in which he studied at the moment we needed to find out the degree to which it related to his ideal. The statistics of doing this are a little intricate, but all that it amounts to is the comparison of the profile of rankings on the study-bedroom with the profile of rankings on the ideal. We took it that the more similar these profiles were the more satisfied students were with their study-bedroom. Figure 2.8 shows the scattergram for the relationship between the student’s spread scores calculated as described above, against degree of similarity of the two profiles just mentioned. It will be seen from this figure that as the student’s spread scores increase, that is, as his degree of ability to discriminate increases, so the variance between the students decreases. This idea is represented schematically by means of the triangle drawn over the points in Figure 2.8. The difference in variance between the top half and the bottom half of Figure 2.8 is significant at the 5% level when tested with an F test. The means for the two halves are not significantly different.

A feasible explanation for Figure 2.8 would seem to me to be along the following lines: the more able an individual is to discriminate between different aspects of the environment, the more likely he is to have a number of different ways of assessing the environment he inhabits at the moment. Consequently, when he makes a judgement about, say, his study-bedroom, he brings to bear many different viewpoints. This leads to his decision about the room being closer to the average for the population. On the other hand, a person with very low abilities to discriminate would only use one or two aspects on which to base his judgement and consequently would be more likely to have an extreme judgement than his more cognitively complex fellows. If this relationship was validated by future studies its value would be quite considerable in practical terms because it provides the possibility of selecting individuals whose response is more in accord with that of their peers, is more likely to be typical of the population at large and is probably more consistent or reliable than average. Our eventual hope is that we will be able to ‘objectively’ select individuals that will give us valid subjective responses and further that we will need fewer subjects. This relationship is probably of more value at present for theoretical reasons in that it is the beginning of an insight into the way in which people deal with the physical world. Subsequent studies have helped clarify the relationship between cognitive complexity and satisfaction with the physical environment. They have shown that in some cases the relationship is a linear one, such that more cognitively complex people are more satisfied with a particular aspect. They have also indicated that the building form itself possibly influences the level of complexity of the user with regard to responses to particular aspects of the environment.

Subjects or objects?
In conclusion, it can be said that an understanding of the interaction of people and buildings and a furthering of the various roles of the environmental scientist cannot be fostered by treating people solely as objects. Information concerning their own thoughts and feelings about the environment is essential whether the designer finds himself in an authoritarian or a democratic relationship with his client. Further, it can be suggested that architectural psychologists and designers should not be afraid of looking at clients and building users from an external viewpoint. This is the case particularly with regard to the selection of respondents.

3 Do we need a theory?
Terence R. Lee

Abstract: The requirements of a theory dealing with the relationships between people and buildings are presented. It is then proposed that objects are mentally coded in terms of where they are and that this coding leads to the formation of schemata or mental maps which relate things to places. Results of studies of mental maps of neighbourhoods, of distances people travel to shop and of the effects of the length of a child’s journey to school on his social adjustment are presented as evidence in favour of the mental map theory.

It is an intriguing paradox of environmental psychology that its main activity should be to study certain phenomena in the human psyche which bear a close resemblance to scientific theories and that in order to do so it needs to construct scientific theories.

The cerebral phenomena to which I refer are the extensive, organized structures of knowledge which each of us builds up during a lifetime about the locations of familiar objects in space. This spatial knowledge is like a theory because it is connected together with a large number of general unifying principles such as ‘here/there’; ‘north/south’; ‘up/down’; ‘port/starboard’ and an infinite number of proprioceptive connections represented by such knowledge as that eggs are frequently to be located in the vicinity of bacon, chimney pots on the top of buildings and beer in public houses. These connections, both general and particular, can be used to make predictions.

It is almost self-evident to me that we need a scientific theory about spatial orientation as it must be to that mythical man in the street that he needs to know where things are if he is to find his way about. The scientist with a theory can move about more rapidly reaching goals which serve as landmarks for future exploration. He can make predictions about unfamiliar areas and follow them through to discovery and confirmation. He does not get lost in the woods because of the inordinate number of trees. However, it is because some psychologists might be content to solve one problem (or make one journey?) at a time and in isolation that I am about to embark on this piece of advocacy.

It is addressed to environmentalists as distinct from architectural psychologists because in my view the emergent laws of the former will be inclusive of the latter. The most orderly delineation of the field would seem to comprise the changes wrought in human behaviour by man’s deliberate manipulation of his own environment.

You will have detected already that I shall be presenting a personal point of view. Indeed, there is not much to build
upon yet, although this should not be a reason for delaying a
start. There will, of course, be some who think that we should
establish the foundations of our specialism exclusively by
helping architects and planners to solve problems. There are
others who think that if we need a theory at all it should not
be about spatial orientation but about emotions and feelings,
mainly aesthetic. I hope to deal with these points of view and
others by developing the arguments in favour of the immediate
adoption of a theory and by proposing my own formulation as
a candidate. I am pessimistic about my chances of persuading
you to adopt my candidate but optimistic enough to hope that
you will at least want to groom one of your own.

The basic structure of theories
What are the basic requirements for a theory? First, we need
corcepts or constructs — the building blocks of the system.
These can be abstract, but they are useless unless they can be
linked to observables. We must be able to define the units in
the system by establishing a procedure for signifying their
presence that is agreeable to fellow observers and which gives
rise to common observation and measurement. Fortunately,
we should have very little trouble with this. Many of our
corcepts already have common agreement — such as 'door',
'house', 'corridor', etc. Others are more intangible, such as
'neighbour', 'community', etc. but I do not foresee too much
difficulty over definition especially if we use the operational
approach of defining concepts by the operations which are
performed to elicit them for observation. For example,
Festing et al. [17.1] for their classic study of the effects of
housing layout on friendships have defined 'friends' as those
ominated in reply to the question, 'who do you see most of
locally?' Mintz [15.1] in his experiment on the effect of
pleasing and ugly rooms on the moods of occupants has reffered
'food' to the degree of benevolence attributed by
subjects to a set of ambiguous photographs of faces.

We shall continue to be criticized by the non-scientists
who may aver that we have not caught the true essence of the
objects or conditions in these operational sets. We have to
reply that science proceeds usually by successive
approximations; not so much by encapsulating the supposed
'real world' every time but by carefully describing the
fragment it is contemplating for the moment in such a way
that future observers will not confuse it with something else.

Careful and systematic observation of the constructs will
reveal certain regularities in the ways they affect each other
and as we feel sure enough to specify these relationships we
can confirm our notions by intruding into the situation and
deliberately manipulating things to see if they respond as we
predicted. This method of proceeding is called, of course, the
experiment.

The next requirement for our theory is a set of
connections between the constructs to symbolize these
observations and this is where psychology is so poorly
served by comparison with other natural sciences. We do not yet
have an abstract calculus, a set of mathematical expressions that
connect one construct with another and enable us to make
deductions from within the system and then to verify them.
We have to rely for the most part on the use of our plain
day language for making general statements of
relationship or laws or for describing models. It is a widespread
but not inevitable convention within psychology to formulate
these connections between constructs in causal terms and to

emphasize mainly the direction towards mankind. In
environmental psychology this implies a theory about how the
physical environment impinges upon human behaviour.
The deterministic component in this approach seems for me to be
intrinsically inevitable but the direction in which we phrase
our theory is merely expedience. It is equally true, in other
words, that man influences the environment and that a
complete theory will ultimately represent this mutual
interaction in which the simple concept of causality is replaced
by one of progressive interdependence.

For the time being however, we should try to construct a
theory in which the inputs are aspects of the built
environment and the outputs are human behaviour and
feelings. The inputs, the outputs and the relationships between
them will be represented by symbols and these will form an
evolving edifice.

Is there a professional pay-off?
I must at once confess that I sympathize with an architect who
is looking for a quick decision on where to site a play space or
whether to build a tower or maisonettes and is handed an
evolving edifice of symbols. He will find it hard to believe that
the strategy I am advocating is in his best interests. It is easier
to argue that it is in the best interests of society for the
following reasons.

Firstly, if we deal with instances in isolation instead of
using them as examples which lead us to the discovery of
generalizations, we shall find that as soon as circumstances
change a little our explanations or the practices we have
recommended on the basis of them, will no longer apply and
we shall be quickly discredited.

Secondly, we shall be confronted ourselves with
apparently absurd contradictions and inconsistencies which
will be irreconcilable unless we look beyond single instances.

Thirdly, unless we continuously narrow and sharpen our
conceptual definitions we shall find that we are operating at a
level no higher than that of thumb. These only work some of
the time because the precise conditions are not specified.

Lastly, because unless we continuously ask why the facts
are as they appear to be, unless we push explanation further
and further back to establish new connections between
hitherto disparate constructs the process of accretion of useful
knowledge will be painfully slow.

Scientific theory building, then, is a strategy which will
work better in the long than in the short run but experience
has already shown that the cost benefit ratio is very high
indeed.

Let us now leave this rather abstract plane and consider
some aspects of the two professional groupings that are
involved in the proposed enterprise.

The psychologist has to remember his commitment to his
own profession, which requires him to bring every piece of
grit to the mill where his colleagues will coordinate it with
their own contributions. An outstanding example of this
dedication was Sigmund Freud. As a physician his first duty
was to his patient but he collated prodigious numbers of
clinical observations and continuously processed and
reprocessed them to form a theoretical framework, part of
which eventually synchronized with the work of others.

This will be a two-stage process of course. The
environmental psychologist has hardly begun to explore the
relevance to architecture and planning of a great deal of
psychological theory already in existence. In the field of
perception, particularly, the work of Bartlett [1,4], the
Gestaltists, Gibson [21,1], Neisser [1,5], Nelson [1,6] and
others contain much that can be readily applied. In the area of
attitudes and judgement the balance theories are highly
relevant and there is much in social psychological theory that
could help in understanding group reactions to architecture
and to devise techniques for participation in planning.

Turning to the architect, his greatest dilemma in this joint
enterprise is already familiar at a different level. He has long
been accustomed to making decisions which require him to
synthesize a multiplicity of conflicting variables. He has to
decide, for example, whether to have thick walls with good
soundproofing and minimum heat loss but high expense or
thin walls with more flexibility and less cost but poor
insulation compensated by higher heating costs. Many other
factors usually intrude such as the urgency of completion date,
local availability of materials, correlated texture finishes, the
anticipated noise environment and so on. When he begins, as
we hope he will, to consider variables of human behaviour, the
complexity will be as great or greater. Is it possible, he asks,
that the human sciences could ever give him sets of formulae
that will genuinely help? At present he is handed information
about one variable among dozens that are relevant but obscure
and he could be excused for saying that he might as well go on
trusting his 'intuition'.

The answer is twofold. The fact that theories are under
construction should modify his attitude so that he is more
likely to consider human-use variables and also, our aim should
be to improve his judgement by continually feeding him more
and better information from our theories until his processes of
decision making, though perhaps still subjectively experienced
as 'intuitive' are nonetheless more accurate.

Another and more profound professional question which
is at present exercising architects is concerned with their role
in society. Many of them appear to accept that the architect is
the servant of society whose duty it is merely to anticipate the
master's needs and cater to them. What kind of house, they
ask, will the man in the year 2000 demand? They also
acknowledge a duty to provide a choice of ways of life from
which the client can select. It follows from this approach that
a theory should be mainly directed towards predicting
consumer satisfaction and the observations on which it is built
will be gathered by asking people in questionnaires and surveys
what they would like to have or whether they like what they
have got.

This seems to me a very low level of operation. In the first
place, the method does not work well because people do not
know what they want when they have not experienced the
alternatives. This does not, of course, inhibit them from giving
an answer to a polite interviewer. Secondly, they have an
extraordinary capacity for adapting to what they have been
given and putting a cheerful face on it. The notion that there is
a large floating population of people who will move into the
optimum architectural environment as soon as it is provided as
unerringly as water finds its own level, is utterly false. It also
sounds highly uneconomic to the non-expert in such matters
because it seems to presuppose a continuous surplus over
requirement in built environment to allow for the continuing
flux.

My own view is that, while recognizing that people make
buildings, the architect should be professionally preoccupied
with the fact that buildings make people. The human
personality does not merely bud and bloom spontaneously and
gravitate towards an environment in which its natural
propensities can 'find expression'. The physical (though more
particularly the social) environment in which it finds itself
serves to shape and mould the developing personality.

Psychologists can help architects to appreciate the nature of
this interaction, but at present we are concerned with the
professional philosophy it entails. It means that the architect,
as a duly delegated agent of society, must be informed of the
direction in which society chooses to go and the human values
which it wishes to promote. He must then so manipulate the
built environment, making this choice rather than that in the
design process, in order that these human objectives are
achieved.

At present he cannot predict the consequences for human
behaviour and feelings of alternative design decisions and this
is the point at which the behavioural sciences should be able to
help him. There are perhaps three discernible ways in which
this can be done and they lie on a graded continuum of
desirability. The first might be called system analysis. It should
become a routine operation for every new building or plan to be
evaluated in use. We should be accumulating systematic
feedback data and processing this at a much higher and more
general level than that of the individual architect. It is difficult
to say who should pay for this operation, that is an
administrative problem, sufficient that everyone would benefit
and that in terms of human efficiency the cost should yield a
high dividend. The classification of this information would be
in terms of building type and it is encouraging that in respect
of several types, i.e., schools, hospitals and offices, the
machinery has already been set into motion.

The second way in which psychologists specifically can be
helpful is in making compatibility studies: investigations
directed to the establishment of a comfortable match between
the built environment and the needs, dimensions and
preferences of the human user. These are studies in which the
knowledge is likely to be organized mainly in terms of the
human senses, such as the receptors for noise, temperature,
iluminatlon, touch and smell. The theories here will transcend
types of building and types of people but will have to be
qualified by these variables. The methods employed involve
the use of experimental subjects as 'human meters' to use the
term employed by Professor Hopkinson. The orientation is
towards the establishment of various sensory thresholds which
have a practical application in establishing standards to serve as
guidelines or acceptable limits for practising architects.

Thirdly, there is the theoretical strategy which
incorporates the previous two but goes further in attempting
to establish connections between every kind of physical input
and human behaviour output, but with intervening or mediating
variables which help to organize the structure. It is
such a theory that I shall now attempt to describe.

A theory of socio-spatial schemata
We must begin with the assumption that man is an organism
that survives only if it interacts appropriately with the
environment. In fact, this interaction is what human behaviour
is about. The form it takes seems to rely only to a very small
extent on programmes that are built into the equipment at the
time of birth. This is in marked contrast to more primitive
organisms (with which environmental psychologists, beguiled
by ethnologists, are nonetheless reckless in drawing analogies) that rely on instincts that are triggered by environmental signals.

The human being has to learn two principal things about the environment. He has to learn the value to himself of different objects which he encounters and the location of these objects. The information comes to him through receptors tuned to the physical energy emissions of the objects but he is saved the inefficiency of constant exploration and discovery by having a huge capacity for storing the residue of past sensations. This storage mechanism of learning and remembering about the environment does not, however, take the simple form of a static accumulation of bits of knowledge heaped up in order of arrival. On the contrary, we seem to be equipped with a continuous sorting process in which fresh information is allocated to existing material of the same kind. It is dispatched to relevant departments and if necessary duplicated many times and sent to a variety of places. We thus each have unique bundles of information about different aspects of the environment and these are slowly and laboriously constructed in our central nervous system during the course of repeated actions and probably after the actions are terminated.

As children develop, these inner representations become more and more accessible to examination by the child in the absence of the external 'real' objects themselves. In other words, they form images or 'schemata' which are open to inspection at any time. They also serve the function of endowing meaning to fresh input which cannot be experienced in isolation from what is there already. In a true sense, then, the environment both natural, social, and built, becomes a unique representation in the nervous system of people who experience it. Once the process has begun, every new perception is an act of construction following referral and it always modifies the organism to some extent either then or later.

It is for this reason that most psychologists have long ago abandoned any attempt to construct one-step theories which go directly from environmental stimulus to human response. Mediating variables such as 'set', 'attitude', 'temperament' or 'schema' have to be built into the explanatory system.

However, what we have been describing so far is familiar enough, it is an attempt to account for the ways in which human beings learn to distinguish between objects in the environment — to know about their value or 'whateness'. Environmental psychologists need to concern themselves also, it seems to me, with the hitherto neglected aspect of 'whiteness'.

The necessary or desired objects are scattered about in the environment and separated by something we call space. Space is a non-object, it cannot be touched, poured, seen, heard, broken, bent or holed. It can only be experienced indirectly as an interval between objects just as time can only be experienced as an interval between events. The size of the interval must depend on our experiences of journeying between objects. These phenomena are so basic to existence in the environment that in addition to coding information about the 'whateness' of objects, we simultaneously code and store information about their 'whiteness'. It is virtually impossible to conceive of an object which does not have a correlated spatial tag.

Even objects such as grass which appear at first to be everywhere are coded as somewhere and we would be surprised to find it sprouting out of our breakfast table or growing on the roof of the car. We would be equally disturbed to find the moon sitting on the grass or a plate of sausage and mash caught in the branches of a tree. This is because although the 'whateness' of these objects is entirely familiar, they also have a 'whiteness' which has been thoroughly embedded in our brain and which governs our behaviour. Without this knowledge we could not locate objects and a large part of behaviour consists in making journeys within a range from arm's length to the space separating the earth from the moon. It is man's extraordinary capacity for navigation and mobility and the factors which determine it which should, in my opinion, form the basis for a theory of environmental psychology.

Every journey which he undertakes must invoke a more or less conscious deliberation similar to a profit and loss accounting. He has to consider the rewards of arriving at a goal (for which he refers to his whiteness schema) and the costs of travelling. The latter will include the regrettable consideration that if we navigate towards one object we cannot be simultaneously enjoying another if this is situated elsewhere. More obviously, however, we have to refer to our spatial schemata to appraise of the whereabouts of the object and how much energy will be needed in reaching it. It is this subjective or phenomenal calculation, based on a unique and personal perception of the world, that determines whether we move towards a goal.

Our next requirement is a plan. We have the capacity to evoke and examine long sequences of images. This is experienced (presumably because we have learned early on to make the real world stand still while we travel through it) as an impression of the self moving through a static image — although, of course, it must be that we are running a sequence past a window in consciousness and running it much faster than in direct behaviour. A simple test of this mechanism can be readily experienced by asking oneself how many road intersections there are between any two familiar points in a city. Sometimes the plan is very patchy and we begin to run off the behaviour itself in the confident hope that as we advance into the environment fresh input will revive more spatial schemata which will help us to complete the plan. The schemata, which can be consulted or ignored, sorted, ordered and conjoined are the raw material of imagination, thought, dreams and plans. Spatial schemata, like all others, are structures which become organized for particular purposes. We first develop a body schema, then establish succeeding layers, each inclusive of the preceding one and concerned, for example, with rooms, houses, streets, neighbourhoods, cities, countries, counties, the world, universe, etc. Put together, they are the space we inhabit and the images we select from in order to form a plan.

For the large majority of navigations, we merely refer to these schemata. Their very uniqueness does lead to difficulty, however, as soon as we need to co-ordinate our behaviour in space with other people who undoubtedly have somewhat different systems. This awkwardness is overcome by the development of large numbers of techniques designed not only to extend the range of accurate navigation but also to proceed by commonly shared standards. Thus we develop rulers, compasses, maps, plans, diagrams and so on which require us to take the further step in mental operation of converting
images into symbols. We can specify a location by a map reference or a compass bearing and describe a journey with a chain of words.

This "error" is removed in modern maps by the adoption of standardized measuring techniques for distance and direction. Even then, however, the external symbolization can only be used to create, revive or reinforce the internal schema – or to communicate it from one person to another. It cannot itself programme an action sequence, only a schema can do that. Moreover, the existence and indeed the use of an accurate map does not preclude a person from behaving in accordance with a subjective 'inaccurate' schema.

Probably the greatest advantages of symbolization are in storing a greater quantity of spatial information than can be carried by a single individual, in storing it more durably than the central nervous system and in providing a means of conjuring the schema of more than one person.

It is interesting to note that the many forms of map, plan and itinerary are no more than externalized representations or symbols of the internal schemata. They do not exist until they are made by man and there are two stages, the perceptual and the executive, at which distortion can occur.

If every individual develops through learning in the environment a repertoire of schemata which govern his mobility, these can be used as mediating variables in a theory. There must be lawful relationships between the physical environment and the types of schemata and a further set which link the schemata to behaviour. Since we are dealing with correlated bundles of stored perceptions, the number of connections need be much smaller than if we were dealing with piecemeal units. It is the discovery of such relationships which should concern us and this becomes quite feasible if we ask people to externalize their schemata by converting them into a drawing or a verbal description. These can then be compared with the physical environment in which they developed and the behaviour which they gave rise to.

The remainder of this paper will be devoted to a brief description of some applications of this approach.

Some applications of the theory

The urban neighbourhood: Perhaps the most contentious problem in post-war planning has been that of the urban neighbourhood unit. This is a concept which emerged as a reaction to the drab and anonymous uniformity of uncontrolled housing development in the thirties. The notion is not rigidly defined, but characteristically it is recommended that a 'socio-economically balanced' residential population of about 10,000 people be given a distinct identity by emphasizing the boundaries of an area with flanking main roads, green belts, etc. A school, a community centre and a shopping precinct should be at the focus of a radial network of residential roads. Many of the houses will be of the Radburn or path-access variety. Industry is to be sited at the edges of units. The aims are aesthetic, economic and, most important, social; i.e., to create a 'sense of community'.

The neighbourhood unit has a long history with a strong flavour of social idealism. It has been supported by many of the most eminent architects and planners and officially adopted for much post-war development including most of the early New Towns. There has, however, been a pervading air of doubt about the principle on the grounds that it is an outmoded 'village green' form of planning, more nostalgic than
real and wholly inappropriate for the supposedly highly mobile city dweller of the twentieth century.

The investigation (Lee [17.2]) was a limited attempt to evaluate the principle. The theoretical approach tried to circumvent a problem which has been troubling sociologists for some years, that is, whether the urban neighbourhood is a social group of mutually interdependent residents or a piece of urban territory. It did this by measuring neighbourhood in the place where it appears to be most salient, that is, in the minds of people. It was found that far from being a defunct phenomenon, its boundaries could be drawn on a map by a high proportion of the housewives who were interviewed, so strongly conscious were they of a section of their locality which was distinctive both in people and place.

When the maps were superimposed, however, there was almost no coincidence of boundaries, even for residents living close to one another. It appears that neighbourhood, though highly salient, is personally unique.

The next step was to analyse the causes of individual differences in a sample representative of the city. This was done by making a complete count of the houses, shops and amenity buildings in each neighbourhood and comparing this with a similar count for a standard physical environment, the half-mile radius drawn about the subject's house (Figure 3.1).

The area of neighbourhoods, though varying widely, is not related to density of population. People do not delineate an optimal number of local residents but a piece of individual territory (average size about 75-100 acres, i.e., about 30-40 hectares) and the number of residents follows from the prevailing density. The social and physical aspects of an individual schema are, however, inseparable. Certain people are included in neighbourliness awareness (not necessarily overt interaction) because they live within the selected territory, but the territory is extended or contracted to include or exclude selected people.

By expressing the size and complexity of the neighbourhood in quantitative terms, corrected for differences in the locality wherein it occurs, it was shown that there is a dimension of neighbourhood involvement which is related to other variables such as age, social class, length of residence, and the location of husband's work.

Brennan's Law: Another area which may be used to illustrate this general approach begins with shopping behaviour. Brennan postulated from a planning survey in Wolverhampton (Lee [17.3]) that housewives prefer to use shops in a downtown direction even when these are not the nearest.

'This observation of the deflection from the true geographical pole of the magnetic pole attracting people's custom is so important to town planners that one may perhaps be permitted to speak of Brennan's Law.' (Smith and Sargent Florence [17.4].)

The empirical finding was amply confirmed by some data I collected in Cambridge, which is shown in Figure 3.2. It will be seen that if housewives are divided into those whose nearest shopping sub-centre lies in a downtown direction and those whose sub-centre lies the other way, there is a substantial difference in shopping pattern. Usage is very high when proximity and direction are both positive, but when the two

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**Fig. 3.2** Data from 'Brennan's Law of shopping behaviour'. Percentage of people using different shopping locations for daily food shopping.
variables are put in opposition, direction appears to be more influential than proximity.

Brennan's explanation was that people's behaviour is not really violating the 'principle of least effort' – it is merely that the local shopping sub-centre is the place which they pass on their way to and from the town centre. However, I found that local and town centre journeys are only rarely combined and although this does not exclude a perceptual explanation it does imply that the subjective view of the city is not based on the frequency of overt behaviour. It is also unlikely to be due to the increasing scale and attractiveness of the sub-centres as one proceeds downtown, for in the present example the city had grown by the absorption of large villages on the periphery and these provide sub-centres of at least equal attractiveness.

It seems necessary to have recourse to a theory such as the socio-spatial schema with a subjective metric that is partially governed by the value attached to the objects within it. Thus, the satisfactions provided by the centre will impose a focal orientation on the city schema and a general foreshortening of all distances in a downtown direction. This deduction takes us well beyond shopping behaviour, which would appear as a special case of a general principle.

It was tested by presenting a sample of students with 22 assorted distance estimations to be made within the city of Dundee. They recorded each judgement separately on a linear scale marked off in one mile intervals and, of course, in random order. However, the destinations were selected in 11 pairs of roughly equal distance, but with one of each pair being an inward journey and the other an outward journey.

The results are shown in Figure 3.3. It appears that there is a general tendency operative. In almost all cases the outward journey is overestimated more than the inward and the effect is highly significant statistically.

A plausible alternative explanation was that the downtown journeys may be more complex, containing a greater variety of valued objects and hence interesting experiences and that this (to draw an analogy from findings in the related area of time-perception) may make the journeys subjectively shorter.

This was tested by comparing the estimations made within an experimental design that considered three variables – inward/outward; complex/simple; and towards/away from a single base. In this study, the inward/outward distinction was again shown to be significant. The other variables showed no effect on estimations but the number of journeys involved was small and the results must be considered tentative.

There is one further variable of the physical environment that apparently has some influence on the formation of spatial schemata of the city. This is the linearity of journeys. It is not yet possible to say whether this factor could be related to Brennan's Law but it certainly has applications to the design of both the inside and outside of buildings.

The hypothesis is that straight-line journeys appear shorter than multi-cornered ones and that the size of the effect is a function of the number of corners. It has not yet proved possible to test this in the field, but a simulation using lines has given positive results. The subjects were asked to manipulate an extensible line apparatus and to adjust it to equality with a series of presented diagrams. Lines of three lengths and with 0; 3; 5; 7 corners were used and the distance between starting point and destination was kept constant for each line length. The results, which are shown in Figure 3.4, indicate an overestimation of length which increases with number of corners.

The socio-spatial schema of rural infant children. My final example is drawn from an educational problem. For some years now rural education authorities have followed an administrative policy which involves the closure of small one- and two-teacher schools and the transportation of the displaced children to larger schools by bus or by an extended walking journey. There has been some misleading expressed about the effects of this policy on rural communities and on the children themselves. In the latter case, with which we are concerned, anxiety has centred on the possibility that children undertaking long journeys may be fatigued and possibly fractious on arriving at school.

The investigation (Lee [17.5]) was conducted in 57 rural schools in Devonshire and involved 883 children aged between 6-8 years. Measures were taken of the children's classroom adjustment in a series of assessments made by their teachers.

**Visual estimation of length as a function of number of corners**

<table>
<thead>
<tr>
<th>No. of Corners</th>
<th>Inward</th>
<th>Outward</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>10</td>
</tr>
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<td>5</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
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</tr>
</tbody>
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**Horizontal presentation**

- 6 inch
- 8 inch
- 10 inch

**Figure 3.3** Rank order of destination pairs by distance

**Figure 3.4** Visual estimation of length as a function of number of corners (Unpublished data)
These included such dimensions as 'ability to concentrate', 'aggressiveness', 'response to affection', etc., and when it was shown that eleven from a total of thirteen such traits indicated the same pattern, they were combined into a single 'index of adjustment'. This was then related to the length and type of journey undertaken by the children and it was found that for both bus and walking journeys the adjustment of the sample progressively deteriorates with duration. The most revealing finding, however, was that children who travel by bus are more affected, time for time, than those who walk (Figure 3.5). This, together with supporting evidence, effectively ruled out a fatigue explanation. The hypothesis that provides a better fit to the results is that children who walk to school have two familiar socio-spatial schemata, the home and the school, which are well connected with a causeway of well-known, articulated territory which they perceive themselves as capable of crossing at any time and on their own volition. Bus children, on the other hand, have two quite separate schemata divided by a 'no-man's-land' which they cannot traverse at all from the time the bus discharges them until about six hours later.

Enough has been said, I hope, to persuade you that a profitable way to advance knowledge and to facilitate predictions from the built environment towards human behaviour is to include as mediating variables the organized inner representations of physical and social relationships which I have labelled socio-spatial schemata. These are relatively easily available for observation either directly or by inference and they do seem to reduce disorder in data and to add organization to our theoretical ideas.

But my main plea is that we should be thinking seriously about some kind of theoretical framework for our rapidly developing field and not necessarily about any particular one.

W. R. G. Hillier

**Abstract:** The place of empirical work in architectural psychology is discussed. The dangers of carrying out such work without making the basic premises explicit are then described. Some of the basic premises and the problems associated with the artifact/people interaction are examined. Following from this a definition of environment as consisting of a physical system and an experience system and their interactions is proposed and the differences between these two systems explored. Finally, strategies for research and a programme for architectural psychology and presented.

**The place of empirical work**

I take it to be the aim of architectural psychology to understand the relations between built artifacts and people, or more precisely, to make progressively better approximations of the nature of these relations, which will show a progressively better correspondence with empirical findings.

I am concerned particularly with the theoretical premises, often unwritten, which always precede empirical work: premises about the nature, purpose and limits of the knowledge we wish to achieve, which will influence the direction of empirical work, its methodology, and its results; premises about the basic characteristics of the field of study, which can often be discussed logically prior to empirical work; premises about methodology; and premises about the relations between the scientist and the field he is studying.

With these aims in mind, this paper will deal with four interconnected themes: (a) the need to make all theoretical premises as explicit as possible so that they can be among the ideas tested by empirical work, and refuted if necessary; (b) the hidden premises which seem to lie behind much current work (which are never refuted because they are never made explicit), and why they do not always take sufficient account of; (c) certain problem characteristics of the field of built environment which may have a direct bearing on the limits of the knowledge we can achieve and also on the methods for obtaining it; and (d) a rough outline of what an alternative framework of theoretical premises might contain, bearing in mind these difficulties.

I would like to make it clear at the outset that I am not doubting the value of empirical work. The opposite is the case. But I am arguing that we should understand its place in the scheme of things and not confuse a recognition of the central place of empirical work in science with 'empiricism' as a philosophy of science.

**The need to make premises explicit**

The strongest argument in favour of the 'empiricist' approach to science (in which you start by collecting data rather than by developing a theory) is that if you start with a theory, you will, being human tend to get results that confirm rather than refute the theory. Its great attraction is that if science can establish that its theories originate in dispassionate observational data, then it can lay claim to objective truth, or something close to it. This basic claim to objectivity and truth is not dispelled by working in terms of probabilities, as most human scientists now do. Empiricism depends on the premise