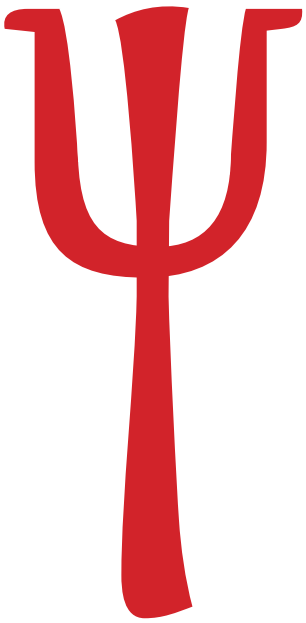

NETHERLANDS JOURNAL OF PSYCHOLOGY

VOLUME 66, NUMBER 2, APRIL 2011

Online screening for depression?

Dutch translation of questionnaire on smoking urges

Is edutainment software really educational?

Volume 66/number 2/April 2011
Netherlands Journal of Psychology

Editorial Policy

The *Netherlands Journal of Psychology* publishes original articles of high quality, including empirical articles, review essays on selected books, theoretical and methodolological papers in any area of psychology, as well as ongoing commentaries and discussion, and short reports on the validation of psychodiagnostic instruments and related methodological tools.

The Journal's focus is on empirical and conceptual studies that contribute to the theoretical explanation of human behaviour and experience. Manuscripts can deal with human development, social processes and the social perspective of human behaviour, psychopathology, forensic psychology and psychiatry neuroscience, psychophysiology, philosophy of mind, the computational approach, emotion, cognition (including attention, perception, and memory), decision-making, human performance, educational psychology, health, selection and assessment and human behaviour in organisations, selection and assessment. Any other manuscripts that may be of importance to those involved with psychological research are welcomed. Manuscripts should be written to the professional and academic readership.

It is the *Netherlands Journal of Psychology's* policy to publish about recent developments in psychology and related fields. It is also the editors' policy to regularly focus on recent developments in psychology in the Netherlands. In particular, authors may be invited to contribute to special issues.

The *Netherlands Journal of Psychology* will help to focus the interest of psychologists, and others professionally interested in the field, on information about developments in a wide area of specialists research activities and results of empirical and theoretical work in the field of psychology.

The *Netherlands Journal of Psychology* offers specialists the opportunity to publish their findings to a broad audience that is scientifically interested in psychology.

The *Netherlands Journal of Psychology* aims at offering a continuous forum for intellectual discussion and transfer of knowledge and information about developments in psychology.

Categories of articles to be published and manuscripts to be welcomed are:

Review articles

Manuscripts should be limited to a maximum of 8000 words. Authors planning contributions that exceed this maximum must contact the editor prior to submitting their manuscript.

Original reports of empirical research

Manuscripts should be limited to a maximum of 5000 words. Authors planning contributions that exceed this maximum must contact the editor prior to submitting their manuscript.

Thematic issues

Authors with plans for planning a thematic issue are encouraged to contact the editor in an early stage. Consultation will be necessary about number of manuscripts, number of words per manuscript, review procedure, covering of the field, etc.

Developments in the field (short)

Manuscripts should be limited to a maximum of 1000 words. Authors planning contributions that exceed this maximum must contact the editor prior to submitting their manuscript.

Book review essays (short)

Manuscripts with a maximum of 1000 words need no preliminary contact with the editor. Authors planning larger contributions must contact the editor.

Letters to the editor

Manuscripts should be limited to a maximum of 500 words. Authors planning contributions that exceed this maximum must contact the editor prior to submitting their manuscript.

Technical notes

Manuscripts should be limited to a maximum of 2000 words. Authors planning contributions that exceed this maximum must contact the editor prior to submitting their manuscript. Authors reporting (in English) on, e.g. validation, of tests and other instruments in the Dutch language or in the Netherlands are encouraged to report in The Netherlands Journal of Psychology. The editors want to inform non-Dutch researchers of developments and of the use of instruments in the Dutch language.

Editor's address

Professor René van Hezewijk
Faculty of Psychology, Open University of the Netherlands, PO Box 2960, 6401 DL Heerlen, the Netherlands
tel + 31 45 576 23 99
All correspondence by e-mail: rene.vanhezewijk@ou.nl

Publisher: Wil Zeegers, Nederlands Instituut van Psychologen, PO Box 9921, 1006 AP Amsterdam, the Netherlands,
E-mail: wil.zeegers@psynip.nl

Subscription rates

Personal rate: € 125.–
Institutional rate: € 226.–
Student rate: € 62.50
All prices are per calendar year and include value added tax (VAT)
Price per issue: € 31.95 (incl. VAT)

Subscription administration

Performis Media, PO Box 2396, 5202 CJ 's Hertogenbosch, the Netherlands, tel: + 31 73 689 58 89. For information and orders, please consult www.performis.nl

Change of address

Please notify any changes in addressee and/or address via www.performis.nl.

Payment

Please use the payment/accept giro form if possible as this simplifies the administrative process.

Advertisements

Performis Media, PO Box 2396, 5202 CJ 's Hertogenbosch, the Netherlands, tel: + 31 73 689 58 89.
The *Netherlands Journal of Psychology* is published four times a year.

ISSN 1872-552x

Contents

VOLUME 66, NUMBER 2, APRIL 2011

Online screening for depression?

A longitudinal web-based study on risk factors for depression

There is consensus that depression can be conceptualised as a continuum whereby symptoms differ in severity and amount of life interference. Individuals with subclinical depressive symptoms are at risk of making the transition to clinical depression. Therefore, it is important to study which factors give cause for individuals to shift towards a clinical state of depression. In this longitudinal web-based study, main risk factors for depression - stress, neuroticism, bias in emotional processing and the two affective dimensions of positive and negative affect - were examined in relation to increased depressive symptomatology in a general population sample.
At baseline, stress, neuroticism and positive affect were significantly associated with depressive symptomatology. Only stress predicted increased symptomatology at follow-up. The self-reported level of stress predicted the individuals' shift on the depression continuum. Web-based screening for individuals experiencing high levels of stress may be useful to detect individuals at risk for depression.
Where: Netherlands Journal of Psychology, Volume 66, 37-43

Received 13 March 2009; Accepted 2 April 2011

Keywords: Web-based study; Continuum of depressive symptomatology; Early detection; Early intervention; Stress

Authors: Nele Jacobs* **, Gert van Dijk*, and Aart Mudde*

* Faculty of Psychology, Open University of the Netherlands

** Department of Psychiatry and Neuropsychology, South Limburg Mental Health Research and Teaching Network, EURON, Maastricht University
Correspondence to: Nele Jacobs, Faculty of Psychology, Open University of the Netherlands, PO Box 2960, 6401 DL Heerlen, the Netherlands
E-mail: nele.jacobs@ou.nl

Depression is a highly prevalent psychiatric disorder worldwide. About 4 to 10% of the population of industrialised countries will meet the DSM criteria within the next year (Ayuso-Mateos et al., 2001; Demyttenaere et al., 2004). Moreover, depression is the fourth leading cause of disease burden and represents a major public health problem significantly affecting patients, their families as well as society (Ustun, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004).

Depression is a prototypical multifactorial disorder in which vulnerability is influenced by many aetiological factors such as genetic liability (Goldberg, 2006; Jang, Livesley, Taylor, Stein, & Moon, 2004; Sullivan, Neale, & Kendler, 2000), stress as represented by stressful life events as well as by small daily hassles (Risch et al., 2009; Wichers et al., 2007a), predisposing personality traits such as low self-esteem, neuroticism, or bias in emotional processing (Bos, Muris, Mulkens, & Schaalma, 2006; Gollan, Pane, McCloskey, & Coccaro, 2008; Jacobs et al., 2006), psychosocial adversity factors such as poor parenting and low social support (Brendgen et al., 2009; Feng et al., 2009), and a prior history of a psychiatric disorder (Kendler, Thornton, & Gardner, 2000).

In addition, there is an emerging consensus that depressive symptoms are not only present in individuals diagnosed with a depressive disorder, but also occur in a significant proportion of individuals from the general population (Kendler & Gardner, 1998; Lewinsohn, Solomon, Seeley, & Zeiss, 2000; Solomon, Haaga, & Arnow, 2001). Prospective studies in both clinical and community-based samples showed that these subthreshold or subsyndromal depressive symptoms are strong predictors of major depression as diagnosed by DSM criteria (Judd et al., 1998). Subthreshold depressive symptoms are quantitatively, but not qualitatively, different from depressive symptoms as displayed by individuals diagnosed with a depressive disorder. Depressive symptoms therefore exist on a continuum with normal experience whereby differences can be observed primarily in severity and amount of life

interference (Lewinsohn, Klein, Durbin, Seeley, & Rohde, 2003; Lewinsohn et al., 2000). As individuals with subthreshold depressive symptoms are at increased risk of making the transition to clinical depression, it is important to study which factors give cause for individuals to shift towards a clinical state of depression. Once these factors are fully known and understood, strategies for early detection as well as for early intervention can be developed in order to prevent individuals from making the transition from a non-clinical to a clinical state of depression.

The aim of this longitudinal web-based study is to examine the extent to which stress, neuroticism, bias in emotional processing, positive and negative affect, representing risk factors from the internalising and the adversity-interpersonal difficulties pathways for depression, predict increase in depressive symptomatology in a large general population sample.

Methods

Participants

Participants were recruited among students of the faculty of Psychology of the Open University of the Netherlands (OUNL), a long-distance university providing high-quality university education (www.ou.nl). Participants received course credits for their participation. Data were collected at baseline in 738 adults with a mean age of 37 years (*SD* = 9.8 years) of which 545 were female (73.85%) and 193 male (26.15%). A total of 437 individuals (73.7% female and 26.3% male) participated at follow-up (6 weeks after baseline), reflecting a response rate at follow-up of 59.2%. Mean age at follow-up equalled 38 years (*SD* = 9.9 years).

Procedure: Virtual Laboratory

As internet technology and internet use are advancing very rapidly and as web-based survey methods are now more sophisticated than a few years ago, web-based psychological research has become a common method of survey research (Denscombe, 2006; Kongsved, Basnov, Holm-Christensen, & Hjollund, 2007; Silss & Song, 2002; van Selm & Jankowski, 2006). Main advantages associated with web-based research are access to a broader range of participants compared with a lab study or a face-to-face study, and a superior cost-effectiveness compared with paper-and-pencil studies as a result of savings in time (no data entry) and financial resources (no postage). However, web-based research can also endanger the integrity and validity of the data due to reduced control in selection of participants, increased possibility of multiple submissions and greater amount of missing data. To counteract these possible pitfalls, a *Virtual Laboratory (VL)* was developed at the OUNL (Zamani & Van Dijke, 2007). VL consists of a 'closed environment', which is only accessible when registered. After registration, the VL software can be downloaded and access to the study questionnaires can be gained. In addition, VL is programmed to detect missing data and urges participants to fill in each single item, avoiding missing data. Six weeks after completion of the baseline assessments, participants automatically receive an e-mail prompting them to re-activate VL and to complete the follow-up.

Measures

The internet administered questionnaires consisted of the Zung Questionnaire, Perceived Stress Scale, Eysenck Personality Scale, Ekmans Pictures of Facial Affect and the PANAS.

Depressive symptoms

Depressive symptoms were assessed using the validated Dutch version of the Self-rating Depression Scale, developed by Zung (Mook, Kleijn, & Van der Ploeg, 1990; Zung, 1965). The questionnaire consists of 20 either positively or negatively formulated items that are based on clinical diagnostic criteria commonly used to diagnose depression. An example of a positively, respectively, negatively stated item is 'I feel downhearted and blue' and 'Morning is when I feel the best'. Participants rated the extent of agreement with these items across a four-point Likert scale ranging from 'never or hardly ever' (1) to 'always or mostly' (4). Positive items were recoded so that higher scores reflect more depressive symptoms. A continuous depression score (sum of scores on the items) was calculated and used in the analyses.

Stress

The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) is a validated and internationally used ten-item measure of self-appraised stress (e.g. 'In the last month, how often have you felt that you were unable to control the important things in your life?'). Participants rated the extent of agreement with these items across a five-point Likert-type scale ranging from 'never' (1) to 'very often' (5). Items such as 'In the last month, how often have you felt that things were going your way?' were recoded in order to allow higher scores to reflect elevated levels of stress. A continuous score (sum of scores on the items) was calculated and used in the analyses.

Neuroticism

Participants filled in the 12 neuroticism items of the Neuroticism-Extraversion subscale of the Eysenck Personality Scale (Eysenck & Eysenck, 1991).

A neuroticism score (sum of 'yes') was calculated and used in the analyses.

Bias in emotional processing

Bias in emotional processing was assessed using a selection of 19 of the original 110 Ekman pictures of facial affect (Ekman, 1993, 1999): six pictures associated with happiness, seven pictures associated with sadness and six pictures associated with fear. Each picture was shown separately to the participants. They were asked to select the emotion - happiness, sadness or fear - which in their opinion best described the emotion expressed on the picture. After recognition, the intensity of the expressed emotion was rated on a scale ranging from 0 to 100. For each emotion, a continuous intensity estimate score was calculated, representing a measure of emotional processing.

Positive and negative affect

Affectivity was measured using the validated Dutch version of the Positive and Negative Affect Schedule (PANAS, Boon & Peeters, 1996; Watson, Clark, & Tellegen, 1988). The PANAS consists of a list of ten descriptors for the Positive Affect scale (PA, e.g. attentive, interested) and ten descriptors for the Negative Affect scale (NA, e.g. distressed, guilty). Participants rated the extent to which the descriptor was applicable to their affective state during the last two weeks on a five-point scale, ranging from very slightly (1) to extremely (5). For each scale, a continuous score (sum of scores on the items) was calculated and used in the analyses.

Data analysis

First, *t*-tests were performed comparing mean scores between dropouts and non-dropouts for all variables. If no significant differences were found, this suggested that the data were not biased due to dropout.

In order to investigate cross-sectional associations, linear univariate regression analyses using STATA (StataCorp., 2007) were carried out with the depression outcome measured at baseline as dependent variable and, respectively, stress, neuroticism, intensity of the happy facial expressions, intensity of the sad facial expressions, intensity of the fearful facial expressions, and positive and negative affect as independent variable. The independent variables as well as the dependent variable were standardised in order to report standardised effect sizes. Subsequently, all independent variables significantly related to depression were entered simultaneously into the model in order to examine whether each variable uniquely contributed to the dependent variable. In all analyses, we controlled for gender as gender-specific factors for depression have consistently been demonstrated (Kendler, Gardner, & Prescott, 2002, 2006; Wauterickx & Bracke, 2005).

In order to assess associations with change in the depression outcome over time, univariate regression analyses were carried out with the depression outcome measured at follow-up as dependent variable and, respectively, stress, neuroticism, intensity of the happy facial expressions, intensity of the sad facial expressions, intensity of the fearful facial expressions, positive and negative affect as independent variable, corrected for baseline depression. The independent variables as well as the dependent variable were standardised in order to report standardised effect sizes. Subsequently, all significant independent variables were entered simultaneously in the model in order to examine whether each variable contributed to the dependent variable - change in depressive symptoms over time - independently from the others. Again, in all analyses we corrected for gender.

Table 1 Descriptives of the participants

	Mean	SD	Min	Max
Depression at baseline	36.00	7.40	20.00	60.00
Depression at follow-up	35.80	7.55	20.00	60.00
Stress	22.51	6.22	10.00	46.00
Neuroticism	16.58	3.26	12.00	24.00
Positive affect	34.88	6.86	11.00	50.00
Negative affect	18.71	7.00	10.00	47.00
Intensity estimate happy faces	54.93	12.91	1.70	88.80
Intensity estimate sad faces	54.93	15.14	3.00	93.30
Intensity estimate fearful faces	75.94	15.65	4.00	100.00

Results

Descriptives

Psychometric analyses of the online administered questionnaires indicated high reliability, ranging from 0.77 (intensity estimates of the sad faces) to 0.98 (Zung questionnaire at follow-up). Mean depression score at baseline (Table 1) was 36 (*SD* = 7.4) and at follow-up 35.8 (*SD* = 7.55). Mean stress equalled 22.51 (*SD* = 6.22), mean neuroticism was 16.58 (*SD* = 3.26), mean positive affect was 34.88 (*SD* = 6.86) and mean negative affect equalled 18.71 (*SD* = 7). Participants recognised on average 5.7 (*SD* = 0.66) of the maximum six happy faces and rated the intensity of the expressed happiness at 54.93 (*SD* = 12.91). Of the maximum seven sad faces, 5.77 (*SD* = 1.18) were recognised as being sad and intensity estimate equalled 54.93 (*SD* = 15.14). Nearly all fearful expressions were recognised (mean: 5.97; *SD* = 0.33), the intensity estimate for this expressed emotion was 75.94 (*SD* = 15.65). No significant differences were found between the mean

scores of dropouts and non-dropouts, suggesting that results are not biased due to specific characteristics of the participants who did not completed the follow-up measures.

Cross-sectional

The results of the univariate analyses showed that depression at baseline was significantly associated with, respectively, stress ($B = 0.67, p < .01$), neuroticism ($B = 0.68, p < .01$), positive affect ($B = -0.48, p < .01$) and negative affect ($B = 0.55, p < .01$). There was no significant association with the intensity estimate of the happy facial expressions ($B = -0.4, p = .32$), the intensity estimate of sad faces ($B = 0.008, p = .83$) nor with the intensity estimate of the fearful facial expressions ($B = -0.07, p = .07$).

The multivariate analyses (Table 2), however, revealed that negative affect was not uniquely associated with depression score at baseline ($B = 0.02, p = .53$), when the effects of stress, neuroticism and positive affect were taken into account. So, current depressive symptomatology was associated with high level of stress, high neuroticism and low positive affect.

Longitudinal

The results of the univariate analyses showed that increase in the depression outcome over time was significantly associated with stress ($B = 0.13, p < .01$) and neuroticism ($B = 0.12, p < .05$). There was no significant association with positive affect ($B = 0.05, p = .17$) and negative affect ($B = 0.06, p = .11$), with the intensity estimate of the happy facial expressions ($B = -0.08, p = .80$), the intensity estimate of sad faces ($B = 0.03, p = .3$) nor with the intensity estimate of the fearful facial expressions ($B = 0.01, p = .70$).

The multivariate analyses (Table 3), however, revealed that neuroticism was no longer significantly associated with change in depression outcome ($B = 0.09, p = .07$), when the effect of stress was taken into account. Thus, increase in depressive symptomatology over time was associated with high level of stress at baseline.

Table 2 Results of the multiple cross-sectional regression analyses with depression score at baseline as dependent variable

	Standardised regression coefficients	SE	95% CI
Stress	0.31**	0.03	(0.24; 0.38)
Neuroticism	0.41**	0.03	(0.35; 0.47)
Positive affect	-0.23**	0.02	(-0.28; -0.18)
Negative affect	0.02	0.03	(-0.04; 0.08)
Gender	-0.07	0.05	(-0.17; 0.04)

** $p < .01$

Table 3 Results of the multiple longitudinal regression analyses with depression score at follow-up as dependent variable

	Standardised regression coefficients	SE	95% CI
Stress	0.11**	0.05	(0.02; 0.19)
Neuroticism	0.09	0.05	(-0.007; 0.18)
Depression at baseline	0.57*	0.05	(0.48; 0.67)
Gender	0.03	0.08	(-0.12; 0.18)

** $p < .05$, * $p < .01$

Discussion

This web-based study examined the extent to which stress, neuroticism, bias in emotional processing, and the two affective dimensions of positive and negative affect, representing main risk factors for depression, were associated with current and future depressive symptomatology. It was shown that self-reported stress, neuroticism and positive affect were significantly associated with current depressive symptomatology. Furthermore, high levels of stress predicted an increase in depressive symptomatology six weeks later.

The results of the cross-sectional analyses showed that high self-reported stress, high neuroticism and decreased positive affect were significantly associated with current depressive symptomatology. The associations between depressive symptoms and stress and neuroticism are already well acknowledged (Duggan, Sham, Lee, Minne, & Murray, 1995; Kendler, Gatz, Gardner, & Pedersen, 2006; Kendler, Kuhn, & Prescott, 2004; Kessler, 1997; Tennant, 2002). Positive affect has recently been put forward in the literature as a major protective factor against depression. Positive affect broadens the individual's attentional focus and stimulates flexibility and problem solving. The experience of positive emotions such as joy and interest helps to build social, intellectual and physical resources which buffer stress (Fredrickson, 2001, 2004; Wichers et al., 2007b). Moreover, it has been demonstrated that positive affect not only buffers against stress, but in addition might attenuate the effect of genetic vulnerability for depression (Wichers et al., 2007b). Therefore, it has been suggested that positive affect might be a crucial component of psychological resilience for depression, or even for psychopathology in general (Ong, Bergeman, Bisconti, & Wallace, 2006; Tugade & Fredrickson, 2004; Tugade, Fredrickson, & Barrett, 2004).

The results of the longitudinal analyses revealed that high levels of stress were predictive of

depressive symptomatology six weeks later. This suggests that individuals experiencing high levels of stress might be at risk of moving up on the continuum of depression, or even more, of making the transition from a non-clinical to a clinical state of depression. The causal link between stress and clinical depression is well established (Kendler et al., 2002; Kendler, Gardner et al., 2006; Van Praag, De Kloet, & Van Os, 2004). Kendler showed that environmental adversity, such as stressful life events, represented one of the strongest predictors for the development of a depressive disorder in the next year (Kendler et al., 2002). In addition, recent research suggests that stress might induce changes in the availability of serotonin and gamma-aminobutyric-acid (GABA), which in turn might contribute to a dysregulation of the hypothalamic-pituitary-adrenocortical axis (HPA axis) and to the development of depression in susceptible subjects (Linthorst & Reul, 2008).

The data in this study were collected using the *Virtual Laboratory*, software especially developed to increase integrity and reliability of web-based collected data. As our results are in line with previous findings from non-web-based studies, this suggests that this goal was achieved. Furthermore, the observed mean of the outcome measures as well as the observed mean of the predictive variables corresponded well with expected means based on normative data or previous research using non-electronic measurements and conducted in comparable populations (Boon & Peeters, 1996; Jacobs et al., 2006; Mook et al., 1990). In addition, psychometric analyses of the online administered questionnaires indicated high reliabilities. This strongly suggests that the VL can be considered a valid and reliable web-based tool to assess self-reported depressive symptomatology and associated risk factors. Individuals might be screened online and individuals at risk might be detected in an early stage of the disorder. As many individuals with depression still remain undetected and untreated (Davidson & Meltzer-Brody, 1999), the development of reliable and valid screening web-based tools is a promising strategy to increase the detection rate of depression.

Furthermore, based on the results of this study, web-based stress-reduction programs are recommended in order to prevent individuals from making a shift on the continuum of depression towards a more clinical state. Recently developed online stress reduction programs show promising results, for example the 'Mystudent-Stress' program, an interactive, online stress intervention for college students, was found to induce changes in important stress management behaviours and stress-related measures (Chiauzzi, Brevard, Thum, Decembrele, & Lord, 2008).

The findings of this study should be interpreted in the light of several methodological limitations. First, the sample consisted of students of the faculty of the Open University of the Netherlands, a highly educated sample in which women were over-represented. Although this sample is not representative for the general Dutch population and results may therefore not be generalised, it is this group of highly educated women who currently find their way to online therapy and participate in e-mental health programs (Christensen, Griffiths, Mackinnon, & Brittliffe, 2006; Cobb & Graham, 2006; van Straten, Cuijpers, & Smits, 2008). Second, vulnerability for depression is influenced by many aetiological factors (Kendler et al., 2002; Kendler, Gardner et al., 2006). This study focused on stress, neuroticism, bias in emotional processing, positive and negative affect as main risk factors associated with *change* in depressive symptomatology. Nevertheless, it must be noted that depressive symptomatology at baseline represents a significant predictor of depressive symptomatology at follow-up. Stress, gender and depression score at baseline explained 69% of the variation in the depression score at follow-up.

To conclude, the results of this study suggest that web-based screening on self-reported stress might be a valid and reliable method for early detection of individuals at risk of making the transition to clinical depression. Web-based interventions might be a promising tool to prevent individuals from making transitions from a non-clinical to a clinical state of depression.

References

Ayuso-Mateos, J. L., Vazquez-Barquero, J. L., Dowrick, C., Lehtinen, V., Dalgard, O. S., Casey, P., et al. (2001). Depressive disorders in Europe: Prevalence figures from the ODIN study. *British Journal of Psychiatry*, *179*, 308-316.

Boon, M., & Peeters, F. (1996). Affectieve dimensies bij depressie en angst. *Tijdschrift voor Psychiatrie*, *41*, 109-113.

Bos, A., Muris, P., Mulkens, S., & Schaalma, H. (2006). Changing self-esteem in children and adolescents: A roadmap for future interventions. *Netherlands Journal of Psychology*, *62*, 26-32.

Brendgen, M., Vitaro, F., Boivin, M., Girard, A., Bukowski, W. M., Dionne, G., et al. (2009). Gene-environment interplay between peer rejection and depressive behavior in children. *Journal of Child Psychology and Psychiatry, 50*, 1009-1017.

Chiauzzi, E., Brevard, J., Thum, C., Decembrele, S., & Lord, S. (2008). MyStudentBody-Stress: An online stress management intervention for college students. *Journal of Health Communication*, *13*, 555-572.

Christensen, H., Griffiths, K. M., Mackinnon, A. J., & Brittliffe, K. (2006). Online randomized controlled trial of brief and full cognitive behaviour therapy for depression. *Psychological Medicine*, *36*, 1737-1746.

Cobb, N. K., & Graham, A. L. (2006). Characterizing Internet searchers of smoking cessation information. *Journal of Medical Internet Research*, *8*(3), e17.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*, 385-396.

Davidson, J. R., & Meltzer-Brody, S. E. (1999). The underrecognition and undertreatment of depression: What is the breadth and depth of the problem? *Journal of Clinical Psychiatry*, *60 Suppl 7*, 4-9; discussion 10-11.

Demyttenaere, K., Bruffaerts, R., Posada-Villa, J., Gasquet, I., Kovess, V., Lepine, J. P., et al. (2004). Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. *Journal of the American Medical Association*, *291*, 2581-2590.

Denscombe, M. (2006). Web-based questionnaires and the mode effect: An evaluation based on completion rates and data contents of near-identical questionnaires delivered in different modes. *Social Science Computer Review*, *24*, 246-254.

Duggan, C., Sham, P., Lee, A., Minne, C., & Murray, R. (1995). Neuroticism: A vulnerability marker for depression evidence from a family study. *Journal of Affective Disorders*, *35*, 139-143.

Ekman, P. (1993). Facial expression and emotion. *American Psychologist*, *48*, 384-392.

Ekman, P. (1999). Facial expressions. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion*. New York: John Wiley & Sons Ltd.

Eysenck, H. I., & Eysenck, S. B. G. (1991). *Manual of the Eysenck Personality Scales*. Londen: Hodder & Stoughton.

Feng, X., Keenan, K., Hipwell, A. E., Henneberger, A. K., Rischall, M. S., Butch, J., et al. (2009). Longitudinal associations between emotion regulation and depression in preadolescent girls: Moderation by the caregiving environment. *Developmental Psychology*, *45*, 798-808.

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology. The broaden-and-build theory of positive emotions. *American Psychologist*, *56*, 218-226.

Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *359*, 1367-1378.

Goldberg, D. (2006). The aetiology of depression. *Psychological Medicine*, *36*, 1341-1347.

Gollan, J. K., Pane, H. T., McCloskey, M. S., & Coccaro, E. F. (2008). Identifying differences in biased affective information processing in major depression. *Psychiatry Research*, *159*, 18-24.

Jacobs, N., Kenis, G., Peeters, F., Derom, C., Vlietinck, R., & Van Os, J. (2006). Stress-related negative affectivity and genetically altered serotonin transporter function: Evidence of synergism in shaping risk of depression. *Archives of General Psychiatry*, *63*, 989-996.

Jang, K. L., Livesley, W. J., Taylor, S., Stein, M. B., & Moon, E. C. (2004). Heritability of individual depressive symptoms. *Journal of Affective Disorders*, *80*, 125-133.

Judd, L. L., Akiskal, H. S., Maser, J. D., Zeller, P. J., Endicott, J., Coryell, W., et al. (1998). A prospective 12-year study of subsyndromal and syndromal depressive symptoms in unipolar major depressive disorders. *Archives of General Psychiatry*, *55*, 694-700.

Kendler, K. S., & Gardner, C. O., Jr. (1998). Boundaries of major depression: An evaluation of DSM-IV criteria. *American Journal of Psychiatry*, *155*, 172-177.

Kendler, K. S., Gardner, C. O., & Prescott, C. A. (2002). Toward a comprehensive developmental model for major depression in women. *American Journal of Psychiatry*, *159*, 1133-1145.

Kendler, K. S., Gardner, C. O., & Prescott, C. A. (2006). Toward a comprehensive developmental model for major depression in men. *American Journal of Psychiatry*, *163*, 115-124.

Kendler, K. S., Gatz, M., Gardner, C. O., & Pedersen, N. L. (2006). Personality and major depression: A Swedish longitudinal, population-based twin study. *Archives of General Psychiatry*, *63*, 1113-1120.

Kendler, K. S., Kuhn, J., & Prescott, C. A. (2004). The interrelationship of neuroticism, sex, and stressful life events in the prediction of episodes of major depression. *American Journal of Psychiatry*, *161*, 631-636.

Kendler, K. S., Thornton, L. M., & Gardner, C. O. (2000). Stressful life events and previous episodes in the etiology of major depression in women: an evaluation of the 'kindling' hypothesis. *American Journal of Psychiatry*, *157*, 1243-1251.

Kessler, R. C. (1997). The effects of stressful life events on depression. *Annual Review of Psychology*, *48*, 191-214.

Kongsved, S. M., Basnov, M., Holm-Christensen, K., & Hjollund, N. H. (2007). Response rate and completeness of questionnaires: a randomized study of Internet versus paper-and-pencil versions. *Journal of Medical Internet Research*, *9*(3), e25.

Lewinsohn , P. M., Klein, D. N., Durbin, E. C., Seeley, J. R., & Rohde, P. (2003). Family study of subthreshold depressive symptoms: risk factor for MDD? *Journal of Affective Disorders*, *77*, 149-157.

Lewinsohn, P. M., Solomon, A., Seeley, J. R., & Zeiss, A. (2000). Clinical implications of 'subthreshold' depressive symptoms. *Journal of Abnormal Psychology*, *109*, 345-351.

Linthorst, A. C., & Reul, J. M. (2008). Stress and the brain: Solving the puzzle using microdialysis. *Pharmacology Biochemistry and Behavior*, *90*, 163-173.

Mook, J., Kleijn, W. C., & van der Ploeg, H. M. (1990). Een herziene Nederlandse versie van de Zung-schaal als maat voor dispositionele depressiviteit. *Tijdschrift voor Psychiatrie*, *32*, 253-264.

Ong, A. D., Bergeman, C. S., Bisconti, T. L., & Wallace, K. A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Journal of Personality and Social Psychology*, *91*, 730-749.

Risch, N., Herrell, R., Lehner, T., Liang, K. Y., Eaves, L., Hoh, J., et al. (2009). Interaction between the serotonin transporter gene (5-HTTLPR), stressful life events, and risk of depression: A meta-analysis. *Journal of the American Medical Association*, *301*, 2462-2471.

Silss, S., & Song, C. (2002). Innovations in survey research: an application of web-based surveys. *Social Science Computer Review*, *20*, 22-30.

Solomon, A., Haaga, D. A., & Arnow, B. A. (2001). Is clinical depression distinct from subthreshold depressive symptoms? A review of the continuity issue in depression research. *Journal of Nervous and Mental Disease*, *189*, 498-506.

StataCorp. (2007). *Stata Statistical Software* (Version 10). Texas: College Station TX: Stata Corporation.

Sullivan, P. F., Neale, M. C., & Kendler, K. S. (2000). Genetic epidemiology of major depression: Review and meta-analysis. *American Journal of Psychiatry*, *157*, 1552-1562.

Tennant, C. (2002). Life events, stress and depression: A review of recent findings. *Australian and New Zealand Journal of Psychiatry*, *36*, 173-182.

Tugade, M. M., & Fredrickson, B. L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology*, *86*, 320-333.

Tugade, M. M., Fredrickson, B. L., & Barrett, L. F. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *Journal of Personality*, *72*, 1161-1190.

Ustun, T. B., Ayuso-Mateos, J. L., Chatterji, S., Mathers, C., & Murray, C. J. (2004). Global burden of depressive disorders in the year 2000. *British Journal of Psychiatry, 184*, 386-392.

Van Praag, H., de Kloet, R., & Van Os, J. (2004). *Stress, the brain and depression*. Cambridge, U.K.: Cambridge University Press.

Van Selm, M., & Jankowski, N. (2006). Conducting online surveys. *Quality & Quantity, 40*, 435-456.

Van Straten, A., Cuijpers, P., & Smits, N. (2008). Effectiveness of a web-based self-help intervention for symptoms of depression, anxiety, and stress: Randomized controlled trial. *Journal of Medical Internet Research, 10*(1), e7.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063-1070.

Wauterickx, N., & Bracke, P. (2005). Unipolar depression in the Belgian population: trends and sex differences in an eight-wave sample. *Social Psychiatry and Psychiatric Epidemiology*, *40*, 691-699.

Wichers, M., Myin-Germeys, I., Jacobs, N., Peeters, F., Kenis, G., Derom, C., et al. (2007a). Genetic risk of depression and stress-induced negative affect in daily life. *British Journal of Psychiatry*, *191*, 218-223.

Wichers, M., Myin-Germeys, I., Jacobs, N., Peeters, F., Kenis, G., Derom, C., et al. (2007b). Evidence that moment-to-moment variation in positive emotions buffer genetic risk for depression: a momentary assessment twin study. *Acta Psychiatrica Scandinavica*, *115*, 451-457.

Zamani, K., & Van Dijke, M. (2007). Virtueel laboratorium: Onderzoeken op afstand. *De Psycholoog*, *42*, 379-380.

Zung, W. W. (1965). A Self-Rating Depression Scale. *Archives of General Psychiatry, 12*, 63-70.

The authors would like to acknowledge Dr. Marius van Dijke for his thorough reading of the draft version of this manuscript and for offering constructive comments.

DR. NELE JACOBS
Associate Professor of Lifespan Psychology
Faculty of Psychology of the Open University of the Netherlands
Main field of interest is the study of daily life affective processes as a predictor for psychopathology and wellbeing across the lifespan
E-mail: nele.jacobs@ou.nl

GERT VAN DIJK MSC
Mental Healthcare Psychologist at Teleos Consult in the Netherlands
Graduated on the research on predictors of depression at the faculty of Psychology of the Open University of the Netherlands
E-mail: gert.vandijk@teleosconsult.nl

DR. AART N. MUDDE
Assistant Professor in Health Psychology
Faculty of Psychology of the Open University of the Netherlands
Main field of interest is the study of determinants of the onset of risk behaviour in adolescence and emerging adulthood
E-mail: aart.mudde@ou.nl

Psychometric properties of the brief Questionnaire on Smoking Urges (QSU-Brief) in a Dutch smoker population

We investigated the reliability, validity, and factor structure of the ten-item Questionnaire on Smoking Urges (QSU-Brief) in a Dutch smoker sample (N = 208). The questionnaire displayed good internal consistency (Cronbach's alphas > .83), and scores were strongly correlated with three other rating scales for measuring craving, urge, and desire for cigarettes, and moderately linked to questionnaires that tap related constructs, such as cigarette dependence. As in previous research, a two-factor structure was revealed. The first factor was best described by 'the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke', and appeared to be associated with negative affect, but not with positive affect. The second factor reflected 'the desire and intention to smoke', and was not associated with either positive or negative affect. The factor structure, however, slightly deviates from the original English version of the QSU-Brief, which might be explained by language differences. Overall, the Dutch translation of the QSU-Brief offers a reliable, valid, and multidimensional assessment of cigarette craving and appears suitable for use in Dutch patients and participants.
Where: Netherlands Journal of Psychology, Volume 66, 44-49

Received 20 March 2009; Accepted 8 February 2011

Keywords: Craving; Smoking; Factor analysis; Validity; Reliability; Dutch

Authors: Marianne Littel, Ingmar H. A. Franken, and Peter Muris

Institute of Psychology, Erasmus University, Rotterdam

Correspondence to: Marianne Littel, Institute of Psychology, Erasmus University Rotterdam, PO Box 1738, 3000 DR, Rotterdam, the Netherlands
E-mail: littel@fsw.eur.nl

Craving, which can be defined as 'the desire to experience the effect(s) of a previously experienced psychoactive substance' (UNDCP & WHO, 1992), is considered an important concept in smoking addiction. Craving is often viewed as the most difficult and aggravating withdrawal symptom during abstinence and quitting (Orleans, Rimer, Cristinzio, Keintz, & Fleisher, 1991; Shiffman & Jarvik, 1976; West, Hajek, & Belcher, 1989). Moreover, several studies have shown that craving hampers successful smoking cessation and that it correlates with relapse after periods of abstinence (Allen, Bade, Hatsukami, & Center, 2008; Doherty, Kinnunen, Militello, & Garvey, 1995; Killen & Fortmann, 1997; Killen, Fortmann, Newman, & Varady, 1991; Niaura et al., 1988; Orleans et al., 1991; Shiffman et al., 1997; Shiffman & Jarvik, 1976; Swan, Ward, & Jack, 1996). Consequently, reliable assessment of craving is necessary in order to predict relapse, improve cessation treatment, and understand the nature of craving in general.

In the past decades, the majority of studies used single- or two-item questionnaires to measure craving (see for an overview Cox, Tiffany, & Christen, 2001). With such a restricted number of questions, the assessment of craving is rather one-sided and the psychometric properties cannot be determined. In order to reliably measure the multi-dimensional aspects of craving, Tiffany and Drobes (1991) designed the 32-item Questionnaire on Smoking Urges (QSU). This self-report instrument intends to capture several different aspects of craving, ranging from positive expectations about the effects of smoking to more general, overwhelming urges to smoke. Factor analysis indicated that the QSU consists of two clearly distinguishable underlying factors, which can be described as 'the

desire and intention to smoke with an anticipation of pleasure from smoking' and 'the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke' (Tiffany & Drobes, 1991).

Nonetheless, because of its length, the QSU turned out to be less suitable in clinical and laboratory settings where a fast assessment of the concept of craving is important. With this in mind, Cox et al. (2001) developed the QSU-Brief, which is an abbreviated version of the QSU consisting of only ten items that can be completed in about two minutes. The shortened scale has good reliability (α = .78 - .97) and a two-factor structure that is generally well in keeping with that obtained for the original QSU. However, two items (items 2 and 5) appeared to be ambivalent by loading on both factors and consequently were not assigned to any subscale of the QSU-Brief, in spite of their inclusion in factor 2 of the original QSU. In the QSU-Brief, factor 1 includes the items 1, 3, 6, 7, and 10, while factor 2 includes the items 4, 8, and 9 (Cox et al., 2001). These favourable psychometric properties have been confirmed in further research (Cappelleri et al., 2007; Cepeda-Benito & Reig-Ferrer, 2004) and since then the 10-item QSU-Brief has been used in a wide variety of studies (e.g., Attwood, O'Sullivan, Leonards, Mackintosh, & Munafò, 2008; Bradley, Field, Healy, & Mogg, 2008; LaRowe, Saladin, Carpenter, & Upadhyaya, 2007).

So far, no cigarette craving questionnaire has been validated for the Dutch population, and consequently studies have primarily relied on a non-validated translation of the QSU-Brief (Littel & Franken, 2007; Littel, Franken, & Van Strien, 2009). Although this research has shown that the Dutch QSU-Brief appears to be sensitive to tasks that are believed to enhance cigarette craving, such as viewing smoking-related pictures, it is still unknown whether the Dutch translation of the QSU-Brief has acceptable psychometric properties similar to its original English version. Therefore, the main goal of the present study was to examine the factor structure, internal consistency, and validity of a translated version of the QSU-Brief in a Dutch smoker population.

Since the two original QSU-Brief factors make reference to positive and negative affect, an additional goal of the current study was to examine the correlations between the QSU-Brief, and especially its subscales, and constructs reflecting positive and negative mood. Research has shown that lower levels of positive affect and higher levels of negative affect predict nicotine dependence (McChargue, Cohen, & Cook, 2004b), that college smokers with elevated symptoms of depression are more dependent on cigarettes than non-depressed peers (McChargue, Cohen, & Cook, 2004a), and that relapse is preceded by increasing or intense negative affect (Shiffman, 2005). In line with these results, negative mood appears to be positively associated with craving (Cox et al., 2001). Positive mood, however, is negatively related to craving in abstinent smokers who are enrolled in a cessation program, but positively linked to craving in active smokers in a laboratory setting (Cox et al., 2001). In the present study, it is predicted that QSU-Brief factor 1 'the desire and intention to smoke with an anticipation of pleasure from smoking' is especially related to positive affect, whereas factor 2 'the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke' is mainly associated with high negative affect and anhedonia. Obviously, such findings would provide further support for the validity of the subscales of the QSU-Brief.

Method

Participants

The sample consisted of 208 smokers (58.7% female) with a mean age of 24.4 years (*SD* = 7.9). Smokers' mean score on the Fagerström Test for Nicotine Dependence (FTND; Vink, Willemsen, Beem, & Boomsma, 2005) was 3.7 (*SD* = 2.3). Of the participants 32.2% smoked on average between one and ten cigarettes per day, 51.4% smoked between 11 and 20 cigarettes per day, 13.9% smoked between 21 and 30 cigarettes per day, and 2.4% smoked more than 31 cigarettes per day. A subset (*N* = 184) of the participants was asked about smoking duration and quit attempts. On average, this group had smoked for 8.0 years (*SD* = 7.9); 63.9% of them made one or more quit attempts, with a mean total duration of 11.6 months (*SD* = 16.1). Participants were recruited by advertisements on internet forums and communities and flyers distributed at the Erasmus University Rotterdam (the Netherlands). They were not allowed to smoke during the completion of the questionnaire.

Materials

All participants filled out the Dutch translation of the QSU-Brief (Cox et al., 2001), which is a self-report questionnaire measuring urges and cravings to smoke. As mentioned in the introduction, the QSU-Brief consists of ten items. Five items (items 1, 3, 6, 7, and 10) represent 'the desire and intention to smoke with an anticipation of pleasure from smoking' and three (items 4, 8, and 9) reflect 'the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke'. All items, including items 2 and 5, contribute to the total craving score. As in the original version of the QSU (Tiffany & Drobes, 1991), a Likert-type scale

Table 1 Factor loadings for items of the Dutch QSU-Brief as obtained with a principal components analysis

Original item (item number) *Dutch translation*	Factor	
	1	2
All I want right now is a cigarette (5) *Het enige wat ik nu wil is een sigaret*	0.87	
Nothing would be better than smoking a cigarette right now (2) *Niets zou beter zijn dan nu een sigaret te roken*	0.85	
Smoking would make me less depressed (9) *Als ik nu mocht roken zou ik me minder depressief voelen*	0.81	
I would do almost anything for a cigarette now (8) *Ik zou er bijna alles voor over hebben om nu te mogen roken*	0.70	
I could control things better right now if I could smoke (4) *Ik zou alles beter onder controle hebben als ik nu mocht roken*	0.65	
I have an urge for a cigarette (6) *Ik ervaar een sterke drang om een sigaret te roken*	0.64	0.53
If it were possible, I probably would smoke now (3) *Als het mogelijk was, zou ik waarschijnlijk nu een sigaret opsteken*		0.87
A cigarette would taste good now (7) *Een sigaret zou me nu wel smaken*		0.82
I am going to smoke as soon as possible (10) *Zodra dit mogelijk is, ga ik roken*		0.80
I have a desire for a cigarette right now (1) *Ik verlang op dit moment naar een sigaret*	0.42	0.79

ranging from 1 (strongly disagree) to 7 (strongly agree) was used for the responses to each question. In addition, all participants filled out the Dutch version of the Fagerström Test for Nicotine Dependence (FTND; Vink et al., 2005), which is a six-item measure assessing smoking habit and dependence. This questionnaire has acceptable reliability and correlates significantly with the number of cigarettes smoked per day. The items of the FTND were scored according to the scoring system described in Heatherton, Kozlowski, Frecker, and Fagertstrom (1991).

Further, a subset of the participants ($N = 84$) completed two mood questionnaires, i.e., the Positive Affect Negative Affect Scales (PANAS; Watson, Clark, & Tellegen, 1988) and the Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995). The PANAS consists of 20 items that either measure positive affect (PA; 10 items) or negative affect (NA; 10 items). Each item refers to a mood state (e.g., proud, scared), and participants rate the extent to which each mood state describes how they feel at the moment of testing on a scale ranging from 1 (not at all or very slightly) to 5 (extremely). High PA is thought to reflect high energy, concentration, and pleasurable mood states, whereas low PA is characterised by sadness and lethargy. Negative affect (NA), on the other hand, refers to distress and unpleasurable mood states, with low NA reflecting a state of calmness and serenity (Watson et al., 1988). The Dutch version of the PANAS, which was used in the present study, has comparable satisfactory psychometric properties with the original questionnaire (Boon & Peeters, 1999).

The SHAPS is a 14-item self-report instrument measuring hedonic tone, i.e., the (in)ability to experience pleasure (Snaith et al., 1995). The Dutch version, employed in the current study, has excellent psychometric properties (Franken, Rassin, & Muris, 2007).

Finally, a subset of the participants reported smoking duration (i.e., for how many years they had been smoking; $N = 181$), the degree of cigarette craving on a scale ranging from 0 to 100 ($N = 84$), and urge and desire for a cigarette on a Visual Analogue Scale (urge-VAS and desire-VAS; $N = 84$).

Procedure

To determine the factor structure of the Dutch translation of the QSU-Brief, an exploratory principal components analysis with Promax rotation was conducted on the ten items. Reliability analysis was conducted to determine internal consistency of the QSU-Brief and its subscales. In order to assess the validity of the QSU-Brief, Spearman correlations were calculated between the QSU-Brief and other questionnaires/rating scales. We selected Spearman correlation because data of the QSU-Brief and the other craving rating scales displayed a non-normal distribution.

Results

Exploratory factor analysis

A principal components analysis was conducted on the ten-item QSU-Brief. A Promax rotation was employed as the two subscales 'desire and intention to smoke' and 'anticipation of relief from negative affect with an urgent desire to smoke' are considered to be non-orthogonal factors (Cappelleri et al., 2007; Cox et al., 2001). Investigation of the scree plot pointed in the direction of a two-factor solution. These two factors had eigenvalues greater than one, i.e., 4.10 and 2.43, and accounted for 41.02% and 24.27%, respectively, of the variance. Eight of the items had a loading of > 0.40 on one of the two factors. The other two items (i.e., items 1 and 6) displayed substantial loadings (i.e., > 0.40) on both factors.

In general, the factor analysis revealed that most of the items loaded most substantially on their hypothesised factor (Table 1), that is, factor 1 consisted of items 2, 4, 5, 8, and 9 and corresponds with factor 2 of the factor structure described by Cox et al. (2001), i.e., 'the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke'. Factor 2 contained the items 1, 3, 6, 7, and 10 and was entirely in accordance with factor 1 of the original QSU-Brief, i.e., 'the desire and intention to smoke with an anticipation of pleasure from smoking'. Items 2 and 5 were not included in their factor solution, but because of high factor loadings and face validity, these items were nevertheless assigned to factor 1 in the present study. Items 1 and 6 initially loaded on both factors, but were assigned to factor 2 in order to avoid too much deviation from the original factor structure.

Reliability

Cronbach's α was .83 for the total score of the QSU-Brief, which indicates that the Dutch translation of this questionnaire has adequate internal consistency. The internal consistency of the separate factors was also good: factor 1 (items 2, 4, 5, 8, and 9: α = .84) and factor 2 (items 1, 3, 6, 7, and 10: α = .84).

Validity

Spearman's correlation coefficients between the QSU-Brief total score and other questionnaires/ rating scales are reported in Table 2. As expected, scores on the QSU-Brief were highly correlated with scores on the craving rating scale, ϱ = .80, p < .01, the desire-VAS, ϱ = .77, p < .01, and the urge-VAS, ϱ = .76, p < .01. In addition, moderate, positive correlations were found between the QSU-Brief and the FTND, ϱ = .14, p < .05, and number of cigarettes smoked per day, ϱ = .25, p < .01.

The subscale representing anticipation of relief from negative affect with an urgent desire to smoke (factor 1) was significantly correlated with negative affect (PANAS-NA), ϱ = .25, p < .01, whereas this appeared not true for the subscale representing a desire and intention to smoke (factor 2), ϱ = .16, ns. Neither of the factors were significantly correlated with positive affect (PANAS-PA), ϱ = - .02, ns and ϱ = - .01, ns. However, both factors were significantly correlated with the SHAPS, ϱ = .23, p < .01 (factor 1) and ϱ = .22, p < .01 (factor 2). To recapitulate, craving, especially the subscale 'anticipation of relief from negative affect with an urgent desire to smoke', is related to negative affect, but not necessarily to positive affect.

Discussion

The present study investigated the factor structure, reliability, and validity of the Dutch translation of the QSU-Brief. It can be concluded that the questionnaire seems to be a reliable and valid measure of cigarette craving. The Dutch QSU-Brief displayed good internal consistency, and scores on this scale were strongly correlated with three other rating scales for measuring craving, urge, and desire for cigarettes, and moderately linked to questionnaires that tap related constructs, i.e., cigarette dependence and number of cigarettes smoked per day.

Table 2 Spearman's correlations between scores on the QSU-Brief and rating scales/questionnaires tapping similar and related constructs

	QSU- Brief	0-100 craving rating scale	Desire-VAS	Urge-VAS	FTND	Cigarettes/ day
QSU-Brief		0.80**	0.76**	0.77**	0.14*	0.25**
0-100 Craving rating scale			0.86**	0.71**	0.33**	0.42**
Desire-VAS				0.73**	0.19	0.29**
Urge-VAS					0.26**	0.31**
FTND						0.75**
Cigarettes/day						

QSU-Brief = Brief Questionnaire on Smoking Urges; VAS = Visual Analogue Scale; FTND = Fagerström Test of Nicotine Dependence.
** p < 0.05, ** p < 0.01*

An exploratory factor analysis revealed a two-factor structure, which is largely in agreement with exploratory and confirmatory factor analyses of the English and Spanish versions of the original QSU (Cepeda-Benito, Henry, Gleaves, & Fernandez, 2004; Davies, Willner, & Morgan, 2000), and the English and Spanish versions of the ten-item QSU-Brief (Cappelleri et al., 2007; Cepeda-Benito & Reig-Ferrer, 2004; Cox et al., 2001).

The first factor, which corresponds with the second factor of the English QSU-Brief, consisted of the items 2, 4, 5, 8, and 9, whilst items 1, 3, 6, 7, and 10 comprised factor 2. In the present study, items 2 and 5 loaded convincingly on factor 1, whereas they loaded ambivalently on two factors in previous studies. This discrepancy might be explained by language differences. Items 2 and 5, i.e., 'nothing would be better than smoking a cigarette right now' and 'all I want right now is a cigarette' convey quite extreme utterances, especially when they are literally translated into Dutch. Because items as 'smoking would make me less depressed' (9) and 'I could control things better right now if I could smoke' (4) are also quite extreme and rarely used in Dutch, it is not surprising that these items load on one and the same factor. The abovementioned items constitute the subscale 'the relief from nicotine withdrawal or negative affect with an urgent and overwhelming desire to smoke', and the inclusion of items 2 and 5 makes this designation even more valid. Furthermore, and in accordance with the findings by Cox et al. (2001), this subscale was significantly correlated with negative affect and anhedonia, thereby yielding further evidence for its relation to negative mood and withdrawal symptoms.

The second factor corresponds with the first factor of the original QSU-Brief, although, in the present study, items 1 and 6 loaded on two factors. Item 6, however, loaded considerably higher on factor 2 than on factor 1, and was thus assigned to factor 2. In order to avoid too much deviation from the original factor structure, item 1 was also assigned to this factor. An explanation for these items loading on both factors might be again the Dutch language. Items 1 and 6 contain the terms 'desire' and 'urge'. Although Dutch people may use phrases such as 'I have a strong desire or urge for a cigarette, it is far more common to employ less strong expressions, e.g., 'I would like/fancy a cigarette'. Nevertheless, items 1 and 6 are less extreme than the items assigned to factor one. This justifies the decision to assign them to factor 2, which can be described as 'desire and intention to smoke'. We are careful with the addition of 'anticipation of pleasure from smoking' to the name of this factor, because the subscale is not significantly correlated with either positive or negative affect and the individual items make no explicit reference to any pleasure or reward that one can get from smoking. In previous research (Cox et al., 2001), an ambiguous relation was found between positive affect and craving in that it was negatively related to craving in abstinent, treatment-seeking smokers, but positively related to craving in active smokers in a laboratory setting. If any relationship between 'desire and intention to smoke' and mood exists, we expect this to be the case with depressive symptoms, since this subscale correlated significantly with anhedonia.

Overall, the Dutch translation of the QSU-Brief offers a reliable, valid and multi-dimensional assessment of craving for cigarettes and is suitable for being used in both laboratory and clinical settings. However, it would be useful if future research confirms the present factor structure in a Dutch sample, since it slightly deviates from the original English version.

References

Allen, S. S., Bade, T., Hatsukami, D., & Center, B. (2008). Craving, withdrawal, and smoking urges on days immediately prior to smoking relapse. *Nicotine & Tobacco Research*, *10*, 35-45.

Attwood, A. S., O'Sullivan, H., Leonards, U., Mackintosh, B., & Munafò, M. R. (2008). Attentional bias training and cue reactivity in cigarette smokers. *Addiction*, *103*, 1875-1882.

Boon, M. T. G., & Peeters, F. P. M. L. (1999). Affectieve dimensies bij depressie en angst. *Tijdschrift voor Psychiatrie*, *41*, 109-113.

Bradley, B. P., Field, M., Healy, H., & Mogg, K. (2008). Do the affective properties of smoking-related cues influence attentional and approach biases in cigarette smokers? *Journal of Psychopharmacology*, *22*, 737-745.

Cappelleri, J. C., Bushmakin, A. G., Baker, C. L., Merikle, E., Olufade, A. O., & Gilbert, D. G. (2007). Multivariate framework of the Brief Questionnaire of Smoking Urges. *Drug and Alcohol Dependence*, *90*, 234-242.

Cepeda-Benito, A., Henry, K., Gleaves, D. H., & Fernandez, M. C. (2004). Cross-cultural investigation of the Questionnaire of Smoking urges in American and Spanish smokers. *Assessment*, *11*, 152-159.

Cepeda-Benito, A., & Reig-Ferrer, A. (2004). Development of a Brief Questionnaire of Smoking Urges--Spanish. *Psychological Assessment*, *16*, 402-407.

Cox, L. S., Tiffany, S. T., & Christen, A. G. (2001). Evaluation of the Brief Questionnaire of Smoking Urges (QSU-brief) in laboratory and clinical settings. *Nicotine & Tobacco Research*, *3*, 7-16.

Davies, G. M., Willner, P., & Morgan, M. J. (2000). Smoking-related cues elicit craving in tobacco 'chippers': A replication and validation of the two-factor structure of the Questionnaire of smoking Urges. *Psychopharmacology*, *152*, 334-342.

Doherty, K., Kinnunen, T., Militello, F., & Garvey, A. (1995). Urges to smoke during the first month of abstinence: Relationship to relapse and predictors. *Psychopharmacology*, *119*, 171-178.

Franken, I. H. A., Rassin, E., & Muris, P. (2007). The assessment of anhedonia in clinical and non-clinical populations: Further validation of the Snaith-Hamilton Pleasure Scale (SHAPS). *Journal of Affective Disorders*, *99*, 83-89.

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K. O. (1991). The Fagerstrom Test for Nicotine Dependence: A revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, *86*, 1119-1127.

Killen, J. D., & Fortmann, S. P. (1997). Craving is associated with smoking relapse: Findings from three prospective studies. *Experimental and Clinical Psychopharmacology*, *5*, 137-142.

Killen, J. D., Fortmann, S. P., Newman, B., & Varady, A. (1991). Prospective study of factors influencing the development of craving associated with smoking cessation. *Psychopharmacology*, *105*, 191-196.

LaRowe, S. D., Saladin, M. E., Carpenter, M. J., & Upadhyaya, H. P. (2007). Reactivity to nicotine cues over repeated cue reactivity sessions. *Addictive Behaviors*, *32*, 2888-2899.

Littel, M., & Franken, I. H. (2007). The effects of prolonged abstinence on the processing of smoking cues: An ERP study among smokers, ex-smokers and never-smokers. *Journal of Psychopharmacology*, *21*, 873-882.

Littel, M., Franken, I. H. A., & Van Strien, J. W. (2009). EEG spectrum changes in response to smoking cues in smokers and ex-smokers. *Neuropsychobiology*, *59*, 43-50.

McChargue, D. E., Cohen, L. M., & Cook, J. W. (2004a). Attachment and depression differentially influence nicotine dependence among male and female undergraduates: A preliminary study. *Journal of American College Health*, *53*, 5-10.

McChargue, D. E., Cohen, L. M., & Cook, J. W. (2004b). The influence of personality and affect on nicotine dependence among male college students. *Nicotine & Tobacco Research*, *6*, 287-294.

Niaura, R. S., Rohsenow, D. J., Binkoff, J. A., Monti, P. M., Pedraza, M., & Abrams, D. B. (1988). Relevance of cue reactivity to understanding alcohol and smoking relapse. *Journal of Abnormal Psychology*, *97*, 133-152.

Orleans, C. T., Rimer, B. K., Cristinzio, S., Keintz, M. K., & Fleisher, L. (1991). A national survey of older smokers: Treatment needs of a growing population. *Health Psychology*, *10*, 343-351.

Shiffman, S. (2005). Dynamic influences on smoking relapse process. *Journal of Personality*, *73*, 1715-1748.

Shiffman, S., Engberg, J. B., Paty, J. A., Perz, W. G., Gnys, M., Kassel, J. D., et al. (1997). A day at a time: Predicting smoking lapse from daily urge. *Journal of Abnormal Psychology*, *106*, 104-116.

Shiffman, S. M., & Jarvik, M. E. (1976). Smoking withdrawal symptoms in two weeks of abstinence. *Psychopharmacology*, *50*, 35-39.

Snaith, R. P., Hamilton, M., Morley, S., Humayan, A., Hargreaves, D., & Trigwell, P. (1995). A scale for the assessment of hedonic tone: The Snaith-Hamilton Pleasure Scale. *British Journal of Psychiatry*, *167*, 99-103.

Swan, G. E., Ward, M. M., & Jack, L. M. (1996). Abstinence effects as predictors of 28-day relapse in smokers. *Addictive Behaviors*, *21*, 481-490.

Tiffany, S. T., & Drobes, D. J. (1991). The development and initial validation of a questionnaire on smoking urges. *British Journal of Addiction*, *86*, 1467-1476.

UNDCP, & WHO. (1992). *Informal Expert Committee on the Craving Mechanism: Report* (No. V. 92-54439T).

Vink, J. M., Willemsen, G., Beem, A. L., & Boomsma, D. I. (2005). The Fagerstrom Test for Nicotine Dependence in a Dutch sample of daily smokers and ex-smokers. *Addictive Behaviors*, *30*, 575-579.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063-1070.

West, R., Hajek, P., & Belcher, M. (1989). Time course of cigarette withdrawal symptoms while using nicotine gum. *Psychopharmacology*, *99*, 143-145.

DRS. MARIANNE LITTEL
Institute of Psychology, Erasmus University, Rotterdam, the Netherlands
Fields of interest: Cognitive processing biases in addiction, attentional bias, electro-encephalography, event-related potentials, response inhibition, error-processing, smoking addiction, computer game addiction, alcoholism, cognitive reappraisal
E-mail: littel@fsw.eur.nl

PROF. DR. INGMAR H.A. FRANKEN
Professor and Chair of Clinical Psychology
Erasmus University Rotterdam, the Netherlands
Main area of interest is addictive behaviours
E-mail: franken@fsw.eur.nl

PROF. DR. PETER MURIS
Full Professor in Clinical Psychology
Institute of Psychology, Erasmus University Rotterdam, the Netherlands
Research focuses on child psychopathology and assessment of individual differences
E-mail: muris@fsw.eur.nl

Is edutainment software really educational?

A feature analysis of Dutch edutainment software for young children

This study examines the educational power of edutainment software for young children. A theoretically justified checklist is presented, based on literature about characteristics of powerful learning environments. The checklist can be used to evaluate characteristics of edutainment (online) games for children in order to obtain an overview of the power of educational software as a powerful learning environment. Eight Dutch edutainment games for young children were selected based on two criteria: the educational aspect of the game and the child's recommended age. This article suggests that current Dutch edutainment software does not seem to meet the theoretical requirements for powerful learning environments. The current checklist can help designers of new edutainment games to improve the educational quality of edutainment software.
Where: Netherlands Journal of Psychology, Volume 66, 50-67

Received 7 February 2009; Accepted 11 November 2009

Keywords: Edutainment software; Powerful learning environment; Playful learning; Evaluation; Characteristics

Authors: Baukje Veenstra, Paul L.C. van Geert, and Bieuwe F. van der Meulen

Faculty of Behavioural and Social Sciences, University of Groningen, Groningen

Correspondence to:
Baukje Veenstra
Faculty of Behavioural and Social Sciences, University of Groningen, Grote Kruisstraat 2/1, 9712 TS Groningen, the Netherlands
E-mail: B.Veenstra@rug.nl

Thirty years ago educators and technologists discovered the educational power of computers (Bryce & Rutter, 2003). As a consequence, new educational computer programs for young children have been developed, also called: 'educational software' or 'edutainment software'. 'Edutainment software' is a contraction of education and entertainment. It means that learning takes places through software that both educates and entertains (Egenfeldt-Nielsen, 2007).

Edutainment software relies heavily on technology, especially computer software (Rapeepisarn, Wong, Fung, & Depickere, 2006). It usually exists in the form of educational electronic games aimed at teaching and learning concepts and processes. It is a game genre that heavily relies on visuals and narratives or game formats, but also incorporates some type of learning objective, for example concepts and processes (Buckingham & Scanlon, 2000; Okan, 2003). The purpose of edutainment is to attract and hold the attention and high motivation of the learners by means of a computer monitor showing rich displays of vividly coloured animations (Embi & Hussain, 2005), in order for learning to take place.

Parents of young children are encouraged to believe that edutainment software stimulates the development of their children's skills (Okan, 2003). Edutainment is therefore advertised as a meaningful experience for young children, because the aim of edutainment is playful learning of one or multiple skills in a particular developmental domain. Edutainment learning depends on the belief that learning is 'fun'.

Many designers of edutainment software for young children (preschool children) claim that their software is beneficial for the development of specific or multiple skills in children. Edutainment software frequently provides messages such as: 'develop preschool skills: vocabulary, early reading, numbers and counting' or 'discover and learn: letters, shapes, colours, cause and effects and memory skills' (for example Disney, 2007; Go Diego Go, 2008). The

marketing often suggests that learning can be fun and that edutainment offers a technology in which playful learning can take place.

However, it is currently still largely unclear whether software for young children that claims a learning effect is really educational and really provides a playful and at the same time powerful learning environment for children. For that reason, it is important to investigate whether the claims of the game designers are empirically supported. Given the wealth of available edutainment software, it is almost impossible to study the effects of each software product. We suggest that a good way of making a preliminary selection of educationally promising edutainment is to first check to what extent a particular software product complies with a number of theoretical criteria for powerful learning. By way of a working definition, we describe powerful learning as learning that takes place effectively and efficiently, leading to permanent increases in relevant and usable knowledge and skills that stimulate and support further learning.

The aim of our paper is firstly to present and theoretically justify a checklist, mainly based on literature about characteristics of powerful learning environments, containing criteria according to which edutainment software can be classified as a more or less powerful learning environment, aimed at achieving powerful learning in young children. Secondly, we will describe how the checklist has been used in a pilot study, evaluating characteristics of Dutch edutainment (online) games for children (between six months and six years) to obtain an overview of the power of educational software as a powerful learning environment.

Characteristics of powerful learning in preschool children

Learning is a complex phenomenon. It can be defined as a relatively permanent change of behaviour or behavioural modification. Learning is a process by which an organism's behaviour is modified. These changes can be more or less permanent and cannot be attributed to maturation, but to exercise or experience (Keller & Werchan, 2006; Smolak, 1986). Learning can also be defined as the act, process, or experience of gaining knowledge or skill, gained in many contexts, for example school or family. It can be seen as a constructivist process: learning is enhanced when the learner actively engages with the content (Elliott, Kratochwill, Littlefield-Cook, & Travers, 2000). Knowledge is built by the learner and not simply supplied or transmitted by the teacher. The building of knowledge can be stimulated by a number of teaching strategies: learning best occurs when children engage in activities that are at the peak of their abilities, when they have to work to their full potential to accomplish a task.

Many factors influence a learning process, for example emotional, motivational, social and cognitive components (Birenbaum, 2003; Howard, Morgan, & Ellis, 2006; Langelier & Connell, 2005). However, there is one major force in learning: social interaction (Vygotsky, 1978). Social contexts are important in learning: they can present new information that may be inconsistent with the child's existing knowledge structures. The central feature of a social learning context is that it provides adaptive, learning-oriented interaction and feedback. For this reason, learning profits from interactions with peers, parents or teachers, but also from human-machine interaction. New structures can be constructed and existing knowledge can be adapted (Birenbaum, 2003).

In Guralnick's (2005) model of factors influencing children's developmental outcomes, family patterns are seen as primarily responsible for child outcomes. An important property of such patterns is the family-orchestrated child experiences, which are defined as things families do to provide meaningful experiences for children. Such orchestrated experiences are responsible, conditional or beneficial for developmental outcomes in children (Guralnick, 2005). Families can provide the child with learning experiences by creating and maintaining the opportunity of developmentally adequate human machine interaction, for example through the internet or computer games. The genuinely social nature of interactions, however, provides an additional value to the machine-based opportunities. In particular, collaboration fosters the learning process of both less and more advanced learners: children tend to perform better in pairs than if they work alone (Lehtinen, 2003).

Social interaction fosters the learner's engagement in particular if it takes place in an environment with playful learning characteristics. Play contexts are environments that strongly engage the learner, and learner engagement is positively related to learning success (Herrington, Oliver, & Reeves, 2003; Kearsley & Shneiderman, 1998). Engagement can be defined as the active focus and energetic involvement with a task. Playful learning characteristics engage or motivate children and these children achieve earlier or better school readiness (Diamond, Barnett, Thomas, & Munro, 2007). Playful learning characteristics therefore foster powerful learning, in that they encourage academic exploration and actively engage children. Development of language, acquisition of emergent literacy skills, capturing attention and knowledge of maths are supported

through play and through guided playful learning (Hirsh-Pasek, Golinkoff, Berk, & Singer, 2009). The National Association for the Education of Young Children (NAEYC) notes that play 'provides a context for children to practice newly acquired skills and also to function on the edge of their developing capacities, to take on new social roles, attempt novel or challenging tasks, and solve complex problems that they would not (or could not) otherwise do' (Hirsh-Pasek et al., 2009, p.23).

An important predictor of powerful learning is the child's ability to self-regulate its actions (Slavin, 2009). Self-regulation or cognitive control (such as goal setting, planning, listening to directions, paying attention or solving a task without continuous supervision) predict academic achievement from preschool to high school (Diamond et al., 2007). Learning self-regulatory skills requires having goals and motivation to attain goals, and learning of this takes place through play (Boekaerts, 1995; Diamond et al., 2007). In this respect, it is important to note that Blair and Razza (2007) have clearly demonstrated the importance of play for teaching preschool children to regulate their own behaviour, thus showing that early playful learning can make a strong contribution to later academic performance. As mentioned earlier, social interaction (e.g. adult-guided interaction) fosters learning in children in playful learning environments (Hirsh-Pasek et al., 2009). However, this interaction should be adapted to at least two characteristics to achieve high engagement. The first aspect is that interaction or instruction should be adapted to the cognitive level and already achieved skills of the child (Vygotsky, 1978). The second characteristic is that the interaction should evoke self-sustaining interest or curiosity of the child (Csikszentmihalyi, 1990).

To begin with the first aspect, interaction or instruction must be matched with a child's cognition or developmental level. Vygotsky introduced the concept of the Zone of Proximal Development (ZPD), which is the difference of what the child can do or learn independently and what the child can do or learn with a more skilled partner (Vygotsky, 1978). Powerful learning can only take place if there is a balance between challenge and already achieved skills (the interaction takes place within the ZPD). The effectiveness of peer interaction (cooperative learning) is also supported by Vygotsky (1978). Peers usually operate within each other's ZPD; they are likely to understand the other child's reasoning process and to provide support that stimulates meaningful learning. This element of social interaction can also be present in activities other than interpersonal interaction, for example computer tools for instruction. The computer can also serve as a ZPD, thus as a 'more capable peer', in which the child is left in much freedom to explore and expend effort in the process (Salomon, Globerson, & Guterman, 1989).

As regards the second aspect, interest and curiosity are central aspects in Csikszentmihalyi's flow theory. He describes *flow* as a way to achieve powerful learning: a form of intrinsic motivation, a feeling of optimal experience (engagement in a task comes from enjoyment or satisfaction to complete a task) (Csikszentmihalyi, 1990; Davis, Bagozzi, & Warshaw, 1992). Flow can be considered 'a psychological state describing the optimal feeling of learners who are cognitively efficient, motivated and happy' (Csikszentmihalyi, 1990). Challenging activities that reach and support the learner's self-sustaining curiosity are central in flow theory. Such self-sustaining curiosity occurs if there is a balance between high challenge and skills (Csikszentmihalyi, 1990). Flow theory integrates three components that are related to engagement: cognition, motivation and emotions (Csikszentmihalyi, 1975; Csikszentmihalyi & Csikszentmihalyi, 1988). One assumption of this theory is that powerful learning environments involve enhanced cognitive processing, are intrinsically motivated and are related to positive emotions (Meyer & Turner, 2006).

Csikszentmihalyi (1990, 1993) constructed the concept of flow along nine dimensions: (1) sensing that one's skills are balanced to the challenges, (2) merging action and awareness, (3) engaging clear goals, (4) directing unambiguous feedback, (5) concentrating on the task at hand, (6) feeling in control, (7) loss of self-consciousness, (8) transforming of time. The ninth dimension implies that the learner has a so-called autotelic experience (intrinsic motivation): the end result of being in flow, a feeling of doing something for its own sake, with no expectation of future reward or benefit (Tenenbaum, Fogarty, & Jackson, 1999). Powerful learning environments should entail all or at least a significant subset of these nine characteristics.

Vygotsky's theory parallels Csikszentmihalyi's flow theory in the sense that powerful learning activities are a balance between challenge and already achieved skills (moderate challenge). A learner feels that his skills are 'stretched' to meet the challenge and experiences flow when his or her perceived skills and challenges are both high (Meyer & Turner, 2006; Liao, 2006). However, an important difference between these theories is that Csikszentmihalyi (1990) is primarily focussed on the self-sustaining interest of the learner to evoke curiosity and achieve engagement, whereas Vygotsky (1978) more explicitly focuses on the readiness of the learner and

on the possibilities implied in the already achieved skills of the child.

Our conclusion is that to achieve powerful learning in children, high engagement or flow should be attained. Interaction or instruction should evoke self-sustaining curiosity and interest in understanding new concepts or tasks. Playful learning environments can therefore function as an appropriate environment for young children to optimally learn new skills and concepts. In addition, in order to achieve powerful learning, social interaction or instruction should be provided within the ZPD of the learner.

The concept of a powerful learning environment

A definition

Educators can promote powerful learning by designing powerful learning environments. According to Bétrancourt, Dillenbourg, and Montarnal (2003) a powerful learning environment generates high learning gains for its users. Learners in powerful learning environments are encouraged to construct their own knowledge, learn in realistic situations and to learn together with others.
There are various slightly different definitions of powerful learning environments, but the common interpretation is that powerful learning environments promote active and constructive learning and present collaborative activities (De Jong & Pieters, 2006).

The level of interactivity (the learners' activity (practice) and interactivity in instruction) is the core 'powerful' mechanism in computer technology (Bétrancourt et al., 2003). In powerful learning environments children can make decisions and are allowed to take initiative in learning. They can make choices which can be explored or manipulated (Gillespie & Beisser, 2001). The instructional design is aimed at integrated sets of learning goals (De Corte, Verschaffel, Entwistle, & Van Merriënboer, 2003). The main goal of powerful learning environments is to learn through practice by improving one or more skills of a child on a particular developmental domain. Instruction must be fully aligned with individual differences and human cognitive architecture (for instance, the limited processing capacity of the human mind; De Corte et al., 2003). The learners' capacities are enhanced or the learners' cognitive capacities are 'stretched' through specific types of support. This support facilitates knowledge acquisition or practice of one or more skills (Linn, Davis, & Bell, 2004; Quintana, et al., 2004).

In this context, engagement can be defined as an energetic involvement as a result of a powerful learning environment. In a similar vein, flow can also be defined as a psychological state of a child that emerges in a powerful learning environment. Powerful learning environments are based on what we know of child developmental theories: they are age appropriate, individually appropriate: they should take an eclectic view of learning (people learn in different ways) and also be socioculturally appropriate (De Corte et al., 2003; Bredekamp & Copple, 1997).

Based on this information, our working definition of a *powerful learning environment* in this context is as follows: an environment in which active and constructive learning is promoted by playful learning and is aligned with individual differences (Vygotsky, 1978) to reach high engagement and flow (curiosity or interest) (Csikszentmihalyi, 1990) in a learner.

Important characteristics

The aim of a powerful learning environment is to create a context in which characteristics of powerful learning are reinforced (see our working definition of powerful learning in the introductory section). Developmental theories related to active and constructive learning have therefore implications for the construction of powerful learning environments (McCarrick & Li, 2007; Gillespie & Beisser, 2001). To enhance powerful learning, children have to be actively involved or highly engaged in order to obtain direct experiences. High engagement and flow can be achieved when children get the occasion to explore in a social and playful learning environment. Through these experiences, children can construct knowledge independently (Hirsh-Pasek et al., 2009).

Effective instructional interactions respond to emotions of the learner, thus suggesting how a goal structure in a learning environment may be emotionally scaffolded, i.e. positively and interactively supported (Meyer & Turner, 2006; Patrick, Turner, Meyer, & Midgley, 2003; Turner, Meijer, Midgley, & Patrick, 2003; Turner & Patrick, 2004). Positive support is associated with the learners' motivation or interest: behaviour is strengthened by praises or rewards (Turner & Patrick, 2004; Slavin, 2009). We have seen that self-sustained interest is an important aspect of flow. Additional elements of flow manifested in powerful learning environments are, for instance, tasks that can be completed, clear goals and immediate, specific feedback (Csikszentmihalyi, 1990).

Vygotsky's developmental notion of the Zone of Proximal Development has its pedagogical counterpart in the notion of scaffolding. The concept of scaffolding was introduced by Bruner in the 1970s and was defined as '… an adult controlling those elements of a task that are essentially beyond the learner's capacity, thus permitting him to concentrate

upon and complete only those elements that are within his range of competence' (Wood, Bruner, & Ross, 1976, p. 90).

In the current article we wish to propose an enriched notion of scaffolding, which entails a general theory of powerful learning environments that is based on the theory of Vygotsky (1978) and on the flow theory of Csikszentmihalyi (1990). In our view, a powerful learning theory should thus be consistent with the characteristics of a scaffolding situation as described by this enriched definition, which we shall develop further in this section. A scaffolding situation stimulates characteristics of powerful learning in young children, for example play, social context, high engagement or flow. It supports and facilitates active and constructive learning (McKenzie, 2000). Scaffolding in the enriched sense also implies that peers, parents and teachers have an influence on the construction of knowledge in the child. They provide the socially mediated practice and experiences within the child's Zone of Proximal Development that Vygotsky (1978) saw as an important mechanism of cognitive development.

Granott (2005) defines successful scaffolding as 'an increase in the scaffoldee's (child/novice) independent activity level following the scaffolder's (adult/expert) scaffolding'. Scaffolding strategies differ among contexts and individuals: they are used to break the task into pieces that are easy to handle for an individual child. Scaffolding is the use of some support that makes a particular learning process possible and can be withdrawn when the child is capable of doing the task independently, that is, when the scaffoldee is inside his Zone of Current Development (ZCD) (Vygotsky, 1978; Granott, Fischer, & Parziale, 2002; Van Geert & Steenbeek, 2006; Granott, 2005). Paraphrasing Van Geert & Steenbeek (2006), scaffolding is a dynamic and self-sustaining coupling between two changing levels: the level of competence embodied in the learner and the level of competence embodied in the level of teaching. It stimulates engagement of the learner: comprehension of a task, motivation, instruction, social interaction and asking questions. It results in effective learning: the skill is advanced and internalised by appropriating the level incorporated in the past scaffolding (McKenzie, 2000; Van Geert & Steenbeek, 2006).

The scaffoldee loses engagement when unsuccessful scaffolding takes place. Unsuccessful scaffolding can be defined as the lack of a relation between the scaffolder's input and the scaffoldee's current or preceding level (Granott, 2005).

The strong positive relationship between scaffolding strategies, based on Vygotsky's ZPD and curiosity (moderate challenge for the learner) of the learner, emphasises the presence of these strategies in powerful learning environments, as defined in the preceding section.

In Van Geert and Steenbeek's (2006) dynamic model of scaffolding, the help and instruction provided by a more competent person (e.g. a teacher, or an edutainment software program) is a function of the learner's current level and of the ultimate goal that the supporting instance wishes to achieve. The goals embedded in a current interaction between a scaffolder and a scaffoldee are thus dynamically inferred from an overarching goal structure that guides the action. Goal structures, but also the participants' concerns and interests, not only guide the process but also guide the emotions that play an important role in the 'flow' of the scaffolding process (Steenbeek & Van Geert, 2007).

Is edutainment a powerful learning environment?

Characteristics of powerful edutainment software

Edutainment that contributes to learning one or more specific skills in a particular developmental domain should have characteristics theoretically substantiated in the literature about characteristics of powerful learning environments.

Powerful learning can be achieved if edutainment contains a number of individually, age and socioculturally appropriate characteristics that stimulate playful learning, motivation, engagement and flow and that allow for the establishment of a scaffolding interaction according to the enriched notion described above. General scaffolding strategies that can be directly related to edutainment software are summarised below.

One of these strategies is conceptual or supportive scaffolding (Cagiltay, 2006; McKenzie, 2000). Examples of mechanisms of supportive scaffolding are: cueing and hinting, prompting, coaching comments, providing **feedback**[1] and advice on performance, provoking reflection or providing a model for design or a structure to design in. Other characteristics of scaffolding that can be used in edutainment software are, for instance, giving clear directions to reduce confusion of the learner or clarifying the purpose. The learner must understand why he is doing the task and why it is important (it provides directions adapted to individual differences of the learner, in order to help the child to achieve the goal). Keeping the learner on task and motivated by providing structure or simplifying the task are two important scaffolding strategies. More examples

[1] Concepts in bold print correspond to the main categories of the checklist in Figure 1.

of scaffolding techniques are: offering assessment and **feedback** to clarify expectations, pointing learners to worthy sources, reducing uncertainty, techniques to surprise and disappoint, delivering efficiency (McKenzie, 2000; Bransford, Brown, & Cocking, 2000).

Other scaffolding strategies necessary for turning edutainment software into powerful learning environments are positive feedback and scaffolding strategies within the ZPD of the individual child, in which there is mutual adaptation between scaffolder and scaffoldee in an iterative or gradual process (Meyer & Turner, 2006; Van Geert & Steenbeek, 2006). Individual capacities (for example intellectual capacities or age, in terms of levels) should be taken into account when instruction is given to a child (Van Geert & Steenbeek, 2006; Vygotsky, 1978; Webb, 1991). Giving examples or demonstrations in terms of **instruction** is also an important aspect of teaching: showing, rather than only telling, is essential for children to learn specific skills (Slavin, 2009).

In order to maintain the dynamics of the scaffolding situation, there should be an overarching or distal **goal** that explicitly guides the scaffolding actions, in function of the current level of competence or skill attained by the child (Van Geert and Steenbeek, 2006).

To stimulate a child's high engagement and flow and in order to achieve a high learning effect, powerful edutainment software should contain scaffolding characteristics such as variety, diversity or novelty to achieve curiosity (Arnone, 2003), perceived control (Ryan & Deci, 2000; Deci, Connell, & Ryan, 1989), challenge and fantasy (Lim & Kim, 2003), competition (Tripathi, 1992), cooperation and recognition (Collopy & Green, 1995). Assessment of performances, e.g. giving insight into norms and gathering information about a child's abilities, improves the skills of the child. If a child monitors his progress toward a goal, the child makes an evaluative judgment about his performances. This can be a motivating influence on the performance and is a critical component of self-regulation: a child takes action to reduce the discrepancy between his own performance and the standard or goal (Slavin, 2009; Driscoll, 1999).

Additional strategies for obtaining powerful learning are moderate challenge, features that simulate interest or curiosity and enhance a child's control and embedded short-term goals (Ames, 1992; Brophy, 2004; Eccles, Wigfield, & Schiefele, 1998; Pintrich, 2003; Pintrich & Schunk, 2002; Stipek, 1996; Meyer & Turner, 2006; Lim & Kim, 2003). **The interface** should not distract from the learning process (e.g. splashy special effects foster impulsive mouse clicks; Healy, 1998). There should be a relation between the displays and the task or goal, but in such a way that a child does not fully realise that the task is educational (Okan, 2003; Embi & Hussain, 2005).

The **content** of edutainment software should be free of ethnicity, gender, and other stereotypes (Aronson, 2002). Interface-learner interaction (the process of manipulating tools to complete a task by interacting with technology) is positively related to flow experience and to a positive learning effect (Liao, 2006).

A systematic list of criteria for edutainment software as a powerful learning environment

Based on the preceding survey of properties and based on often referenced heuristics in the literature of specific characteristics of computer games (e.g. Embi & Hussain, 2005; Polonoli, 2004), a systematic list with concrete, measurable characteristics has been developed to evaluate the quality of edutainment software as a powerful learning environment.

The goal of the checklist (Figure 1) is to provide information about the educational power of edutainment software. The list makes it possible to check whether software contains scientifically or heuristically based characteristics that contribute to learning or development of one or multiple skills in children. With this checklist, users (for example parents, teachers) are informed about the value of particular edutainment software as an educational environment.

Software designers are informed about which positive criteria edutainment games should satisfy in order to count as powerful learning environments. The more positive characteristics a game contains from those mentioned in the list, the higher the probability that the edutainment software will indeed provide a powerful learning environment. Further studies of powerful learning environments, especially in the context of digitally supported learning, may help to extend and improve the current checklist.

Checklists often contain a cut-off score, implying that if certain requirements are not fulfilled, the evaluated product (for example a test or an educational software program) is not acceptable or does not meet minimal standards. Because the current list has still a provisional character, a cut-off score has not yet been determined. Instead, for each scale, three possible scores are presented: unsatisfactory, satisfactory and good.

At present, the checklist's *validity* is confined to theoretical or concept validity. That is, it is based on the theoretical criteria for powerful learning environments extracted from the literature and on heuristic and common-sense-based criteria for educationally adequate software. Predictive validity could be established by investigating the association, for instance by means of correlations, between the checklist scores of particular edutainment software and that software's learning effects. Such investigation would be highly labour-intensive and a goal for future research. As regards the checklist's discriminatory validity, we will discuss a pilot study in which eight (commercially) available edutainment programs were compared in the next section.
The checklist contains a number of main questions (for example feedback, instruction, learning goals, and interface), which are subdivided into more

Table 1 Percentage agreement between two raters per item

Item number in checklist	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Game 7	Game 8	Percentage agreement
1	1	1	1	1	1	1	1	1	100
2	0	0	1	1	1	0	1	0	50
3	1	1	1	1	1	1	1	1	100
4	1	1	1	1	1	1	1	1	100
5	1	1	1	1	0	1	0	1	75
6	1	1	1	1	1	1	1	1	100
7	1	1	1	1	1	1	1	1	100
8	1	1	1	1	1	1	1	1	100
9	1	0	1	1	0	1	0	0	50
10	1	1	1	1	1	1	1	1	100
11	1	1	1	0	1	1	1	1	87.5
12	1	1	1	1	1	1	1	1	100
13	1	1	1	1	1	1	1	1	100
14	1	0	1	1	1	1	1	1	87.5
15	1	1	1	1	1	1	0	0	75
16	1	1	1	1	1	1	1	1	100
17	1	0	0	1	1	1	1	1	75
18	0	1	0	0	1	1	1	1	62.5
19	1	1	1	1	1	1	0	1	87.5
20	1	1	1	1	0	1	0	1	75
21	1	1	1	1	1	1	1	0	87.5
22	0	1	1	0	0	1	0	0	37.5
23	1	1	1	1	1	1	0	1	87.5
24	1	0	1	1	1	1	1	1	87.5
25	1	1	1	1	1	1	1	1	100
26	1	0	1	1	1	1	1	1	87.5
27	1	0	1	1	1	1	1	1	87.5
28	1	1	1	1	1	1	1	1	100
29	1	1	1	1	1	1	1	1	100
30	1	1	1	1	1	1	1	1	100
31	1	0	1	1	0	0	0	0	37.5
32	1	0	0	1	1	1	1	1	75
33	1	1	1	1	1	1	1	1	100
34	1	0	1	1	1	1	1	1	87.5
35	1	1	1	1	1	1	1	0	87.5
Percentage agreement	91.4	71.4	91.4	91.4	85.7	94.3	77.1	80	85.4

Score 1: agreement between the raters, score 0: no agreement on the specific item

specific items. If the main question is answered negatively, the user is directed to the next main category. To score the questions in the checklist, users have to study the instructions about the operationalisations of the main definitions used in the checklist (Appendix I).

As to the reliability of the checklist, we present the results of a small pilot study in which eight edutainment games were evaluated by two raters. The study showed that the inter-rater reliability was .85. This reliability can be considered as good or acceptable (Table 1). 100% agreement was measured on many items, e.g. items 1, 3 and 4, although some items have a relatively low score on the percentage agreement, in this case items 22 and 31. Concerning item 22 it was unclear whether technical support was included or not. This item should be changed into 'the child can independently operate the program (with the exception of technical support)'. The formulation of item 31 should be adapted into 'the game is arranged for all ethnicities (not provided by information on the cover)'.

A critical evaluation of current edutainment software

Educational claims

In this pilot study eight randomly selected games of 30 purchased edutainment games and one available online game are evaluated with the Edutainment Software Evaluation Checklist (ESEC) (Figure 1).

The aim of the study was to evaluate whether Dutch edutainment software contains important educational features as mentioned in the ESEC. In Table 2 the game properties and educational claims are summarised.

Two game selection criteria were determined to evaluate an appropriate game in this study. Firstly, games had to provide explicit information about the educational aspect of the game in order to decide whether a game can be called edutainment software or mainly entertainment. Games with entertainment as the only goal were of course not selected in this study. To decide whether the game contains an educational aspect, information about educational claims had to be clearly available to the customer, a criterion that we operationalised by the requirement that the educational aim had to be clearly formulated on the cover of the game package or in the manual. The educational aims must specify which skill, or multiple skills, will be fostered through playing the specific game. Secondly, the game had to be suitable for young children between six months and six years of age.

The games in this study were purchased in the period November 2008 to February 2009 in Dutch online shops, in Dutch toy and entertainment/media shops. Thirty edutainment games were purchased, based on the two selection criteria mentioned in this section. Two mini-laptops of five purchased laptops were randomly selected in this evaluative study. Five CD-ROM games were randomly selected of the ten purchased CD-ROM and one Dutch *free* online game on an internet-website was selected, based on the first selection criterion. No other *free* online Dutch games with clear educational aspects mentioned on their website were found on the internet. This aselect sample of selected games therefore seems to be statistically reasonably representative.

Figure 1 and Table 2 see next pages →

Figure 1 Edutainment Software Evaluation Checklist (ESEC)	
Game name:	
User name:	
Date:	
Particularities:	

Evaluation		
Category	Total score (write the total raw score per scale in this column)	Conclusion (circle the appropriate category based on the column 'total score')
1. Feedback		0-4: unsatisfactory 5-8: satisfactory 9-10: good
2. Learning goals		0-3: unsatisfactory 4-6: satisfactory 7-8: good
3. Instruction		0-2: unsatisfactory 3-4: satisfactory 5: good
4. Interface		0-3: unsatisfactory 4-5: satisfactory 6-7: good
5. Level		0-2: unsatisfactory 3-7: satisfactory 8-9: good
6. Content		0-3: unsatisfactory 4-5: satisfactory 6-7: good

Question number	Question	Correct/most appropriate answer
Category 1	Scaffolding/feedback strategies	
1	**Is there feedback in the game?**	**1 - yes** **0 - no** **→ If 'no', go to question 8**
2	After playing the whole game	1 – yes 0 – no
3	During playing	2 – yes, immediately after the child's action 1 – yes, with delay 0 – no
4	Automatically	2 – yes 1 – only when the child asks for it 0 – no
5	Quality of feedback: value	2 – feedback is given mostly positively (stimulating) (e.g. no, that's not correct, but look further!) 1 – mostly neutral feedback is given 0 – mostly negative feedback is given (only as a correction) (e.g., no that's not correct)
6	Quality of feedback: specificity	1 – specific (e.g. this (spec) is right) 0 – global – (e.g. that's right)
7	Quality of feedback: clarity	1 – (mostly) clear and logical for children 0 – (mostly) incomprehensible
		Total score Feedback: 0-1-2-3-4-5-6-7-8-9-10 *(circle the total raw score of this category)*

Category 2	Clear (learning) goals in the manual or in the game	
8	**Are there clear learning goals in the manual/ cover for parents and/or child (either paper or digital manual or in-game support)?** ***(e.g. improves spatial insight or improves mouse skills)***	**1 - yes** **0 - no** **→ If 'no', go to question 11**
9	Information/instruction about how to play the game to reach the goal *(e.g. information how to find the golden coins: when all the golden coins have been found, spatial insight has been improved)*	1 – yes 0 – no
10	It is clear how the performances of the child are in comparison with the learning goal *(e.g. 50% of the golden coins have been found)*	1 – yes 0 – no
11	Clear goal(s) in the game *(e.g. 'find the golden coins')*	1 – yes 0 – no
12	**There are skills that will be improved according to the game designers**	**1 - yes** **0 - no** **→ If 'no', go to question 15**
13	The improvement of skills is based on empirical studies and/or theoretical foundations	2 – yes, with information about theory and/or empirical studies 1 – yes, but only with references 0 – no
14	The improvement of skills through this specific game is scientifically founded	1 – yes 0 – no
		Total score Feedback: 0-1-2-3-4-5-6-7-8-9-10 *(circle the total raw score of this category)*

Category 3	Instruction in the game or in the manual	
15	**Before the game starts, is there instruction for the child about how to play the game?**	**1 - yes** **0 - no** **→ If 'no', go to question 19**
16	Possibility to practice the game before the task will be carried out?	1 – yes 0 – no
17	Examples or demonstration of the game before it starts or during the game	1 – yes 0 – no
18	Supervision of an adult/more capable peer necessary to play the game (with exception of technical support/installation)	2 – no 2 – yes, with information that supervision is necessary, AND with instruction about how to assist the child 1 – yes, with information that supervision is necessary OR with instruction about how to assist the child 0 – yes, with no information that supervision is necessary AND no instruction about how to assist the child
		Total score Feedback: 0-1-2-3-4-5-6-7-8-9-10 *(circle the total raw score of this category)*

Category 4	Interface	
19	Graphics/colour/sound are appropriate, clear and attractive and not distractive (e.g. many splashy special effects) for the user group	1 – yes 0 – no
20	Spoken language in the game is clear and understandable for the user group	2 – yes 1 – sometimes too difficult for the user group 0 – no, mostly too difficult
21	The navigation buttons are clear and consistent for the user group	1 – yes 0 – no
22	The child can easily and independently operate the program (if the child is mouse skilled)	1 – yes 0 – no
23	The game has a high level of interactivity	2 – yes, by non-verbal or verbal actions of figures in the game 1 – yes, by feedback in general (e.g. only invisible but auditive feedback) 0 - no
		Total score Feedback: 0-1-2-3-4-5-6-7-8-9-10 *(circle the total raw score of this category)*

Category 5	Level	
24	**Are there levels in the game(s)?**	**1 - yes** **0 - no** **→ If 'no', go to question 29**
25	Possibility in the game to start at the appropriate level and to skip unadaptive levels	1 – yes 0 – no
26	Difficulty is adaptive to the performances of the child?	2 – yes, automatically 1 – yes, but not automatically 0 - no
27	Are there norms in the game that give insight for parents/teachers in the development of the child?	2 – yes, based on (empirical) research 1 - yes, but not based on (empirical) research 0 - no
28	Is it clear what child criteria are needed to play the levels adequately? (Information on cover/in manual/in game about minimal requirements age, cognitive and motor skills of the child per level)	*Calendar age:* 1 – yes 0 – no *Cognitive skills:* 1 – yes 0 – no *Fine motor skills (mouse skills):* 1 - yes 0 - no
		Total score Feedback: 0-1-2-3-4-5-6-7-8-9-10 *(circle the total raw score of this category)*

Category 6	Content characteristics	
	Gender/ethnicity	
29	Information on the cover or in the manual about gender and/or ethnicity of the user group	1 – yes 0 – no
30	The game is designed and appropriate for both sexes (boys and girls)	1 – yes 0 – no
31	The game is arranged for all ethnicities	1 – yes 0 – no
	Engagement or flow	
32	The game contains variety, diversity or novelty (e.g. in setting, goal or task) to achieve curiosity	1 – yes 0 – no
33	The game contains competitive elements	1 – yes 0 – no
34	The game stimulates cooperation with peers	1 – yes 0 – no
35	The child is challenged in the game	1 – yes 0 – no
		Total score Feedback: 0-1-2-3-4-5-6-7-8-9-10 *(circle the total raw score of this category)*

Table 2 see next page →

Table 2 Game properties and educational claims of the eight selected games

Game name	Publisher	Kind of game	Advised Age	Educational claims
Computer Kid Friend	Clementoni	Mini-laptop	from 3 years	Learning letters, numbers, forms and colours
Bumba Laptop	VTech	Mini-laptop	from 9 months	Learning forms, objects, words, sounds and music, language development, sensory development, discovering and exploring, motor skills
Teletubbies (1998)	BBC Worldwide Ltd. Memphis Belle B.V.	CD-ROM	from 2 years	Learning areas: eye-hand coordination, talking and listening, recognising forms, places, sizes, amounts, spatial insight, following patterns, fantasy and creativity
Tweenies – Mega Knutselfeest (2004)	BBC Worldwide Ltd. Memphis Belle B.V.	CD-ROM	from 3 years	Creativity and fantasy
Go Diego go! (Nick Jr) (2008)	Viacom International Inc.	CD-ROM	from 3 years	Learning new animals, animal sounds and tracks, development of visual and motor skills, solving problems, counting, respecting animals and environment
Disney - Het boek van Poeh – Verhaal met een staartje (2007)	Disney Interactive Studios	CD-ROM	from 3 years	Numbers, letters and word associations, recognising patterns, forms and colours, making connections, critical thinking, memory training, analytical and creative thinking, solving problems and following directions, spatial insight
Sesamstraat – De avonturen van Elmo in Mopperland (2004)	Sesame Workshop	CD-ROM	from 3 till 6 years	Solving problems, recognising cause and effect, sharing with friends
www.samenslim.nl	The internet	Online game	from 3 till 5 years	Learning to learn

Table 3 Results of the evaluation of the eight selected games

Main categories	Bumba Laptop	Teletubbies (1998)	Tweenies – Mega Knutselfeest (2004)	Computer Kid Friend	Disney - Het boek van Poeh – Verhaal met een staartje (2007)	Go Diego go! (Nick Jr) (2008)	Sesamstraat – De avonturen van Elmo in Mopperland (2004)	Samenslim.nl
Feedback	-	-	+/-	+/-	+/-	+	+	+
Learning goals	-	-	-	+/-	+/-	+/-	-	+/-
Instruction	+/-	+/-	-	-	-	-	+/-	+/-
Interface	+/-	+/-	+	+	+	+/-	+	+
Level	-	-	-	-	-	+/-	+/-	+/-
Content	-	-	-	+/-	+/-	+/-	+/-	+/-
Total unweighted quantified score (max. 12)	2	2	3	5	5	6	7	8

+ = good, +/- = satisfactory, -= unsatisfactory

Does available edutainment software comply with the list of criteria?

The results of the evaluation are discussed in terms of the six main categories of the checklist. In Table 3 the results of the evaluation are presented.

Feedback

There are considerable differences in the quality of feedback strategies between the eight selected games, as defined and measured by our checklist. Bumba Laptop and Teletubbies obtain the minimum score (zero) on this main category of the ESEC. These products lack the important characteristic of feedback. These scores are not acceptable in terms of powerful learning environments.

Computer Kid Friend, Disney and Tweenies score satisfactorily on this category. However, in all games global feedback is given and in the Tweenies game, feedback often sounds negative with a nagging voice when a child gets it wrong. In the Disney game, feedback is only given as a correction when a child does something wrong.

The games evaluated positively with the checklist are Go Diego Go, Sesamstraat and Samenslim. All three games score the maximum score on this part of the checklist. Specific, clear and positive feedback is given in these games, which is likely to stimulate the child to play another game or to try again in a difficult task.

Learning goals

For the *learning goals* of all the selected games in this study, there are four *unsatisfactory* and four *satisfactory* scores. No game was evaluated by the maximum score 'good' on this topic. However, all games formulated clear learning goals on the cover and/or in the manual.

It can be concluded that none of the selected edutainment games contain scientifically and theoretically founded evidence that these specific games cause improvement in one or multiple skills. All package covers promise that one or multiple skills will be learned by playing that specific game, but they do not provide scientific evidence for their claims.

The Samenslim website states that scientific research on the effectiveness of these games is still going on. The Samenslim game is the only game in which information is given about the theoretical foundations of the game in the form of a scientific article. In the manuals of the other selected games no information was available about empirical studies or theoretical foundations.

In the Teletubbies game it is unclear what the child has to do to reach the learning goal, that is, there is no clear in-game goal. One positive aspect of the Disney game is the possibility to check the performances of the child in comparison with the learning goals. Disney is the only game in which this check (to measure the degree of goal attainment) is possible.

Instruction

The instruction in the selected games is not optimal. Some games contain no instructions before the game starts: Tweenies, Go Diego Go or Computer Kid Friend and Disney. In the Teletubbies game there is no instruction before the game starts, but the manual describes how to play the game. The Disney game can be started when the child clicks on the left mouse button on a figure on the screen, but the child is not instructed to click to select a game. When the game starts, no instruction or demonstration is given about what to do to reach the game goal.

The eight selected games do not contain demonstration or practice possibilities. A positive aspect of most games is that they can be played independently (without supervision of an adult). Go Diego Go is a game for children from three years on. The name of the child has to be filled in before starting the game and in order to play the game the level has to be chosen. Also the language in the game, meant for children from three years of age, is sometimes too difficult to comprehend. This means that supervision during the start of the game and while playing this game is desirable, but the negative point is that the manual provides no information about how to assist the child

Interface

In all games graphics, colours and sounds are appropriate and clear. Sounds are used for appropriate instructional and attractive reasons and graphics are colourful and attractive. Some games contain language that is too difficult for the user group, for example too difficult animal names are used in Go Diego Go. Disney and Bumba Laptop (for children from *nine* months) sometimes use too difficult words in the sentences (English words, unfamiliar first names or difficult animal names), which makes instruction or interaction complex.

In most games the navigation buttons are clear and consistent, but in the Teletubbies game, it is unclear what the child must do to reach a specific goal in the game. In this game it is unclear how to play (where to click on) to make progress in the game. In our opinion it is difficult to independently operate the program. A positive aspect of most of the eight games is that they contain a high level of interactivity, as well as non-verbal actions of the figures and verbal actions of the figures in the game (e.g. asking questions).

Level

The ESEC checklist demonstrates a considerable variability in the quality of the levels: five of the selected games contain no levels, three games contain (adaptive) levels. This means that in five of these games there is no possibility to start at the appropriate level or that the game is not adaptive to the child's performances. Go Diego Go, Sesamstraat and Samenslim score *satisfactory* on this part of the checklist, because they contain multiple levels and they can be started at a higher or lower level. The reason why none of these games are evaluated as *good* is that none of them contain child criteria to play the levels adequately. No information is given about the properties of the child (e.g. cognitive skills, motor skills) that serve as criteria for deciding at which level the child should enter the game or continue the game. Insight into the progress of the individual child is not possible for parents or teachers in any of the eight games.

Content

All selected games are appropriate for both sexes and various ethnicities. A striking positive aspect is that in Teletubbies and Go Diego Go, black and white figures play a role in the game. On the cover of Bumba Laptop, a black and a white child are displayed. None of the games gives information about the appropriateness for both sexes or various ethnicities.

Most games contain variety and novelty: multiple games can be played and games change in for example settings or tasks. However, the goal of the Teletubbies game is not clear, Teletubbies stimulates the curiosity of the children by making various activities become visible if the child takes action. In this way curiosity of children can be achieved. Competitive elements are not present in the games, but children are regularly challenged in the games, by means of remarks of role players in the game, e.g. 'click again!' or 'no, that is not correct, we'll try another!'. Cooperation with peers is only stimulated in the Disney game, where 'playing together with friends' is mentioned in the game.

Conclusion

From the evaluation it can be concluded that only a small number of the eight selected Dutch edutainment software programs is moderately positively evaluated. Most games lack important characteristics of levels, content, instruction and learning goals. These games are negatively evaluated and are not sufficient to count as *powerful* learning environments.

The most positively evaluated characteristic of the selected games is the interface, which is evaluated as satisfactory or good. High interaction, attractive colours and sounds stimulate engagement and therefore playful learning of the child. The fact that the interface is the most positive aspect – and not for instance the goal or learning content – suggests that the makers of edutainment focus more on superficial aspects such as the visible interface, than on deeper aspects that relate to the aspect of powerful learning.

Another moderately positively evaluated characteristic is the feedback given in the games, which is mostly evaluated as satisfactory. However, this feedback is generally of a global and negative nature. In our opinion, characteristics in edutainment games should be improved, particularly in providing positive, specific and adaptive feedback instead of negative and global feedback. Concrete, positive feedback is crucial for powerful learning environments: it stimulates intrinsic motivation and engagement of the learner and as a consequence powerful learning can take place.

In spite of a moderately positive evaluation of the interface and the feedback strategies in the games, it can be concluded that only a small number of the games can be considered to be a *powerful* learning environment. Half of the games contain some, but not enough, characteristics of a powerful learning environment. Therefore they need to be further improved, and the currently lacking important characteristics of instruction, levels and learning goals (mentioned in the checklist) need to be compensated, in such a way that in the end the games can effectively foster powerful learning in young children.

Information about effects of empirical studies and theoretical foundations should be given in the manuals, in order to provide evidence that a specific game is really effective in the development of a young child. The content of the games can be improved by providing information about appropriateness with regard to gender, ethnicity and by introducing competitive elements in the games.

More research has to be done to study skills that are required for the child to be able to play a game or a particular game level adequately (entrance conditions). In other words, individual games have to be studied in detail in order to evaluate the appropriateness of each game or game level for the intended user group. After having done so, we can then proceed by providing norms that give insight into the performances and development of individual children.

It is therefore essential that software designers (together with educators) develop their edutainment software, taking into account the characteristics mentioned in the checklist. In this way edutainment software may function as a powerful learning environment for young children.

Current Dutch edutainment software does not seem to meet the theoretical requirements in the literature, in which characteristics of powerful learning environments are described. The edutainment software is particularly specialised in the entertainment characteristics instead of the educational aspect of the games. In the design of new edutainment games, the educational part of edutainment software should be more clearly emphasised. Instruction, feedback and content should be presented in such a way that young children are intrinsically motivated to learn in an environment that is as playful as it is powerful.

References

Ames, C. (1992). Classrooms: Goals, goal structures, and student motivation. *Journal of Educational Psychology, 84,* 261-271.

Arnone, M. (2003). Using instructional design strategies to foster curiosity. *ERIC Digest,* 3-4.

Aronson, J. (2002). Stereotype threat: Contending and coping with unnerving expectations. In J. Aronson (Ed.), *Improving academic achievement: Impact of psychological factors on education* (pp. 279-301). San Diego, CA: Academic Press.

Bétrancourt, M., Dillenbourg, P., & Montarnal, C. (2003). Computer technologies in powerful learning environments: The case of using animated and interactive graphics for teaching financial concepts. In E. de Corte, L. Verschaffel, N. Entwistle, & J. van Merriënboer (Eds.), *Powerful learning environments: Unravelling basic components and dimensions* (pp. 143-157). Oxford: Elsevier Science.

Birenbaum, M. (2003). New insights into learning and teaching and their implications for assessment. In M. Segers, F. Dochy, & E. Cascalar (Eds.), *Optimising new modes of assessment, in search of qualities and standards* (pp. 13-36). Dordrecht, Netherlands: Kluwer Academic.

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, *78*, 647-663.

Boekaerts, M. (1995). Self-regulated learning: Bridging the gap between metacognitive and metamotivation theories. *Educational Psychologist, 30,* 195-200.

Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn: Brain, mind, and experience & school*. Washington, DC: National Academy Press.

Bredekamp, S., & Copple, C. (1997). *Developmentally appropriate practice in early childhood programs*. Washington, DC: NAEYC.

Brophy, J. (2004). *Motivating students to learn*. Mahwah, NJ: Lawrence Erlbaum Associates.

Bryce, J., & Rutter, J. (2003). Gender dynamics and social and spatial organization of computer gaming. *Leisure Studies, 22,* 1-15.

Buckingham, D., & Scanlon, M. (2000, November). *That is edutainment: Media, pedagogy and the marketplace*. Paper presented to the International Forum of Researchers on Young People and the Media, 26-29 November 2000. Sydney, Australia.

Cagiltay, K. (2006). Scaffolding strategies in electronic performance support systems: Types and challenges. *Innovations in Education and Teaching International, 43*, 93-103.

Collopy, R. B., Green, T. (1995). Using Motivational Theory with At-Risk Children. *Educational Leadership, 53,* 37-40.

Csikszentmihalyi, M. (1975). *Beyond freedom and anxiety*. San Francisco, CA: Jossey-Bass.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

Csikszentmihalyi, M. (1993). *The evolving self*. New York: Harper & Row.

Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (1988). *Optimal experience: Psychological studies of flow in consciousness*. Cambridge, UK: Cambridge University Press.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology, 22*, 1111-1132.

Deci, E. L., Connell, J. P., & Ryan, R. M. (1989). Self-determination in a work organization. *Journal of Applied Psychology, 74,* 580-590.

De Corte, E., Verschaffel, L., Entwistle, N., & Van Merriënboer, J. (Eds.) (2003). *Powerful learning environments: Unravelling basic components and dimensions*. Oxford: Elsevier Science.

De Jong, J. & Pieters, J. (2006). The design of powerful learning environments. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of Educational Psychology* (2nd ed., pp. 739-754). Mahwah: NJ, Lawrence Erlbaum Associates.

Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318,* 2073-2078.

Driscoll, M. P. (1999). *Psychology of learning for instruction*. Boston: Allyn and Bacon.

Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). Motivation to succeed. In W. Damon, (Series Ed.) & N. Eisenberg, (Vol. Ed.), *Handbook of child psychology: Vol 3. Social, emotional, and personality development* (5th ed., pp. 1017-1095). New York: Wiley.

Egenfeldt-Nielsen, S. (2007). Third generation educational use of computer games. *Journal of Educational Multimedia and Hypermedia 16*, 263-281.

Elliott, S. N., Kratochwill, T. R., Littlefield-Cook, J., & Travers, J. (2000). *Educational psychology: Effective teaching, effective learning* (3rd ed.). Boston, MA: McGraw-Hill.

Embi, Z. E., & Hussain, H. (2005). Analysis of local and foreign edutainment products – an effort to implement the design framework for an edutainment environment in Malaysia. *Journal of Computers in Mathematics and Science Teaching, 24*, 27-42.

Gillespie, C. W., & Beisser, S. (2001). Developmentally appropriate LOGO computer programming with young children. *Information Technology in Childhood Education,* 229-245.

Granott, N. (2005). Scaffolding dynamically toward change: Previous and new perspectives. *New Ideas in Psychology, 23*, 140-151.

Granott, N., Fischer, K. W., & Parziale, J. (2002). *Bridging to the unknown: A transition mechanism in learning and development*. New York, NY: Cambridge University Press.

Guralnick, M. J. (2005).An overview of the developmental systems model for early intervention. In M. J. Guralnick (Ed.), *The developmental systems approach to early intervention* (pp. 3-28). Baltimore: Brookes.

Healy, J. M. (1998). *Failure to connect: How computers affect our children's minds – And what we can do about it*. New York, NY: Simon & Schuster.

Herrington, J., Oliver, R., & Reeves, T. C. (2003). Patterns of engagement in authentic online learning environments, *Australian Journal of Educational Technology, 191,* 59-71.

Hirsh-Pasek, K., Golinkoff, R. M., Berk, L. E., & Singer, D. G. (2009). *A mandate for playful learning in preschool*. Oxford: University Press.

Howard, C., Morgan, M., & Ellis, K. (2006). Games and learning ... Does this compute? In E. Pearson & P. Bohman (Eds.),

Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2006 (pp. 1217-1224). Chesapeake, VA: AACE.

Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for technology-based teaching and learning, *Educational Technology*, *38* (8), 20-23.

Keller, H., & Werchan, A. (2006). In C. Hoare (Ed.), *Handbook of adult development and learning* (pp. 407-430). Oxford: University Press.

Langelier, C. A., & Connell, J. D. (2005). Emotions and learning: Where brain based research and cognitive-behavioral counseling strategies meet the road. *Rivier College Online Academic Journal 1* (1).

Lehtinen, E. (2003). Computer-supported collaborative learning: An approach to powerful learning environments. In E. de Corte, L. Verschaffel, N. Entwistle & J. van Merriënboer (Eds.), *Powerful learning environments: Unravelling basic components and dimensions* (pp. 35-54). Oxford: Elsevier Science.

Liao, L. F. (2006). A flow theory perspective on learner motivation and behavior in distance education. *Distance Education, 27*, 45-62.

Lim, D. H., & Kim, H. (2003). Motivation and learner characteristics affecting online learning and learning application. *Journal of Educational Technology Systems, 31*, 423-439.

Linn, M. C., Davis, E. A., & Bell, P. (Eds.). (2004). *Internet environments for science education*. Mahwah, NJ: Lawrence Erlbaum Associates.

McCarrick, K., & Li, X., (2007). Buried treasure: The impact of computer use on young children's social, cognitive, language development and motivation, *AACE Journal, 15*, 73-95.

McKenzie, J. (2000). Scaffolding for success, from now on. *The Educational Technology Journal, 9*, 1-7.

Meyer, D. K., & Turner, J. C. (2006). Re-conceptualizing emotion and motivation to learn in classroom contexts. *Educational Psychological Review, 18,* 277-290.

Mory, E. H. (2004). Feedback research revisited. In D. H. Jonassen (Ed.). Handbook of research on educational communications and technology (2nd ed., pp. 745-783). New York: Lawrence Erlbaum Associates.

Okan, Z. (2003). Edutainment: Is learning at risk? *British Journal of Educational Technology, 34*, 255-264.

Patrick, J., Turner, J. C., Meyer, D. K., & Midgley, C. (2003). How teachers establish psychological environments during the first days of school: Associations with avoidance in mathematics. *Teachers College Record, 105,* 1521-1558

Pintrich, P. R. (2003). Motivation and classroom learning. In W. Reynolds & G. Miller (Eds.), *Handbook of psychology: Educational psychology, 7,* (pp. 103-122). New York: Wiley.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and applications (2nd ed.)*. Upper Saddle River, NJ: Merrill Prentice Hall.

Polonoli, K. (2004). What makes educational software educational? *Virginia Society for Technology in Education Journal, 18*(2), 44-51.

Quintana C., Reiser, B. J., Davis, E. A., Krajcik, J., Fretz, E., Duncan, R. G., Kyza, E., Edelson D., & Soloway, E. (2004). A scaffolding design framework for software to support science inquiry. *Journal of the Learning Sciences, 13*, 337-386.

Ramaprasad, A. (1983). On the definition of feedback. *Behavioural Sciences, 28,* 4-13.

Rapeepisarn, K., Wong, K. W., Fung, C. C., & Depickere, A. (2006). ACM International Conference Proceeding Series; Vol. 207. In *Proceedings of the 3rd Australian conference on Interactive entertainment, 4-6 December 2006* (pp. 28-32). Perth, Australia.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well being. *American Psychologist, 55,* 68-78.

Salomon, G., Globerson, T., & Guterman, E. (1989). The computer as a zone of proximal development: Internalizing reading-related metacognitions from a reading partner. *Journal of Educational Psychology, 81*, 620-627.

Slavin, R. E. (2009). *Educational psychology: Theory and practice (9th ed.)*. Upper Saddle River, NJ: Pearson.

Smolak, L. (1986). *Infancy*. Englewood Cliffs, NJ: Prentice Hall.

Steenbeek, H. & Van Geert, P. (2007). 'Do you still like to play with him?' Variability and the dynamic nature of children's sociometric ratings. *Netherlands Journal of Psychology, 63*, 86-101.

Stipek, D. J. (1996). Motivation and instruction. In D.C. Berliner & R.C. Calfee (Eds.), *Handbook of educational psychology* (pp. 85-113). New York: Macmillan.

Tenenbaum, G., Fogarty, G., & Jackson, S. (1999). The flow experience: A Rasch analysis of Jackson's Flow State Scale. *Journal of Outcome Measurement, 3*, 278-294.

Tripathi, K. N. (1992). Competition and intrinsic motivation. *Journal of Social Psychology, 132*, 709-715.

Turner, J. C., & Patrick, H. (2004). Motivational influences on student participation in classroom learning activities. *Teachers College Record, 106,* 1759-1785.

Turner, J. C., Meyer, D. K. Midgley, C., & Patrick, H. (2003). Teacher discourse and students' affect and achievement-related behaviors in two high mastery/high performance classrooms. *Elementary School Journal, 103,* 357-382.

Van Geert, P., & Steenbeek, H. (2006). The dynamics of scaffolding. *New Ideas in Psychology, 23,* 115-128.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Webb, N. M. (1991). Task-related verbal interaction and mathematics learning in small groups. *Journal of Research in Mathematics Education, 22,* 366-369.

Wood, D. J., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving, *Journal of Child Psychology and Psychiatry, 17*, 89-100.

BAUKJE VEENSTRA, MSC
PhD Student
Faculty of Behavioural and Social Sciences, University of Groningen, the Netherlands.
Especially in the field of computer use and learning in toddlers according to the dynamic systems theory approach
E-mail: B.Veenstra@rug.nl

PROF. DR. PAUL L.C. VAN GEERT
Professor of Psychology
Faculty of Behavioural and Social Sciences, University of Groningen, the Netherlands.
Especially in the field of dynamic system models of development.
Research topics: elaboration of dynamic systems models of development; language and socio-cognitive development; cognitive change and educational psychology
E-mail: Paul@vangeert.nl

PROF. DR. BIEUWE F. VAN DER MEULEN
Professor of Orthopedagogy
Faculty of Behavioural and Social Sciences, University of Groningen, the Netherlands
Especially in the field of early childhood assessment and intervention, the last five years with a focus on chronically ill children and their families
E-mail: B.F.van.der.Meulen@rug.nl

Appendix I

Operationalisation of the main definitions used in the checklist (Figure 1)

1. **Feedback:** information presented in the program that allows comparison between an actual outcome and a desired outcome (Ramaprasad, 1983; Mory, 2004).

   Examples of feedback strategies in the context of this checklist
   - *Assistance:* 'You have to do this or that.
   - *Corrections:* 'No, that's not the correct answer'.
   - *Supportive feedback:* 'Go further' or 'well done!'

2. **Learning goals:** the general educational aims of the program. What will the child learn from playing the edutainment game? Learning goals focus on the child's skills or attitudes.

3. **Instruction:** a message (verbal or written) that is describing how the game should be played; instruction what the child has to do to play the game adequately. Instruction is given before the game starts (or during the start of the game) or is described in the manual.

4. **Calendar age:** the chronological age that is determined by the date of birth of the child.

5. **Cognitive skills:** are the basic mental abilities children use to think, study, and learn. Examples of cognitive skills are intellectual abilities such as logical reasoning, language comprehension or production, memory, writing, analysing and prioritising.

6. **Fine motor skills:** fine motor skills refer in this context to the small movements of the hands wrists and fingers to use the keys on the keyboard or to use the mouse adequately. In most types of edutainment software, the child has to be able to click and move the mouse to play the game adequately.

7. **Ethnicity:** represents social groups with a shared history, sense of identity, geography and cultural roots which may occur despite racial difference. Examples are black and white children or low and high socioeconomic status.

8. **Variety/diversity:** the appearance of the game (e.g. colours or game-setting), the task or learning goals vary.

   Examples of variety or diversity in edutainment software are
   - More games are available on the same CD-ROM, website or (mini) laptop
   - Games vary in setting, task, goal, sounds or reinforcement

9. **Competitive elements:** a 'combat' can take place in the game between two or more players or between the child and the figures in the game to strive for a goal which can not be shared.

10. **Cooperation with peers:** the child is stimulated to play the game with another child or together with a figure in the game (e.g. 'assisting' the figure in the game).

11. **Challenge:** through verbal or non-verbal feedback in the game, the child is challenged to play more games, go further when the task is difficult or when the child does not click or move the buttons or mouse (does nothing at all).

    Examples of challenge in edutainment software are
    - *Supportive feedback (see point 1 in this Appendix) or reinforcements.*
    - *Interactive elements in the game (e.g. 'Go! Go! You can do this!' Or 'Will you help me?' or 'Click on the mouse button when you know the answer')*
    - *(Adaptive) levels*
    - *A clear in-game goal (e.g. find ten golden coins, then you go a level higher)*

Notes for contributors

The Netherlands Journal of Psychology publishes exclusively in English, UK spelling. Manuscripts must be original and not currently under review or published elsewhere. Articles, Notes and other contributions should not exceed the word limit mentioned elsewhere on the cover without consulting the editor.
If an anonymous review is preferred, the manuscript should include two title pages, one with identifying information and one with the title only. All personal information should be excluded from the body of the text as well. Only manuscripts prepared in this fashion will be subject to blind reviews. Manuscripts are not returned to authors.

The associate editors will assist authors in preparing the manuscript conform the Journal's editorial policy. Because of the broad range of subject matter covered by the journal, authors are encouraged to supply the names of one or more potential referees. Doing so in no way guarantees that the editors will request reviews from these individuals, although such referees may be called upon in addition to those of the editors' choosing.

Netherlands Journal of Psychology follows the publication style of the American Psychological Association. All manuscripts require an abstract of 100-150 words typed on a separate page and 5-10 key words should be provided. Cited references should be presented in the text by author and date and be collated into a reference list at the end of the article with the following information: author(s), year of publication, title and publishing data. Authors are encouraged to consult the *Publication Manual* of the *American Psychological Association* (5th Edition, see downloadable Style Sheet for quick overview). Authors are requested to restrain from 'overcitation'. Often two or three references will suffice.

Manuscripts not properly prepared will not be considered.
Authors should supply a brief note of about 50 words with their main fields of interest, and including their mailing address, an electronic-mail address, and phone and fax numbers. Authors are responsible for obtaining permission from copyright holders for reproducing any illustrations, tables, figures or lengthy quotations previously published elsewhere. Authors are sent a pdf of the published version.
Copyrights are conform the publisher's guideline (see cover).
Authors must submit manuscripts in electronic formats to:

Rene.vanhezewijk@ou.nl

Address of the editor

Editor of the Netherlands Journal of Psychology
Prof. R. van Hezewijk
Faculty of Psychology OUNL
PO Box 2960
6401 DL Heerlen
The Netherlands