter often a basis for innovation.

So ubiquitous are the socio-cultural and environmental necessities of designs and technologies to the successful uptake of them with end users, that it may be postulated that unless a school curriculum necessarily studies the cultural and ecological dimensions of all and each design and technology project, the transaction of learning taken place in the school may be rightly contested as mis-educative. So essential is the need to always examine the socio-cultural and environmental co-dependencies of all human creations that to omit or under-represent their role in directing design and technology choices is to foster a flaw in the learner's intellectual frame for material and digital judgment. It is difficult to defend design and technology judgments – the choices and decisions we take about the material and digital artifacts that litter, aide, and shape our daily lives – if we teach this area of knowledge without connecting those choices to understanding the social and ecological trade-offs that are inevitably implied.

There is perhaps no other subject field in the school curriculum that so deliberately demands a tight synthesis of learning of people, their innovations, and their ecologies than the study of human design and technology. If we add to this the meta-level of teaching in addition to doing and learning design and technology in and across any culture, we find ourselves standing before an immensely uncharted and exciting field of scholarship and educational practice.

CONCLUSIONS

When it comes to culture in design and technology, we have a lot of work to do. Throughout the field of design and technology studies, scholars will continue to link overtly, and by inference, matters of design and technology to human beliefs, values,

and culture. Where they do, we, in education, ought give their propositions serious attention and follow-up, knowing that such associations are not by accident but due to the inseparable nature of how our subject matter is ontologically embedded in culture and ecology as a characteristic of its epistemic foundation. What we cannot do is play the role of culture down, or over-simplify its position in the design and technology curriculum of pupils, teachers and all branches of designing from the craftsperson, the product designer, the food technologists, the textiles technologists, to the engineer, builder and architect and the software and service designers and developers. All these areas are branches off the common discipline stem of designing and working technologically. Our subject offers the curriculum a foundational proposition that humanity, the worlds we design and engage with every day, and the ecology that makes both possible, when integrated towards accommodating at least an initial purpose and context criteria of use, together form the empirical stem of the discipline. It is why culture and ecology, as well as tool design, systems, symbols, and ethics, all form necessary and legitimate ontological dimensions to the field. If a good education in design and technology is to mature, we have the foundations for how the discipline builds its body of knowledge, and defends and validates its outcomes; this includes the test of best fit optimization that is contextually validated. We have a subject, indeed we may assert a discipline, that has developed a deep and rich stem and branch body of knowledge that will continue to define humanity. We can count culture as axiologically grounded in the proper study of design and technology education and practice.

REFERENCES

Al-Rodhan, Nayef R. F., & Palgrave Connect (Online service). (2011). *The politics of emerging strategic technologies implications for geopolitics, human enhancement, and human destiny St Antony's series* (pp. 1 online resource.). Retrieved from http://ezproxy.lib.monash.edu.au/login?url=http://www.palgraveconnect.com/doifinder/10.1057/9780230304949

Anthes, G. H. (1998). A walk in the PARC. *Computerworld, 32*(20), 73–74.

Australia. Parliament. House of Representatives. Standing Committee on Aboriginal Affairs. (1987). *Return to country: the aboriginal homelands movement in Australia.* Canberra, Australia: Australian Government Publishing Service.

Australian Race Discrimination Commissioner. (1994). *Water: A report on the provision of water and sanitation in remote Aboriginal and Torres Strait Islander / Federal Race Discrimination Commissioner.* Canberra, Australia: Australian Government Publishing Service.

Balint, P. J., Stewart, R. E., Desai, A., & Walters, L. C., (n.d.) *Wicked environmental problems: Managing uncertainty and conflict.* Stockholm, Sweden: Springer-Verlag.

Brown, V. A., Harris, J. A., & Russell, J. Y. (2010). *Tackling wicked problems through the transdisciplinary imagination* (p. 312). London: Earthscan. Retrieved from http://www.google.fi/books?id=Evgk1z2SAeAC&dq=wicked+problems&lr=&source=gbs_navlinks_s

Ferlie, E. (2013). *Making wicked problems governable?: The case of managed networks in health care* (1st ed.). Oxford, England: Oxford University Press.

Gunn, W., & Donovan, J. (Eds.). (2012). *Design and anthropology: Anthropological studies of creativity and perception.* Surrey, England: Ashgate.

Harris, M. (Ed.). (2007). *Ways of knowing: New approaches in the anthropology of knowledge and learning.* Oxford, England: Berghahn Books.

Mayne, A. (2014). *Alternative interventions. Aboriginal homelands, outback Australia and the centre for appropriate technology*. Adelaide, Australia: Wakefield Press.

Nafus, D. (2008). *Why designing relationships is better than designing for the bottom of the pyramid.* Paper presented at the Subversion, conversion, development: Public interests in technologies. University of Cambridge, Cambridge.

Ritchey, T. (2010). *Wicked problems, social messes: Decision support modeling with morphological analysis* (1st. ed.). Stockholm, Sweden: Ritchey Consulting.

Roberts, S. (2011). Technology for the future, design for the present? In A. J. Clarke (Ed.), *Design anthropology: Object culture in the 21st century* (pp. 229–243). Austria: Springer.

Schultz, J. (2011). *Wicked problems, exquisite dilemmas Griffith review* (pp. 1 online resource (p. 268)). Retrieved from http://libraryproxy.griffith.edu.au/login?url = http://griffithreview.com/editions

Schumacher, E. F. (1999). *Small Is beautiful: Economics as If people mattered: 25 years later. With Commentaries* (2nd ed.). Berkeley, CA: Hartley & Marks.

Seemann, K. (1986). *Appropriate Technology in Iriri: a micro-hydroelectric project in the Solomon Islands.* (Advanced Research Project (dissertation), BSc (Ind Arts)), Faculty of Built Environment, School of Architecture, University of New South Wales. Retrieved from http://www.apace.uts.edu.au/docpublish/iriri.html

Seemann, K. (2007). Waking up the subject: From craft to critical technacy. *Journal of Curriculum Perspectives, 27*(3), 74–76.

Australia. Parliament. House of Representatives. Standing Committee on Aboriginal Affairs. (1987). *Return to country: the aboriginal homelands movement in Australia.* Canberra, Australia: Australian Government Publishing Service.

Walker, B. W., & Seemann, K. (1988). *The Aboriginal technical worker feasibility study report (ATWORK): a national co-operative curriculum development project of the Australian Conference of TAFE Directors.* Alice Springs: Centre for Appropriate Technology, Alice Springs College of TAFE.

Willoughby, K. W. (1990). *Technology choice: A critique of the appropriate technology movement.* London, England: Intermediate Technology Publications.

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