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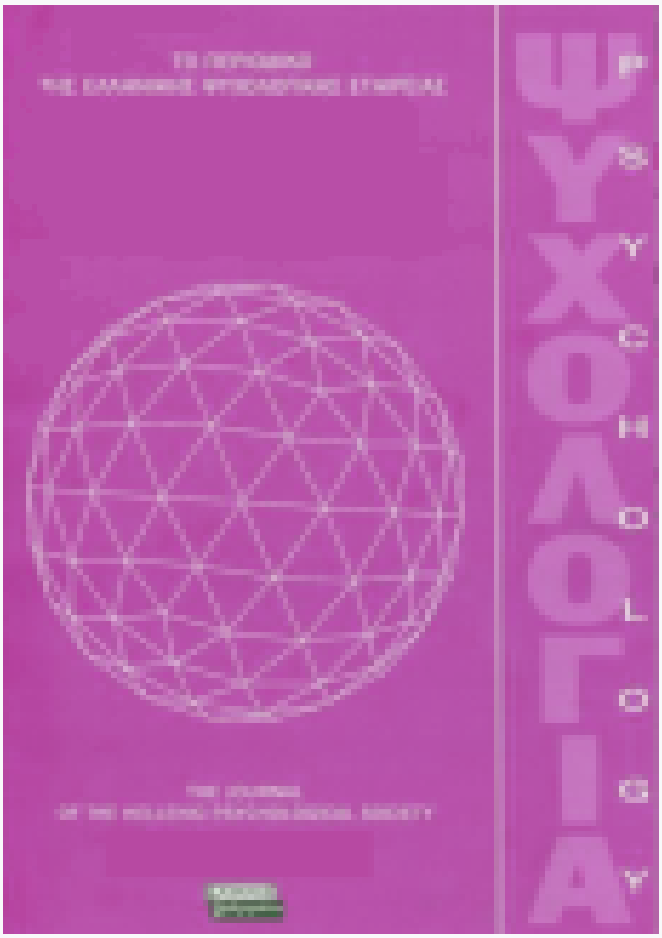

Psychogerontology and Gerodynamics

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Psychogerontology and Gerodynamics

JOHANNES J.F. SCHROOTS
European Research Institute on Health and Aging
and University of Amsterdam, The Netherlands

ABSTRACT At a time where Western Europe is becoming concerned with the quality of life of aging persons, it is appropriate to develop gerontological theory and research. Historicaly, there are three psychogerontological models: Age, aging and the aged. The psychology of the aged is concerned with the thematic study of the problematic and non-problematic elderly. The psychology of age focuses on age differences and compares groups of people of different ages. The psychology of aging studies some typicalness of change of average functioning and intra- and interindividual variability over time. A theoretical explanation of the variability phenomenon along with trends in average functioning will be given in terms of gerodynamics, i.e., the study of the dynamics of aging. Gerodynamics is based on general systems theory and modern chaos theory, which essentially postulates that there is an ordering principle in entropy itself. Chaos theory emphasizes that under far-from-equilibrium conditions certain systems run down while other systems simultaneous evolve and grow more coherent. The practical implications of gerodynamics and the suggested models will be illustrated with selected examples from psychogerontology, and by means of the Life-line Interview Method in particular.

The citizens of the European Community (EC) are increasingly older citizens. There are more than 60 million older people (aged 60 and over) in the EC, representing just under one in five of the population. Nearly one-third of the Community's population and one-fifth of the labour force are over the age of 50. By the year 2000 older people will comprise more than one-fifth of the population and, by, 2020 they will represent more than one-quarter (see Table 1). The figures for Greece are hardly different from the European trend, as Table 1 shows clearly.

Generally, declining fertility and mortality rates are considered to be the main sources of the observed and the projected demographic transition from a relatively low to an increasingly higher proportion of older and very elderly people in our populations. This change and the pace at which it is taking place raise a number of important policy issues, varying from living conditions and way of life to the labour market, social integration, health and social services. For example, the unprecedented increase in life expectancy in this century has resulted in a large number of elderly people, any of whom are vulnerable to developing problems of health

Address: J.J.F. Schroots European Research Institute on Health and Aging, Faculty of Psychology, University of Amsterdam, Roeterstraat 15, 1018 WB Amsterdam, The Netherlands

Table 1
The older poppulation in 1990 and 2020 as a percent of the total population in the 12 member states of the European Community (Eurostat, 1991)

		B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	EUR 12
1990	50+	32.0	30.8	34.1	32.8	29.6	29.7	23.6	32.4	31.1	27.4	29.2	31.2	31.3
	60+	20.4	20.3	20.8	19.4	18.5	19.1	15.1	20.2	19.1	17.2	18.2	20.7	19.7
	65+	14.7	15.5	15.3	13.7	13.2	14.0	11.3	14.4	13.3	12.8	13.2	15.6	14.4
	75+	6.6	6.9	7.4	6.0	5.4	6.8	4.4	6.3	6.0	5.3	5.3	6.8	6.5
	85+	1.4	1.4	1.4	1.0	1.0	1.5	0.7	1.1	1.1	1.1	0.8	1.5	1.3
2020	50+	43.5	40.4	47.1	40.2	41.1	39.5	36.5	46.8	42.0	40.5	41.0	38.0	42.2
	60+	28.2	25.8	29.7	26.0	24.9	26.1	22.9	29.9	26.8	25.2	25.5	36.4	26.7
	65+	20.8	19.5	22.2	19.9	18.3	19.7	16.6	22.8	19.3	18.6	18.8	27.6	20.0
	75+	9.1	8.2	10.6	9.2	7.9	8.2	6.1	10.7	8.2	7.4	8.7	12.4	8.9
	85+	2.8	2.0	2.5	5.5	2.1	2.4	1.3	2.8	2.1	1.9	2.8	3.6	2.4

and individual competence. For Greece there is an extra complication because of the major differences between rural and urban areas, particularly with regard to health and social services (Walker, Guillemard, & Alber, 1991. Ziomas, 1991).

Many policy issues and questions require comprehensive studies for their answers. At a time where Greece - like all other member states of the EC - is becoming concerned with the quality of life of aging persons, it is appropriate to develop gerontological research that can be used to optimize health and individual competence to maintain independent living. The science of psychology has much to offer to this type of research, called psychogerontology.

The psychology of the aged

Historically, there are three psychogerontological models: Age, aging and the aged. Research on the psychology of the aged, focuses on older people and later life. Grounded in a stages-of-life perspective, most studies of the aged - whether the young-old or the old-old - demonstrate a thematic approach and little coherence. In preparing a college text on adult development and aging, Birren & Schroots (in print) came up with at least thirty different psychological themes, varying from sensation and perception, attachment and bonding, sexual behaviour and personality to depression and dementia, competence and wisdom, age and the search for meaning. In this introductory text, thematic studies with regard to retirement and special services for the elderly (e.g., nursing homes and old people's homes) were not taken into account, but even without these studies the field does not provide a coherent sight, theoretically at least.

Given the many different themes, however, the psychology of the aged may be broadly defined as the study of the problematic and non-problematic elderly from a psychological perspective. It is hardly accidental that the main themes of problematic and non-problematic elderly do not differ much from the

objects of the clinical psychology of the aged, as well as the general and experimental psychology of the aged, respectively. For lack of theory, the field has heavily borrowed from these older, and certainly more respectable «islands of knowledge» in psychology. As such the psychology of the aged bears a resemblance to the much older field of child psychology, which studies the first stages of the human life span.

Although current stage theories differ widely, almost all assume - implicitly or explicitly - divisions of the life-span into two, three or more chronological periods. In spite of serious criticism of the rather arbitrary divisions in age groups, age-linked stage theories appeal not only to the general public, but also to the applied branches of the behavioural and social sciences. After all, age-linked stages justify professional specialization and the preoccupations of professionals with particulary ages, as well as the organization of professionalized services around the age of the population served, i.e., fetus, newborn, preschool, school aged children, adolescence, young adults, middle aged and old adults (Birren & Birren, 1990).

Given the greying of society with increasing proportions of problematic elderly, it can be predicted that more and more clinical research will be conducted in the field of physical and mental health, and that more and more clinical psychologists and/or psychogerontologists will be involved in the health care for the elderly, in one way or another. The rational of the prediction is that the physical health problems of the elderly are often multiple, chronic, and - although treatable - not curable (Fries & Crapo, 1981). In other words, the physical health problems of the aged ask for a behavioural, social and nursing care approach, rather than for a typical medical solution of the problems. As a matter of fact, psycho-gerontologists are already active in the field of mental health for quite some time, in particulary with regard to cognitive and affective health problems like dementia and depression. Given, for instance, the increasing prevalence figures for dementia with age - prevalence figures rise to over twenty two percent for those aged 80 and above (Cooper & Bickel, 1984) - it goes without saying that more and more psychologists will be involved in mental health care for the elderly in the near future (La Rue & McCreary, 1991).

The psychology of age

The second psychogerontological model is related to the psychology of age, which focuses on age differences. Most research according to the model has been cross-sectional, describing and comparing different groups of people of different ages measured at the same time. This approach results in cross-sectional age differences, which are too often erroneously interpreted as age changes, aging of changes in behaviour over time. It is a persistent falacy to suggest that - for example - some decline of memory on the basis of cross-sectional age differences is caused by age or the aging process. To avoid this falacy it is necessary to carry out longitudinal research, in which for example the memory performance of a group of people is compared with the group's own performance at other periods in time.

For the purpose of illustration, Figure 1 displays the Psychology-of-Age research model from the planned EuGeron study on Aging, Health and Competence (Schroots,

1993a) EuGeron stands for EC Concerted Action in Gerontology, which is intended - generally speaking - to stimulate the implementation of human aging research in the EC member states, like Greece among others.

The general purpose of the EuGeron study is to develop a knowledge base about the relative contribution of biophysiologic and psychosocial phenomena to changes in competence across the life-span. The concept of competence calls for some explanation. First, the term «competence» is a layman's term and - as such - hard to define and operationalize in more scientific terms. According to Webster (1979) the meaning of competence is (1) sufficient means for a modest livelihood, and (2) condition or quality of being competent; ability, fitness, legal capability, power, or jurisdiction. Bengtson (1985) describes competence from a social-psychological perspective and distinguishes the following aspects (1) adequate role performance, (2) adequate coping and processing of novel stimuli, and (3) sense of efficacy. In this respect, he remarks that competence is one key to understanding successful aging (see also Baltes & Baltes, 1990). But perhaps the best description is given by Willis (1992) when she defines every-day competence as the adult capability or potential to perform adequately those activities considered essential for living on one's own.

Table 2
Categories of variables involved in the EuGeron study

– Age:	35-84 years
– Sociodemographic and environmental factors:	gender
	socio-economic status
	region
	living conditions (income, hounsing work, services)
– Life-style factors:	exercise
	smoking/drinking (alcohol, coffee)
	nutrition
– Psychosocial factors:	psychological (cognitive performance, coping, locus of control, time perspective, purpose in life)
	social (management of interpersonal relationships, network)
– Biophysiologic factors:	anthropometrics (length, weight, vital capacity)
	organ systems (nervous, cardiovascular, immune)
	health status (history)
– Competence:	physical (activity, mobility)
	psychological (life-satisfaction/well-being, and self-perceived health/quality of life/independence/age and aging)
	social (role performance)

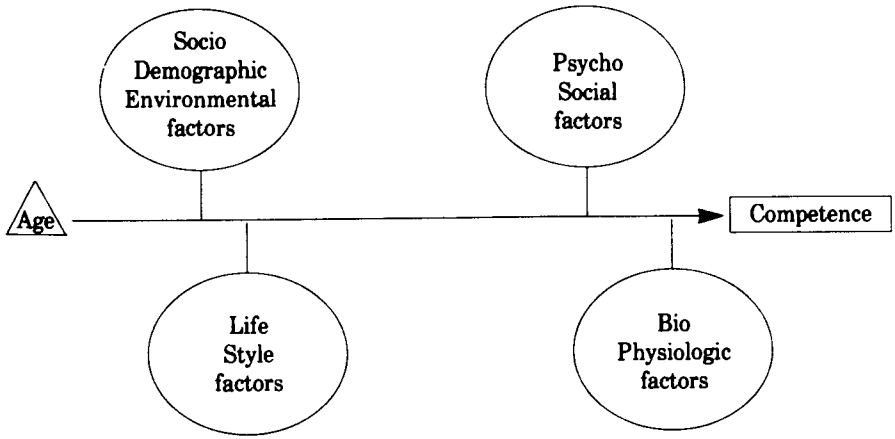

Figure 1
Research Model for the EuGeron study on Aging, Health and Competence (Schroots, 1993)

Given Willis' definition, the concept of competence is conceived as a meta-concept (like the concept of intelligence) with both objective and subjective connotations, i.e., competence as defined by others (objective), or as perceived and experienced by the individual him - or herself (subjective). Recent studies suggest that there is an increasing difference between objective and self-reported health with age, in the sense that older people report themselves as much healthier than they in fact are on the basis of a medical examination (Schroots, 1993b). It would be interesting to know whether similar differences with age can be found for objective and subjective measures of competence. The policy implications of these differences would be far reaching with regard to living conditions, labour market, health, social services, etc.

As the research model (Figure 1) clearly suggests, the central research question of the EuGeron study concerns the relation between age (independent variable) and competence (dependent variable), and the extent to which intervening factors, i.e., sociodemographic, environmental, psychosocial, biophysiologic and life-style factors are related to the observed differences with age. In explanation of the research model the broad categories of variables shown in Table 2 are selected (examples of more concrete variables are put in parentheses).

With the Psychology-of-Age model in mind, it should be noted that the Eugeron study is designed as a cross-sectional study in longitudinal perspective; that is to say, EuGeron is planned as a base-line survey study, to be conducted on a representative community based sample of around 3000 individuals (aged 35-85), which - in principle - should be examined every three years after the start of the study. The central research question then concerns the measurement of longitudinal age changes in relevant variables instead of cross-secional age differences.

The psychology of aging

The third and last psychogerontological model is concerned with the psychology of aging, which studies some typicalness of change of average functioning and intra- and intraindividual variability over time (Birren & Cunningham, 1985). Variability over time refers to the phenomenon of increasing variability with age within as well as between individuals. That is to say, as people grow older, they become more unlike each other on any given characteristic; also, the individual variances associated with average level of functioning increase with age: individual characteristics or functions have «good days» and «bad days» for the old, more so than for the young. The question arises as to what the explanation might be for the change processes and phenomena of variability.

From the perspective of general systems theory and thermodynamics, two fundamental processes of change can be distinguished in human ontogenesis, development and aging, which are conceptualized as follows (Schroots, 1988). According to the second law of thermodynamics, there is an increase of entropy in energetic systems; entropy is defined here as a measure for disorder. Generally speaking, one might say that according to this law each living system, e.g., the human individual, moves toward maximum disorder (entropy) or minimal differentation, in short, toward death. This tendency can be counterbalanced by the release of entropy to the environment and/or the import of negative entropy (negentropy) or information into the system. In other words, the tendency to maximum disorder can be prevented by the tendency toward order, negentropy or information. Thus, according to general systems theory from a thermodynamic perspective, the development of the individual is explained in terms of absorbing information. Aging, on the other hand, can be conceptualized in terms of increasing entropy or disorganization with age.

The ontogenetic processes of development and aging can be visualized as two parallel processes of change or two sides of the same coin called life (Figure 2). At the start of ontogenesis (conception), the developmental process is most visible or manifest, while at the same time the signs of aging are still obscure or latent, and vice versa at the end of ontogenesis (death).

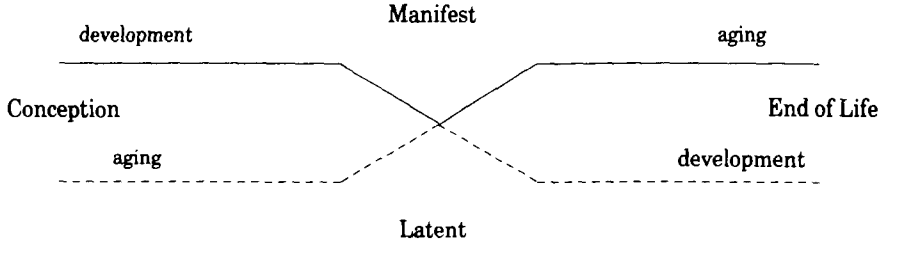

Figure 2
Diagram illustrating the relationship of the processes of development and aging over the course of life (Birren & Schroots, 1984)

The ontogenetic view of development and aging bears some resemblance with Baltes' (1987) view of age-related change as a joint expression of gains (development) and losses (aging) over the life-span. The age-related changes are visualized by Baltes almost identical with the above diagram (Figure 2) as the sum-total of gains and losses, which shifts proportionally with increasing age. However, as it turned out, both general systems theory and Baltes' gain/loss conceptions partially failed to describe and explain the complex phenomena of development and aging and the concomitant increase of variability (Schroots, 1988). A new concept is needed in the field of psychogerontology, which recognizes the increasing complexity and variability with age in individual lives.

Gerodynamics

Recently, the concept of aging has been redefined. Living open systems such as the human individual are continuously fluctuating. Strong fluctuations in individual lives, as might be the case with increased age, do not fit well with the classical model of equilibrium thermodynamics developed during the 19th century. This model led to the introduction of thermodynamic concepts like entropy, dealing with processes near equilibrium for closed systems only.

To solve the problem of fit for fluctuating, open systems in far-from-equillibrium conditions, Prigogine (1979) and his associates developed the so called chaos theory or theory of dissipative structures. This theory postulates that a single fluctuation or a combination of them may become so powerful - as a result of positive feedback - that it passes a critical level and shatters the preexisting form or structure. At this moment - termed the bifurcation point - it is inherently impossible to determine in advance which direction change will take: whether the system will desintegrate into chaos or leap to a new, more differentiated order, that is, a dissipative structure. However, the more variable and the more fluctuating the system is, the more energy it must dissipate or disperse in order to sustain its structure. Thus, Prigogine's solution of the problem of fit is that order emerges because of, and not despite, entropy or disorder. Order can actually arise spontaneously out of disorder and chaos through a process of self organization.

Prigogine and his co-workers demonstrate clearly that entropy is not merely a downward slide toward chaos and disorganization. Under non-equilibrium conditions certain (sub)systems run down (lower order structure) while other (sub) systems simultaneously evolve and grow more coherent (higher order structure) (see Figure 3). In terms of nonlinear dynamics (chaos theory) aging can now be defined as the process of increasing entropy with age in individuals, from which disorder and order emerge. The scientific discipline which studies the dynamics of aging, as discussed above, is called gerodynamics (Schroots & Birren, 1990).

In the final analysis, gerodynamics might explain the process of psychological aging or geronting. This is defined as the processes of optimizing self-regulation and independence of environmental variation in the presence of some decreasing capacities and resources which the individual may experience (Birren & Schroots, 1984). In other words, gerodynamics might explain, for example, why some people grow in wisdom and others do not.

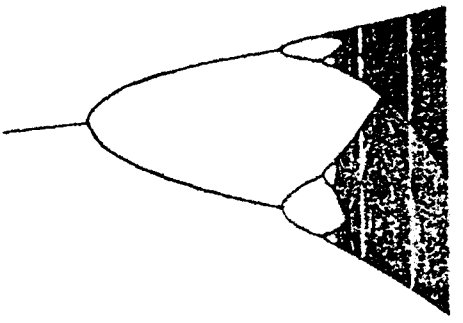

Figure 3
Emerging fluctuations upset the system's dynamic equilibrium (straight line) and cause a cascade of bifurcations (branching points) into higher and lower order structures

Life-line Interview Method

The new dynamic view of aging has many practical implications regarding health, assessment, intervention and prevention programs for the elderly. Unfortunately, this is not the place to discuss these exciting, new perspectives. However, an exception should be made for a recently developed biographical assessment method, called the Life-line Interview Method (LIM).

Essentially, this method has been developed on the basis of metaphors which people use to describe their life histories and expectations for the future (Kenyon, Birren, & Schroots, 1991). When older persons are asked to describe their life, they frequently use metaphors like the «footpath», which stands for the journey one makes from birth to death, when one alternately crosses the mountains and valleys of life. In a typical LIM-session, a person is asked to place perceptions of his or her life visually in a temporal framework by drawing his or her life-line. This life-line is the graphical, two-dimensional representation of a footpath - with time on the horizontal dimension and affect on the vertical dimension - which symbolizes the course of human life. With the help of this method one can elicit biographical information about important life-events in a non-verbal, visual way. As soon as the life-line has been drawn, the subject is asked to label each peak and each dip by chronological age and to tell what happened at a certain moment or during an indicated period. At the same time, the interviewer makes a verbatim report of what the subject sees as the most important events in his of her life. Figure 4 shows the life-line of Mrs. K., a depressed 81 year old widow.

One of the unsolved problems with regard to the content analysis of verbatim reports concerns the categorization of unstructured data in such a way that they can be analyzed statistically and significantly. With the LIM a method is presented in which the person him of herself categorizes and structures the data in terms of number of events, age and affect. The quality of self-structuring makes it also possible to analyze the interview data in terms of branching points, i.e., those changes in the life of the individual, which direct the life-path distinctly, and which are separated

Table 3
Summarized analysis of Mrs. K's verbatim report (Schroots & Ten Kate, 1989)

Age	Branching point	Event	Affect
		Past	
0	birth (0)		
0-16		childhood	+
		school	+
		teacher	+
		sister	+
		being practica	+
		mother	-
16	leaving school (1)		
16-22		move	-
		help at home	-
22	marriage (2)		
22-30		marriage	0
		husband	-
		children	+
		financial problems	-
30	crisis/war (3)		
30-40		crisis/war	-
40	end of war (4)		
40-50		husband	+
50	illness husband (5)		
50-72		husband	-
		son	-
		grandchild	-
		daughter-in-law	-
72	move (6)		
72-79		move	+
		travelling	+
79	illness (7)		
79-81		being ill	-
		being old	-
		Future	
81	future (1)		
81-86		no faith in future	-
		failing health	-
		black pessimism	-
86	death (II)		

in the time from each other by one or more affective events. Table 3 shows a summarized analysis of Mrs. K. verbatim report in terms of age, branching points, events and affect.

Earlier, the term «bifurcation» has been introduced in the section on gerodynamics. Bifurcation means literally «the fact of dividing into two parts or branches». In other

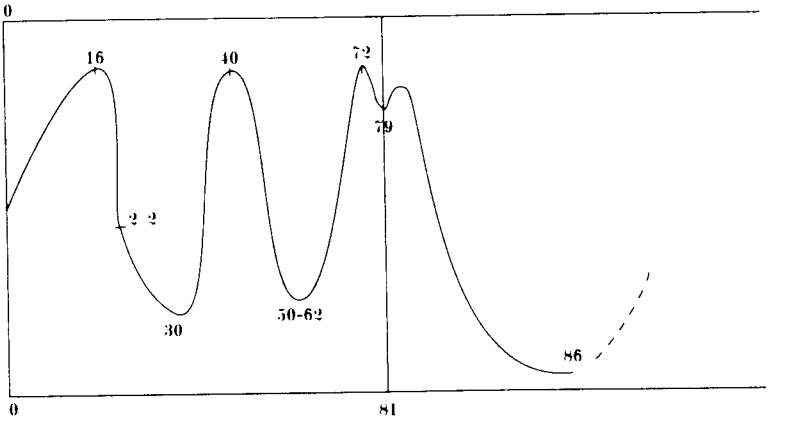

Figure 4

Mrs. K's life-line, drawn in the LIM grid (dimensions: 300x185 mm), with chronological age (yrs) on the horizontal dimension and affect on the vertical dimension (Schroots & Ten Kate, 1989)

words, the term bifurcation point is similar to the branching point as defined before. Generally speaking, bifurcations or branching points are abrupt changes of form or structure. As such, they form part of topology, a branch of qualitative mathematics that deals with qualitatively distinct forms and their transformations. In the following, the more general term «tranformation» will be used, as not all gerodynamic changes are bi-

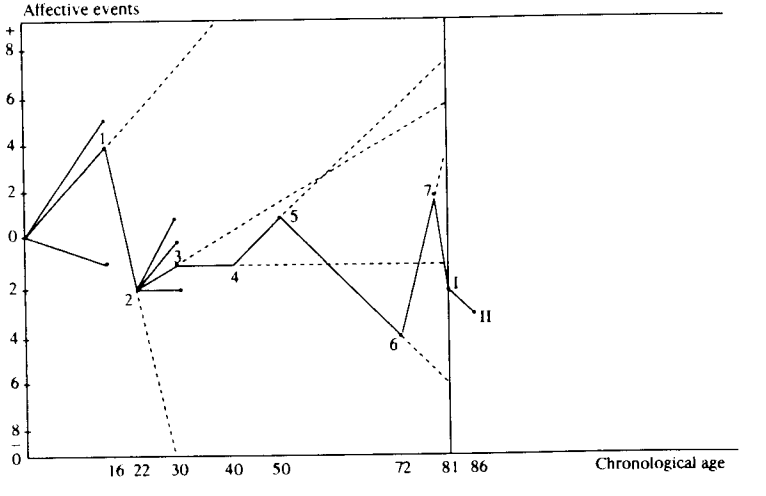

Figure 5

Mrs. K's branching tree, projected in the LIM grid, with chronological age (yrs) on the horizontal dimension and number of affective events (positive, negative or neutral) on the vertical dimension (Schroots & Ten Kate, 1989)

furcations or branching points. Moreover, transformations relate to both processes of development and aging, which - in combination - determine the increasing variability of the individual with age.

From the LIM perspective, it should be emphasized that branching points are the transformations of an individual in the sense of Prigogine's bifurcation points. That is to say, in the absence of fluctuation the individual maintains a dynamic equilibrium and moves through time in a straight line until emerging fluctuations direct the life-path distinctly (see also Figure 3). In other words, the life-line or life-path of an individual consists of a series of transformations over the life-span. The question arises, then, whether the transformations of an individual are related in some way or another; or, to put it differently, is there a pattern or structure in individual life?

At the beginning of the life course - with conception - the individual is awaiting an as yet unknown but finite number of transformation. As the individual moves through time and the transformations occur, a branching pattern emerges that looks very much like a branching tree, composed of consecutive trunk-segments or relatively stable periods of affective events, as well as moments of instability or branching points from which branches of potential life-paths originate, i.e., not realized possibilities in an individual life. Figure 5 shows Mrs. K's «branching tree» with chronological age on the horizontal dimension of the LIM grid and number of affective events (positive, negative or neutral) on the vertical dimension.

As many scientists have found out in the past, there is a mathematical problem in describing the variation in patterns of branching trees. If we knew how to formally describe these patterns, then we would have a «measure» for the life pattern of an individual. Recently, however, there have been developed quantitative summarizing descriptions of irregular structures, like branching trees, coastlines, mountains, clouds, and so forth. These irregular forms are called «fractals», which are closely related to the basic science of nonlinear dynamics, and - as a matter of fact - fractual rules have been used successfully to construct branching trees (cf. Schroots, 1988). In our view it is only a matter of time and the fractal approach will be used to characterize and quantify the pattern of individual lives as reflected in their autobiographies (Schroots, to be published).

In concluding this paper, we would like to re-emphasize our earlier statement that the science of psychology has much to offer to the development of psychogerontological theory and research.

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