

# Effects of literacy on cognitive aging: some notes(\*)

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*Though neural cells die and do not replace themselves, mental capacity for learning need not decline with the years. Indeed, it is not the quantity of brain cells that counts; it is their ability to form new interconnections that determines brain power. Neuroplasticity describes the process through which the brain continually reorganizes itself. [...]*

*Neuroplasticity holds considerable promise for education. [...]*

*On the basis of neuroplasticity research, one could accurately conclude that the brain will respond to appropriate mental exercises just as the body does to physical exercises. [...]*

James O. Connelly (n.d.: 2)

## *Introductory note*

As each old adult is expected to present a different cognitive profile due to several factors (see below Bäckman et al. 2001: 366), cognitive aging is anything but a uniform process. Thus, bearing in mind the present education scenario of the Portuguese population (see Pinto 2004a: 79), it may be hypothesized that the offer of opportunities to reach higher levels of literacy (in a broader sense) will

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certainly improve the prognosis concerning cognitive aging among the elderly in Portugal.

My aim then in this text is to suggest that the level of literacy in a broader sense (see below) may play a very effective role in cognitive functioning across adult life span and represent a critical demographic factor which is worthy of study when policies aimed at preventing cognitive decline<sup>1</sup> are to be implemented.

### *Different ways of looking at literacy*

It is relevant to look at the way literacy has been defined from at least two theoretical points of view (see De Lemos 2002: 3). But one should also be aware of the fact that information and communication technologies (ICTs) – for example the Internet – are contributing to the redefinition of the nature of literacy<sup>2</sup>. Indeed, according to Karchmer et al., “the nature of early literacy has undergone substantial transformation in the past 20 years [...]” (Karchmer et al. 2003: 176).

Let us then consider the above-mentioned theoretical perspectives. On the one hand, the cognitive-psychological approach is associated with the definition of literacy in a narrower sense<sup>3</sup>, and, on the other hand, the socio-cultural approach has to do with the definition of literacy in a broader sense (see De Lemos 2002: 3).

The former meaning of literacy is essentially concerned with the ability to read and write (see De Lemos 2002: 3). Hence, the cognitive-psychological

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<sup>1</sup> Or positively rephrased according to Matos (see also Matos 1996), “at enhancing/promoting cognitive sustainability”. This suggestion, as well as others taken in due account, is part of Francisco Gomes de Matos’ useful comments on a previous version of this text, sent to me in April 2005.

<sup>2</sup> In this text, literacy should be taken in its traditional sense. As for other types of literacy, see R. E. Hodges (Ed.) (1999: 1). Other types of literacy, such as *cognitive literacy*, *creative literacy*, *ecoliteracy* or *peace literacy* are however not included in *The literacy dictionary. The vocabulary of reading and writing*, published by the International Reading Association (1995), as Francisco Gomes de Matos writes in his comments on a previous version of this text (see note 1). In this regard, and in the same context, I cannot help transcribing F. Gomes de Matos’ words: “[a]ge related literacy could have its place in the sun, too (or, more specifically, gerontoliteracy).”.

<sup>3</sup> According to De Lemos (2002: 3), the narrower definition of literacy is usually meant as “the conventional or commonsense view of literacy”.

approach linked to this way of looking at literacy aims at identifying the processes underlying the ability to read and write, as well as their development (see De Lemos 2002: 3). The latter meaning of literacy, the broader one, is advocated by those who consider literacy as a social process, which evolves thanks to the exposure to literacy practices connected with particular environments and which is intimately linked with its social and cultural context (see De Lemos 2002: 3).

These two meanings of literacy make me think of Magda Soares' notions of "letramento" and "alfabetização". "Letramento" (see literacy in a broader sense) is defined by this author as "estado ou condição de quem não apenas sabe ler e escrever, mas cultiva e exerce as práticas sociais que usam a escrita" [*state or condition of someone who not only knows how to read and write, but who cultivates and exercises the social practices which use writing*] (Soares 2001: 47) and "alfabetização" (see literacy in a narrower sense) is defined as follows: "ação de ensinar/aprender a ler e a escrever" [*action of teaching/learning to read and write*] (Soares 2001: 47).

From my point of view, literacy should not be confined to the ability to read and write or even to comprehend and produce written texts (see De Lemos 2002: 3). I think that the literacy which I am concerned with should rather be understood as a process of deriving meaning from text (see De Lemos 2002: 3), or "creating meaning in/for texts" as F. Gomes de Matos suggests<sup>4</sup>. Therefore, I advocate a broader sense of literacy.

I also defend the idea that literacy implies other language skills: "language skills such as listening and speaking, as well as [...] other skills including the interpretation of visual material<sup>5</sup>, the use and understanding of mathematical concepts and notation, computer 'literacy', and critical thinking." (De Lemos 2002: 3).

It is true that literacy in a broader sense cannot exist without the ability to read and write (literacy in a narrower sense), which relies on two fundamental prerequisites/skills that are expected to be obtained through explicit teaching, through reading instruction, i.e., symbol-sound knowledge and phonemic awareness (cf. De Lemos 2002: 7). Nevertheless, other factors may play an outstanding role in recognising words visually with a minimum of phonological

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<sup>4</sup> See note 1.

<sup>5</sup> In this regard, see Pinto (2004b: 60 and ff.) when she refers to the narrating by the elderly of stories depicted visually.

processing (see De Lemos 2002: 7). They are, according to De Lemos (2002: 7), visual processing skills and short-term and long-term phonological memory. These factors are, however, for De Lemos, more dependent on a “self-teaching mechanism”. In other words, still according to this author, the greater the number of words recognised visually – the better one reads and the more one is inclined to increase his/her exposure to print –, the more fluent one’s reading is and the less dependent one will be on the cognitive demands which reading decoding requires, making it possible to focus cognitive efforts and energy more on comprehension than on decoding.

It is important to highlight the fact that the basic skills required to read (and write) should become automatic as early as possible so that less time and cognitive energy will be spent on decoding – especially of non-familiar words – in order to attain the required reading fluency and comprehension. (See also Stanovich 2000: 38.) De Lemos (2002: 7) also considers that the work undertaken to increase word recognition skills and therefore to build up a store of visually recognised words is due to the “self-teaching mechanism” already mentioned, which is doubtless crucial to attain fluency and speed of reading.

#### *Some notes on cognitive aging*

Before going into detail about the type of literacy which applies to this text, let us have a look at the meaning of “cognitive aging”.

If we take into account cognitive development from a life span perspective (see Doron & Parot 2001: 224), I believe that we are also faced with the concept of “cognitive aging”. Cognitive aging is doubtless a concept worth studying if we try to give an answer to Park’s question “What happens to the cognitive system as we get older?” (Park 2000: 3), and if we wish to contribute to the understanding of the effects of aging on cognitive function (see Park & Schwarz 2000: xi).

Furthermore, how can we balance the losses associated with cognitive aging with the increase<sup>6</sup> of knowledge and experience which is a consequence of aging (see Park 2000: 3)?<sup>7</sup>

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<sup>6</sup> Or, in Francisco Gomes de Matos’ words, “enhancement/deepening of knowledge”. See note 1.

<sup>7</sup> See, for example, Juncos Rabadán & Pereiro Rozas (1998: 67-68) when they share with us interventionist suggestions at the level of discourse.

About intelligence and memory functioning in aging, Bäckman et al. (2000: 513) add that research data indicates that “fluid intelligence, episodic memory, and working memory are associated with a robust age deterioration, characterized by a relatively early onset of decline that continues into very old age.” And they continue: “In contrast, tasks tapping crystallized intelligence and semantic memory typically demonstrate stability across much of the adult life span, with the onset of deterioration occurring in later stages of life.”

Moreover, according to Park (2000: 8), “the speed at which information is processed, [...] working memory function, [...] inhibitory function, and [...] sensory function” are (also) four important mechanisms hypothesized to explain age differences in cognitive functioning.

These mechanisms are also taken into account by Jones & Bayen (1998: 676) when they add, based upon literature, that “[c]urrent theories of cognitive aging suggest that age-related changes in cognitive abilities are the result of cognitive slowing [...], limited processing resources [...], and failure to inhibit task-irrelevant information [...].” And the authors also state that age-related decline in cognitive functioning may be accompanied by sensory deficits (see Jones & Bayen 1998: 676).

*Does literacy in a broader sense play any role in cognitive aging in general?*

Is it then possible that literacy in a broader sense may contribute, among other things, to narrow the gap caused by age changes in terms of semantic and episodic memory, on the one hand, and crystallized and fluid intelligence on the other hand in the course of the life span?

To what extent can literacy in a broader sense do anything to optimize the performances which cannot do without these two patterns of memory and intelligence (see Bäckman et al. 2000: 502-503.)?

What about the possible role played by literacy in (explicit) declarative memory and implicit, procedural (nondeclarative) memory (see Prull et al. 2000, and Köpke 2004: 12.)?

It is perhaps too early to establish a linear connection, if it exists, between levels of literacy in a broader sense with age-related (decline in) cognitive functioning. Studies on effects of literacy will then be welcome not only in terms of a better understanding of the phenomenon of language attrition in first language (see Köpke 2004: 14) but also, in my opinion, to reach a better understanding of language development across adult life span in healthy subjects.

As regards the possible role of the level of literacy in cognitive functioning across life span, I hypothesize that continuous education, as well as continuous exercise of social practices of use of writing (literacy in a broader sense), may be of great help to prevent the advance of cognitive slowing and inhibitory function, and to enhance processing resources by means of compensatory mechanisms. We should bear in mind that continuous education is also concerned with learning. In fact, as for cognition, learning plays a very important role because, as Barbara Köpke reports about L2, quoting Zobl (1995: 35, it “relies on memorization and problem-solving and leads to explicit, conscious knowledge [...]»” (Köpke 2004: 12)<sup>8</sup>.

It is then expected that, in spite of the great variability within this population, lifelong learning<sup>9</sup> should enhance metacognitive skills and consequently improve explicit and conscious knowledge.

When older adults cannot find the ways to compensate their cognitive slowing without external help, then society should provide them with the means they need.

I would then suggest that opportunities should be offered to every citizen to get the desired level of instruction, to update his/her knowledge through lifelong learning, to attend university or other programs for senior citizens if they so desire when they retire, as well as, following F. Gomes de Matos’ *way of thinking*, to foster and enhance their communicative/linguistic creativity, their creative dimension<sup>10</sup>.

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<sup>8</sup> In this respect, see also Kemper et al. (2001: 228).

<sup>9</sup> It is worth noting what Bereiter and Scardamalia mean by “lifelong learner”, i.e., “someone who has a lifelong *commitment* to learning, that is, someone whose top-level goals that govern major life plans, include learning roles.” (Bereiter & Scardamalia 1989:362). Actually, this way of looking at the term “lifelong learner” has to do with “intentional learning” which “refer[s] to cognitive processes that have learning as a goal rather than an incidental outcome.” (Bereiter & Scardamalia 1989: 363). The question which may be raised is whether older people in general when they wish to attend, for example, university programs for senior citizens take learning as a goal, i.e. in the intentional sense.

<sup>10</sup> See note 1. As for the creative dimension, see also Withnall ([this volume, p. 19](#)). Indeed, Withnall’s text as a whole may also be taken as a good example of a positive way of looking at aging.

*Some data on computer training courses for older adults*

In this context, and bearing in mind the cognitive and sensory functioning across life span, it seems pertinent to report, according to Jones & Bayen (1998)<sup>11</sup>, the way the instructors of computer training courses for older adults are advised so that students may benefit as much as possible from those programs. Among other things, they are recommended to “[a]llow sufficient time during instruction for older adults to process events and information (Jones & Bayen 1998: 677) [...] [,] [p]rovide more pauses during lectures”, so that older adults may take notes and rely therefore on external memory aids, “[a]llow students to ask questions during instruction to help clarify information [...] [,] [s]et aside time for class discussions so that students have extra processing time [...] [,] [m]inimize the amount of reading required during instruction – or provide extra time for reading [...] [,] [p]rovide opportunities for students to complete hands-on activities at their own pace [...] [and] [a]djust the «control panel» settings to accommodate students’ needs.” (Jones & Bayen 1998: 678-679).

As for the limited processing resources, Jones & Bayen (1998: 679) suggest, based upon literature, that environmental support may improve memory tasks. With regard to «lack of inhibition», the same authors assert that teachers are expected to “[m]ake the learning objectives clear and explicit to minimize the chances of irrelevant information entering into students’ working memory [...] [,] [o]rganize hands-on activities so that students work on only one specific task at a time [...] [,] [u]se language as explicitly as possible to minimize irrelevant connotations and inferences that may be drawn by older adults [...] [,] [e]liminate noise disturbances in the classroom because older subjects have difficulty ignoring irrelevant auditory stimuli [...] [,] [b]e aware of and regulate other environmental distractions in the classroom such as unnecessary movement, extreme temperatures, and poor lighting. [...] [and] [c]hoose an appropriate time of day to schedule class.” Indeed, as the authors stress, “[i]nhibition may be less efficient at non-optimal times of the day.” (Jones & Bayen 1998: 683-684)<sup>12</sup>.

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<sup>11</sup> Jones and Bayen’s article “reviews current theories of cognitive aging and derives implications for teaching older adults to use computers.” (Jones & Bayen 1998: 675).

<sup>12</sup> For more information about training older adults to use the computer, see Baldi (1997), Echt et al. (1998), as well as Mayhorn et al. (2004). As for the inhibition deficit and its implications in cognitive and lexical processing, see Juncos Rabadán & Elosúa de Juan (1998: 36 and ff.).

In order to help diminish the effects of reduced sensory functioning in older adults<sup>13</sup>, Jones & Bayen (1998: 685) present other recommendations concerned especially with visual perception due to the fact that teaching the use of computers is the main aim of their study. What is more, taking into account the suggestions of the current theories on cognitive aging, the authors add that instructors are expected to use different types of teaching methods (see Jones & Bayen 1998: 686) because they are naturally dealing with another important variable, i.e. individual differences. Indeed, it should remain very clear that older adults are not a homogeneous group of people (see, in this regard, Glendenning 1995: 469 and 481; Czaja 2001: 548; Sáez Carreras 2002: 35). (See also Bäckman et al. (2001: 360-366), in respect, for example, to episodic memory functioning, with regard to the large performance differences in older adults as a result of different factors, such as demographic – age, education and sex – , lifestyle, health-related, and genetic factors.)

*Education as a possible factor in prevention of cognitive and language decline*

Education – and supposedly the level of literacy –, although it should primarily be seen as a promoter of cognitive sustainability<sup>14</sup>, is also focussed as a possible important factor of protection against decline in later age by authors such as Coffey et al. (1999: 189) when they refer to the “reserve hypothesis” of brain aging, by Verghese et al. (2003: 2509) when they assert: “Katzman proposed that persons with higher educational levels are more resistant to the effects of dementia as a result of having greater cognitive reserve and increased complexity of neuronal synapses [...]. Like education, participation in leisure activities may lower the risk of dementia by improving cognitive reserve [...]” (see also Glendenning 1995: 469), and, as far as language is concerned, by Juncos-Rabadán (1996: 669) when he suggests that education contributes to enhance narrative performances in all age groups due to the fact that “it improves the metacognitive skills involved in narrative competence.” and when he adds that education seems “to mitigate the negative effect of age on narrative capacity.” (Juncos-Rabadán 1996: 682)<sup>15</sup>.

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<sup>13</sup> Or, in positive terms (see Matos 1996), to help “sustain” sensory functioning (see note 1).

<sup>14</sup> As for positive rephrasing, see note 1.

<sup>15</sup> As regards language in the elderly, see also Juncos Rabadán (1998), and Pinto (2004b: 59 and ff.).



*Other possible implications of education*

Finally, I hope that continuous education and therefore a good level of literacy (in a broader sense) may lead older adults to be able to take as much advantage as possible from:

1. postformal style of thought

In respect to this style of thought, Csikszentmihalyi & Rathunde (1990: 30-31) suggest that "postformal thought" has the following features: "a. One recognizes the relativity of various formal systems through *life experience* and is able to assume contradictory points of view. b. One acknowledges the *interrelatedness* of all experience and the inevitability of change and transformation. c. One adopts a more "metasystemic" or *reflective* and integrative approach to thinking (often dialectal). d. One makes choices with *commitment* to a certain course of action [...]."

2. wisdom

With regard to wisdom, if the category "wise person" as used in daily language may be included in the general concept of "wisdom", I share Holliday and Chandler's view (Holliday & Chandler 1986 referred to by Csikszentmihalyi and Rathunde) when they portray the wise person as having: "a. a general competence (a dimension that overlaps with logical intelligence or technical ability); b. an experience-based pragmatic knowledge; and c. reflective or evaluative metaanalytic skills." (Csikszentmihalyi & Rathunde 1990: 30). Moreover, I wish to add Sternberg's wise words when he describes wise people as follows: "Wise people know what they know and what they do not know as well as the limits of what can be known and what cannot be [...] Wise people welcome ambiguity, knowing it is an ongoing part of life, and try to understand the obstacles that confront themselves and others in life." (Sternberg 1990: 157). In fact, the author's words were written in the realm of what he calls "a metacognitive stance" (Sternberg 1990: 157). On the other hand, wisdom should also be associated with "knowing and doubting" (see Meacham 1990: 185, 187, 189).

and

3. metacognitive skills

In this regard, based upon literature, it is possible to share the following opinions. For Kitchener and Brenner, "metacognition allows one to monitor the effectiveness of a particular strategy for solving a problem" (Kitchener & Brenner 1990: 216). According to Hertzog and Hultsch, "[m]etacognition can be defined

as cognitions about cognition [...]”. And the authors add: “We identify and treat three major categories of metacognitions: (a) knowledge about cognition and cognitive functions, (b) the monitoring of the current state of the cognitive system, and (c) beliefs about cognition (including beliefs about aging and cognition and beliefs about one’s own cognition).” (Hertzog & Hultsch 2000: 417).

It is worth noting that the applied science aimed to educate older people and which advocates a competential approach, i.e. gerontagogy, does not neglect these aspects (see Lemieux & Sánchez 2001: 85 and ff.).

### *Final remarks*

The three above-mentioned concepts (postformal style of thought, wisdom and metacognitive skills), which I deeply believe benefit from higher levels of education, should be present in older adults – and even before as happens with some people – so that they may remain active participants in different activities of their communities, be critical towards the world and the way society is used to looking at them, and – last but not least – acquire the necessary compensatory mechanisms to resist cognitive decline or, in positive terms, to enhance cognitive sustainability<sup>16</sup>.

To conclude, I hypothesize that education, i.e., a good level of literacy in a broader sense, as one of the critical variables which should be taken into consideration in the realm of a successful cognitive aging process, should contribute, following F. Gomes de Matos’ suggestion, to enhance the cognitive strengths of the elderly and to monitor their cognitive weaknesses, also helping them towards sustained, creative literacy experiencing<sup>17</sup>.

Quoting Stald’s words about another area of research, the topic of this text – effects of literacy on cognitive aging – belongs to a domain where, in fact, “[m]ore research needs to be done...”. (Stald 2002: 47). Therefore, this text should be taken as a mere act of sharing with you my views and concerns on this subject at this point of my research.

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<sup>16</sup> See note 1 in regard to Francisco Gomes de Matos’ comments on a previous version of this text.

<sup>17</sup> See note 1.

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