university of groningen

Aging attriters

How methodological challenges can help construct bilingual theories

Merel Keijzer

Rosalind Franklin Fellow

University of Groningen

m.c.j.keijzer@rug.nl

http://www.rug.nl/staff/m.c.j.keijzer/

CLCG
Center for Language and Cognition Groningen

university of groningen

Loss of Language Skills Conference (1980)

IC(F)LA

- ICFLA 1: 2002
- ICFLA 2: 2005
- ICLA 3: 2016

university of groningen

Lifespan perspective on attrition

Twin processes: L2 acquisition and L1 attrition

- Regression
- Primary cause attrition

Twin processes: L2 attrition and L1 reversion

- Temporary vs. permanent
- Aging

Lifespan perspective on attrition

Twin processes: L2 acquisition and L1 attrition

Regression

Primary cause attrition

Twin processes: L2 attrition and L1 reversion

Temporary vs. permanent

Aging

Twin processes: L2 acquisition, L1 attrition

› L1 attrition is "promising the exploration of the links between the brain, mind, and external factors that are also of interest for research on multilingualism" (Köpke, 2007: 10)

› For the longest time attrition was mostly tackled by linguistics, however:

> long-standing debate whether L1 non-use or L2 acquisition that drives attrition (cf. Schmid, 2011; Bice & Kroll, 2015)

› From bilingual processing perspective twin processes of bilingual competition

The role of regression

› Jakobson's (1941) regression hypothesis: last in, first out.
  - Preoccupation of the field to look at attrition as an analogy or mirror symmetry of acquisition
    - Language development rather than attrition or acquisition (Herdina & Jessner, 2002)
  - Regression treated as theoretical framework to study attrition (Goral, 2004; Köpke & Schmid, 2004), but it is not a theory
  - Order prediction borne out of data (Keijzer, 2007; Keijzer, 2010), but mirror symmetries with child language acquisition mainly stems from competition.
    - Bilingual competition vs. cognitive immaturity

university of groningen

In short....

- Attrition as a field took most of its initial theorizing from second (and first) language acquisition
- The reverse pattern has always been an important focus
- The competition aspect of bilingual processing has often been overlooked in the past...

- Aging attriters can not only shed more light on this but also feed back into bilingual (processing) theories.

Biological and cognitive changes of aging

› Recent years have seen a host of studies on healthy aging
  - Increased proportion of elderly in developed countries (Alho, 2008)

› Cognitive resources decline with age (cf. Wingfield & Grossman, 2006):
  - Processing speed
  - Working memory (capacity)
  - Inhibition mechanisms

- Age-related cognitive decline impacts on language (cf. Burke & Shafto, 2008)
  - Increased difficulty comprehending speeded speech
  - Impaired ability to comprehend and produce complex syntax
  - Experience with word finding and selection difficulties

Less work on people who grow old in an L2 environment (but see de Bot & Makoni, 2005, Pot, Keijzer, de Bot, submitted)

> changing perspective: advanced age as a legitimate life stage and multilingual aging within that

Similarities attrition and language change in healthy aging

> Goral (2004):

- First noticeable changes in lexical access and retrieval, manifested as false starts, hesitations, disfluencies
  - Problems seem phonological rather than semantic
- A noticeable impact of social networks:
  - reduced L1 input; reduced interaction in old age
- Goral points out difference in cognitive resources which don't decline in attrition but do in aging.
  - Does point out two languages competing for competition may have similar effect
  - How about aging attriters?

http://news.utexas.edu/2014/08/22/the-politics-of-immigration-puts-our-elders-at-risk

What happens to older attriters?

- Linguistically:
  - Twin processes of L1 reversion and L2 attrition
- Cognitively:
  - They are dealing with double competition
    - Bilingual competition
    - Cognitive resources competition due to advanced age
      - Many manifestations that may have been interpreted as L1 reversion and L2 attrition may instead reflect reduced inhibition and bidirectional changes

Twin hypothesis older migrants (de Bot & Clyne, 1989: 67)

- First language reversion: as immigrants grow older, they tend to use the L1 more than they did in middle age
- Second language attrition: as immigrants grow older, they tend to forget vocabulary and lose grammatical rules that they used in middle age

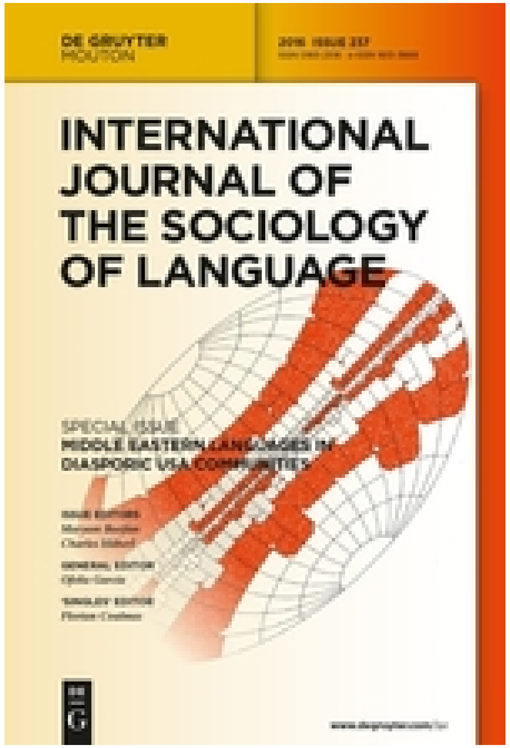
As a result: aged care facilities based on this ‘fact’

- “It is common knowledge these days [...] that ageing is often accompanied by language reversion” (Haines 1999)
- “research [...] clearly shows that language reversion in later life is common”
- Some of the observed cases may be linked to pathological factors such as early dementia, which can selectively affect a bilingual’s languages (Fabbro, 1999)

- So conclusion that L1 reversion has occurred is not based on linguistic observations, but self-reports and reports by family and friends (de Bot and Clyne 1989; de Bot and Lintsen 1986) – ‘persistent myth’ (Schmid & Keijzer, 2009)
  - Clyne (2011): only 1 out of 45 (Dutch and German) migrants in Australia said their L2 skills had become poorer to the detriment of resurging L1 levels (referring to de Bot & Clyne, 1989)
  - Crezee (2008): little evidence L2 attrition in Dutch migrants in Australia
  - Seebus (2008) found fear of L2 attrition and L1 reversion to be recurrent theme in her interviews with Dutch migrants in Australia, but no actual evidence for this happening

- As with language attrition issues in general, biological, cognitive and environmental factors need to be taken into account (Köpke, 2007).
- Keijzer (2011), newly formulated twin hypotheses:
  - As immigrants grow older their cognitive resources decline, causing a reduction in overall verbal fluency and longer RTs on language tasks
  - As immigrants grow older, they show increased difficulty with the correct activation and inhibition of their two language systems, leading to more (bidirectional) interferences

Schmid & Keijzer (2009)



- Aim: to assess simplistic predictions for a linear development of first and second languages against a more complex perspective which takes into account psycholinguistic aspects of activation, inhibition and cognitive aging
- Activation Threshold Hypothesis (Paradis, 2004) is often coined as a framework to study attrition
  - Building on frequency and recency of use, L2 use should get better, L1 use worse with time
  - But activation threshold crucially not only relies on recency/frequency of activation, but also inhibition of irrelevant information (Green 1998)

- What is often experienced as memory loss is inhibition becoming less effective (e.g. Burke 1997; Burke and Osborne 1997; Burke and Shafto 2008, Radvansky, Zacks and Hasher 2005).
- Not the case of information becoming lost or inaccessible, but more difficulty suppressing irrelevant information, blocking the target
  - In Schmid & Keijzer (2009) we presented a more detailed investigation of this claim, focusing on lexical access and fluency

university of groningen

Method: participants (n = 249)

Group	M/F ratio	Age	AaE	LoR
Germans in Canada (n=53)	19/34	63.27 (11.02)	26.19 (7.20)	37.07 (12.49)
Germans in Neth. (n=53)	18/35	63.28 (9.48)	28.76 (7.19)	34.52 (11.27)
Controls: Germany (=53)	18/35	66.88 (11.00)	-	-
Dutch in Canada (n=45)	21/24	66.44 (7.38)	22.02 (5.99)	44.42 (9.11)
Controls: Neth. (n=45)	21/24	66.24 (7.95)	-	-

Method: materials

- Semantic verbal fluency task: animals and fruits/vegetables (Goodglass and Kaplan, 1983)
- Free speech: Charlie Chaplin film retelling task (Perdue, 1993)
  - Lexical richness D (McKee, Malvern and Richards, 2000)
  - Disfluency: number of filled pauses and hesitations (Schmid and Fägersten, 2010)

Results

› There was a lexical attrition effect: attriters were significantly outperformed by controls, with the exception of filled pauses:

	Attriters		Controls		T-Test	Effect size
	mean	sd	mean	sd		(r)
VF	19.80	4.51	23.68	4.85	t (244) = 6.392. p < ,001	0.38
D	62.99	16.36	69.36	16.22	t (243) = 2.998. p = .003	0.19
FP	48.70	34.98	46.49	32.18	t (243) = .501. p = .617	0.03
REP	12.92	10.67	6.70	5.33	t (243) = -5.344. p < ,001	0.32

Assessing the effect of age: means per age group and per condition:

		VF	D	FP	REP	CS
	<57	22.33	66.88	36.52	10.21	4.24
	57-64	20.02	68.55	50.63	12.92	8.01
ATTRITERS	65-67	19.91	63.22	48.87	9.20	5.08
	68-71	17.95	56.89	63.02	17.49	11.52
	72+	19.17	60.66	40.15	13.48	10.10
	<57	25.89	73.64	43.84	6.41	
	57-64	24.55	72.23	53.30	6.04	
CONTROLS	65-67	23.60	68.46	53.56	6.12	
	68-71	21.61	65.92	38.36	6.82	
	72+	21.76	65.05	41.76	8.17	

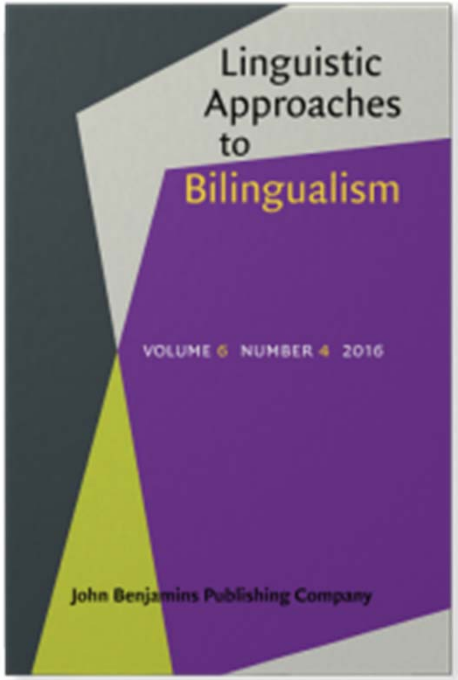
- An effect of age was found: older participants were consistenty outperformed by younger peers across conditions
- Two trends for aging attriters:
  - the attriters in the age range of 68-71 were outperformed by all other groups on every one of the dependent variables under observation
  - the contrast between attriters and controls was largest in 68-71 range; virtually disappeared among the 72+ year olds

university of groningen

Discussion

- In control condition almost linear decrease of verbal fluency and fluency scores
- Less linear path for attriters: here worst performance in 68 to 71 year olds but post 72 scores picked up again: not much attrition effects anymore here compared to controls (who also deteriorated)
- Tentative indication for the observation of language reversion
  - No cognitive tasks were included here, nor were self reports part of the study
  - No allowances were made for individual differences

Keijzer & Schmid (2016)



- L1 Dutch emigrants in Australia
- An array of language (proficiency) and cognitive tasks
- Their group score data set off against two groups monolinguals: Dutch and Australian
- Main aim twofold: look at language performance but also cognitive performance, also to look at upside of bilingual processing (the advantageous outcome of competition)
- Follow-up case-based individual analyses
  - More closely inspect the worst and best performing bilinguals in terms of language and cognitive performance

Cognitive performance: the ‘bilingual advantage’

› Experience shapes cognition
  - E.g. London cab drivers’ voluminous poterior hippocampal area (Maguire et al., 2000)

› Bilingual experience impacts on cognition beyond the language domain
  - Bilinguals outperform monolinguals on tasks tapping constructs like Working memory or inhibitory control (Valian, 2015)
  - BUT: bilingual experience highly variable
    - Age of acquisition
    - Input differences
    - Personal factors: education, cognitive ability

- Most mixed results in the realm of late bilingualism (cf. Tao et al., 2011; Luk et al., 2011; Festman (2012))
- Context determines the magnitude of the bilingual advantage
  - Behavioral ecology of bilingualism (cf. Green & Abutalebi, 2013): Adaptive control hypothesis
    - Interactional context in which bilingual is situated (single, dual or dense CS situation) leads to different adaptive changes in control processes
    - See also the work by Verreyt et al. (2016)
    - Mixed designs can shed light on these issues

university of groningen

Method: participants (n = 173)

Group	Age	AaE	LoR
Dutch in Australia N=62	64.66 38-86	27.23 13-61	36.80 1-61
Controls Netherlands N=54	62.46 39-85	-	-
Controls Australia N=57	60.84 36-87	-	-

The Study: Materials

Language tests

- Semi-structured Interview*
- C-test*
- GJT*
- PPVT*
- VFT category*
- VFT letter*

Cognitive tests

- Mini mental state examination
- General processing speed task
- Raven
- Reading Span Task*
- Backward digit span
- Modified Wisconsin Card Sorting Test
- Simon Task
- Stroop Task*

Results: There was an attrition effect

Group Statistics					
	Group: bilingual or monolingual controls	N	Mean	Std. Deviation	Std. Error Mean
Total accuracy score Dutch GJT	Dutch-Australian bilinguals	55	21,18	3,533	,476
	Dutch monolingual controls	51	21,12	3,508	,491
Total accuracy score Dutch C-test	Dutch-Australian bilinguals	57	82,58	18,459	2,445
	Dutch monolingual controls	51	89,41	11,945	1,673
Peabody Picture Vocabulary Test NL raw score	Dutch-Australian bilinguals	60	189,25	6,771	,874
	Dutch monolingual controls	54	187,15	8,090	1,101
Mean number of lexical items named in both category fluency tasks of the Dutch verbal fluency task	Dutch-Australian bilinguals	60	18,7567	5,18898	,66989
	Dutch monolingual controls	53	21,6415	4,64756	,63839
Mean number of ledical items named in both phonological fluency tasks of the Dutch verbal fluency task	Dutch-Australian bilinguals	60	9,1083	3,17577	,40999
	Dutch monolingual controls	53	10,7642	3,81117	,52350

Effects of age

- There was a significant effect of age for all the language measures under investigation
  - The oldest old group performed significant more poorly on all measures
    - Set off against the middle aged and youngest old groups
    - No difference middle aged and youngest old

Almost linear decrease in language score, no evidence for reversion

The second phase of the study

› Two-step, mixed methods procedure:
  - Group analyses: three groups' ANOVA/T-test per test not to complicate the models because of power limitations
  - Qualitative analyses:
    - Different background variables per group explaining the results
    - Best and poorest performing bilinguals and their characteristics
    - Language (use) backgrounds related to outcomes

On a group level no differences were found between the monolinguals and bilinguals on the cognitive measures of the test battery

But there were trends…for the oldest old participants

- The clearest trends emerged for the tasks previously labeled to tap inhibitory control: Simon Task and Stroop task
  - Bilinguals were markedly (though not significantly) faster at resolving conflict: smaller Stroop and Simon effect scores
  - Bilinguals produced the best but also the poorest scores – lost in group effects
  - Bilinguals as a group produced the largest standard deviation

Results: correlation analyses

- Impact individual factors on results:
  - active lifestyle
  - Education
- Different pattern emerged for different groups:
  - Active lifestyle did not tie in with any group scores for the bilinguals, but did for the Simon scores of the English monolingual groups (r=.566*)
  - Education related to inhibitory scores like Simon Task for bilinguals (r = .530*) but only with language measures (C-test, VFT) for monolinguals
    - The WM measures (RST, Digit Span) correlated
    - The Stroop and Simon tasks correlated
    - The WCST did not correlate with any other task

The Adaptive Control hypothesis and our bilinguals….

- To more closely examine why the bilinguals’ scores were so broadly distributed, their code-switching behavior was correlated with the Simon and Stroop task scores
  - CS behavior operationalized as number of switches (L1 > L2 and vice versa) per minute in oral interview: CS index

Table: Mean number of CS in oral interviews

	From L1 Dutch to L2 English	From L2 English to L1 Dutch
CS index	N = 19 M = 0.982 (SD: 0.99) Range: o.21 – 3.13	N = 19 M: 0.512 (SD: 0.82) Range: 0.47 – 3.46

No correlation was found between:
Simon Task * CS index: $p = .210$
Stroop Task * CS index: $p = .688$
But there was an aging effect: older adults produced more (bidirectional) CS: Keijzer & Kootstra (in prep.)

Code-switching environments per individual rather than group

- There was no significant correlation between the CS index (number of switches per minute) and the Simon and Stroop effect scores, but there were trends:
  - Dense code-switchers (as evidenced from the interview data) produced lower accuracy scores and bigger Simon/Stroop effects
  - Subjects who produced zero code-switches were generally the ones performing high on the cognitive control tasks too
  - These effects were especially pronounced in the oldest old subjects

› But apart from overt CS behavior, we also asked the participants about their language use patterns
  - Percentage of daily language use: Dutch vs. English
  - Language used at home:
    - Only Dutch
    - Only English
    - Both languages

    And asked how comfortable they felt using either language

    Classified participants as moving in single, dual or dense CS language environments

university of groningen

- More than individual variables like education and active lifestyle, language use patterns correlated with the results for the bilinguals
  - Main language in the home correlated with Simon scores: $r = -.536$*
  - If more Dutch in the home still, faster processing speed in general: $r = .460$*

(Summary) results: case-based analysis

› More extreme results for the bilinguals: SDs larger, range of scores bigger, best and poorest performing 5 subjects of the entire pool were found in the bilingual group
› The highest vs. lowest scoring bilingual individuals for language proficiency and cognitive abilities do not always coincide
› Rather than language proficiency or other individual factors like education, active lifestyle, etc. language environment influences cognitive control scores
  • Best performing bilinguals (cognitive domain) reported the biggest percentage of Dutch usage still – dual language contexts
  • Poorest performing bilinguals were the ones who reported not speaking any Dutch anymore in their daily lives – single language contexts

university of groningen

Discussion

- Based on linguistic observations, there is a linear decrease in language scores
- For all age cohorts conflated, there is an attrition effect
- No evidence for reversion in the oldest old cohort
- In general, there is a relation between the language use patterns of the attriters and their cognitive scores, although only for the oldest old cohort
- Speaks to the advantages of the double competition in aging attriters > once in advanced life phases, advantages can be felt

university of groningen

General discussion

- “It is a feature of ageism that older people are depicted in terms of what they no longer have or are” (Clyne, 2011)
- The myth of universal L1 reversion and L2 attrition does not stand on firm ground (mixed results at best, mostly null results).
- Competition as the overarching modulator that can also lead to positive outcomes...

Recap: Lifespan perspective on attrition

Twin processes: L2 acquisition and L1 attrition

Regression

Primary cause attrition

Twin processes: L2 attrition and L1 reversion

Temporary vs. permanent

Aging

L1 attrition, L2 acquisitio n
Cognitive competition: inhibition problems, confounded by multilinguual aging
Individual trajectories
L1 reversion, L2 attrition

How attrition data can influence bilingual theories

- Fiercely debated topic is the transfer from language control to cognitive control
  - It has been said that we need to understand more thoroughly what language and cognitive control are (Hartsuiker, 2015)
  - Aging attriters can shed light on this:
    - In one lifetime different language control dominance patterns
    - Different language use patterns can be related to the outcomes
    - Even more interesting in coming years as transition from migrant to expat.

5. And now?
Research directions post ICLA3

Future pointers:

- › Combine semi-longitudinal designs with cross-sectional work
  - • Track people in transition from youngest to oldest old
- › Augment discrete-point language tests with actual observations and diary reports
- › Augment language and cognitive observations with EEG/ERP studies and (f)MRI work
- › Only then can Barbara's quote really live up to expectations:

- Attrition is “promising the exploration of the links between the brain, mind, and external factors that are also of interest for research on multilingualism” (Köpke, 2007: 10)

university of groningen

Thank you for listening and thanks to:

NWO innovation scheme grant 275-70-030 to M. Keijzer

Research Assistants:

Janna Brummel
Lisa de Goede
Marieke Hoeijmakers
Michael Sanderson
Suzanne Hermans
Jennifer Kline
Adriaan Hogervorst

CLCG

bcn

NWO
Netherlands Organisation for Scientific Research