

THE ROLE OF HAND DRAWING IN BASIC DESIGN EDUCATION IN THE DIGITAL AGE

Rein Have, Martin van den Toorn

r.have@tudelft.nl

m.w.m.vandentoorn@tudelft.nl

Faculty of Architecture
Delft University of Technology
POBox 5043
2600 GA DELFT
The Netherlands

Abstract. In the last decennia, hand drawing has been slowly moved out of the curricula in architecture schools and the teaching of computer skills has taken over. It has also created an 'intellectual dichotomy of viewpoints'; the digital and analogues.

The question now is how to find a new balance for teaching basic design in architecture schools. This paper, partly reflective, partly research, will elaborate a viewpoint and a general approach of how hand drawing can be part of contemporary curricula in design schools.

In the first part we will analyse some new insights that can be developed on the basis of results of research in drawing and in cognitive sciences. Hand drawing, representation and visual thinking will be the key issues to be dealt with. In the second part we will set up a conceptual framework for curricula in design schools with special attention to hand drawing, design and studio teaching.

One of the conclusions is that hand drawing not only needs to be fully integrated with digital techniques in order to be used as design tools but it needs also to be integrated into the entire curriculum to be effective. Another important aspect is that hand drawing has more functions in design teaching; learning to see and to think visually are key issues that need an active approach in any design school.

1. INTRODUCTION. The 90-s and the beginning of the millennium have been characterised by the 'taking over of the computer' as a design tool at almost all architecture schools, also at Delft. Gradually it has become clear that in architectural design you can do a lot digitally but the same goes for analogue approaches.

In all schools, hand drawing is back now and teaching advanced computer graphics in the first year is over. There is no question of returning to the good old times, without a computer. Neither of going back to the high-tech amazement of the last decades.

Two major developments have influenced this recent controversy. First of all the promise of the new computer technology both in software and hardware has for some people created the idea of the complete taking over of the computer in (architectural) design, often complemented and fuelled by expensive advertising by computer firms. Gradually this idea has evolved to a more realistic viewpoint that the computer can do a lot but not everything. Also efficiency has become more important; sometimes you can do things with a computer but it takes more time and way more investments in software and hardware.

The second development comes from a totally different direction. Research in drawing and in cognitive sciences has shown the fundamental role of the direct hand-brain relation in problem solving, conceptualising and visual thinking in general. It means that hand drawing is not just an old-fashioned, artistic trick but can be a way of acquiring new knowledge.

The term 'drawing'

'Drawing' in this paper is used as a generic term that comprises sketching, mapping, diagramming, making cross-sections, touching up drawings, drawing from life, doodling, technical drawing and other similar activities. For most people, drawing has an artistic connotation. There is nothing wrong with that but in design drawing is first of all a tool despite the fact that drawings of some designers are even sold for high prices. This tool is first of all used to communicate either with oneself or with others. Secondly it is a tool for developing ideas, doing design experiments and eventually developing plans (Dee, 2008).

Drawing in practice, research and education

From the Renaissance on, after the discovery of the perspective, drawing became a new activity in the building process (Pérez-Gómez & Pelletier, 2000). It represented a new intermediary step in the design process in which a representation of the building to be constructed could be evaluated, judged before realisation. Also in contemporary practice, hand drawing plays a key role (Graves, 1977; Simon, 1988; Robbins, 1997; Laseau, 2001; Olin, 2008; Riedijk, 2009).

All design education, till roughly the second part of the last century, trained observation by drawing from life. There are still educators that are convinced of this principle — take Unwin and Siza as two examples — and it still exists in certain curricula of architecture schools. There is also a number of schools that has removed hand drawing out of the program but are re-introducing hand drawing now but the question is in what form?

In science, drawing has always played a role but mostly in representation of results of research. Nowadays the role of 'knowledge visualisation' is growing, also in the sciences (Judelman, 2004).

2. RECENT DEVELOPMENTS IN THE CONTROVERSY BETWEEN HAND DRAWING AND COMPUTER DRAWING IN DESIGN SCHOOLS. Some years ago the use of the computer came at such a level that many designers and educators thought of the end of hand drawing. If you look at architecture schools all over the world now, you see that hand drawing is still at the curriculum and that some have even reintroduced hand drawing in the recent years.

What developments have influenced the controversy between analogue and digital in drawing? In our view there have been three developments that have changed the views on computer drawing, hand drawing. First of all drawing research, secondly developments in cognitive sciences and finally the rise of the concept of visual thinking.

Drawing research

When in 2003 the 'Arts and Humanities Research Board' (AHRB) published their views on research in the arts and humanities (arts, 2003). They emphasised the specific character of the research in the arts and humanities, both methodological and in terms of types of knowledge. A number of subjects and domains was put forward, both disciplinary and interdisciplinary. The establishment of the AHRB in 1998 has changed the viewpoint on research, scientific methods in the arts and humanities to a great extend. The board gave also research grants to artists, scientists and designers alike. One of the domains of research that was made possible was research on drawing. In the context of this paper we put forward one example of drawing research by Cain (2010). Her publication 'Drawing — the enactive evolution of the practitioner', shows how a personal but systematic investigation of practice can lead to new viewpoints. She researches drawing both as a process and as a product. The research method is very interesting; Cain uses her own conscious experience as a basis for research and study but at the same time using scientifically verifiable methods by explicitly describing viewpoints and conclusions and relating these results to other researchers.

Another important study in this controversy is the publication of Treib (2008) 'Thinking / drawing — confronting an electronic age'. In this publication a number of practitioners, researchers from diverse disciplines and domains have presented their viewpoints on this controversy. One term that is often used is 'hybrid'; it is not either or digital or analogue but rather hybrid. Some of the authors have worked out this controversy very precisely and have described the role of drawing in an excellent way like for instance Olin (2008).

Cognitive sciences

This is a vast domain of research. For this paper we want to put forward the distinction between the different types of knowledge that is made in the cognitive sciences. Stillings et al. (1998) distinguish between declarative knowledge (knowing what), procedural knowledge (knowing how) and tacit knowledge (personal knowledge). This distinction is extremely interesting for design disciplines, first of all because it gives a better overview how these different types of knowledge play a role in design. A second important phenomenon is 'tacit knowledge' referring to personal knowledge, experience; very well fit for design disciplines (Polanyi, 1966).

Another important issue in the cognitive sciences is that the mind is considered as a computational and information processing entity. So, drawing is not seen as a mechanical reproduction of the world we see but as an interaction between knowing and seeing (Latour, 1987). The direct hand/brain connection enables that drawing can be seen as a way of acquiring new knowledge (Purcell & Gero, 1998; Toorn, 2009).

Visual thinking

The concept of 'visual thinking' is not new. Best known are probably the publications of Arnheim on this subject especially his book (Arnheim, 1971). Arnheim referred mainly to art history and put forward the dichotomy between seeing and knowing, primarily from a psychological point of view. Probably Leonardo Da Vinci was the first who used visual thinking in his work, which is also visible in his notebooks. In the 20th century, Paul Klee, is a less known but equally interesting example, of making use of visual thinking that is visible in his notebooks (Klee, 1961; 1970). With the emergence of the cognitive sciences, the concept of 'visual thinking' has gained new interest and content. The interaction between seeing, knowing and drawing forms the basis for this new content. It means that the core of design is visual thinking and visual knowledge (Fish & Scrivener, 1990; Do & Gross, 1996; Eckert et al., 2004; Dee, 2008). This knowledge remains for a large part tacit knowledge but for another part can be made explicit as design knowledge. Hand drawing plays a key role in visual thinking and thus in design in general.

3. THE KEY ROLE OF HAND DRAWING IN DESIGN EDUCATION. Riedijk (2009) puts forward that the drawing is the 'raison d'être' of the architect. No architect can survive without drawing. Unwin (2009) states that you only learn to design by analysing plans. This analysis has to be done by drawing, either drawing from life or analytical drawings of constructions, details, or other aspects of architecture. These are just two contemporary statements that refer to drawing in relation to (architectural) design.

Drawing is the simplest way of visualisation and a very human activity. It is also a manner to register your ideas, what you see. Drawing is a medium, a language for designers. Visual thinking and visual problem solving are typical for all designers and is mainly based on drawing due to the direct relation between hand and brain. In the end it results into a form of visual knowledge; a knowledge system that is crucial for all spatial designers. This visual knowledge can refer to spatial, visual, material aspects of the form of the everyday environment. Drawing is a core activity in professional communication in architecture and landscape architecture. In all phases of the design process drawing plays a key role, though very differently.

Hand drawing and sketching gets nowadays plenty of attention also outside design disciplines on the internet see for instance: www.urbansketchers.org. Sketchers all over the world exchange their work and discuss results. A remarkable phenomenon of hybrid development in digital

times.

3.1 The different phases in the design process; visualisation, drawing and design.

Visualisation, drawing and design are closely related but are not the same. Visualisation has to do with communication by visual means. Visualisation is making use of 'visual language'; for all designers this is a language they have to learn.

Visual thinking is basic for design as problem solving technique. Visual thinking in design disciplines has three important components:

- Conceptual and perceptual thinking
- Abstraction; being able to abstract from practice in everyday life.
- Being able to distinguish between pattern and process; the dynamics of landscape form and design.

Drawing is an essential means for visual thinking. The interaction between visualisation, drawing and design comes back in the different phases of the design process; perception, analysis, synthesis.

• Perception

All knowledge starts with observation, perception and vision. In most cases you study a problem by visually researching it. That process is building forth on what you already know but adds new information, new insights but also new questions to what you already know. That is the start of all scientific research. In 'Education of vision' (Kepes, 1965), a number of different authors shed light on their knowledge, experiences and views on how to teach this 'learning to see' in different disciplines.

A very similar process takes place in design disciplines. You start with a design problem — either commissioned or out of curiosity, fascination — by analysing the problem in a visual way. In the process of gaining more insight, you start conceptualising the problem towards a solution. The elaboration of his first concept will eventually lead to the final plan. In this phase of perception, drawing is a means for learning to see at a professional level.

This means that observation, visualisation and imagination play a key role in the start of any design process especially the intermingling of these three. Observation, learning to see actively is the start of research. An important way in this learning process is drawing, both from life and conceptually; they go hand in hand.

• Analysis

In analysis, drawing is a research tool. Unwin (2009) is very clear on the role of drawing for architects:

I have already mentioned that the primary medium for analysing examples, for acquiring and practising the common language of architecture, for playing with ideas, is drawing. For architects, drawing is a non-negotiable essential skill. An architect who does not draw is like a politician who does not speak. Both need a medium through which to develop and express ideas (their own, or those they have borrowed from elsewhere).

Nowadays a great deal of architecture-related drawing is done on computers, but still the timeless simplicity of a pencil and blank sheet of paper is attractive. To a large extent the language of architecture is the language of drawing. And if, as in the case of people in prehistory, you find yourself with no pencil and no paper, you can always draw your ideas with a stick in the dirt. And if you draw them big enough — like a child with leaves in the playground — they just about become works of architecture in themselves.

Unwin considers hand drawing as an active way of learning by analysing realised plans. In our opinion, the same goes for landscape architecture although there are slight differences in the types of drawing that are used as compared to architecture. Next to plan, section and view in architecture, in landscape architecture block diagrams, obliques and exploded views are frequently used to comprehend the visible and what cannot be seen, the dynamics of landscape form but above all the distinction between the different levels.

In Delft at the Faculty of Architecture, Guney and his colleagues has introduced and developed

the idea of precedent analysis in architecture (Guney, 2008). In his teaching and research, hand drawing plays a key role. The premises are identical to Unwin's; you learn by drawing from earlier projects. Methods and approach of the analysis vary; Guney uses the work of Clark & Pause, Steadman and Ching as a basis for analysis. Unwin uses his own approach (2009). In landscape architecture the analysis of gardens by Moore et al. (1993) and the recent work of Szántó (2010) are interesting examples of the role of drawing in analysis.

- Synthesis

In the search for a synthesis between program and plan, drawing is used as a problem-solving activity. All drawing is — like design — a more or less continuous flux, moving from temporarily certitude, through questioning and discovery to a next approximation of the final goal. This cycle is repeated until the result is satisfactory for that moment. In drawing this questioning takes place in the mind and the result in a visual representation, a drawing, a sketch (Halprin, 1986; Goldschmidt, 1994; Olin, 1996).

Mapping, layering and the analysis of form and process and the search for new representations that can lead to new insights. 'Mapping' here, is used as a general term describing a form of visualising processes, sequences and change. It can take the form of a 'mind map', a fast and simple sketch of an itinerary or the representation of complex processes in space and time. Of course the working with real maps, mostly called cartography, is also a form of mapping. Closely related to mapping is 'layering'. The making use of different layers of information, is a tool that is very much used in mapping of all sorts, both for analysis and for presentation purposes.

4. A FIRST OUTLINE FOR HAND DRAWING IN A BACHELOR'S PROGRAM IN AN ARCHITECTURE SCHOOL. We consider hand drawing to be essential for all designers to develop their perception of form and designed form. We call this 'visual research' of the form of the (urban) landscape as a start for all design projects in landscape architecture.

In the beginning of the design process, first conceptual sketches and design work is mostly done by hand. It is not only faster but gives also much better direct feedback to what you did design.

Not only for visual research and conceptual sketches but also in direct communication with clients a designer should be able to draw to express his/her ideas, communicate information because it is simple and direct. Looking at the design process as a whole in most cases it will come down to hybrid use of analogue and digital, of the different techniques on the basis of efficiency and goals.

- Learning to draw

Another presumption in our teaching is that everybody can draw or more precisely; everybody can learn to draw. If we use the term 'drawing' it is not primarily referring to the artistic activity and its use by artists as a means of personal expression and visualising ideas. Drawing for designers is first of all a means of visual communication with yourself and with others, it should be seen as a type of 'handwriting'. Students should be able to communicate their ideas by drawing without thinking first how to draw. In fact it is a form of communicating with your own brain (Hoffman, 1998).

Drawing from life is an essential means to learn to see and for becoming a trained observer of the landscape, so it also helps you to develop a sensitivity for visual form. We see drawing as a cognitive process where the dynamic relation between doing and thinking is essential. That's why: 'the more you draw, the more you see' and vice versa.

Drawing in design can be seen as a primary means of abstraction. All drawing is selection. This making of selections is also one of the characteristic of drawing and gives it its strong communicative power. So it focuses because it reduces information.

In the first year we don't have much time to go out in the field to teach drawing from life. We use photographs to draw from, not as a replacement but as a pragmatic choice in the given time

limits. Students should practice drawing from life themselves, this can also be done inside, like drawing objects in the studio, the view from the window.

Touching up of drawings (in Dutch: ‘Opwerken van tekeningen’)

Drawings — like plans, texts for papers — are not made in one step, that is a romantic idea. Even experienced designers need more steps to develop a plan; it is a process. The process of ‘touching up’ a drawing by redrawing it several times either by means of tracing paper or just by redrawing them. The ‘classical’ way of touching up drawings is to start in pencil, redraw in ink and add colours later. But in the digital age all kinds of hybrids between paper, pixels and bytes are possible and offer new opportunities.

- Functions of drawing in design

The earlier mentioned artistic connotation makes it necessary to distinguish between different functions of drawing in design. We have organised them in three groups (Toorn & Have, 2010).

- Communications both internally and externally (with other people)

Drawing in different forms plays a major role in communication. First of all the internal communication between doing (hand) and thinking (brain). Secondly the communication with others like clients, users, decision makers.

- Development of vision, training observation and perception

Learning to see, becoming a trained observer is the first part of every discipline's education. In design disciplines, with their visual focus, learning to see is even more crucial. Starting a design education means embarking on a life-long journey on learning to see, it never ends.

Training observation; the development of vision by systematic observation and visual research of form, colour, material, structure, size and scale. Observation studies and development of vision are also related to framing, the necessity of making selections and reductions in order to come to grips with the complexity of the form of the everyday landscape. Learning to see cannot be learnt from books, it takes practice, fieldwork and above all drawing.

- A design tool as a means for visual thinking

Drawing is one of the key elements in visual thinking. Drawing, visualising and thinking are closely related. Drawing as the development of visual knowledge by doing. Drawings, visual representations are not made in one stroke; that’s a romantic vision.

- How to organise hand drawing as integral part of a Bachelor's program?

The different types and functions of drawing have to be implemented in the course of three academic years, that is six semesters. To enable a real integration, hand drawing has to be taught in different didactic ways; as separate courses in the first year, as workshops during design studios and as a fieldtrip (Kattendijke, 1973) and final project in which the application of what has been learnt takes place. In the first year specialised teaching staff for drawing takes care of teaching the basics. In the second and third year this staff together with the studio masters organise the teaching of drawing in the studio.

didactic form	semester	content
course	1	basics 1: learning to see, perspective, plan drawing
course	2	basics 2: colour, diagramming & mapping, presentation
workshop	3	technical drawing
workshop	4	drawing in design; experiments
workshop	5	drawing in research; precedent analysis
fieldtrip & final project	6	documentary drawing (fieldtrip) & final project

These different uses of drawings are also related to different types of drawing. For developing ideas you use a different type of drawing than for the detailed working out of technical

drawings.

Types of drawing

Apart from plan, section and view, the basic types of drawings that are used in architecture and landscape architecture are: observational, conceptual, problem solving, analytical, technical, representational drawings. Different techniques of drawing can be used in each of them; plan, section, view, thumbnails, diagrams, overlays. Panorama's, block diagrams and sequences are typically used in landscape architecture.

	conceptual	analytical	problem solving	representational	technical
BASICS	x			x	
technical					x
drawing in design			x		
drawing in research		x			
fieldwork		x	x	x	x
FINAL PROJECT	x	x	x	x	x

5. CONCLUSIONS. In the contemporary situation, hand drawing, computer drawing and all sorts of hybrids between them will find a place in design education. Note that learning hand drawing first is necessary. First of all because it takes more time and secondly you can learn the application and use in computer drawing faster. A third reason for the return of hand drawing in architecture schools is that it redefines the core of design education. Drawing can be a way of acquiring new knowledge. It means that hand drawing is not only an integral part in the first years but needs continued development in the studios and in the final project.

The search for hybrid applications; a role for research

We start out with hand drawing, because hand drawing takes most time to learn and to get used to. For designers, computer drawing is a technique that has no use without visual knowledge, drawing and design knowledge.

The computer can be of great help in many processes of visual communication. Digital means like computer, digital camera and scanner are widely used already and can be a great help and sometimes the only means to do a job. Computers should be used for repetitive and complex tasks, for work that needs lots of changes. Use hand drawing for researching a study area, for rapid sketching of first ideas and concepts as a start for a solution and for communication with clients, users. Hand drawing is a basic need, computer drawing is a skill that requires training. Hand drawing should be a daily routine like hand writing; you should be able to do it quickly without thinking how to do it. We see most in hybrid use of both on the basis what is needed and what is efficient. Don't forget: both computer drawing and hand drawing are a means not a goal. New media offer new possibilities of making visible; elements, structures and processes. The interaction between old and new media offers an extra 'layer' of potential new views, visions and ideas.

In all exercises we pay attention to the relation between analogue and digital; the need for hybrid application. Very roughly you could say that in the conceptual phase the analogue drawing techniques are dominant and in the technical phase the digital techniques. For anything that has to be changed frequently, digital drawing techniques are handy. We emphasise the use of both analogue and digital techniques and media (Toorn & Have, 2010).

Didactics; a role for research

For designers drawing is not a goal in itself. We see drawing as a means of communication (brain-hand co-ordination, with other designers, users, decision-makers). This means that with all drawing in architecture and landscape architecture three key factors are important to keep in

mind:

- consistency of communication; is it understandable as a series steps that lead to a solution?
- efficiency of communication; do you use your means of communication in the most efficient way?
- effectiveness of communication; do you get your message across to the target group?

From our experiences in teaching visualisation, we have come to the conclusion that teaching staff should not be drawers that make 'good-looking' drawings. These types are very well known in design schools, people who seem to be 'naturally' gifted. Why not these types?

First of all because those people tend to stick to their own style, they don't try out, don't experiment in other styles. Sometimes they even cannot work in a different style. In teaching this is a drawback since students have to be exposed to different styles to enable developing their own.

Secondly there is a psychological argument. Upon seeing these 'good-looking' drawings, students will immediately be convinced that they will never learn to draw like this — which is in most cases true — and will thus have an enormous barrier in learning to draw.

REFERENCES

1. Arnheim, R., Visual thinking, Berkeley, UCPress, 1971
2. The arts and humanities: understanding the research landscape, London, Arts and Humanities Research Board (AHRB), 2003, 18 p
3. Cain, P., Drawing — The enactive evolution of the practitioner, Bristol, intellect, 2010
4. Ching, F.D.K., Architecture — Form, space, and order, New York, 1996, 2nd ed.
5. Dee, C., Plus and minus: critical drawing for landscape design, in: Treib, 2008, 60-72
6. Do, E. & M.D. Gross, Drawing as a means to design reasoning, Palo Alto, Stanford University, 1996
7. Eckert, C. & A.F. Blackwell & M.K. Stacey & C.F. Earl, Sketching across design domains, in: Gero et al., 2004, 79-10
8. Ferguson, E.S., The mind's eye: Nonverbal thought in technology — 'Thinking with pictures' is an essential strand in the intellectual history of technological development, Science 197(1977) 827-837
9. Fish, J. & S. Scrivener, Amplifying the mind's eye: sketching & visual cognition, Leonardo 23(1990) - 1, 117-126
10. Gero, J.S. & B. Tversky & T. Knight (eds.), Visual and spatial reasoning in design III, Sydney, Univ. of Sydney, 2004
11. Goldschmidt, G., The dialectics of sketching, Creativity Research Journal 4(1991), p 123-143
12. Graves, M., The necessity for drawing: tangible speculation, Architectural Design 47(1977) – 5 384-394
13. Guney, A., Architectural precedent analysis — A cognitive approach to morphological analysis of buildings in relation to design process, in: Moraes Zarzar & Guney, 2008, p 91-115
14. Halprin, L., Lawrence Halprin: Changing places, San Francisco, San Francisco Museum of Modern Art, 1986
15. Hoffman, D.D., Visual intelligence — How we create what we see, New York, W.W. Norton & Company, Inc., 1998
16. Judelman, G.B., Knowledge visualization — problems and principles for mapping the

knowledge of space, Montreal, McGill University, 2004

17. Kattendijke — Onderzoek naar de ruimtelijke structuur en karakteristiek, THD, Bouwkunde, 1973
18. Kepes, G. (ed.), Education of vision — Vision + value - series, New York, George Braziller, 1965
19. Klee, P., Notebooks Vol. 1 — The thinking eye, New York, George Wittenborn Inc., 1961
20. Klee, P., Notebooks Vol. 2 — The nature of nature, New York, George Wittenborn Inc., 1970
21. Laseau, P., Graphic thinking for architects & designers, New York, 2001, 3rd. ed.
22. Latour, B., Visualisation and cognition: drawing things together, Knowledge and Society, 6(1986), 1-40
23. Moraes Zarzar, K.M. & A. Guney (eds.), Understanding meaningful environments — Architectural precedents and the question of identity in creative design, Amsterdam, IOS press, 2008
24. Moore, Ch.W. & W.J. Mitchell & W. Turnbull jr., The poetics of gardens, Cambridge, MIT Press, 1988/1993
25. Olin, L., More than wriggling your wrist (or your mouse): thinking, seeing and drawing, in: Treib, 2008, 82-100
26. Pérez-Gómez, A. & L. Pelletier, Architectural representation and the perspective hinge, Cambridge/London, MIT Press, 2000
27. Polanyi, M., The Tacit Dimension, New York, Anchor Books, 1966
28. Purcell, A.T. & J.S. Gero, Drawings and the design process, Design Studies 19(1998), 389-340
29. Riedijk, M., De tekening, de bestaansreden van de architect — The drawing, the architect's raison d'être, Rotterdam, 010, 2009
30. Robbins, E., Why architects draw, Cambridge MA, MIT, 1994/1997
31. Simon, J., Croquis perspectifs de 130 paysagistes — Aménagement des espaces extérieurs No. 11, Brive, 1988 (rééd.)
32. Stillings, N.A., Weisler, S.W., Chase, Chr.H., Feinstein, M.H., Garfield, J.L., Rissland, E.L., Cognitive Science — An Introduction, Cambridge/London, MIT Press, 1998, 2nd. ed., 2nd. pr.
33. Szántó, C., A graphical analysis of Versailles garden promenades, Journal of Landscape Architecture (2010) - Spring, p 52-59
34. Toorn, M. van den, Hand drawing as a means of acquiring visual knowledge, in: Gómez Chova et al., 2009, 677-684
35. Toorn, M. van den , R. Have (eds.), Visualisation in urban design and landscape architecture, Delft, Faculty of Architecture, 2010
36. Treib, M., Drawing/thinking: confronting an electronic age, London, Routledge, 2008
37. Unwin, S., Analysing architecture, London, Routledge, 1997/2009, 3rd ed.