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A longitudinal study of psychological changes in cognition and self in late life

Abstract

The diversity and resilience characteristic of the closing phases of human development are investigated by longitudinal study of change and development in about the last 30 years of the life-span. The Australian Longitudinal Study of Ageing (ALSA) is a population-based psychobiosocial and behavioural study of a cohort of 1,947 adults from Adelaide over the age of 70 years. Four annual waves of data collection started in 1992. At Waves 1 and 3, an extensive personal interview covered psychological, behavioural, social, biomedical, economic, and other contextual variables. Participants also had the opportunity to provide psychological data on cognitive and psychosocial (self) dimensions through completion of a series of objective assessments and standard paper-and-pencil inventories. Data from these two waves is used to describe and explain changes in cognitive and psychosocial domains, particularly the complexity of functioning, potential gains and losses in memory and well-being, and the interplay amongst these aspects of functioning. Once a range of noncognitive and cognitive contextual factors are taken into account, individual differences in processing and intrapersonal resources contribute significantly and substantially to functioning in each domain, and the contribution from ageing per se is minimised. Furthermore, a "limited impact" hypothesis of late life development suggests that later declines may be a byproduct of rather large decrements in some subset of a population, with the majority showing stability. Insofar as heterogeneity increases with ageing, age per se is increasingly less able to predict functioning. This work identifies some key sources of heterogeneity that may be indicative of ageing well.

***Keywords**: ageing, cognitive functioning, life-span human development, longitudinal, psychological changes, resilience, sense of self*

Ageing well

The prominence of the life-span view of human development, coupled with the demographics of population ageing, make consideration of normal psychological functioning among the oldest old crucial to a complete characterisation of human development. More and more people are living to advanced ages, making study of the later portions of the life span particularly relevant. In 1976, 9% of the Australian population was over the age of 65. The

percentage had increased to 12% in 1996 and is projected to rise to 16% (or 3.5 million people) by 2016 (ABS, 1996). In 1992, an Australian Longitudinal Study of Ageing (ALSA) began at Flinders University in Adelaide, under the direction of Gary Andrews. This cross-disciplinary multidimensional project provided a vehicle for studying aspects of psychological development during late life.

Psychological study of development across the life-span predates recent increases in population-level trends. Its origins have been traced back more than 200 years to Tetens in Germany and to Carus, Quetelet, and others (Baltes, Lindenberger, & Staudinger, 1998; Baltes, Reese, & Lipsitt, 1980). However, the 1970s marked a watershed in a return to thinking about human development as a lifelong process. Perhaps the most significant influence arose from the emergence of the life-span view of human development, as articulated by Paul Baltes, Hayne Reese, Warner Schaie, and others. They instigated what has become known as the Life-Span Developmental Framework, the crux of which is the view that development and ageing are part and parcel of lifelong change processes. Baltes' emphasis on individual differences and the multidimensionality of human development gave rise to a contextual metatheory of human development that is particularly well-suited to studies of adulthood and ageing (Baltes et al., 1980; Baltes, 1987; Baltes et al., 1998). Notions consistent with a life-span view provided a conceptual impetus for much of my work on normal ageing.

Four propositions, taken from eight outlined by Baltes et al. (1998, Table 18.3, p. 1043), espouse key elements of individual functioning. The four provide an excellent vehicle for drawing together the sometimes seemingly disparate and unwieldy data that comprise the Australian Longitudinal Study of Ageing (or ALSA), the focus of this report. Three of these propositions deal with life-span changes in (a) the dynamic between biology and culture; (b) the allocation of resources to distinct functions (i.e., growth vs. maintenance vs. regulation of loss); and (c) the gain-loss dynamic; the fourth adopts (d) ontogenetic and historical contextualism as the guiding paradigm. These propositions are not mutually exclusive, and they can be used to describe and explain age-related changes in behaviour that are the essence of human development.

Brief descriptions of each indicate how the life-span approach can be used to formulate sets of hypotheses for investigation and how those hypotheses can be linked to findings from our study of older adults. Given the sensitivity of the life-span approach to the heterogeneity that is characteristic of elderly adults, the present study examines the role of psychological resources that vary greatly throughout life, particularly the role of processing resources and self-resources in underpinning memory and well-being, respectively.

Multidimensionality: Biology and culture

Simply put, the distinction between biology and culture captures an earlier life-span proposition concerning the multidimensionality of human

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development. This parallel becomes clear in Baltes et al.'s (1998) definition of *culture:* "the entirety of psychological, social, material, and symbolic (knowledge-based) resources which humans developed over millennia which...make human development as we know it possible" (p. 13; see also Cole, 1996; Durham, 1991; Valsiner & Lawrence, 1996). In this definition of culture, development takes place concurrently in many arenas (i.e., multidimensionality), and resources have a central role.

Multidimensionality was examined in ALSA in two broad domains: cognition and personality-and-self. Both domains include a range of subdimensions or more circumscribed, specific domains. For instance, cognition includes a general index of cognitive ability and more specific measures of language, memory, and perceptual speed. The dimension of self incorporates measures of well-being, control and self-esteem.

Resource allocation

Some variables within ALSA's dimensions of cognition and self might be considered resources (i.e., personal characteristics available for allocation to underpin outcomes seen in other measures). In the literature on ageing, perhaps the best known psychological resources are those associated with resilient cognitive functioning (e.g., Salthouse, 1996). In particular, perceptual speed (i.e., the rate at which information can be processed) has been conceptualised as a key resource requirement for effective performance on memory and other intellectual tasks. More recently, self-related resources have been posited that contribute to well-being or affective ageing (M. Baltes & Lang, 1997; P. Baltes & Smith, 1997; P. Baltes et al., 1998; Thoits, 1995). Perceived sense of control and self-esteem are self-related psychological resources that contribute to well-being (Thoits, 1995).

Resource constructs of control and self-esteem will be examined with molar indicators, although specific domains (e.g., memory or health) can be measured. Likewise, global indicators of well-being are high morale and absence of depressive affect as measured using standard instruments (Diener, 1994; Thoits, 1995). Although it is expected that these well-being measures will be inversely related (e.g., higher scores on morale associated with lower scores on depression), the desirability of multiple outcome indicators is consistent with many theorists of successful ageing who argue for the multidimensional nature of well-being (e.g., Baltes & Baltes, 1990; Ryff & Essex, 1991).

Gain-loss dynamic

Development can be viewed in terms of gain and loss, entailing multidimensional and multidirectional change. Baltes et al. (1998) conceptualised development not as "a monolithic process of progression and growth, but as an ongoing, changing, and interacting system of gains and losses in adaptive capacity" (p. 1046). The dynamic may be played out across domains; losses in one can be compensated for by gains in another, or vice versa. Moreover,

fluctuations may occur over time within a domain, and the gain-loss dynamic thus relies on longitudinal observations (Rogosa, 1995). This dynamic is explored in ALSA by identifying the direction of change over time and the extent of gains and losses on cognitive and psychosocial measures.

The limited impact hypothesis (Salthouse, 1991) proposes an explanation for the often observed negative age trends in cognition. It suggests that trends may be artefactual. Salthouse raised the possibility that they reflect "rather dramatic declines for a small segment of the population, with most people maintaining stable levels of cognitive performance" (p. 67). In essence, a small group of individuals may be responsible for the group mean level decrement, whereas the majority of people will show stability in their performance from time 1 to time 2.

A further implication of the limited impact hypothesis explored in the ALSA data is that there should be variability in the *rate* of change between age groups. Given the modest amount of research on these relationships and mixed support for the limited impact interpretation (Christensen, Mackinnon, Jorm, Henderson, Scott, & Korten, 1994; Morse, 1993), analyses of memory, speed of processing, and verbal ability revisit this hypothesis. Both speed of processing and verbal ability underpin memory by drawing on different aspects of general intelligence. Speed taps fluid intelligence, while verbal ability draws on crystallised intelligence. Moreover, these domains of functioning have different change patterns in later life.

Contextualism as paradigm

The fourth and final life-span proposition concerns the utility of contextualism as paradigm. Contextualism operates at many levels. Minimally, it entails consideration of both the circumstances of ageing (i.e., the situation) and individual differences (i.e., the person). The circumstances of ageing might include changes in life-style, living arrangements, marital status, or patterns of engagement in activities. Individual differences might include a broad range of personal characteristics that distinguish people from each other (e.g., health, educational background, sense of self, processing efficiency, or general ability). Thus, individual differences include the psychological *resources* brought to situations by individuals that permit them to function more or less well (M. Baltes & Lang, 1997; Salthouse, 1991). These aspects of context are more interesting psychologically than sociodemographic variables. In the spirit of adopting contextualism as paradigm, I have attempted to identify the extent to which these individual differences contribute to specific domains of functioning and to explore contributions from specific resource factors only after controlling for other possibly confounding effects.

For example, in the cognitive domain, we and others have shown that perceptual speed or processing efficiency is a major resource contributing to age-related differences in memory (e.g., Bryan & Luszcz, 1996; Luszcz, 1992; Salthouse, 1985, 1996). However, remembering also may be affected by

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general ability level, verbal ability, health, affective status, and so on. Luszcz, Bryan, and Kent (1997) showed that, after controlling for these cognitive and noncognitive individual differences, speed of information processing remained the central mediator of the relationship between age and episodic remembering in the baseline ALSA sample. The question addressed in this paper is whether this effect persists over time and, in particular, whether these baseline cognitive processing resources contribute to memory performance two years later.

Resources in the self-domain can be examined as mediators between the relationship of activity and well-being. The notion that maintaining an active lifestyle and being engaged with the world will preserve well-being was at the heart of some of the earliest research on successful ageing (Neugarten, Havighurst, & Tobin, 1961, 1968; see also Hendricks, 1994). It remains a topic of active research (Reitzes, Mutran, & Verrill, 1995) and theorising (Achenbaum & Bengtson, 1994; Carstensen, 1995). Self-esteem and sense of control have been identified as resources (Thoits, 1995) that may contribute to the maintenance of well-being. Amongst older adults, the associations between well-being and personal control (e.g., Abeles, 1991; Rodin & Timko, 1992) often have been studied, but self-esteem as a mediator of well-being has rarely been studied in older adults (see, however, Duffy & MacDonald, 1990; Krause, 1987). Self-esteem and sense of control have not been looked at concurrently as mediators, and their role in the maintenance of psychological well-being in very old adults has never been examined.

This gap in the literature is surprising, especially as self-esteem has been defined as "the individual's positive or negative attitude toward the self as a totality" (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995, p. 141) or self-acceptance. These notions resonate with Erikson's (1959) concept of integrity, the ultimate goal of psychosocial development. Its absence is thought to be indicative of poor psychological adaptation or adjustment, in the final phases of life. Thus, the assumption is that self-esteem and well-being go hand in hand (see also Markus & Herzog, 1991; Ryff & Essex, 1991). The empirical justification and, hence, the veracity of this assumption has rarely been demonstrated for very old adults. ALSA data showed that self-esteem comprised not only an element of positive self-regard but also a sense of usefulness (Ranzijn, Keeves, Luszcz, & Feather, 1998). Moreover, control mediated the relationship between self-esteem and morale (Luszcz, 1996).

Interrogating the data

The aim of this excursion into some of the psychological findings from ALSA is to address the issue of the role of cognitive resources and self-resources in the maintenance of memory and well-being, respectively, rather than simply describing mean levels of performance at each wave and the pervasiveness of changes in them for the sample as a whole. Firstly, however, the gain-loss dynamic and the limited impact hypothesis are explored by examining results for variables in the domains of cognition and self for evidence of gains,

losses, or stability over a 2-year period. A second way of exploring this dynamic is to compare across-wave change and stability in classifications of individuals experiencing cognitive difficulty or depressed affect.

With regard to resources as mediators of psychological functioning, the role of processing speed is reasonably well-established in cross-sectional work. Less attention has been given to longitudinal relationships or to the role of self-resources. By adopting contextualism as paradigm, the mediational role of these resources is investigated after adjusting for a range of characteristics that comprise the unique context for each individual studied. Studies of very old people provide a unique opportunity to examine functioning at its most differentiated, since very late in life the cumulative effects of individualised experience should most clearly reveal the impact of mediating factors (Perlmutter, 1988).

Method

Fuller methodological features of ALSA are available elsewhere (Clark & Bond, 1995; Luszcz, 1996; Luszcz et al., 1997; vanDoorn & Kasl, 1998). Briefly, ALSA is a cross-disciplinary prospective study of adults over the age of 70 that began in Adelaide in 1992. It is a population-based psycho-bio-social and behavioural study of a cohort of 1,947 adults living in the community or in residential care. Initial data collection took place between September 1992 and March 1993, with four subsequent waves at yearly intervals. Waves 2, 4, and 5 were short telephone interviews lacking psychological content and are not pursued here.

An extensive personal interview at Waves 1 and 3 canvassed psychological, behavioural, social, biomedical, economic, and demographic variables. Participants also had the opportunity to provide data on further psychological and biomedical dimensions through participation in a series of objective assessments in a separate individual assessment session. All sessions were held in the respondent's usual place of residence. Additional psychological data were sought by inviting interviewees to self-complete and return a supplementary set of standard paper-and-pencil inventories. These design features result in progressively less available data for the individual assessment and self-complete components, relative to data arising from the initial personal interview (see analytic strategy).

Participants

The primary sample was constructed via the South Australian Electoral Database (Hugo, Healy, & Luszcz, 1987). Households in the Adelaide Statistical Division were identified in which residents included one (or more) individual born before 30 June, 1922 (i.e., someone over the age of 70 at the commencement of the study).

A random sample of 3,263 primary target subjects was drawn, of which 2,705 were eligible for inclusion in the sample; 1,477 (55%) were recruited into the study. In addition to these primary participants, other household

members (mainly spouses) over the age of 65 were invited to participate. Of these 903 potential recruits, 67% agreed to participate. Thus, a further 610 individuals (including 597 spouses of primary target subjects) were added to the sample from this source, bringing the total number of Wave I participants to 2,087. Of these, 1,947 were aged 70 or more (1,040 men and 907 women). It is these people over 70 whom I have studied. By Wave 3, death has claimed 237 respondents (12%). The Wave 3 response rate, exclusive of the deceased, was 91%. The age and gender distribution at both waves was very similar (see Table 1).

Key measures

The principal cognitive and personality-and-self variables are listed but have been described in detail elsewhere (Luszcz, 1996; Luszcz et al., 1997; Ranzijn et al., 1998). In addition to these psychological measures, a range of background details and self-report measures were also recorded.

Cognitive measures. Cognitive measures were derived from standard psychometric tests. During the initial personal interview, these tests included items from the Mini Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975; see also Folstein, Anthony, Parhad, Duffy, & Gruenberg, 1985) to measure general cognitive functioning and vocabulary items taken from the Canberra Inventory for the Elderly (CIE; Christensen et al., 1994). Three instruments were administered, in the order listed, as part of the individual

Table 1. Age and gender distribution of participants at Waves 1 and 3.

Sex		Cohort 70–74	75–79	80–84	85+	Total
Wave 1						
Male	*N*	280	283	235	242	1,040
	%	14	15	12	12	53
Female	*N*	282	241	194	190	907
	%	15	12	10	10	47
Total	*N*	562	524	429	432	1,947
	%	29	27	22	22	100
Wave 3						
Male	*N*	237	231	180	162	810
	%	15	15	12	10	52
Female	*N*	256	195	160	136	747
	%	16	12	10	9	48
Total	*N*	493	426	340	298	1,557
	%	32	27	22	19	100

Note. By Wave 3, 237 had deceased; 1,710 were available; 91% participated.

assessment: a shortened version of the Boston Naming Test (BNT; Mack, Freed, Williams, & Henderson, 1992), an extended form of the Digit Symbol (DS) subscale of the WAIS-R (Hart, Kwentus, Wade, & Hamer, 1987) and the National Adult Reading Test (NART; Nelson, 1982). Consistent with Salthouse (1985, 1996; see also Luszcz, 1992), the cognitive resource of perceptual speed was based on the Digit Symbol task and indexed by the number of symbols substituted correctly in 90 seconds. Incidental memory was assessed for the pictures named on the BNT and the symbols substituted on the DS. Incidental memory tasks provide a moderate level of difficulty (Berkman et al., 1993). In addition, they assess memory as a byproduct of other processing activities, under conditions that equate encoding activities and that rely on effective implementation of retrieval strategies for good performance. For these reasons, the incidental memory tasks are likely to promote heterogeneity in performance. With the exception of NART errors, higher scores reflect better performance on all measures.

Sense of self measures. Measures of sense of self included the 20-item Centre for Epidemiological Studies–Depression Scale (CES-D; Radloff, 1977; Radloff & Teri, 1986), a 10-item Self-Esteem Scale (Bachman, O'Malley, & Johnson, 1978, revision of Rosenberg, 1965), a 15-item version of the Philadelphia Geriatric Center Morale Scale (Lawton, 1975), and 12 items from the Expectancy of Control subscale of the Desired Control measure (Reid & Ziegler, 1981). High scores on these scales indicate more depressed affect, better self-esteem, stronger morale, and a more external sense of control, respectively. In keeping with Thoits (1995), control and self-esteem were conceptualised as psychological resources that may mediate the relationship between age or activity and well-being, which was operationalised as depression and morale.

Other measures. Other background details and self-report measures included marital and educational status, health, morbidity, use of medications, and activities of daily living (Fillenbaum, 1988). Completion of the Adelaide Activities Profile (Clark & Bond, 1995) gauged participation in domestic, social, and service activities.

Analytic strategy

Most analyses are based on responses from all participants with data for each variable. This strategy of inclusion of as much data as possible enabled maximisation of the range or spread of scores, thus most fully representing the original sample longitudinally. The same pattern of results was obtained when parallel analyses were run with a common subset of participants or with all available respondents from the full community sample.

Age Group (70–74, 75–79, 80–84, ≥ 85) by Time (1, 2) MANOVAs were used to examine change over time for cognitive (picture and symbol memory, perceptual speed, general cognitive functioning) and sense of self (depression, morale, self-esteem, and control) variables. In addition, evidence of gains, losses, or stability over a 2-year period was examined in two ways.

Firstly, change scores were computed for each variable (Williams & Zimmerman, 1996), defined in terms of standard deviation or standard error of measurement (Bosworth, Schaie, & Willis, 1996; Dudek, 1979): Changes scores were "loss" (≥ 1 *SD* or *SEM* below the mean), "gain" (≥ 1 *SD* or *SEM* above the mean), and "stable" (those in between). Secondly, individuals were classified according to pre-existing criteria as experiencing cognitive difficulty (Folstein et al., 1985; < 80% or 16 out of 21 MMSE items correct) or depressed affect (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977; scores > 16 on CES-D). Classification status at each wave was compared.

Hierarchical multiple regression techniques were used to assess the mediational function of cognitive (speed) and psychosocial (self-esteem and control) resources. In the case of mediation of the relationship between age and memory at Time 2, contributions from Wave 1 distal, noncognitive variables of gender, health, activity, and depression were examined first, followed by distal cognitive variables of verbal ability and general cognitive ability. Only then was the additional contribution of speed at Wave 1 to reduction of any residual age-related variance in remembering at Wave 3 examined.

Hierarchical regressions were also used to examine whether self-resources mediated the relationship between activity level and well-being. The contribution of the self-resources of control and self-esteem was examined only after entering age, gender, marital status, education, health, and current cognition. Further longitudinal analyses focused on the extent to which self-resources and well-being at Wave 1 predicted well-being at Wave 3. Wave 3 measures included morale and depression. Activity was dropped from these models: It made little contribution in Wave 1 analyses, and initial analyses that included activity in longitudinal models showed that it neither featured significantly in the models nor changed the impact of other measures.

Results and discussion

Change over time and the limited impact hypothesis

Consistent negative cross-sectional and longitudinal age trends, and some interactions of age and time, suggested more decline in the older than younger cohorts (see Table 2 for a summary of MANOVA results and Tables 3 and 4 for age group and time means and standard deviations). Age main effects were seen for all measures. Time main effects were seen for speed, picture memory, depression, morale, and self-esteem.

These effects were modified by the crucial Age x Time interaction for current cognition, speed, picture memory, and depression. According to the means, however, the group as a whole is cognitively able and has a positive sense of self. Furthermore, the cohorts are not vastly discrepant from each other, although significant differences emerged.

Where mean age effects occurred, their impact differed. The two oldest cohorts differed from each other (12.82 vs. 13.32) and correctly named fewer pictures than the two other groups (13.9 and 13.95). Those over 80 years of

Table 2. Summary of MANOVA results for domains of cognition and self.

Domain and variable	*N*	*F*: Age	*F*: Time	*F*: Age x Time
Cognition				
Current Cognition	1,375	42.46***	2.01	4.90**
Speed	814	73.12***	47.70***	5.68***
Naming	888	23.62***	2.15	2.07
Memory: Symbol	791	9.95***	2.26	0.65
Memory: Picture	886	41.83***	57.76***	2.88*
Self				
Depression	1,426	15.75***	16.45***	2.75*
Morale	747	9.08***	7.75**	1.19
Self-esteem	758	5.41***	18.60***	0.82
Control	767	7.90***	1.88	2.40

Note. *Ns* vary because analyses used all available data for participants over 70 years of age.
*$p < .05$. **$p < .01$. ***$p < .001$.

age remembered fewer symbols (5.78 and 6.07), compared to those 75-79 (6.5) or younger (6.67). Control orientation was more internal in the youngest cohort (25.08), compared to all other cohorts (26.31, 26.36, 27.69). Simple time effects showed a small but significant decrease in morale (25.29 vs. 25.07) but an increase in self-esteem (41.55 vs. 42.41) over the 2-year interval.

Current cognition, as gauged by MMSE items, showed an interesting pattern. Over 2 years, the youngest cohort showed significant improvement and the oldest group significant decrement. While performance decrements were seen between each of the three older cohorts at both Wave 1 and Wave 3, the youngest group performed significantly better than these groups at both waves. Perceptual speed results displayed the most age-differentiated pattern. At both waves, differences between each group were significant. Apart from the youngest cohort, all groups slowed over the 2-year interval. The Age x Time interaction for immediate picture memory revealed that change over time was significant in the three older, but not the youngest, cohort. In general, the two older cohorts differed from the two younger ones. Depression was the only sense of self indicator to show the interaction. Again, the two older groups showed a significant increase in depression over time. At Wave 1, the two extreme groups differed from the two intermediate ones. At Wave 3, the difference between each group was significant.

Thus, age-cohort analyses supported the expectation stemming from the limited impact hypothesis of an increased rate of change toward the end of life. Differences seen across waves were more marked for the two older cohorts. This phenomenon is also consistent with notions of terminal change

Table 3. Age group means and standard deviations at Wave 1 (W1) and Wave 3 (W3) for cognitive and psychosocial (self) domains.

Domain and variable	Cohort 70–74	75–79	80–84	85+
Cognition				
Current Cognition W1[ai]	19.64	19.54	19.12	18.48
	(1.91)	(1.65)	(2.56)	(2.59)
Current Cognition W3	19.96	19.74	19.28	18.15
	(1.50)	(1.57)	(1.97)	(3.05)
Speed W1[ati]	35.87	31.67	26.57	23.68
	(9.66)	(9.51)	(9.84)	(8.37)
Speed W3	35.47	29.35	25.35	20.78
	(9.65)	(10.32)	(9.98)	(9.54)
Naming W1[a]	13.92	13.87	13.42	12.94
	(1.60)	(1.45)	(1.63)	(1.97)
NamingW3	13.97	13.94	13.22	12.70
	(1.52)	(1.57)	(1.94)	(2.12)
Memory: Symbol W1[a]	6.74	6.64	6.19	5.74
	(1.60)	(1.60)	(1.97)	(2.22)
Memory: Symbol W3	6.61	6.49	5.95	5.82
	(1.84)	(1.93)	(2.11)	(2.39)
Memory: Picture W1[ati]	6.35	5.71	5.14	4.58
	(2.13)	(2.25)	(2.29)	(2.35)
Memory: Picture W3	6.05	5.23	4.41	3.68
	(2.21)	(2.28)	(2.32)	(2.20)
Self				
Depression W1[ati]	6.74	7.93	7.96	9.47
	(6.33)	(7.08)	(7.14)	(7.42)
Depression W3	7.04	8.07	9.07	10.89
	(6.73)	(7.03)	(7.78)	(7.67)
Morale W1[at]	25.87	25.05	25.03	24.36
	(3.00)	(3.50)	(3.32)	(3.32)
Morale W3	25.80	24.92	24.57	23.83
	(3.33)	(3.42)	(3.50)	(3.49)
Self-esteem W1[at]	42.04	41.09	40.95	40.05
	(4.97)	(5.56)	(5.61)	(5.74)
Self-esteem W3	43.21	42.42	41.69	40.93
	(5.08)	(5.77)	(5.51)	(6.22)
Control W1[a]	25.51	26.38	26.72	27.39
	(4.63)	(5.21)	(5.64)	(4.92)
Control W3	24.66	26.24	26.00	28.00
	(5.21)	(5.94)	(5.80)	(5.82)

[a]significant age effect. [t]significant time effect. [i]significant interaction of age by time.

Table 4. Effects of time: Means and standard deviations at Wave 1 and Wave 3 for cognitive and psychosocial (self) domains.

Variable	Wave 1 *M (SD)*	Wave 3 *M (SD)*
Cognition		
Current cognition	19.30 (2.16)	19.44 (2.07)
Speed*	31.06 (10.47)	29.60 (11.13)
Naming	13.65 (1.66)	13.61 (1.80)
Memory: Symbol	6.48 (1.79)	6.34 (2.02)
Memory: Picture*	5.64 (2.32)	5.11 (2.41)
Self		
Depression*	7.81 (6.98)	8.44 (7.33)
Morale*	25.30 (3.29)	25.07 (3.46)
Self-esteem*	41.55 (5.40)	42.41 (5.55)
Control	26.22 (5.09)	25.77 (5.71)

*significant difference.

(Berg, 1996) and is likely to reflect the proximity to death in members of this cohort (vanDoorn & Kasl, 1998).

A second source of evidence bearing on the limited impact hypothesis was derived from an examination of the categorical distributions of stability, loss, and gains in performance over the 2-year period. Most participants (e.g., ≥ 70%) showed stability, with much smaller segments of the sample showing gains (e.g., 4–18%) or losses (e.g., 11–19%). Chi-square analyses crossing change status and age cohort again showed that increasing age was associated with membership in the loss group for some variables. The same overall pattern was seen when standard error of measurement (*SEM*) defined category membership. Those summarised in Table 5 used the *SD* criterion, although Dudek (1979) questioned the appropriateness of this approach.

Members of groups defined according to pre-existing criteria for cognitive or affective status are summarised in Table 6. These analyses showed that the majority of the sample was neither cognitively challenged nor experiencing substantive depressed affect. Classifications remained stable in 85% of cases for depression and 90% for cognition. Classification shifts showed both gains (6% for both domains) and losses (4% for cognition, 9% for depressed affect). These classifications are an insufficient basis on which to identify genuine cognitive impairment or clinical depression; they are most likely indicative of the lower end of the distribution of "typical ageing" (Stones, Kozma, & Hannah, 1990).

Resources as mediators of memory and well-being

Multiple regression analyses showed that Wave 1 characteristics contributed significantly to Wave 3 memory (see Table 7). Although speed remained a key

Table 5. Gain and loss classifications[a] in cognitive and psychosocial (self) domains.

Domain and variable	Mean change[b]	% Loss	% Gain	% Stable
Cognition				
Current Cognition	.14	82	17	1
Speed	-1.5	13	9	78
Naming	-.04	12	2	86
Memory: Symbol	-.13	8	6	86
Memory: Picture	-.53	19	8	73
Self				
Depression	.63	10	15	75
Morale	.22	18	12	70
Self-esteem	.86	11	11	78
Control	-.45	14	11	85

[a]± 1 *SD* criterion. [b]simple change scores (see Williams & Zimmerman, 1996).

Table 6. Cognitive and affective classifications at Wave 1 and 3.

	Wave 3					
Wave 1	"No"		"Yes"		Total	
	n	(%)	*n*	(%)	*N*	(%)
Poor Cognition[a]						
Yes	76	(6)	40	(3)	116	(8)
No	1,199	(87)	60	(4)	1,259	(92)
Total	1,265	(93)	100	(7)	1,375	(100)
Depressed Affect[b]						
Yes	85	(6)	72	(5)	157	(11)
No	1,140	(80)	129	(9)	1,269	(89)
Total	1,225	(86)	201	(14)	1,426	(100)

[a]Criterion is based on cut-offs comparable to Folstein et al. (1985). [b]Criterion is based on Weissman et al. (1977).

resource, the longitudinal results indicate the importance of other cognitive resources. Current cognitive functioning predicted symbol recall and verbal ability predicted picture recall. For both memory indices, after controlling for Wave 1 status on all other contextual variables, remembering two years earlier

added 10% (pictures) or 20% (symbols) to the variance in current remembering. Previous memory had more effect for symbols than pictures, perhaps in part because the same symbols, but different pictures, were recalled on the two occasions and because the symbols were encoded multiple times, but the pictures were encoded only once. As was the case at Wave 1 (Luszcz et al., 1997), cognitive factors had a larger impact on memory performance than did noncognitive factors at Wave 3. Indeed, when all variables were in the model, beta weights showed that contributions from noncognitive factors that appeared significant when entered earlier in the model no longer were. The picture memory results are consistent with those showing that cognitive predictors substantially reduce age-related variance in episodic memory (Hultsch, Hertzog, & Dixon, 1990; Luszcz et al., 1997), while those for symbol memory are consistent with others showing that age-related variance can be eliminated entirely (Bryan & Luszcz, 1996; Troyer, Graves, & Cullum, 1994).

Self-resources

Table 8 provides a summary of the hierarchical regressions conducted with morale and depression as criterion variables. At Wave 1, the base model entered only the contextual variables as predictors (R^2 = .178 and .244, for morale and depression, respectively). Subsequent models entered either activity or self-resources after the contextual ones. The final models looked at the extent to which self-resources continued to predict well-being after controlling for activity and vice-versa (i.e., the mediation of the relationship

Table 7. Summary of cognitive resources multiple regressions.

	Symbol		Pictures	
Variable	ΔR^2	$\sum R^2$	ΔR^2	$\sum R^2$
Noncognitive	.039	.039	.095	.095
Cognitive	.049	.088	.080	.175
Speed	.039	.127	.097	.267
Recall Wave1	.208	.335	.099	.366
Age	.001^{ns}	.336	.019	.385
F	.74^{ns}		19.32	
F		18.29		24.08

Note. Noncognitive variables include physical and functional health, activity level, depression and gender; cognitive variables include vocabulary, current cognition and NART errors; speed is correct digit symbol substitutions; Recall Wave 1 is performance on symbol or picture task, respectively. ΔR^2 = Change in R2; $\sum R^2$ = cumulative R^2. All effects are significant unless marked *ns* = nonsignificant.

Table 8. Summary of self-resources multiple regressions.

Model		Morale ΔR^2	Morale ΣR^2	Morale $F\Delta$	Depression ΔR^2	Depression ΣR^2	Depression $F\Delta$
	Wave 1						
1 & 2	Background[a]	.18	.18	21.99	.24	.24	32.65
1	+Activity	.02	.20	18.86	.01	.25	30.04
	Self-Resources	.11	.31	28.82	.04	.29	30.35
2	+ Self-Resources	.12	.30	35.79	.04	.29	32.87
	Activity	.01	.31	4.32	.00	.29	*ns*
1 & 2	Overall F		31.25			30.04	
	(df)		(13, 907)			(12, 908)	
	Wave 3						
3 & 4	Background[a]	.272	.272	35.53	.265	.265	44.86
3	+ Self-Resources	.048	.320	20.17	.062	.327	34.48
	+ Well-Being[b]	.241	.561	310.62	.109	.436	144.08
4	+ Well-Being[b]	.287	.559	370.62	.142	.407	179.02
	+ Self-Resources	.002	.561	*ns*	.029	.436	19.26
3 & 4	**Overall** *F*		80.47			60.02	
	(df)		(9,568)			(9,742)	

Note. ΔR^2 = Change in R^2; ΣR^2 = cumulative R^2.
[a]Background variables: age, gender, education and current marital and health status.
[b]Well-being refers to the respective morale or depression measure taken at Wave 1.

between each set of variables and well-being by the other). A total of 31% of the variance was explained in morale and 28.5% in depression. The majority of the variance explained is attributable to background characteristics: being married, reporting better health, and using fewer medications featured significantly in the final equation for morale (accounting for 58% of the explained variance). In the case of depression, additional significant contributors came from poorer cognitive status and more illnesses and difficulties with ADLs (accounting for 85% of the explained variance). After controlling for the contextual variables, activity added 2.1% to the variance in morale and 0.4% to the variance in depression. This outcome compares with contributions of 12.4% and 3.8% from the self-resources, after the effect of contextual variables were taken into account.

The hypothesis that self-resources mediate the relationship between activity and subjective well-being was clearly upheld for depression. Activity's unique contribution was meagre, after controlling for the potential confounds. In contrast, self-resources markedly reduce (by 67%) but do not eliminate the contribution from activity (now 0.7%) to morale. To put these finding into perspective, the mediation of the self-resources and well-being relationship by activity was also examined. The picture that emerged is quite different. Self-

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resources continue to be strong predictors, activity producing reductions in variance of only 7% and 13% for depression and morale, respectively.

In summary, the majority of the variance in well-being at Wave 1 is attributable to contextual variables. The remaining variance is attributable primarily to self-resources. For morale, 11% of total variance is uniquely attributed to perceived control and self-esteem; the lower figure for depression is 4%. Of the self-resources, self-esteem (9% vs. perceived control 2%) is the more important predictor of morale, and perceived control (3% vs. self-esteem 0.8%) is more important for depression. Activity (domestic and household maintenance) contributed less than 1% to morale and nothing to depression after adjustment for (i.e., net of) all other variables.

To assess the applicability of self-resources prospectively, a series of longitudinal models was run in which self-resources were entered after the contextual variables, and then the respective Wave 1 well-being measure (e.g., morale at Wave 1 and morale at Wave 3). For both morale and depression, the self-resources added significantly to the variance (5% and 6%, respectively). However, morale (24%) and depression (11%) were better predictors of their respective Wave 3 levels.

The second series of models entered the Wave 1 well-being measure prior to entry of the self-resources variables. Because Wave 1 well-being is taken into account, these models are looking at change in well-being over time. These analyses showed that morale at Wave 1 (29% of variance) but not the self-resources (0.2% of variance) contributed significantly to change in morale. In contrast, for depression, the self-resources continued to make a significant contribution (3% of variance). Examination of betas in the final step of the model supports the conclusion that those with a stronger sense of self-esteem 2 years earlier will be less vulnerable to increases in depression over this period. For both sets of regressions, the contextual variables contribute the major component of explained variance, as was the case in the cross-sectional analyses. For both morale and depression, higher self-rated health and being married are significant. For depression, being female is also associated significantly with overall levels of depression at Wave 3 and deterioration in it over 2 years. A total of 56% and 44% of the variance in morale and depression was explained.

The centerpiece of this inquiry was the notion that concurrent or pre-existing self-resources are conducive to well-being. Overall, the results point to their importance for the two well-being indicators examined in this analysis of the ALSA. At baseline, both self-esteem and perceived control were important predictors of unique variance in well-being and mediated the modest relationship between it and activity. Concurrent self-resources are associated with higher levels of well-being. The longitudinal analyses confirmed that pre-existing self-resources are beneficial to maintenance or improvement in well-being over time, as measured by depressed affect. While Wave 1 self-resources were predictive of later morale, this relationship was eliminated when Wave 1 morale was taken into account first.

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Conclusion

Results from this sample of very old adults lend support to later life changes implied in Salthouse's limited impact hypothesis of cognitive decline. There was evidence for the basic implication that most people will show stability in their performance from time 1 to time 2. Age and most change variables showed small but significant correlations, lending support to a second implication of variability in the rate of change from one age to another. Age differences observed for change in picture memory, speed of processing, and current cognitive status generally showed that only extreme groups differed significantly. Differences were small in an absolute sense and over time. This trend is consistent with others showing small amounts of change or stability over a 2-year interval. A longer interval might have revealed more change. Furthermore, some of the "change" reported here might be more aptly described as intraindividual variability (Nesselroade, 1991). This possibility cannot be ruled out. It was also the case that the two older groups showed more decline than the two younger cohorts

Even late in life, therefore, cognitive change over 2 years appears small and unlikely to be of consequence until the ninth decade. Even then, it does not seem to compromise everyday functioning. Maintenance of a positive outlook on life was the norm in this sample. Because these results stem from a population-based sample, they are likely to reflect ageing typical of a wide cross-section of older Australians.

Contextual analyses examining resources supported the hypothesised relationships in both domains. Psychological resources contributed independently to memory or well-being after taking into account a range of background variables, such as age, gender, education, functional or physical health, activity level and, for memory, general intellectual ability. In both cognitive and personality-and-self domains, psychological resources independently predicted current functioning, growth, and resilience, above and beyond that attributed to this complex of individual differences.

Applied and theoretical importance can be ascribed to the evidence that, even if measured quite globally (Smider, Essex, & Ryff, 1996), self-resources play a significant role in predicting well-being. These subjective evaluations by individuals, unlike more objective constraints, liabilities, or deficits, may be more plastic and amenable to manipulation. The amenability of psychological state to self-motivated change highlights an avenue that could be followed to promote ageing well in those who may be struggling with this phase of life. This could be the focus of interventions aimed at improving one's outlook on life and, in turn, quality of life and sense of well-being.

A theoretical point implicit in this approach is that personal resources (control and self-esteem) are precursors to well-being (morale and depression) rather than alternative dimensions of it. Initial factor analysis of our measures supported this distinction. Two distinct factors were identified: Morale and depression loaded on one (accounting for 37% of variance), and self-esteem and control loaded on the other (31% of variance). In addition to

Thoits' (1995) conceptual framework, Ryff and Essex's (1991) empirical work on dimensions of well-being provides some justification for the present formulation. Ryff and Essex's factor analysis revealed three factors, suggesting separable dimensions: (a) general well-being, with loadings for morale, depression, self-esteem, and control; (b) self-acceptance and positive relations with others; and (c) sense of control. Their solution, of course, can say little about the processes or mechanisms that provide a basis for the relationships among the factors.

My contention is that conceptualising some dimensions of well-being as resources that safeguard or bolster others will shed light on the mechanisms by which well-being, whether cognitive or affective, is maintained. I was pleased to find, after having arrived at this conceptualisation, convergent evidence of similar thinking amongst Carol Ryff and her colleagues. Usually, they conceptualise engagement (purpose in life and personal growth) as an aspect of well-being (Ryff & Essex, 1991; Ryff & Keyes, 1995). In something of a departure, Ryff and her colleagues (Smider et al., 1996) have recently conceptualised some dimensions as psychological resources and have also suggested that examination of pre-existing psychological resources may be particularly useful in longitudinal investigations, a view consistent with other recent reports (e.g., Baltes & Lang, 1997).

Returning to the life-span view, multidirectionality (i.e., patterns of gains, losses, and stability) was observed within each of the two target domains over the 2-year interval between major waves of the ALSA. Multidimensionality was evidenced in that overall loss was more likely to occur in measures from the cognitive domain, although stability and gains were visible within this and the personality-and-self arena. Losses were mainly limited to those in the oldest age cohort or undergoing some challenge that might serve as a trigger for decremental change. A further illustration of multidimensionality is that the trajectories of change varied within and across domains. Clearly, the study and its findings are interpretable within the conceptually rich life-span developmental theoretical perspective.

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Ageing-aging spelling variants: Instead of the APA-preferred "aging", the alternative "ageing" is used to complement the ALSA choice.

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