Errata

Sid 31 - 46  referenser 1 - 19 skall vara referenser 99 - 117

Sid 44  rad 1 (cf pg ??) skall vara (cf pg 10)

Sid 49  referenser 1 - 3 skall vara referenser 118 - 120

Sid 99  Figure 1 text i övre högra rutan: '13 declined participation'

Sid 99  '-' text i nedre vänstra rutan: '5 unassessable'

Sid 99  '-' alla rutor skall förbindas med den vertikala linjen
CONSEQUENCES OF STROKE
Aspects of Impairments, Disabilities, and Life Satisfaction.
With special emphasis on Perception and on Occupational Therapy.

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som med vederbörligt tillstånd av Rektorsämbetet vid Umeå Universitet
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Birgitta Bemspång

Umeå 1987
CONSEQUENCES OF STROKE
Aspects of Impairments, Disabilities and Life Satisfaction.
With special emphasis on Perception and on Occupational Therapy

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ABSTRACT

Perceptual and motor functions and self-care ability after stroke were assessed within two weeks (n:109; mean age 69±10) and 4-6 years (n:75;70±9) after admission to a non-intensive care stroke unit. Sixty-two of the long-term stroke survivors reported on their life satisfaction (7 items) as experienced (in retrospect) before the stroke and at the time of the investigation. Perceptual functions and actual levels of life satisfaction were registered in 60 clinically healthy subjects aged about 60 or about 80 years.

Both early on and late after stroke the 16 items of perceptual function were clearly grouped into two factors, which neatly fitted an ecological perceptual concept. One factor characterized low-order and the other higher-order perception. Impairments of low-order perception occurred for about 10% of the patients, whether investigated early or late after stroke. No one among the reference populations had such impairments. Higher-order perceptual impairments prevailed in 60% early on and in 57% late after stroke and were often more pronounced than those occurring in the reference populations, among whom 35% of the 60 year olds and significantly more - 77% - of the 80 year olds had such impairments. Hence, perceptual impairments are common after stroke, but slight age-dependent reductions should be considered when higher-order perceptual function is assessed and treated after stroke.

Together with motor function, which was impaired in 52% of the early and 36% of the late stroke samples, higher-order perceptual function and to a limited extent low-order perception could predict the level of self-care ability in 70% and 62% of the early and late samples, respectively.

Whereas levels of global and of domain specific variables of life satisfaction were similar in the two reference populations, the stroke had lead to a reduction in life satisfaction for 61% of the long-term survivors. Reductions were particularly pronounced for global life satisfaction and for satisfaction with leisure and sexuality. Although significantly associated with motor impairment and self-care disability, these reductions could not be attributed only to impairments and disability.

The findings are discussed with particular reference to assessment and treatment in occupational therapy.

Key words: stroke, impairment, disability, life satisfaction, perception, hemiplegia, occupational therapy.
CONSEQUENCES OF STROKE
Aspects of Impairments, Disabilities and Life Satisfaction. With special emphasis on Perception and on Occupational Therapy

by

Birgitta Bernspång
The illustration on the front page, the "key of life" (or anch/ankh) is an ancient Egyptian symbol which, among many things, is regarded as a sign of life and health, and also as a key to the knowledge of mysteries. This key of life is the unifying symbol of the Swedish Occupational Therapy Association.

(Drawn by Ulrika Lindgren.)
To:

The Stroke Patients
ABSTRACT

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Key words: stroke, impairment, disability, life satisfaction, perception, hemiplegia, occupational therapy.
This thesis is based on the following papers, which will be referred to in the text by their roman numerals:

I: Eriksson, S., Bemspång, B. and Fugl-Meyer, A.R.
Perceptual and motor impairment within two weeks after stroke. A multifactorial statistical approach.
Accepted for publication in the Occupational Therapy Journal of Research.

Motor and perceptual impairments in acute stroke patients: Effects on self-care ability.
Stroke, 18: 1081-1086, 1987

III: Bemspång, B., Viitanen, M. and Eriksson, S.
Impairment of perceptual and motor functions. Their influence on self-care ability 4-6 year after stroke.
Submitted to the Occupational Therapy Journal of Research.

Perceptual function in the elderly and after stroke.
Submitted to the Scandinavian Journal of Caring Sciences.

Life Satisfaction in Long-Term Survivors After Stroke.
Scandinavian Journal of Rehabilitation Medicine, in press
INTRODUCTION

Stroke

Stroke is defined by the World Health Organisation (WHO) as 'rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent causes other than those of vascular origin'\(^1\) The distribution of different types of stroke can be seen in Figure 1. Regardless of the cause of brain lesion, the impairments are the same if the same area is damaged.

\[\text{Figure 1. The distribution of different types of stroke in patients at the Umeå Stroke Unit}^2.\]
The stroke incidence in a Swedish east-coast area fairly close to the Umeå district - Söderhamn, about 450 km south of our catchment area - is 2.9 per thousand population\(^3\). In the Umeå district 97\% of the stroke population are \(\geq 50\) years of age\(^2\). As illustrated in Figure 2 the estimated survival rate after stroke within the Umeå district is 77\% after three months, 69\% after one year and 37\% after five years\(^4\).

During the decade 1971-1981 the number of hospital days for stroke-patients in the Stockholm area doubled\(^5\). It is estimated that this patient-group now consumes more than 2 million hospital days annually in Sweden\(^2\).

![Life-table product](image)

**Figure 2.** Survival of the total CVD population admitted to the Umeå Stroke Unit during Jan 1978 to Dec 1982 (n=409) depicted with 95\% confidence intervals\(^4\).
Impairment, Disability, and Handicap

Those involved in health care particularly physicians, have long used the International Classification of Diseases (ICD,6) to classify any disease in numbers. The ICD is based on the following model:

etiology -> pathology -> manifestation

However, the model fails to reflect the full range of problems which lead people to make contact with a health care system. In other words, the consequences of an illness cannot be deduced7.

At least in the Scandinavian countries, where the languages are relatively poor in synonyms, the term handicap has generally been used to characterize these consequences. Hence, the word handicap has been used to designate problems within a multidimensional sphere, ranging from deficits at the organ-level to the possible financial problems created, per se, by those deficits.

In 1980 the WHO published a manual of classification relating to the consequences of disease; the International Classification of Impairments, Disabilities and Handicaps (ICIDH, 8). According to this manual an impairment is loss or abnormality of psychological, physiological or anatomical structure or function. Impairments, therefore reflect disturbances at the organ-level, while a disability is a restriction or lack of ability (resulting from impairment) to perform an activity in the manner or within the range considered
normal for a human being. Hence, disabilities reflect disturbances on the level of the person.

Whereas these definitions help to structure the consequences of disease, we have not used the numerical codes attached by the ICIDH to the categories of impairment and disability analyzed here. Moreover, while the definition of impairment is strictly adhered to, for reasons given below, the ICIDH definition of disability is not rigidly used.

The ICIDH is normative, built on a concept of illness, i.e. impairments, disabilities and handicaps are "objectively" assessed by the evaluator. Fugl-Meyer and Fugl-Meyer\textsuperscript{9} following studies of sexuality and leisure after stroke\textsuperscript{10} proposed an alternative model for rehabilitation based upon a concept of health. Their model (Figure 3) differs mainly in that a disability is a disability only as long as it precludes the pursuit of vital life goals.

Figure 3. A conceptual rehabilitation model of health and the consequences of disease, by Fugl-Meyer and Fugl-Meyer\textsuperscript{9}. 


The model indicates (left-hand side of diagram) that a healthy person has functions which enables her to act in order to satisfy vital goals. These sources of satisfaction are individual characteristics and the individual is the only one who can reliably report the actual level of satisfaction derived from these sources.

The stroke-victim may present signs of impairment which in turn may lead to disabilities, that must, however, be seen in the light of previous as well as possible new vital goals. If, for instance, through the endeavours of the occupational therapist or a rehabilitation collective, the permanently impaired subject can re-orientate herself to the achievement of new or modified wholly worthy, realizable and satisfiable life-goals she can regard herself and should be regarded by others as healthy. It is therefore of paramount importance to adequately identify and quantify not only the impairments and disabilities per se and their impact on each other, but also the values, interests and roles (cf11) of each subject. Only by doing this can a holistic rehabilitation program be successfully conducted. Thus, all categories of rehabilitation personnel, foremost perhaps the occupational therapists, by regarding the impacts of different impairments on each patients abilities to act should seek to mobilize the patients' resources for reaching optimal life satisfaction.

Impairments after Stroke

The bodily functions most often impaired by stroke may be divided into three groups10:
Wade, Langton Hewer, Skilbeck and David\textsuperscript{12} have presented a fairly comprehensive survey of impairments following stroke. In this dissertation the interest is mainly devoted to \textit{mobility} in terms of motor control and \textit{sensing} in terms of perceptual function. Impairments of cerebral integration are not analyzed except as selection criteria.

\textbf{Motor function}

Stroke patients have often been defined according to their motor impairment alone: 'hemiplegia'\textsuperscript{13, 14}, probably because their motor dysfunction is obvious and causes immediate problems. When impaired, due to stroke the motor behavior must be seen as de-sophisticated because the hierarchical control of motor function already described by Jackson\textsuperscript{15}, has been tampered with. Sensory stimuli and feed-back are incompletely interpreted by the central nervous system. This leads to more or less pronounced disturbances of the locomotor balance between postural muscular adaptation and purposeful selective contraction of one or a few muscles\textsuperscript{16}. 

\begin{itemize}
  \item * mobility: motor control joint function
  \item * sensing: exteroception proprioception perception
  \item * cerebral integration: cognition communication (aphasia) motor praxis (apraxia)
\end{itemize}
Motor dysfunction may range from manifest hemiplegia to slight dyscoordination. Various methods have been developed to measure this impairment\textsuperscript{17,18,19} also see \textsuperscript{12}. Motor impairment occurs in between 50-80\% of the acute stroke-cases according to the survey of the literature by Wade et al\textsuperscript{12}. This wide range may be a reflection of the adequacy of different measures. In a Swedish urbanized area Fugl-Meyer et al found that the incidence of first stroke with hemiplegia in the population under 66 years was 0.32/1000 inhabitants\textsuperscript{20}.

Petlund\textsuperscript{21}, in his study of prevalence and 'invalidity' from stroke in a Norwegian county, found the point-prevalence of stroke survivors to be 4.4/1000. Of these 61\% (2.7/1000) had residual (motor) impairment.

Unfortunately, the recovery of motor function has usually been studied only in selected series of patients. Most recovery takes place within 3-6 months after stroke. Some patients may, however, continue to improve their motor function even up to or more than one year after stroke\textsuperscript{20,22}.

Contracture (i.e. decreased passive range of joint motion) is fairly common after stroke with impaired motor control, and has been found to be closely associated with the level of motor control\textsuperscript{22}. The development of contracture is generally preceded by pain during passive or active motions. We have not been able to locate studies that correlate motor function to perceptual deficits and it is questionable whether the sensing impairments, extero- and proprioception, are associated with motor function. Thus some authors\textsuperscript{19,23,24} have found such correlations while others\textsuperscript{25} have
failed to find any association between sensory loss and motor function.

**Perceptual function**

There are two prevailing definitions of perception. The traditional concept has been described by many authors, among them Levine and Schefner\textsuperscript{26}:

"Perception refers to the way in which we interpret the information gathered (and processed) by the senses. In a word, we sense the presence of a stimulus, but we perceive what it is" (also see \textsuperscript{27}).

This concept is referred to as *indirect* as opposed to the *direct* 'ecological' theory of perception given by Gibson\textsuperscript{28}, who maintained that information is picked up rather than processed. As stated however by Bruce and Green\textsuperscript{29}, realism is the basis for both direct and indirect theories. Furthermore, both theories affirm that our contact with the real world is revealed to us by perception. Moreover, they agree that learning can influence the perceptual experience. The differences are primarily related to how we perceive the world. Traditional theory maintains that the world of objects and surfaces must be reconstructed by piecing together primitive elements, while in contrast the ecological direct approach states that we perceive directly the qualities of surfaces and objects. Further, the direct theory holds that perception is not mediated by either inference or problem solving. The ecological concept as modified by von Hofsten\textsuperscript{30} can be seen in Figure 4.
According to Gibson (1966)\textsuperscript{28} and followers\textsuperscript{30, 31}, perception is comprised of \textit{extraction} of information through the receptors. This extraction includes not only the receptor cells but also the motor function of the head, neck and the rotation of the body. For man to pick up information from the surroundings, these functions must be intact. The information that is picked up must resonate with \textit{internal representations} in order for man to understand what is perceived. Shepard\textsuperscript{31} described perception as a hierarchical \textit{resonance} with more simple \textbf{low level} and complex \textbf{higher level} modes. The low level perception is comprised of functions such as recognition of color, form or other attributes of objects. The higher level of
perception includes more complex and 'meaningful' objects and events in the environment. Shepard argues further that the higher levels do not need to react to the lower levels first but can react directly to the higher levels. The resonance initiates an action. Thus, according to Gibson and followers, perception also includes action. Neisser (pp112-113) instead of talking about stages or levels of processing, describes the processes as embedded rather than successive, characterizing the actions as hierarchically embedded in more extensive actions.

According to the ecological model, perception is controlled by thoughts, will, memory and emotions which guide our attention. If we cannot direct our attention we cannot perceive. The characteristic quality of perception compared to other mental activity is, again, that it is direct. The borderline between perception and cognition has, so far, not been defined, but immediate perception does not require cognition which is much slower. Immediacy is needed when acting on the environment, as the environment acts independently of us. Gibson and Shepard describe the perceptual process as necessary for the ability to act directly in the environment thus, a malfunctioning perceptual process must mean an inability to adapt and thus to function adequately in any activity.

Applying a symptom-oriented approach to perceptual impairments, several authors have demonstrated close correlations between perceptual functions and other aspects of sensing. For instance, Kaplan and Hier found a significant association between tactile extinction and figure-ground as well as the Rey-figure tests; and Smith et al between spatial disorientation and proprioception.
The causality between perceptual function, motor function and extero/proprioceptive functions is difficult to deduce. The peripheral sensing function is obviously a prerequisite for adequate perception. On the other hand, loss of perception in half the body must reasonably lead to a change in or loss of the experience of touch, pain, limb position and movement. Moreover, as illustrated in Figure 4 weakened motor control must result in a decreased orienting motor function possibly leading in turn to decreased perception.

During this century different perceptual impairments, not as obvious as the motor impairments, have been described following stroke. The prevailing symptom-oriented approaches have led to a wealth of terms to describe specific perceptual deficits\textsuperscript{34}. The neglect-symptom after stroke is probably the one best described\textsuperscript{35, 36, 37}. Following the symptom-oriented approach, Söderback and Normell\textsuperscript{38}, who adhere to the indirect concept of perception, recently listed different perceptual dysfunctions which occur in patients with acquired brain damage, together with symptoms of amnesia, aphasia and apraxia, a total of 18 symptoms. Their patients had between one and four of these symptoms. While it is very important for clinical reasons to identify different perceptual difficulties it also seems important to identify greater entities of perceptual functions/dysfunctions.

Syndrome-, rather than symptom-thinking, may prove important for identifying key-points in the perceptual process; key-points which may lead to improved treatment specifications, for instance in occupational therapy. However, few, if any clearly defined attempts
have been made to define perception or perceptual impairments in stroke-patients within a theoretical framework. This lack of a unifying concept is, or should be, frustrating to the clinician as few stroke patients present only one isolated perceptual impairment. One reason for this being that most cerebral infarctions (76% of strokes$^2$) circumscribe such large areas that the symptom-oriented approach, successfully used by Luria$^3$ when describing the consequences of penetrating brain injuries, is of limited general interest in stroke rehabilitation.

Neither rehabilitation nor, more specifically, occupational therapy appear to be well described in patients with perceptual impairments due to stroke; and most reports deal with selected samples in terms of population, lesion site and/or symptoms. Gordon et al$^4$ described a symptomatic typology of perceptual deficits in patients with right brain damage. According to these authors, the basis for treatment programs should be a three-step hierarchical approach beginning with the more basic scanning functions in order, thereafter, to train sensory awareness and spatial organisation, and proceeding thirdly to treatment of more complex visuoperceptual skills. These authors and Lincoln et al$^5$ could not, however, demonstrate any long-lasting significant effect of their perceptual retraining programs as related to 'spontaneous' perceptual recovery. But both samples were highly selected. Hier et al$^6$ described perceptual recovery in right hemisphere stroke in relation to lesion size and locus of lesion. They found recovery was better for smaller lesions and if "tissue near the main locus of injury" was spared.
Finally, some of these perceptual deficits encompass an inability on the part of the patient to be aware of the deficits. This is a well-known difficulty in the treatment of perceptual impairments after stroke. Such patients are often mistakenly thought to be demented or to have little insight into their disease or they may be thought to have resorted to psychological denial.

**Disabilities after Stroke**

As stated above (page 9) disabilities are restrictions on, or the lack of, the ability to perform an activity. They reflect disturbances on the level of the person. Disabilities must be seen not only in relation to the activities the patient employed before the disease (stroke) to achieve vital, satisfactory goals, but also to the vital and realizable goals she can set now, that she is impaired. Disabilities are manifold (see for instance ICIDH). They may constitute restrictions on survival roles: i.e. self-care maintenance or on leisure, occupation etc. But they may also be of a psychological nature such as restrictions on inter-personal understanding and communication. This concept is in general agreement with the ideas of occupational therapy theoreticians (Kielhofner, Reed).

The main focus of occupational therapy in stroke is usually on mobilizing the stroke-victim's own resources to act. In this context it is worth noting that the occupational therapist Borg has said that physical therapy generally focuses on treatment of impairments while occupational therapy is primarily concerned with disabilities.

An obvious goal for most "healthy" people is to be able to manage the simple chores of daily self-care (self-care ADL - activities of
daily living) i.e. to be independent in terms of personal hygiene, dressing and feeding. Evaluation and treatment of self-care ADL have for many years been the hallmark of occupational therapy. Proficiency in self-care is therefore used in the studies presented here as a reasonable measure of disability.

Many ADL-indexes have been developed according to different principles (for references see 12, 46, 47). In stroke patients Gresham et al48 compared three widely used indexes for stroke; the Katz Index of ADL, the Barthel Index and the Kenny Self-Care Evaluation. A positive agreement was found between all three indexes.

There are few valid reports on the incidence of self-care disability after stroke. Among 404 immediate survivors of stroke, Marquardsen49, after excluding the 5% who died within two months, found that 50% were fully independent in self-care ADL when discharged from a department of neurology. It seems that there are just as few epidemiologically anchored investigations on both the recovery and the prevalence of ADL-disability after stroke. In his prevalence-study Petlund21 found that 49% were dependent as regards self-care ADL. This is in agreement with Carroll50, who demonstrated that 50% of long-term survivors of stroke, were independent as regards self-care ADL, and with findings in Gothenburg, Sweden where 58% of all survivors of first stroke with hemi-motor-deficit younger then 66 at the time of stroke, had some minimal reduction in self-care ADL-capacity20.

In 162 patients with stroke admitted to a department of rehabilitation, Skilbeck et al51 found that the self-care ADL-
capacity (Barthel scores) improved significantly during the first 3 months after the stroke. After that, only a few, initially severely disabled subjects showed further improvements. Among one-year stroke survivors Andrews et al\textsuperscript{52} found that only 6.5\% showed further recovery between 6-12 months after stroke. Several authors have found close associations between impairments and the ability to manage self-care ADL. Thus, disturbances in motor-control are closely correlated with ADL disability\textsuperscript{53, 54}. Furthermore, both contracture and joint pain have been demonstrated to be closely related to proficiency in managing self-care ADL\textsuperscript{54}, probably due to the influence of the motor impairment per se on these impairments. Perceptual dysfunctions have been found to influence the recovery in terms of independence after stroke\textsuperscript{55, 56, 57}. Lehmann and collaborators\textsuperscript{58} found that patients with intellectual/perceptual deficits were less likely to gain from rehabilitation, but obviously they should not be denied rehabilitative care.

It is generally considered important to start treatment early after stroke to optimize recovery of self-care ability\textsuperscript{59}. The positive effect of an acute care stroke unit has been measured in terms of ADL-function in the discharged patients\textsuperscript{60}. Wade et al\textsuperscript{12} discussed the problems involved in comparing different studies measuring ADL using different indexes, and gave examples of recovery in terms of independence in ADL, mostly within one year after stroke.

As is the case for perceptual deficits after stroke, most studies of disabilities are conducted for selected samples of strokes. Another problem is that most studies describe the impact of only one impairment on self-care ability\textsuperscript{61}. It is important to estimate the
relative positions of the different impairments in relation to the self-care ability.

**Life satisfaction**

Over the last quarter of a century measurements of the quality of life have become increasingly popular to describe the holistic as opposed to the biomechanistic goals of medical care. Many different approaches and theoretical models have been used. (For general overviews see Kajandi\textsuperscript{62}, who favours the four-dimensional model of Naess\textsuperscript{63} and Schuessler and Fisher\textsuperscript{64} who categorize quality of life into one general "global" and several domain specific items). From the rehabilitation sphere Stensman\textsuperscript{65} has also provided a valuable survey of some pertinent literature on this subject. In agreement with Schuessler and Fisher he used quality of life synonymously with life satisfaction.

The human being is a social being. Any disease affecting her, also affects her social life, and stroke is no exception; but we know of only a few studies of the quality of life/life satisfaction in the post-stroke population. For many reasons given above a person's ability to act and to participate in life are often afflicted. The psycho-social situation is nearly always affected after stroke for both the patients and the relatives, as has been discussed by several authors\textsuperscript{10, 66, 67, 68}. Sjögren demonstrated that younger first stroke hemiplegic or hemiparetic subjects reported decreases in satisfaction with leisure\textsuperscript{69} and with sexual life\textsuperscript{70} to a great extent. The decreases were closely paralleled with decreased activity in these respects. Ahlsiö et al\textsuperscript{71} found that global life satisfaction was decreased for 77\% of patients.
with a consequent reduction in quality of and satisfaction with life. But they also showed that some patients reported a better quality of life after the stroke than before. Najman and Levine\textsuperscript{72} emphasized the problems of constructing objective measures for quality of life, and in agreement with the conceptual model underlying this dissertation, stressed the importance of a self-reported quality of life.

**Occupational therapy**

An overview of the history of occupational therapy has been given by Bing, 1980\textsuperscript{73}. The following is a short summary of some major steps in the history of occupational therapy.

Throughout the history of man people have been aware of the importance of being occupied (see for instance Karlsson\textsuperscript{74}). The opinion that man is a unique responsible being has been a common point made through the ages. This was particularly pronounced under the age of enlightenment in the 18th century, when even the mentally ill were seen as beings with needs and resources. The French psychiatrist Pinel and the English Quaker Tuke\textsuperscript{75} were pioneers who strove to develop a meaningful existence for the people in the mental hospitals. This concept was labelled Moral Treatment and was a reform rather than a method\textsuperscript{76}. The basic idea was that sick people should engage in regular daily occupations with a balance between work, recreation and rest. The movement was spread to the USA primarily by the Quakers. Rush, the father of the American psychiatry, according to Bing, was strongly influenced by the
movement. He maintained that man by nature is an active being and
differentiated between goal-directed activity and aimless training. 

Occupational therapy evolved out of the moral treatment movement, as an independent profession, at the beginning of the 20th century. The term "Occupational Therapy" was first used at a rehabilitation center founded in 1915 by the tuberculous architect Barton. He coined the phrase "If there is an occupational disease, why not occupational therapy?". 

The strong influence of the natural sciences up until the middle of the 20th century meant a displacement towards a reductionistic scientific approach even in occupational therapy. However, the last three decades have seen a return to the original holistic ideas. Thus, at the beginning of the 1960s Reilly declared that the main principle of these ideas is "that man, through the use of his hands as they are energized by mind and will, can influence the state of his own health". She introduced the concept occupational behavior which was later defined by her follower Kielhofner as 'activity in which persons engage during most of their waking time; it includes activities that are playful, restful, serious and productive'. The holistic approach has resulted in the development of several theoretical models (cf Reed) which all describe occupational therapy but do not necessarily agree with each other. Kielhofner and coworkers have further developed Reilly's ideas about man in relation to work and activity using a system-theoretical framework.
It thus appears that in general there is good agreement between the model of the rehabilitation process previously described\textsuperscript{9} and the more specific occupational therapy models discussed above.

The occupational therapy model developed by Reed\textsuperscript{80} seems to be particularly applicable to Gibson's perceptual theory \textsuperscript{28}. One of the main features in Gibson's theory is the \textit{attention} needed to pick out the information from the environment. Likewise, Reed explains the importance of picking out the right occupation, with cooperation from the patient, that which best fits the patient's needs, interests and \textit{best maintains or gains attention}.

The consequences of stroke have probably been treated by occupational therapists whenever the profession has dealt with people other than the mentally ill, focusing mainly on the ability/disability after stroke. As in most health care professions detailed evaluations are the basis upon which the occupational therapist can design adequate treatment-programs. At this point it should however be pointed out that whereas assessments using scores and scales must be considered important, observations of the individual's interactions in relation to her resources within her total (ecological) situation are of immense value. This type of observation is often difficult to formalize schematically, but probably constitutes a major task within occupational therapy evaluations. Moreover the vital goals, values, interests, and roles of each patient should be familiar to the rehabilitation collective.

Treatment has often concentrated on the very obvious, i.e. the retraining of motor function and regaining abilities lost because of hemiplegia. Most occupational and physical therapists working
within the framework of holistic rehabilitation teams have long used basically identical methods when treating motor disturbances. Various methods based on neurophysiological concepts aimed at advancing motor recovery after stroke with hemiplegia/hemiparesis have been developed\textsuperscript{17, 18, 85, 86, 87}. Most of these methods have been developed empirically by physical therapists and physicians but have been used by both occupational and physical therapists. Even biofeedback is quite widely used with stroke\textsuperscript{88}. Interestingly a recent comparative study of integrated behavioral and physical therapy, using biofeedback vs treatment based on the Bobath concept failed to demonstrate the superiority of one therapy over the other\textsuperscript{89}. Even slot-machines have been tried as a means of regaining motor control and have, in fact, been reported to result in better rehabilitation progress. Fine motor coordination was the variable affected the most\textsuperscript{90}. It is of outmost importance when treating motor impairment as related to abilities/disabilities that there is consensus on the principles and praxis of treatment methods. Nowadays occupational therapy generally is actively concerned with the assessment and training of apraxia (a facet of cerebral integration). Cognition and aphasia are also dealt with, among others by occupational therapists (cf\textsuperscript{38, 91}). In Sweden the involvement of occupational therapists in the treatment of aphasia is due to some extent to the lack of qualified speech-pathologists.

Perceptual impairments have been extensively assessed and treated by occupational therapists during the last few decades \textsuperscript{38, 91, 92}. The increasing attention paid to perceptual problems may best be explained by the understanding of the interplay between perception
and action (see pg 15). The lack of a practically applicable concept of perception seems to have led to a certain lack of assessment and treatment rationales. An analogous situation in terms of treating motor impairment would be training the wrist function after stroke without regard to the total motor function or even the motor function of the shoulder, elbow and fingers.

AIMS OF THE STUDY

The aims of the present studies were:

- to describe in stroke patients - capable of cooperating, treated at a stroke unit - prevalence of motor- and perceptual impairments and of self-care disability during the first two weeks after stroke and in long-term stroke survivors

- to explore whether an ecological concept of perception can adequately be used for defining perceptual impairments and their influences on self-care ability after stroke

- to characterize level of life-satisfaction in long-term stroke survivors and to relate the level of different parameters of life satisfaction to motor impairment and to self-care disability

- to relate the findings to occupational therapy praxis
SUBJECTS

In January 1978, a stroke unit was established at the Department of Internal Medicine at the University Hospital in Umeå. This non-intensive Stroke Unit admits about one representative third of the hospitalized stroke population in the district which has about 116,000 inhabitants, evenly distributed as to gender.

Figure 5. A map of Sweden showing the Umeå district.

Papers I and II

Every patient admitted to the Stroke Unit during a 3-year period was considered for the study. The six-bed Stroke Unit admits
patients with an acute cerebrovascular disease, excluding subarachnoidal hemorrhage, directly from the emergency room. The hospital is the only one in the district which treats patients with acute stroke. The method used for patient allocation results in a sample that is representative of all those admitted for acute stroke in the hospital catchment area. This applies to age and sex distributions, severity of neurological deficits on admission and prevalence of concomitant disorders\textsuperscript{58,94}. All patients in the Stroke Unit were subjected to a structured program of evaluation, nursing, medical treatment, and early activation\textsuperscript{93}. Diagnostic procedures include a computerized tomography scan for each patient.

Originally 267 patients admitted to the unit during the period September 1978 - September 1981 were considered for inclusion. After exclusions for various reasons 109 patients remained. As motor and perceptual assessments require patient cooperation, a number of individuals were not assessable because of aphasia and/or confusion. Patients who had already participated in the study were not included again if readmitted to the Stroke Unit. Mean age ± SD was 69±10 years. As a result of the eligibility criteria, impaired consciousness on admission to the Stroke Unit was less common in patients included in the study than in the total stroke population.

**Papers III and V**

Patients:

All surviving subjects admitted to the Stroke Unit during the period January 1978-September 1981 were investigated from January through April 1985. Hence, the investigations considered
inclusion of patients who had survived 4-6 years after stroke. Because of the eligibility criteria which in paper III demanded valid communication, vision and fulfilled assessments, and in V verbal communication, there was a slight difference between the populations in the two studies. There were 75 patients in study III and 62 patients in V.

Reference subjects:

Sixty subjects shown to be clinically healthy by case history and medical examination, volunteered to participate in investigations of perceptual functions and life satisfaction. Thirty-four were between 60-61 years and 26 between 78-81 years old.

**Paper IV**

In this investigation the respondents in studies I, II and III were included together with the reference population from study V.

**METHODS**

**Impairments**

Motor function were assessed in Papers I, II, III, and V using a stroke specific test developed by Fugl-Meyer et al\textsuperscript{19}, based on the motor development concepts described by Twitchell\textsuperscript{13}. The Brunnstrom method\textsuperscript{85} for assessing and treating the stroke-patient according to the level of motor function was used in the development of this numerical scale. The test has been found to be valid and reliable\textsuperscript{95, 96, 97, 98}.  

30
Perceptual function was evaluated in Papers I, II, III, and IV with a screening tool modified from a method developed in Israel\(^1\). It has been translated and quite extensively modified to suit Swedish conditions. It is suitable for 'bed-side' use in order to meet clinical needs for evaluation in the acute stage. During the time between studies I - II and studies III - V the assessment was supplemented to further clarify some of the perceptual functions/ dysfunctions which occur after stroke. The changes aimed at increasing the number of variables, assessing visual perception (i.e. figure-ground, object-constancy) and visuo-motor functions (i.e. block-designs, matchstick constructions, copying geometric designs), in order to obtain more detailed information about disturbances within these fields.

The two versions are described in detail in Appendices A and B. However, in study IV only those variables assessed on both occasions were used.

Two different aspects of cognitive function were assessed. **Orientation in time and space** were evaluated in study II and used in the calculations of factors influencing the self-care ability. For details see Appendix C. As a selection criterion the cognitive ability of the reference population (studies IV, V) and for the patients in study III-V the test developed by Folstein et al 'the Mini Mental State'\(^2\) were used. The scoring ranges from 0-30. Subjects scoring < 23 (indicating possible dementia) were excluded.

The occurrence of **depression**, which may be an impairment but also - as a reaction - may constitute a disability\(^9\), was screened in the
long-term survivors after stroke using a method described by Montgomery and Åsberg\(^3\). Scores $\geq 32$ were taken as an indication of depression/depressive reactions (scale range 0-60).

Disability

**Self-care ability** was measured in studies I - V with an assessment developed for stroke patients and of direct clinical value to the occupational therapists\(^5\). Each of 20 items are expressed in terms of "can and does". Other widely used indexes measuring ADL (4 and 5) are more suitable for gauging the caring-load of the ward but give too little information of practical value to an occupational therapist. Activities assessed were personal hygiene, dressing and feeding. For details see Appendix D.

Life satisfaction

Social well-being was measured as life satisfaction using the majority of an instrument recently described\(^6\). The items are shown in Appendix E. In the patients, the instrument identified the self-reported global (one item) and domain specific (6 items) life satisfaction prior to the stroke (as reported in retrospect) and at the time of the investigation. Thus, changes could be calculated. In the reference population only actual life satisfaction was explored during the structured interview.

**STATISTICS**

In I-IV the statistical analyses were aimed at constructing factors representing perceptual and motor functions in the material. The
factors were found with factor analyses based on Pearson correlation coefficients (I - III) and with sum of original scores (II, IV). The scores from factor analyses were then used in multivariate regression analyses to explain the variation in self-care ability, and the sum of scores in discriminant analyses when analyzing the trichotomized self-care ability. To evaluate covariations between pairs of data, simple crosstabulations ($\chi^2$-tests) were applied (V). Calculations were made with the Statistical Package for the Social Sciences (SPSS)$^7$ and with SYSTAT®$^8$.

RESULTS

Impairments, acute phase I, II, and IV

The occurrence of motor and perceptual impairments is shown in Table 1. Less than half the patients were without motor dysfunction (48%), another 14% had only slight dyscoordination and 38% had either hemiplegia or hemiparesis. Among the perceptual items assessed, scores lower than maximum occurred for as few as 5% and up to 40% of the patients and 39% had full scores on each variable. The lowest prevalences of dysfunctions were found in variables demanding only visual perception.

Factor analyses produced three factors explaining 73% of the variance of the dataset. Two of these were orthogonal perceptual factors. In terms of ecological perception (cf above) one characterized aspects of visual 'low level' perceptual function (10% scored less than maximum), the other factor characterized aspects of visuo-motor function or 'higher level' perceptual function (60%
scored less than maximum). The third factor incorporated only one variable: motor function.

Orientation in time and space was not included in the factor analysis. Scores of less than maximum indicating impairment in this aspect occurred in 13%.

Table 1. Frequencies of perceptual and motor impairments, and of self-care disability in stroke initially and 4-6 years after stroke.

<table>
<thead>
<tr>
<th></th>
<th>initially</th>
<th>4-6 years after stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemiplegia/hemiparesis</td>
<td>52</td>
<td>36</td>
</tr>
<tr>
<td>Low-order perception</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Higher-order perception</td>
<td>60</td>
<td>57</td>
</tr>
<tr>
<td>Orientation in time and space</td>
<td>13*</td>
<td>*</td>
</tr>
<tr>
<td>Self-Care disability</td>
<td>45</td>
<td>32</td>
</tr>
</tbody>
</table>

* not investigated

Impairments, 4-6 years after stroke, III, IV, and V.

In this sample 9% had slight dyscoordination and 27% had hemiplegia/hemiparesis (cf Table 1). Scores lower than the maximum for the different perceptual items varied in a manner very similar to that observed at the acute stage. Factor analysis confirmed the finding of three - one motor and two perceptual - principle factors found in the acute phase which explained 88% of the variance of impairment. However and possibly due to expansion and modification of the assessment tool (cf Appendix B) variables meant to characterize figure-ground and object constancy were now contained within the low-order perceptual factor. The relative
occurrence of impairments within the three different factors lower than maximum is shown above, in Table 1.

Disability

In the early stage after stroke (I and II) slightly more than half of the population were independent in self-care, while 21% were partly dependent and 24% dependent. The corresponding figures 4-6 years after stroke (III) were 32% dependent, of these 11% were partly dependent. Due to the slightly different selection criteria in study III and V, 39% of the patients in V were dependent.

Linear regression analyses using the three individual factor scores were applied to calculate the effect of perceptual and motor function on self-care ADL. At the early stage after stroke the model explained 58% of the self-care scores actually obtained. The two most important regressors were motor function and higher-order perception, which both had a significant (p <0.0001) predictive effect on self-care ADL, while that of low-order perception was not significant.

A regression analysis in the 4-6 year study, identical in principal, explained 71% of the variance in self-care ADL scores. At this time the t-test showed significant predictive effects on self-care ADL (p <0.01) for all three impairment factors.

In order to facilitate the use of the tool described for assessment of perception for the clinician, two ad hoc indexes were computed. One characterizing low-order perception (scoring range 0-14) and the other characterizing higher-order perception (scoring range 0-18). In discriminant analyses (II) these indexes were used dichotomized
into: maximum score vs less than maximum score. These analyses also incorporated motor function dichotomized into hemiplegia/hemiparesis vs slight dyscoordination. In one of the two analyses orientation in time and space was also incorporated, dichotomized in a manner similar to that given above for perceptual indexes.

The analyses correctly predicted 70% of the level of self-care ability mainly by motor function and higher-order perception. However, only a few partially dependent patients were correctly classified. Low-order perception and orientation in time and space were closely correlated ($r = 0.60$) and appeared to be of little and interchangeable importance.

As in Paper IV clinically healthy elderly subjects may have slight perceptual impairments a discriminant analysis was repeated dichotomizing the higher-order perceptual index into $\leq 17$ vs $\geq 16$. This analysis gave the same principal results correctly predicting 62% of the level of self-care ability. However, the predictive power of the higher-order perception now increased considerably.

**Perceptual dysfunctions in stroke and healthy adults, IV**

Using the two perceptual indexes from I and III the clinically healthy subjects invariably had no impairment on the low-order index. Slight impairments occurred on the higher-order index in 35% of 60-year-old and in 77% of 80-year-old healthy subjects. Considerably more pronounced disturbances occurred in the stroke victims, among whom about 60% had impairments of higher-order perceptual function and about 10% had low-order perceptual deficits.
Life satisfaction 4-6 years after stroke. V

The patients' reported level of satisfaction with life prior to stroke was the same as the reference subjects' level of satisfaction. More of the stroke subjects though than the reference population, reported that the time before stroke was very satisfying. Sixty-one per cent of the stroke subjects reported a decreased level of satisfaction in one or more areas at the time of the investigation. Most often there was reduced global life satisfaction, quite closely followed by decreased sexual satisfaction for the married subjects. Reductions in satisfaction with self-care ability and leisure were reported by about one-third of the subjects. The satisfaction levels after stroke were significantly lower than those of the reference population concerning global, self-care, leisure and sexual satisfaction. Reported changes in global, leisure and sexual satisfaction were significantly associated with motor function. But a good proportion of subjects with normal motor function reported reduced satisfaction in these areas. The level of self-care ability was significantly correlated to life satisfaction in general, to experienced self-care and to sexual satisfaction.

Among all items of life satisfaction, only decrease in leisure satisfaction was significantly associated with the occurrence of depression/depressive reactions, which prevailed in 16% of the patients.
DISCUSSION

Impairments as consequences of stroke are manifold, and both visible and invisible. This dissertation focusses on the motor and perceptual impairments. The most evident impairment after stroke is disturbed motor control whose origin was already the subject of speculation in 50 or 150 AD by Aretaios\textsuperscript{9}. Most functional treatment programs for stroke also emphasize training of motor deficits.

During this century awareness problems and in particular impairments of perception have increasingly attracted interest. This interest has, mostly, resulted in descriptions of signs and symptoms and in empirical neuropsychological and occupational therapy approaches to treatment. In this context it may be interesting to note that early in his career, Sigmund Freud described perceptual problems as 'visual agnosia' (see 34). Generally the symptoms have been connected to specific functional areas of the brain. However, it has been clearly demonstrated that many areas are involved in most functions (cf10).

Hence, in the rehabilitation of stroke patients it is often of minor help to focus on specific symptoms, as combinations of different perceptual impairments are the rule rather than the exception.

The underlying concept of this dissertation is that cerebro-vascular diseases often result in impairments (i.e. disturbances at the organ level) which in turn may cause disabilities (i.e. restriction of or lack of ability to perform an activity which the subject wants to perform).
Disability should thus be seen in relation to pre-morbid life goals as well as to the goals the patient can set up after the stroke. In this series of studies the prevalence of perceptual impairments in stroke patients was about equal (60%) both early on and 4-6 years after stroke. With advancing age there is, however, an ongoing process where the higher-order perceptual functions deteriorate somewhat (IV). The present results support those of other authors 11, 12, 13. The consequences are that even healthy elderly subjects may suffer a loss of one or a few points in their higher-order but not in their low-order perceptual functions. Allowing for this loss of one point, the patients showing perceptual dysfunctions in higher-order variables would thus be 45% in the initial investigation and 48% in the long-term follow-up instead of 60% and 57% respectively.

The prevalence of motor impairment differed between the early and the late phase, being 52% at the former and 36% at the latter. Moreover 45% were to some degree dependent in self-care ADL early on after stroke and 32% later after stroke. Among those who were dependent 24% were completely dependent in the early phase, while the corresponding figure 4-6 years after stroke was 21%.

For two reasons these prevalences of impairments and of self-care disability must probably be seen as under- rather then as over-estimates. Firstly, the methods used for assessing impairments demanded a certain minimum level of communication. Hence, patients with a degree of aphasia that precluded meaningful communication and also severely cognitively disturbed patients were excluded. A relatively greater proportion of these patients may conceivably have motor and/or perceptual disturbances. Secondly all
patients had initially been treated at a stroke unit. At the time of the investigation of early prevalence of impairments and disability the Stroke Unit (6 beds) had an extra full time stroke nurse and a rehabilitation staff of 0.5 occupational therapist and up to 0.5 physical therapist. Once a week these three professionals had a rehabilitation round together with a specialist in physical medicine and rehabilitation.

In a comparative analysis Strand et al\textsuperscript{14} demonstrated that throughout the first year after stroke the need for hospitalization was markedly lower for those stroke patients treated at the unit than for those treated in the hospital's general medical wards. Thus, intensified early activation may have a positive effect on both the short- and long-term prevalence of impairments and disability. Garraway\textsuperscript{60}, found that significantly more patients treated at the specialized unit were independent in ADL when discharged than those treated at medical units. But in general agreement with Hamrin\textsuperscript{15} he found that the differences had disappeared at a one year follow-up.

One major finding is that the perceptual functions/ dysfunctions measured with the tool modified from Najenson et al\textsuperscript{99} clearly fall into two domains of perception. These two perceptual domains appear to fit adequately into the theoretical concept of perception originally given by Gibson\textsuperscript{28} and described in some detail previously (cf pg 15). Remarkably, one and the same model is valid both in the early phase and 4-6 years after the stroke in spite of the fact that the instrument was not exactly identical (cf Appendices A and B) for assessment early on and late after stroke. This may be one
explanation for the fact that figure-ground and object-constancy moved from the higher-order (I) to the low-order (III) factor.

The pragmatic values of assessments of motor and perceptual impairments in the treatment of stroke patients appear well documented for their predictive effects (I,II,III,IV) on the ability to manage self-care ADL.

One feature of the present studies is that perceptual dysfunction, particularly that of higher-order, is a sizeable predictor of ADL-ability. This is particularly true if the quite frequently occurring slight to moderate reduction of higher-order perceptual function with advancing age is taken into account.

As previously shown, motor function was the major predictor particularly in the early phase. After 4-6 years, however, the predictive effects of motor and of higher-order perception overlapped. A tentative explanation for the apparently greater importance of perceptual function late rather than early on after stroke is that it may be comparatively easy to learn how to deal with self-care ability by compensating for motor disturbances; while perceptual dysfunctions (perhaps un-noticed by the patients) cannot be compensated for in the same manner. It appears logical that higher-order perception is an important predictor for self-care ADL as higher-order perception often reflects a certain level of meaningfulness.

The predictive effect of motor and higher-order perceptual function/dysfunction appears to be stable not only over time but also when different statistical methods are used. Thus, the discriminant analyses used in studies II and IV, in principle confirmed the
explanatory power of motor and higher-order perceptual functions for level of self-care proficiency early on after stroke. In fact the discriminant analyses mainly by means of motor and higher-order perceptual functions explained a greater proportion of level of self-care ability (II: 70%, IV: 62%; depending upon where the higher-order perceptual index was dichotomized) than did the linear regression analysis. The degrees of explanation provided by the indexes appear adequate for prediction in clinical praxis of the ability to manage self-care ADL. Therefore, the perceptual indexes and especially that characterizing higher-order perception may be of value.

Dysfunction in low-order perception did not occur in the two groups of healthy subjects, none of whom had signs of dementia or confusion; and only a small minority of patients had reduced low-order perception. In fact orientation/disorientation in time and space, was positively associated with low-order perception. Taken together with the interchangeability of their discriminant function coefficients (as dichotomized indexes, II) as explanatory variables it appears that low-order perception reflects a basic quality of sensing the actual situation in which the patient is.

Most, if not all, existing tools for clinical evaluation of perceptual function are based on the 'traditional' perceptual theory that visual perception is an indirect process, where visual perception constitutes stimuli to the eyes, interpretation of and response to the stimuli. Perception is often regarded as a part of 'intellectual' function (see for instance 38). Applying the direct approach to perceptual function, there is no stepped interpretation of sensory stimuli.
between the extraction of information and action. Through adequately directing our attention we thus perceive what is of importance for us at any given moment, and act accordingly. This theory is evidently not immediately applicable to the tests per se for perceptual function. Therefore, and perhaps particularly in occupational therapy, it seems important to think in terms of 'situations' into which the patients can be put in order to gauge whether appropriate actions, indicating intact perception, are elicited. These 'situations' could encompass different degrees of difficulty, and assess different parts of the 'direct' perceptual function (for example: action, attention, internal representation). Such a perceptual diagnostic tool might provide the best clues for actual treatment in occupational therapy. Hence, the most important clinical implication of the perceptual model described in this dissertation may be its' possible value in the construction of pragmatic assessment and treatment situations and sequences.

In this context it should be emphasized that several of the variables incorporated in the tool are adaptations or modifications of items included in neuropsychological assessments described by other authors34, 39, 91, 16, 17. However, a major clinical virtue of the present tool for assessment of perceptual function/dysfunction is its utility bed-side in the early phase after stroke. In contrast many neuropsych-logical test-batteries are extensive including a great wealth of items assessing not only perception. They require several hours of concentration and performance on the part of the patient. An assessment situation which is very difficult to achieve with stroke patients, particularly during the early phases after stroke.
The final outcome of stroke treatment may best (cf pg ??) be measured in terms of experienced social well-being (life satisfaction). Assuming this is right the rehabilitation (or coping) process for about two-thirds of the long-term stroke survivors studied in Paper V has not been successful, mainly but not solely because of impairment and disability.

It could be argued that 'subjective' measurements of life satisfaction are dubious, due to lack of validity; and the present measurements obviously are not congruent with the 'objective' classification of level of social integration proposed by the WHO. However, the internal validity of the tool appears to be adequate, particularly when the 6-graded scales are trichotomized. Thus, there was a close correspondence between patients' retrospective reports on life satisfaction before stroke and the reports of the reference population. In this context it is important to note that in these healthy elderly subjects levels of life satisfaction appear to be very stable between the ages of 60 and 80.

In other investigations close associations between decreases in the level of activity and the level of satisfaction derived from the activity have been found. Thus, in selected series of stroke survivors Sjögren found this was true for leisure and for sexuality. The present, and expected, finding of a close association between reductions in self-care activity and in satisfaction with self-care ADL further substantiates that forced limitations on the activities a subject wants to perform have a negative impact on the quality of life. Thus, whereas the stroke patients in this investigation may have received adequate initial medical and training care at the Stroke Unit they
have apparently not been supported sufficiently when it comes to modifying previous life goals or finding new and rewarding ones. On the other hand, the fact that satisfaction derived from family life and contacts with friends was only rarely reduced, indicates the experience of good support from family and friends. This support, though, does not preclude - and may in fact reinforce (cf18) the fact that stroke leads to a transition from satisfactory participation to passive, frustrated spectating.

From the point of view of occupational therapy it has been suggested that interests are dispositions to find pleasure in certain occupations that lead an individual to initiate or maintain involvement in various occupations11. It appears that these dispositions (or goals) are maintained after stroke; but they are often not pursued. The consequence is a discrepancy between perceived roles, interests and values and actual ability after stroke. It is, therefore, of great importance to guide the stroke patient - and perhaps even others close to her - along a road of necessary modifications of previous life goals or re-orientations towards new realizable and fully rewarding ones. Within the areas of self-care ADL and leisure such guidance may best be provided by the occupational therapist. That active treatment to improve the satisfaction with leisure is of great importance may be illustrated by the finding (V) that depression/depressive reactions was significantly associated with leisure satisfaction. Furthermore, with advancing age leisure activities become increasingly important for life satisfaction19.
It should, nevertheless, be emphasized that even though both motor and perceptual impairments lead to a lack of ability to pursue pre-stroke life goals and therefore ultimately result in a long-lasting reduced life satisfaction, a considerable proportion of non-impaired and non-disabled 4-6 year stroke survivors experience such reactions. In these subjects losses of social well-being may best be explained by the psychological impact, such as that arising from fear and anxiety, of the stroke.

GENERAL CONCLUSIONS

The present series of studies show that the investigated aspects of perceptual function can neatly be fitted into the ecological concept of perception. Together with motor function perception, which to some extent is age-dependent, can predict level of self-care ability in the majority of the stroke patients - particularly in those who survive more then half a decade after stroke. By this time for more than half of the surviving stroke population the quality of life has deteriorated, not as an effect of advancing age, but to a great extent because of the limitations - imposed by impairment and/or disability - of premorbid life-style.

These findings may be helpful in the rehabilitation care of stroke patients. Moreover, the findings may be of particular value for the identification of the consequences of stroke and for setting holistic goals and treatment rationales in occupational therapy.
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APPENDIX A (I,II,IV)

Perceptual assessment used in the acute stage.
Sixteen items distributed on 12 variables were used to assess perceptual function. Four of these (A-D) were double, assessing recognition and identification. The scale construct for all items ranged from 0 (totally incorrect perception) through 1 (impaired perceptual function) to 2 (normal function). Thus the score for perceptual function ranged from 0 to 32.
The first four (A-D) items were similar in administration. Items H, I, J and K all assessed paper/pencil performance.

A: **size**: This double item incorporated three wooden cylinders placed on a table in front of the patients who were asked to **recognize**, when presented with two duplicates, the correct length of the cylinders. The patients were then asked to **identify** the cylinders in order of length.

B: **form**: Patients should (without using their hands) **identify** three flat wooden figures of different shapes (triangle, square and circle) and **recognize** two duplicates.

C: **color**: Patients should **identify** four cards of different colors (blue, green, yellow and red), and **recognize** two duplicates.

D: **spatial relations**: were examined by showing the patients three different cards each depicting a man with a ball in his hand, the hand being in different positions. The patients were first asked to **identify** the positions, then **recognize** (by comparison) two different duplicates.

E: **body parts**: Patients should point or by other means correctly identify both left and right knee and third fingers after the command: "show me your ...".

F: **block design**: Patients were given six cubes (three blue, one red, one green and one yellow) and asked to construct a simple L-shaped block design consisting of three cubes shown to them in a picture. They were told to use the number of cubes necessary for the construction.

G: **figure-ground relations**: This was assessed by showing a twofold picture where the upper part showed an embedded picture combined by three drawn objects. The bottom part displayed six objects. The patients were asked to identify the three embedded pictures (adapted form Ayres115).

H: **draw-a-clock**: The patients were asked to draw a clock in a pre-drawn circle.

I: **draw-a-person**: The patients were asked to make a frontal view drawing of a person

J: **copy figures**: Patients were asked to copy six different geometrical figures.

K: **goblet**: Patients were asked to complete left and right sides of a pre-drawn half goblet after seeing the complete picture.

L: **object constancy**: was assessed by asking the patients to identify well-known every day objects photographed from an unusual angle.

APPENDIX B
Perceptual assessment used with stroke survivors 4-6 years after stroke. Scale construct is the same as described in Appendix A. The sum of scores for all items was 46.

A: **color, form and size**: these three visual qualities are assessed with regard to the subject's ability to **recognize** and **identify** colors (red, green, blue and
APPENDIX B (III)

Perceptual assessment used with stroke survivors 4-6 years after stroke. Scale construct is the same as described in Appendix A. The sum of scores for all items was 46.

A: color, form and size: these three visual qualities are assessed with regard to the subject's ability to recognize and identify colors (red, green, blue and yellow), forms (triangle, square, star and circle) and different sized cubes (five sizes).

B: spatial relations: four photographs of differently laid tables were shown to the subject, who were asked to identify two duplicates. They should also recognize the spatial placement of some objects in the photographs.

C: body-parts: subjects were asked to point to body-parts named by the examiner. Body-parts on both sides were mentioned.

D: embedded figures: see figure-ground Appendix A. Two embedded figures were used.

E: photographs: subjects were asked to identify four photographs of well-known objects each on a mixed background.

F: hidden figures: subjects were shown a picture with three partially hidden figures. They were to identify the objects (adapted from Luria39).

G: object constancy: subjects were shown a composite picture with one big photograph and four smaller photographs of well-known objects. Subjects were asked to identify the same object. Five different composite pictures were included in the assessment.

H: spatial orientation: the examiner asked four questions about the room where the evaluation took place, for example: where is the door in relation to You?

I: "match-box": subjects were asked to identify the position of a matchstick (placed by the examiner) in relation to the box.

J: geometric designs 1: see 'copy figures' in Appendix A

K: geometric designs 2: subjects had first to copy a drawing of a three-dimensional cube drawn on a paper and then copy a bee-cell which the examiner drews in front of the subject.

L: match-stick constructions: subjects were asked to copy six different constructions made of three to four sticks (adapted from Benson and Barton1).

M: draw-a-clock: see Appendix A.

N: draw-a-person: see Appendix A.

O: block designs: three different photographed block designs with 4-9 cubes were shown to the subject (one at a time) who was given 12 cubes to construct the designs with (adapted from Benton2).

P: draw half-a-goblet: see Appendix A.

Q: draw-a-house: subjects were asked to draw a picture of a house (adapted from Warrington et al3).
APPENDIX C

Orientation in time and space was assessed using five questions. Scale construct for each item was 0 = not oriented, 1 = patient needed verbal cues, 2 = correct.

How long have you been here? (week, month or half a year)
What time of day is it? (morning, afternoon or evening)
What time is it?
Where are you? (institution)
Where are you? (town)

APPENDIX D

The 20 items included in the self-care ADL assessment. Scale construct for each item: 0 = cannot perform the activity; 1 = can with assistance; 2 = can with technical aids; 3 = can and does perform the activity.

Grooming
1. Wash upper half of body
2. Wash lower half of body
3. Climb in and out of bathtub
4. Shower and dry oneself
5. Brush teeth, use tube of toothpaste
6. Comb hair
7. Cut nails
8. Manage in bathroom

Dressing
10. Put on and take off shirt without buttons
11. Put on and take off blouse/shirt
12. Put on and take off socks
13. Put on and take off shoes
14. Put on and take off coat
15. Put outdoor clothes on and take them off a clothes-hanger
16. Put on skirt and/or long trousers
17. Pick up small objects from the floor

Eating
18. Eat prepared food
19. Drink from a glass or cup
20. Butter a slice of bread
APPENDIX E

Instrument used to assess by structured interview global (one item) and domain specific (6 items) life satisfaction. Scale construct for each item: 6 = very satisfied; 5 = satisfied; 4 = rather satisfied; 3 = rather dissatisfied; 2 = dissatisfied and 1 = very dissatisfied.

Items:

- Life in general
- Self-care ADL
- Leisure
- Togetherness, friends
- Togetherness, family
- Marriage
- Sexuality
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