An Intelligent Architecture

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Prologue You and I have, in all probability, grown up thinking of intelligence as a property possessed by human beings. We claim some have it to a greater and others to a lesser degree. We test for how much of it we each have, and even have a club for those with lots of it. We have, traditionally, talked of some animals as having it, with an astonishment akin to that of colonial adventurers discovering that native human animals may have it. More recently, we have talked of intelligence in computers: in principle and in practice. Now that computing is spilling out of the grey box and into our clothing, we talk of smart clothes, meaning we want also to think of them as being, in some way, intelligent. We talk a lot of intelligence.

At the same time, a contemporary characteristic is the inflation of terms. For instance, a typist becomes a secretary, and a secretary a Personal Assistant. The rubbish (trash) collector becomes a Garbage Disposal Engineer, Sanitation Controller, or some such.

Possibly the greatest offender of all in the inflation of terms is the computing and information industry. Here, a flattened monomedium becomes multi-media, a term used formerly suggesting not homogenisation but an increase in variety. What is simply action and reaction (possibly with a menu of [multiple] choices) is fobbed off as interaction. And a device which performs simple behavioural circus tricks has intelligence: no! Better than that, it has Artificial Intelligence (AI).

But if this is intelligence, what about our intelligence, as human beings? Is that not more than merely an ability to perform clever tricks? And if it is just that, why are and how can we be satisfied with a description based in trickery, and so limited?

When we come to discuss the intelligent building, are we happy to be limited to a notion based in trickery? And if not, what should we do about this?

On intelligence I will begin my argument with a discussion of intelligence, although I will not attempt an academic survey. Much of what has been written about intelligence seems to miss a crucial point, which is that intelligence is experienced, by us. Rather than summarising definitions of intelligence and arguing their shortcomings, I will write about how we experience intelligence, in order to examine the concept in what I hope will be a useful fashion. That is, I will go back to some of the assumptions under which we attempt to study intelligence, in order to look at them anew.

When I attempt to define intelligence, I am confronted by considerable problems. For instance, intelligence may be defined by or within a particular context. There are those who are remarkable in some special area, but generally incompetent. There are those whose intelligence is very hard to attach to anything, and, even more, to measure. And there is the strangeness of IQ testing, where what is tested is, at least in large part, the ability of the person being tested to pass the IQ test – which, however, entails only a particular range of tasks and certainly fails to recognise, even less measure, a large range of exemplifications of intelligence.

Rather than attempting to define, and thus either give a definition so wide it is scarcely useful, or so narrow it misses the point most of the time, I would like to propose a different approach: one that is both much more designerly, and also reflects how we appreciate intelligence in another. This is a recognition approach. You and I recognise intelligence when we come across it. (When we disagree, we can discuss this intelligently!) We learn about intelligence (accepting a constructivist approach, which has a certain psychological resonance) through generalising from individual instances we have observed: that is, we observe, we generalise (find pattern) and we create the concept of intelligence, which we then both modify as we go, and allow to determine whether various acts and behaviours we observe are intelligent or not.

Notice the two ways of using the concept we develop from generalisation; to include and exclude from a category, and to modify what may be included and excluded from the category by redefining the category. These uses involve a circularity in the form of dialogue or conversation: we will come to the importance of circularity later.

And now we can consider how we might determine the presence of intelligence. In his seminal paper 'Computing Machinery and Intelligence',[1] Alan Turing developed a way of considering the question of whether a computer is intelligent or not which removed the question from the world of the emotional (how awful!) and from argument over in principle questions (depending on initial, but always questionable,

definitions of intelligence) to a world of the practical. Turing's Test, as it is known, is based in the recognition of the quality intelligent by the observer. The set up of the Test, as Turing initially described it, involves some extra complications: my summary below is a simplification, although I believe it to be true to the spirit of Turing's original.

Consider the following situation:

You are in a room with a communication channel that might be used with equal facility by a computer and a human. You communicate via this facility with whatever is on the other end (which you cannot discover, or contact via any means other than this facility). In other words, you communicate with a conceptual Black Box.[2] Thinking that you are communicating with a fellow human, you consider that the behaviour is intelligent: or, finding the behaviour intelligent you assume you are communicating with a human. But somehow you discover that you were communicating with a machine.

Does this alter the (intelligent) behaviour? No.

So why should you alter your assessment of whether it is intelligent?

Turing's answer, with which I wholeheartedly agree, is that you should not. The behaviour is intelligent regardless of what enacted the behaviour, because you recognised the behaviour to be intelligent.

(For the record, Turing's Test was originally characterised by Turing as follows: 'An interrogator is connected by teleport to two correspondents, one of which is an human and the other a computer programmed to respond like a human. The interrogator then asks questions of each respondent, with a view to discovering which one is which.')

Where does intelligence lie?

The Turing Test is a very radical tool. On careful examination we discover it suggests a way of looking at the world implying that world is very different to how we normally believe it is![3] We will even discover that the world is not quite as the Turing Test assumes.

In the Turing Test, the observer interacts through what is thought of as an interface which we suppose to have something behind it with which the interaction takes place. As a result of this interaction, the observer at some point recognises that this supposed something is exhibiting intelligent behaviour.[4]

In other words, the observer comes to a conclusion, through interaction and recognition, that whatever is being interacted with has the quality of intelligence. Which means that the observer is attributing, as a result

of his interaction with the presumed something, the quality of intelligence to that something. Note that the quality is present through recognition and hence attribution, rather than being a property of (being owned by) that something: intelligence is not within the object, but is attributed to the object by an observer through recognition, according to this view.[5]

Think of what we do with (other) humans. We interact in a space between us which is the interface, the space allowing the interaction, as through two skins.[6] We think there is something inside these skins, though we do not normally check. Through this interaction, we determine whether the person is intelligent or not, and (often) whether intelligence is limited to a particular sort, or is more general. The analogy between how we interact with another person to determine whether or not they are intelligent, and the method of Turing's Test, is, I hope, clear.

Then, where does intelligence lie? Insofar as we recognise intelligence, it lies in the recognising (and the cognising, although this is no place in which to discuss their relationship). And that, in turn, lies in the observer, who attributes the quality to the observed (and, by the Law of Mutual Reciprocity, also to the observer himself).

And under what circumstances does the observer come to recognise the quality as present? When in interaction with the observed: intelligence lies between the observer and the observed, it is recognised in interaction, and is an attribute of the observer to the observed (and to the observer's self) that comes from the shared behaviour of their interaction.

Finally, what defines the roles of the observer and the observed? They are defined by convention. By the Law of Mutual Reciprocity, and in order for there to be interaction, both must be observers of the other, treated as observed.[7]

In effect, intelligence exists in a system in which each component is observer, to itself, and observed, to the other: in which each recognises intelligence in the behaviour of the other in an interaction, and attributes the quality to the other.

The behaviour of each, which, in interaction, gives rise to the recognition of the quality intelligence, takes place in the space between each: the space of interaction (the interface space) where each meet and can act.[8]

These behaviours come about in interaction. They do not, therefore, belong to one or the other participant. Thus, to write of 'attributing the

quality intelligent to the observed by the observer' is too simple an account: the attribution is to the shared behaviour (in this space between) to which each contributes. Intelligence is not in the (behavioural) action, or even the consequent reaction, but in the actions/reactions shared between the participants, and takes form as their interactive behaviour. Intelligence is shared: recognition of it may be single, or mutual.

Thus, when we pursue the argument Turing made about intelligence – and I have not yet found any other argument that really allows us to deal (in a manner reflecting how we experience it) with this centrally human concept which resists definition and is coloured by prejudice – in the new, extended, post-Turing understanding developed above, we find that intelligence is not what we thought, and that to look for intelligence in some object is pointless. We must look for intelligence between us, as observers, and what we observe, in the space in which we behave together, the space between, the interface.[9]

It is no wonder that the great gurus of Artificial Intelligence studies, in and since the 1960s, were dismissive of Turing's Test: for it renders their programme essentially meaningless. They could program clever tricks into the computer for it to perform, but they were not really approaching intelligence. Their dismissive handling of an alternative model suggests they understood its strengths, and the weakness of their own position, only too well. Perhaps Minsky's move to 'The Society of Mind' (1985) is a token of this?

On architecture and intelligence

For many, architecture means buildings. For the moment (and untypically) I will accept this assumption. Later, I will deal with architecture that is neither built nor intended to be built.

So how is it with buildings? Are the buildings we produce nowadays under the monicker 'intelligent' recognisable as intelligent, in the light of the argument above? If not, what's missing: what would be needed to introduce intelligence into buildings?

Currently, the intelligent building is understood as constituted of a pretty normal building equipped with a computational box of tricks which somehow responds to (usually human and environmental) behaviours impinging upon it. An example of this on a massive (and still, as far as I know, fictional) scale, can be found in Philip Kerr's book *Gridiron*.[10] I will return to this book below.

Probably the oldest example of this sort of building is a building with thermostatically controlled central heating (or cooling), where a simple sensor-switch working with a heat (or cooling) source and distribution system generally make a building much more pleasant to be in than it

would otherwise have been. But would this ever have been thought of as intelligent? Perhaps, when such behaviour still seemed wondrous, but not today, and not in the light of the above, post-Turing understanding.

Nowadays we see considerable extensions of such an arrangement as the thermostat, embodied in the environmentally sensitive building where, for instance, louvres react to the sun's angle in order to provide shade at all times: and we call such buildings intelligent. It is revealing to note that tracking the sun's position in order to act accordingly is a task of the same order as tracking the temperature in a room in order to decide whether to turn the heating on. Indeed, intelligence is frequently used to refer to the provision of services and devices that help sustain an acceptable environment within the building. Then we extend our notion to include lifts (elevators), which, through the use of fuzzy logic and models of probable use profiles can decide how to act in ways that surprise us and increase their effectiveness.

(It is worth noting that Lotfi Zadeh, the inventor of fuzziness, denies it is either true or intelligent, unlike many of his acolytes. Zadeh maintains it's a fudge that works reasonably for now – while we look into better and more refined ways of constructing descriptions.[11] The claim that fuzziness brings intelligence is not made by Zadeh.)

Buildings considered intelligent according to a generalisation of the above examples can hardly be considered intelligent within the framework provided by Turing's test and my extension of it to the post-Turing understanding. They perform tricks, but they do not give us anything that is remotely interactive, nor is there any meaningful sharing: simply a response to some stimulus in an action/reaction mode. There can be no attribution of the quality of intelligence here. The term intelligent used in relation to such buildings is another example of terminological inflation, and is a travesty.

Most of what we put into buildings that we then use to justify calling them intelligent are servicing devices. The intelligent internet fridge, which keeps a list of what you've got in stock, orders replacements, and suggests menus is a telling example. Of course, it might be very useful. It is probably closer to being interactive than the thermostat/heating system. But it scarcely verges on the truly interactive.[12]

The buildings and devices we currently have are nowhere near interactive, let alone intelligent. They are merely built to include clever tricks that allow them to react, often in ways designed to retain a static stability.[13]

On design and intelligence

Another way in which we might consider architecture is through the act of design. Whereas there are those, myself included, who do not accept that architecture and building are synonymous, or even nearly

so, there are few who do not believe that architecture is a consequence and maybe also constituted of design. To consider a less built architecture (and intelligence), I will consider design (and intelligence).

We can currently buy what we call intelligent CAD (Computer Aided Design) packages, and we find ways of using computers to generate and draw forms to be built which we also often refer to as intelligent.

Yet what is on offer is simply an extension of what we can do ourselves. There is nothing in the least interactive about any of these packages: they are slaves that do our bidding rather than – as is necessary for an interaction – partners that join with us in interaction. An intelligent intervention by a computer involved in the design of a building might be expected to give us something we had never previously anticipated in response to what we put forward, and then to develop some outcome with us, through a process of dialogue.

You might say that there are times that computers, when we use them to help us design, do this. There may be. But when they do it is more often through accident rather than intention. The intention in (almost) all such (CAD) systems is to improve on the designer's performance within the framework of the designer's wishes, of some design task, rather than to find a way of developing an 'own' position. I contrast this to my position: I want to know what the computer offers me on its own terms, when we share.

You might also say that this is a matter of development. It is certainly true that as computers get faster their ability to so vastly exceed human ability in certain respects means that they appear to be doing something that comes from them rather than us, because although we can conceive of and define the task, we cannot conceivably complete it. So in a sense it does come from the computer. But in a more profound sense, it does not. They are still performing according to our wish and task setting.

You might say, finally, that my criticisms contradict my delight in holding to the Turing Test. And in a sense you would be right. But I used, and then extended, the Turing Test for intelligence as a basis from which to develop a position. And it is the position consequent upon the Turing Test, when extended, that I am proposing. Behind the Turing Test there are insights. In defining his Test, Alan Turing works with assumptions (which I believe to have been unconsciously held by him and to have remained unexamined) far more revolutionary than I believe he himself saw: for him the test was essentially a pragmatic device to close down an undecidable and unproductive area of argument and dispute: indeed, it was subtitled an 'imitation game'. It is, however, the assumptions he made that, upon further examination, give us insight

into intelligence. And, while in the test as first stipulated, the appearance of intelligent behaviour to be just that (ie was to be taken to be intelligent behaviour) this assertion itself tells us something about intelligence which allows us to consider certain of its qualities in a more meaningful manner than is generally the case.

We will have intelligence in design with computers when we treat the computer seriously enough to learn to listen to what it might offer, rather than insisting that it do our bidding.

The question as to whether something is intelligent or not might be roughly resolved by asking whether the responses you get from it could have been placed in a menu of options to be chosen from beforehand. That this quick test would preclude much human action (multiple test exams, filling in official government and voting forms) is no bad thing.

Intelligence and the interface

The way we meet with computers, as much as with each other, is through an interface. We are by now well aware of this and it needs, I believe, no explanation.

When we meet each other, we do so in a manner that allows us to exchange and to 'leave space' for what the other offers to be placed in the arena of our meeting. We recognise this by and in referring to this space as being between us. We talk of what we share/hold/discover (etc.) between us. We recognise that the most powerful metaphor for interaction is a conversation held between two or more people.

Intelligence is, I have argued, a quality attributed by one to the other in an interaction. Intelligence requires interaction and is shared: it is found in the contribution of both participants and is held between them.

Current computer interfaces are, with few if any exception known to me, essentially non-interactive. By this I mean that they are presented (extending our architectural metaphor based in space) not with a space between, but as flat walls on and through which actions are carried out. We push buttons on panels, literally or metaphorically, whether we are being sensed (for instance moving) or are using that WIMP environment that once seemed so fresh and now seems so trivialisingly stifling. These permit action/reaction involvement, but exclude interaction, and hence intelligence: when there is no space for the computer to contribute there can be no interaction.

To support and develop intelligence in the relationship between computer and human, we need to rethink the interface so that it does not exclude interaction by removing the space between in which interaction can occur and, thus, intelligence may become. This applies to any partner we may wish to develop an intelligent relationship with.

We want intelligence in computers? Then we need an interface that will support rather than exclude it. We want intelligence in architecture (or in the buildings we embody architecture in)? Then we need an interface that will support rather than exclude it: and if we are relying on computers to provide the intelligence, to drive the building, then the interface with the computer will need to create a space between.

Fortunately, humans have developed interfaces that inherently and structurally support such possibilities. For us, intelligence is 'natural' – at least in the respect that our means of interacting are so structured that interaction, in the sense in which I have used it here, is preferred. If we want intelligence in the artefacts we produce, then we must at least give those artefacts the structures that will allow intelligence before we decide whether intelligence is a possibility or not. In this manner, intelligence depends on the interface of our interaction, and we have a big task at hand to design interfaces that generate, recognise and use the space between.[14]

Intelligent architecture

What, then, should we expect of the intelligent building?

It will not be characterised by reactive service systems no matter how sophisticated, nor by clever devices, although these may well be part of it.

Nor will it, in my estimation, do what we could do, but faster, bigger, smaller (ie better!).

What it will do is converse with us, offering us insights into our lives and to ways of living we would never have dreamed of ourselves. (It would not have dreamt of them by itself, either.)

That is to say, an intelligent architecture will join with us in a debate, the subject of which will be how we might live so we (the architecture and the inhabitant) gain effectiveness and delight in living (forging lives) together. The medium of discussion will be how the building is: its climate, its appearance, its spatial arrangements and volume. The form of the building, its spaces and our use of (habitation in) these spaces will be the expression of the conversation that will demonstrate the intelligence both of the architecture and of us.[15] It may reach a point where it appears to take a stable form (to stop) – but only for a moment!

When faced by another intelligence, we may look for confirmation of our intelligence. We are far more likely to gain that confirmation through being taken to be intelligent ourselves, than through fawning flattery. If we want an intelligent architecture we must look for an architecture, whether as building or as way of designing, that will allow

us be stretched, and will offer us its insights as we offer it ours. An intelligent architecture will treat us as intelligent – as we also treat it as intelligent.

Our involvement will demonstrate trust and respect for the intelligence of the architecture, rather than a need to determine and control it. We will accept the intelligence of the architecture as we already accept the essential intelligence of each other person.

Intelligent architecture will show us new ways of living that will be without precedent and will deeply surprise and delight us. It will do this by all sorts of means, including re-forming itself. But the more I specify these means, the less unprecedented they become, and so I shall cease. I don't know what intelligent architecture will do, but I'll recognise it as intelligent when I see it. And I know it will surprise me, which I will enjoy so long as I remain open-minded.

On fear of intelligence

Notions of our involvement with machines as partners, and of granting them rights and respecting their intelligence, always bring up fear. This fear has a long history, and has for long been played on by writers and, more recently, filmmakers. The Golem and other ghoulish reconstructed monsters made with the aid of machines and injected, other-than-natural-human intelligence (from, for instance, electric shocks) have a grand history and a devout following. The more recent development of the computer has pushed this fear, creating a quantum leap. The dangerous and ultimately evil computer, so well depicted by HAL in Stanley Kubrick's *2001: A Space Odyssey* (UK/USA 1968), should theoretically be kept in its place by Isaac Asimov's regulations, restricting computers (robots) to always support the human even at their own expense. Fears that these machines might run amok are evoked in films such as *The Terminator* series. In *Monolith*, the writer Philip Kerr has a building that is supposedly intelligent (though its intelligence shows mainly in service and security systems and would not be seen as intelligent in the terms developed here) which becomes belligerent and attacks its inhabitants, bringing the fear of the artificially intelligent into the realm of the building.

I find this fear strange and ill-founded. It stems, it seems to me, from a terror of not being in control, related to an inability to trust. The fear is that if we are not in control, we will be hurt.[16] The assumption is that whatever it is that we come to fear it is not benevolent. We now have this notion firmly inbuilt: for instance, we find this when we describe the world as a survival of the fittest, meaning the meanest. We believe that the world we live in is not benign or generous: instead, is threatening and will harm us, and we act accordingly. That's not what Darwin intended by the notion of 'fitness', and it is anyhow a result of confusing the description with what is described. This paper is not,

however, the place to pursue this line of argument. At least one reason we consider the world threatening is because we have developed descriptions and explanations couched in these terms, and, consequently, have built ourselves ways of thinking and behaving that are based in this description. The result is self-fulfilling prophesy.[17]

But the notion of intelligence, above, is different. It requires a level of collaboration: interaction cannot work without generosity and collaboration. If intelligence is shown in the space in between and is an attribution of an observer that is the result of interaction, there is no longer a basis for fear. Under these circumstances, intelligence is a benign and shared quality, not a threat. The notion of the greater machine intelligence, the fear of Frankenstein and of the building in *Gridiron*, no longer makes sense because intelligence is a gift in recognition of a quality in behaviour in interaction, from one to another. And it is assumed to be reciprocated: that is, to say you are intelligent I must be intelligent enough to recognise intelligence, and also I assume that the intelligence that I attribute to you, coming in and from interaction, is also mine.

In an interactive world of such mutual reciprocity, what we assume of others we assume also of ourselves.[18] When we enslave others, we enslave ourselves just as the brutaliser brutalises himself: and we behave without generosity, we plant seeds of bitterness and anger. When we act with generosity and an open mind, we give those qualities not only to ourselves, but also to those with whom we interact. Whether or not the behaviours of those we recognise as intelligent is benign or dangerous depends, in this view, on how we construct them, and how we behave.

In this I find myself for once almost in agreement with control engineer Kevin Warwick who, in a recent radio interview, talked about possible human responses to machine intelligence. He both denied that intelligence could be defined, and insisted we had no option but to collaborate. I think his reasons were more pragmatic and less powerful than those I give, but (speaking pragmatically) the result is much the same.

We neither have good reason to fear, nor good reason to act to engender fear. The question is not of the artificial, whether a manipulator of abstract symbols, or a building: it is of how we describe the world leading to restriction or to opening up. This is the challenge we face in discussing and developing an intelligent architecture.

Notes

1 Alan Turing, 'Computing Machinery and Intelligence', *Mind*, LIX, no. 23 (1950).

2 Ranulph Glanville, 'Inside Every White Box there are two Black Boxes trying to get out', *Behavioural Science*, 12, no. 1 (1982).

3 This can be seen as one point of origination of the constructivist position. See, for instance: E. von Glasersfeld, *The Construction of Knowledge* (Salinas CA: InterSystems Publications, 1987); E. von Glasersfeld, 'An Exposition of Constructivism: Why Some like it Radical', in R. Davis, C. Maher, and N. Noddings, *Constructivist Views on the Teaching and Learning of Mathematics* (Reston Va: National Council of Teachers of Mathematics, 1990), and in G. Klir, *Facets of Systems Science* (New York: Plenum Press, 1991).

4 This is a paraphrase of how the Black Box functions. See, for instance, Glanville (1982)

5 However, when I attribute a quality to myself, I am, in effect, claiming the quality I attribute as a property of me.

6 We have not needed to know the (physical) source and mechanism of intelligence to be able to recognise and act with it. We do not know the source and mechanism. We may never know them and, even believing we do know them, we are not dependant on this knowledge for our ability (already well developed) to work with intelligence.

7 The Principle or Law of Mutual Reciprocity states that, when I distinguish between myself and an other, the qualities I give to me must be potentially available to that other as the qualities I give to the other must be potentially available to me – notice the word 'potentially'! The basis for this assertion is found in: Ranulph Glanville, 'The Self and the Other: the Purpose of Distinction', in R. Trappl, *Cybernetics and Systems '90*, The Proceedings of the European Meeting on Cybernetics and Systems Research (Singapore: World Scientific, 1990).

8 Ranulph Glanville, 'Behind the Curtain', in *Consciousness Reframed I*, ed. Roy Ascott (Newport,:UWC-Newport, 1997)

9 The mechanism by which we can make the examination that allows us to come to the conclusion there is intelligence is the conversation. I shall not go into this here. The interested reader can look at Glanville's web contribution on Pask: Glanville, R., *Gordon Pask*, ISSS luminaries section, www.isss.org/lumPask/htm (1997).

10 Philip Kerr, *Gridiron*, (London: Chatto and Windus, 1995).

11 Lotfi Zadeh, personal communication (1996).

12 My doctoral student, Gillian Hunt, at CAiiA, University College of Wales in Newport, has made this argument in far greater depth that I ever will, although her work has not yet reached the conclusion of a doctoral thesis. G. Hunt, personal communication (1998).

13 Ranulph Glanville, 'Variety in Design', *Systems Research*, 11, no. 3 (1994).

14 Ranulph Glanville, 'Behind the Curtain', in *Consciousness Reframed I*, ed. Roy Ascott (Newport: UWC-Newport, 1997).

15 I believe that the reason I was invited to contribute to this volume is because the editor and I spent several hours together exploring these ideas, in Snowbird, Utah, USA, at the end of 1999. I would like to thank him not only for these and other discussions, but for the exact eking out of some of what I was hoping to say in this paper, so that I said it, and said it better.

16 I have argued extensively for the benefit of unmanageability and the loss of control. I do not want to repeat this here. Those interested may look, for instance, at R. Glanville, 'A Ship without a Rudder', in *Problems of Excavating Cybernetics and Systems*, eds. R. Glanville and G. de Zeeuw (Southsea: BKS+ 1994); R. Glanville, 'The Value of Being Unmanageable:

Value and Creativity in CyberSpace', (1997) in *Netzwerke: Kooperation in Arbeit, Wirtschaft und Verwaltung*, eds. H. Eichman, J. Hochgerner and J. Nahrada (Vienna: Falter Verlag, 2000); R. Glanville, 'Listen!', in *Proceedings of the Conference on Problems of Participation and Connection*, Amsterdam 1999, (in press 2001).

17 Which is not to assert there is nothing fearful, but rather that we make of what we confront what we will.

18 See Glanville (1990) and Ranulph Glanville, 'Control, Complexity, Conversation and Trust',in *Grenzen ökonomischen Denkens*, eds. Hans A Wuerthlich, Wolfgang Winter and Andreas Philipp (Wiesbaden: Gabler, 2001).