



The Dimensions and Structure of the Concept Of Coping in the Iranian Culture: Reliability, Validity and Introductory Development Of The Adapted Coping Response Inventory

The present research aimed at analyzing the nature and structure of the concept of coping in the Iranian culture. For this purpose, preliminary data was collected from a sample of college students ($n = 50$) through questionnaire and interview procedures. The objective of this phase of the study was to collect information of coping strategies and behaviors commonly used by Iranians. In a second phase of this study, the latest version of the CRI along with Iranian coping activities was administered to Iranian college students ($N=365$). Maximum Likelihood Analyses (MLA) and Principal Component Analyses (PCA) were performed on subjects' responses, which supported the multidimensionality of the concept of coping in the Iranian context. Confirmatory factor analyses did not replicate the CRI eight-factor solution, with Varimax or Oblique rotations. PCA on responses to the mixed scale yielded seven factors after Varimax rotation, as follows: Factor 1: Religious Coping ($\alpha = .92$), Factor 2: Rational Problem Solving ($\alpha = .83$), Factor 3: Cognitive Avoidance ($\alpha = .79$), Factor 4: Positive Reappraisal ($\alpha = .77$), Factor 5: Seeking Guidance and Support ($\alpha = .78$), Factor 6: Seeking Alternative Rewards ($\alpha = .61$), Factor 7: Acceptance or Resignation ($\alpha = .61$). Although a majority of theoretically based dimensions of coping appeared to be commonly used by Iranian college students, the findings of this study have uncovered different patterns which these dimensions may form in the Iranian setting as well as a new and important dimension of coping not considered in standard coping scales. Overall the results suggest a different conceptualization of the construct of coping for the Iranian context which might have important implications for the use and further development of the CRI, and all other standard coping scales in the Iranian context.

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"Coping" is a key concept in mental health research due to its mediating/moderating role in the relationship between stress and health outcomes according to traditional and current theories of stress (Lazarus & Folkman, 1984; Lazarus, 1993). Numerous interactions theories of human development (e.g., Mangusson, 2000) indicate that

coping strategies and behaviors are acquired throughout the development of personality and those environmental and contextual factors are central in the formation of personality. According to these theories, culture is one important environmental factor and religion can be considered a sub-category of culture.



Using the concept of coping as a complex relationship between the person and the environment, and considering that variability of coping arises from the variability of the context in which coping occurs and that coping involves personality-based processes and cognitive and behavioral efforts to change or manage the stressor, it is suggested that generalizations of scientific constructs, like coping, mainly borrowed from Western cultures, need to be empirically assessed before they can be reliably and validly used in non-Western cultures.

The evaluation of psychometric properties of coping scales is a very much felt necessity in stress research, specially when scientific constructs have been developed in settings quite different, culturally and otherwise, from the settings where these scales are meant to be used. One important psychometric measurement parameter concerns construct validity. Kerlinger (1973) considers construct validity as a link between psychometric notions and theoretical notions; in that, the researcher wishes to know the 'meaning' of the construct that is being measured by a given test and does not simply want to validate a test. Given the revolutionary changes that have taken place, for the past twenty years, in the human sciences, the validity of innumerable psychological constructs has been questioned and many of them have been profoundly revised. Such is the case with the definition of 'self' (Watson, 1990), 'knowledge' and 'mind' (Fodor, 1995), 'learning' (Anderson, 1999), 'development' (Magnusson, 2000), 'intelligence' (Gardner, 1981; Sternberg, 1985), 'abnormality and psychological disorder' (Pfeiffer, 1982), among the most relevant constructs for the present purposes. In a similar vein, traditional theories of coping (Lazarus & Folkman, 1984; Lazarus & Launier, 1978) can be said to need profound revision of basic assumptions about the inclusion of certain coping activities like religion and hypothesis about its role in the coping process (Pargament, Ensing, Falgout, Olsen, Reilly, Van Haitsma, & Watten, 1990). Recent advances in religious coping research (Levin, 1994) indicate that religious coping is indeed a commonly used coping activity in representative community samples and it can be considered most instrumental for explaining certain conceptual variables, like being able to find meaning from a life crisis, which are important for coping adaptively with undesirable life events, characterized by uncontrollability and unpredictability (Maton, 1989). Research with physical health problems like

cancer, and other illnesses that give origin to chronic stress are exemplary instances of the role of religion in real life crisis (Aguilar-Vafaie & ValiMirza, in press). Given the recognized theoretical limitations as far as the conceptualization of coping is concerned, the questionable construct validity of most well known standard coping scales, and the inability to generalize empirical findings, it is suggested that research of coping finds a middle ground, so to speak, and take advantage of both deductive and inductive approaches to the study the phenomenon coping, utilizing theory based measures of coping and at the same time giving room for obtaining coping strategies empirically from data (Amirkhan, 1990; Moos, personal communication).

A review of the literature on coping scales indicated that extensive construct validity studies have been performed with the Way of Coping Questionnaire (WCQ) (e.g., Folkman & Lazarus, 1980; Aldwin, Folkman, Schaefer, Coyne & Lazarus, 1980; Vitaliano, Russo, Carr, Mauirio, & Becker, 1985; Mischel & Sorenson, 1993) whereas much less number of studies were found with the Coping Responses Inventory (CRI, Moos, 1993). Nonetheless, the CRI was chosen as the theoretical based measurement of coping for this study because this scale has been extensively and systematically used to investigate the role of coping in the stress process with representative community samples (e.g., Holahan & Moos, 1985; 1986; 1987; 1990) with quite encouraging results. The CRI is a 48-item self-report questionnaire that combines the *focus* based and the *method* based strategies of coping and assesses eight types of coping responses, dividing them into approach and avoidance sets of responses and each set is further divided into two categories that reflect cognitive or behavioral coping methods (Moos & Schaefer, 1993). The CRI-Adult (Moos, 1993) was developed in several stages. First, an initial 19-item version was obtained from samples of alcoholic patients and normal controls. In the second stage, a 32-item version was developed and tested with samples of depressed patients and normal controls. In the third, fourth and fifth stages, expansion of the item pool, and final revision of the inventory took place, based on a 72-item inventory, data were obtain from more than 1,800 adults including physically ill patients, people who faced life crises, normal and problem drinking adults who participated in several studies.

Given the clinical significance of different coping strategies with respect to mental health and



Table 1
Psychometric Characteristics of the Adapted Coping Responses Inventory-Adult Scale

	α	M	SD	Factor Loading
Factor I: Religious Coping	.916			
1. Did you read the Holy Quran? (50).		1.61	1.07	.749
2. Did you commend yourself to the saint Imams (religious leaders) for your problem to be solved? (25).		2.18	1.06	.740
3. Did you try to secure God's grace, compassion? (40).		2.39	.910	.739
4. Did you give more importance to obligatory prayers? (14).		2.29	.960	.724
5. Did you ask forgiveness and attention from God? (89).		2.28	.950	.706
6. Did you silently recite prayers in order to decrease your worry? (78).		1.56	1.11	.698
7. Did you go to religious places like Mosques, or Shrines? (52).		1.89	1.01	.693
8. Did you plead for your problem to be solved? (11).		2.59	.78	.689
9. Did you perform optional prayers in order for your problem to be solved? (27).		1.13	1.13	.689
10. Did you rely and placed your hopes on God to take care of your problem? (8).		2.66	.680	.656
11. Did you take advantage of known religious saying your problem or decrease your worry? (55).		1.53	1.09	.629
12. Did you pray to be guided and/or become more powerful? (CRI-43).		2.35	.950	.603
13. Did you visit a friend or a family member to get away from problem? (38).		1.84	1.19	.602
14. Did you give charity for your problem to be solved? (65).		1.64	1.12	.570
15. Did you conceive your problem as an exam from God? (80).		1.76	1.08	.524
Factor II: Rational Problem Solving	.830			
16. Did you try to analyze the problem by reaching to one or many solution for each component of the problem? New Item (28).		1.45	.960	.597
17. Did you try get help from your thinking? New Item (51).		2.26	.770	.595
18. Did you try to find out more about the situation? (CRI-35).		1.96	.940	.550
19. Did you take things a day at a time, one step at the time? (CRI-44).		1.79	.940	.543
20. Did you try not to act emotional and act in a rational way? New Item (83).		1.96	.950	.532
21. Did you go over in your mind what you would say or do? (CRI-17).		2.04	.880	.531
22. Did you try to think deeply and seriously about the problem? New Item (10).		2.33	.91	.518
23. Did you try to become acquainted or recognize each one of the matters that worried you? New Item (12).		2.03	.950	.490
24. Did you decide what you wanted and try hard to get it? (CRI-20).		2.03	.990	.459
25. Did you try to show patience and resistance with respect to the problem? New Item (92).		2.30	.780	.451
26. Did you think of different ways to deal with the problem? (CRI-1).		2.51	.780	.410
27. Did you do something that you didn't think would work, but at least you were doing something? (CRI-48).		1.57	.910	.360
28. Did you try to learn to do more things on your own? (CRI-36).		2.17	.890	.347
Factor III: Cognitive Avoidance	.788			
29. Did you try to think less about the problem? New Item (39).		1.53	.980	.654
30. Did you try not to think about something that has past? New Item (81).		1.24	1.04	.642
31. Did you try not to think about the problem? (CRI-13).		.980	1.03	.639
32. Did you try to ignore the problem? New Item (41).		1.23	.990	.632
33. Did you try to forget the whole thing? (CRI-5).		.990	1.09	.613
34. Did you try to get away from a situation that caused you stress and worry? New Item (26).		1.75	1.02	.492
35. Did you try at the beginning to not pay attention to the problem? New Item (9).		1.10	1.08	.412
36. Did you try to put off thinking about the situation, even though you knew you would have to at some point? (CRI-29).		1.19	1.01	.384
37. Did you try to deny how serious problem really was? (CRI-45).		.910	1.09	.367
Factor IV: Positive Reappraisal	.766			
38. Did you try to tell yourself that things will get better? (CRI-34).		2.04	.880	.585
39. Did you compare your problem with the much serious problems of others? New Item? (64).		1.59	1.01	.489
40. Did you think about how you were much better of than other people with similar problems? (CRI-26).		1.63	1.02	.484
41. Did you remind yourself how much worse things could be? (CRI-10).		1.64	1.07	.475
42. Did you tell yourself things to make yourself feel better? (CRI-2).		2.19	.780	.406
Factor V: Seeking Guidance and Support	.777			
43. Did you seek guidance from family members and friends? New Item (69).		1.46	1.06	.792
44. Did you tell your problem to family members and/or friends to have their sympathy? New Item (56).		1.55	1.00	.761
45. Did you tell about your problem to your family so that they be informed about it? New Item (82).		1.33	1.15	.710
46. Did you talk with your spouse or other relative about your problem? (CRI-3).		1.52	1.08	.701
47. Did you talk with a friend about the problem? (CRI-11).		1.67	1.06	.508
48. Did you seek help from persons or groups with the same type of problem? (CRI-27).		.90	.96	.417
49. Did you consult with a specialist about psychological matters? New Item (29).		.28	.72	.349
Factor VI: Seeking Alternative Rewards	.605			
50. Did you try to make new friends? (CRI-23).		.850	1.02	.508
51. Do you listen to music? New Item (43).		1.70	1.11	.449
52. Did you turn to work or other activities to help you manage things? (CRI-47).		1.38	.960	.437
53. Did you spend more time in recreational activities? (CRI-39).		.980	.920	.422
54. Did you take a walk when you were worried? New Item (42).		1.40	1.07	.359
55. Did you read more often as a source of enjoyment? (CRI-31).		1.43	1.01	.337
56. Did you resort to eating for forgetting your worry? New Item (70).		.69	.96	.325
Factor VII: Acceptance or Resignation	.609			
57. Did you realize that you had no control over the problem? (CRI-14).		1.50	1.11	.554
58. Did you accept it, nothing could be done? (CRI-30).		1.17	1.15	.504
59. Did you lose hope that things would ever be the same? (CRI-46).		.960	1.04	.473
60. Did you keep away from people in general? (CRI-24).		.960	1.01	.424
61. Did you expect the worse possible outcome? (CRI-38).		1.38	1.13	.399
62. Did you wish the problem would go away or some how be over with? (CRI-37).		2.60	.780	.396
63. Did you think that the outcome would be decided by fate? (CRI-22).		1.83	1.05	.352



the fact that although the coping scales of the CRI have been regarded as relatively stable across situations and populations (see CRI Manual - Moos, 1993), there have been no studies that specifically addressed the reproducibility of these scales in a different cultural setting, the present study aimed at examining the psychometric properties of the CRI in an Iranian setting using an Iranian version of the questionnaire. Specifically, item analysis and internal consistency analyses of the responses of Iranian respondents to the Iranian CRI, and the reproducibility of the factor structure from which the eight coping scales were derived will be examined. In addition, a set of adapted coping scales will be constructed from the factor structure that emerged in the study, and will be evaluated against the original scales as a set of alternative coping scales in the Iranian context.

METHOD

Subjects and Procedure

The 415 subjects who participated voluntarily in the study were Iranian college students who had enrolled for summer classes in diverse majors of specialization at Ferdowsi University, Mashad city, Iran. The initial sample ($N = 50$) was conformed by 50% males and 50% females, aged between 18 and 28 ($M = 21.62$, $SD = 2.65$), and 88% of them were single and 22% married. The final sample ($N = 365$) was constituted by 57.3 % female and 38.10 % male subjects (4.6% of the subjects did not identify their gender), aged between 18 and 40 years ($M = 22.7$, $SD = 3.5$), of which 77.3% were single and 22.7% married.

For the pilot phase of the study, an open-answer questionnaire was administered to the subjects of the initial sample who were requested to think about of the most stressful events they had encountered in the past six months and list activities they had used to deal with the situation.

In the final phase of the study, subjects responded to a Farsi translation of the revised 48-item final version of the CRI, and the 45-item master list of original Iranian items, in terms of the frequency of using these activities in coping with the most stressful event they had encountered in the past six months. Finally, all subjects responded to a 13-item social desirability scale (Ballard, 1992) to assess the degree to which responses are based on motivations to give a good impression and thus considered a source of unreliability of the

responses.

Instruments

A master list was prepared from the listing of coping responses obtained from the pilot study. A total of 45 items were gathered from the pilot study. The criterion for choosing an item to conform the final master list was that the item be listed at least once and that it was not mentioned in the CRI.

The authors translated the 48-item version of the CRI into Farsi from the revised English version (Moos, 1993). Every effort was made to ensure that the original meaning intended by each item be retained in the Farsi translation. An Iranian university professor was responsible for back-translate the Farsi version into English. Any discrepancies were then discussed and resolved by joint agreement.

A final scale was prepared by integrating the original master list and CRI items, which added up to 93 items. This mixed scale was administered to the final sample. Thirty three items from the master list (73.33%) were considered in the final adapted scale and conformed 52.38% of this adapted scale. Percentage distribution of new coping activities was as follows: religious, 42.4%; problem-solving, 18.2%; cognitive avoidance, 15.15%; social support and guidance, 12.1%; seeking alternative rewards, 9.1%; positive reappraisal, 3.03%; and no items related to acceptance or resignation nor emotional discharge.

The authors in addition translated a short version of the Marlowe-Crowne Social Desirability Scale developed by Ballard (1992). As with the CRI standard procedures were followed in the translation of this test. Correlation of coping activities with this scale is indicative of data pollution on the basis of the respondents tendency to lie.

RESULTS

Coping Activities

The 93 item responses of 365 subjects to the CRI and original items, representing 48 CRI and 45 new coping activities, were tabulated. Each of the 93 activities was reported to be used by a certain percentage of respondents (range 3.3%-83%). Specifically, it was found that only 4 activities (4.3%) were used somewhat to a great deal by 90% or more of the respondents, and included religiosity

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(New Items 8, 11), logical analysis (CRI Item 1), and wishful thinking, a kind of cognitive avoidance (CRI Item 37). Fourteen activities (15 %) were never used by 83% to 38.6% of the respondents. The activities not commonly used by respondents in this study included activities reflecting risk taking (CRI Item 16), seeking alternative rewards, such as making new friends (CRI Item 23) and eating (New Item 70), and cognitive avoidance in the form of denial (CRI Item 44). Particularly noteworthy was that 72.1% of the respondents reported that they had never sought professional help (CRI Item 19) and 83% of the respondents reported that they had never sought professional help in relation to psychological problems (New Item 29).

The Dimensions of Coping Based on the CRI and New Iranian Items

Given the recognized cultural idiosyncracies of oriental cultures (Matsumoto, 1996), it was pertinent to see above all whether there are coping responses in the Iranian population that are not considered in standard scales developed in Western cultures and if so assess whether the addition of new Iranian items would fortify the CRI or would change its content and therefore yield different dimensions from those specified by the CRI. Clarifying the dimensionality of coping is important in developing a better understanding of what people do under stressful conditions, in other words, examining the 'meaning' that coping has for people. The various coping dimensions might be more optimally expressed by coping activities that are culturally relevant and which might have greater probability of assuming a strong mediator role while dimensions expressed by irrelevant or inappropriate items might show a weaker relation between stress and illness, disorder or deviance. Such distinctions, if they exist, would greatly clarify our theoretical understanding of the relations between stress and mental health and/or disorder and would be useful in developing ecologically valid clinical interventions for use by individuals in high-stress situations.

Item Distributions

Distributions of the new items and CRI items were examined for range restriction and multivariate normality. All 63 items incorporated in the final scale yielded responses throughout the full possible range; thus, range restriction was controlled. Item skewness and kurtosis of items conforming the final adapted scale was also within

acceptable ranges.

Factor Extraction

The subjects ($N = 365$) responses to the total mixed scale were entered into principal factor analysis (PFA) and principal component analysis (PCA) and Oblimin and Varimax rotation procedures were examined, comparison of rotation methods did not yield different results; however, results from PCA, in terms of extracting a number of factors for optimal interpretation were more acceptable, thus findings from PCA are reported from now on. After examining 2- to 8 factor solutions with Varimax and Oblimin rotation methods, and based on screen plot analysis in conjunction with interpretability, a seven-factor solution was chosen which accounted for 35.94%. Final communality estimates for this solution ranges from .598 to $< .10$ with a median of .428. The solution is presented in Table 1. As can be seen, the first factor, labeled Religious Coping, stresses the individual's personal loving relationship with God throughout the coping process. Correlation of this scale with CRI scales (see Table 3), suggests that spiritually based coping takes on the one hand the form of emotional reassurance from guidance and support, positive framing of problems, and guidance in problem solving and thinking, and on the other hand, also gives room for dissociation and avoidance and emotional confrontation. In the second factor, labeled Logical Thinking and Problem Solving, the response to the negative event incorporates a strong internal component which according to CRI terminology, it is called logical analysis, the second factor also includes items from CRI seeking guidance and a few problem solving items, because of its emphasis on cognitive aspects, this factor was labeled, Rational Problem Solving. Cognitive avoidance, the third factor, incorporates items that exemplify attempts at dissociation from the problem. The fourth factor, Positive Reappraisal, involves ways of redefining the problem; it also implies a positive and constructive approach to the problem. Seeking Guidance and Support, the fifth factor, includes mainly consulting with other people in similar circumstances, with family members, spouse, and friends, mainly to receive emotional support. The sixth factor, Seeking Alternative Rewards, is defined by performing alternative activities to forget or avoid facing the problem. Acceptance or Resignation, the last and seventh factor, incorporates seven items that denote



Table 2

Intercorrelations, Mean Scores, and Internal Consistency of the Seven Adapted Coping Scales (N=365)

Adapted Coping Scale	1	2	3	4	5	6	7
1. Religious Coping	-						
2. Rational Problem Solving	.311**	-					
3. Cognitive Avoidance	.080	.117*	-				
4. Positive Reappraisal	.317**	.430**	-.224**	-			
5. Seeking Guidance and Support	.231**	.204**	.072	.236**	-		
6. Seeking Alternative Rewards	.139**	.291**	.285**	.221**	.162*	-	
7. Acceptance or Resignation	.071	-.154**	.136**	-.134*	-.016	.027	-
Mean score	29.73	26.40	10.93	9.08	8.71	8.42	10.40

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

an emotionally based strategy of hopeless and escapist encounters with the problem.

Table 2 presents the scale means and standard deviations, item means, and internal consistency estimates for each of the seven adapted coping scales. The scale and items means indicate that religious coping activities in the first place, followed by rational problem solving were most involved in coping and seeking alternative rewards, (e.g., eating) were least involved. Many of the other coping activities were commonly used by our sample. The alphas for the adapted coping scales are high to moderate.

Construct Validity of Adapted Scales

Table 3 presents the intercorrelations between pairs of the adapted and original coping scales. Besides Religious Coping which did not have a direct corresponding original scale in the CRI, all other adapted scales, with exception of Rational Problem Solving, correlated significantly high with the corresponding original scales, this is not surprising considering that adapted scales were composed of items falling mainly in pure CRI categories, indicating that the adapted scales were conceptually similar to the original ones. The adapted Rational Problem Solving scale loaded high with both original Logical Analysis and Problem Solving scales. It must be noticed however that in the case of original scales Logical Analysis scale correlated moderately high with Problem Solving (.552) and Positive Reappraisal (.489), and Problem Solving correlated moderately high with Positive Reappraisal (.491), showing that these three aspects of coping did not appear to be readily differentiated by respondents. In addition, the original Logical Analysis and Problem Solving

scales are both correlated moderately high with Seeking Guidance and Support (.40 & .50, correspondingly), which also pinpoints to the lack of differentiation by respondents of these three dimensions. Finally, original Problem Solving and Seeking Alternative Rewards scales are correlated moderately high with Positive Reappraisal (.491), showing that these three aspects of coping did not appear to be readily differentiated by respondents. In addition, the original Logical Analysis and Problem Solving scales are both correlated moderately high with Seeking Guidance and Support (.40 & .50, correspondingly), which also pinpoints to the lack of differentiation by respondents of these three dimensions. Finally, original Problem Solving and Seeking Alternative Rewards scales are correlated moderately high and thus it is also indicative of lack of independence of the two additional original scales.

In the case of adapted scales, intercorrelation among the scales was considerably reduced, for instance, the adapted scales of Seeking Guidance and Support and Seeking Alternative Rewards showed greater independence from Rational Problem Solving. However, in the present analysis the lack of independence between logical analysis and problem solving and between problem solving with positive reappraisal was repeatedly encountered. Religious Coping, a newly developed scale, was very stable, appearing repeatedly and almost intact in the various factor solutions, and is most related to the adapted Positive Reappraisal scale and least related to adapted Cognitive Avoidance and Acceptance or Resignation, which is indicative of the construct differentiation of religious coping activities.



Table 3
Correlation Between the Original and Adapted Coping Scales (N=365)

CRI Coping Scale	LA	PR	SG	PS	CA	AR	SR	ED	RC	APS	CA	PR	SG	SR	AR
1. Logical Analysis	..								.246**	.710***	.179**	.434**	.184**	.275**	-.070
2. Positive Reappraisal	.486***	..							.294**	.473**	.209**	.892***	.182**	.268**	-.223**
3. Seeking Guidance & Support	.402***	.346***	..						.443**	.463**	.049	.377**	.754***	.252**	-.071
4. Problem Solving	.552***	.491***	.499***	..					.291**	.805***	.075	.456**	.302**	.267**	-.193**
5. Cognitive Avoidance	.211**	.174**	.022	.077	..				.088	.139*	.799***	.215**	.035	.253**	.265**
6. Acceptance or Resignation	-.049	-.159**	-.075	-.175**	.264***	..			.087	-.155**	.193**	-.089	-.029	.075	.905***
7. Seeking Alternative Rewards	.395**	.398***	.315***	.552***	.313***	.006	..		.234**	.388**	.365**	.368	.206**	.757**	-.060
8. Emotional Discharge	.160**	-.049	.240***	.125*	.116*	.264***	.131*	..	.219**	.146**	.016	-.016	.178**	.261**	.358**
Mean score	11.28	10.80	8.89	10.39	8.73	8.59	7.83	7.60							
Social Desirability	-.045	-.052	-.021	.035	-.101	-.020	-.003	-.112**	-.016	.030	-.060	-.090	.044	.034	.032
Coefficient alpha	.54	.69	.54	.69	.51	.55	.57	.47	.92	.83	.79	.77	.78	.61	.61

Note: LA= Logical Analysis; PR= Positive Reappraisal; SG= Seeking Guidance and Support; PS= Problem Solving; CA= Cognitive Avoidance; AR= Acceptance or Resignation; SR= Seeking Alternative Rewards; ED= Emotional Discharge; RC= Religious Coping; APS= Rational Problem Solving

* $p < .05$. ** $p < .01$. *** $p < .0001$.

To examine the effects of gender, age group, and marital status, multivariate analyses of variance (MANOVA) were performed on the set of seven adapted coping scale scores. The results indicated that there was a significant overall gender effect, $F(7, 361) = 3.54, p < .0001$, and a significant overall marital status effect, $F(7, 361) = 3.67, p < .0001$ and the overall Gender x Marital was nonsignificant.

Univariate analyses (ANOVAs) on each of the adapted coping scales indicated that women were more likely than men to use religious coping activities, $F(1,361) = 28.30, p < .0001$. No other gender differences were found in coping with the adapted scales. Single subjects relied more on Acceptance and Resignation, $F(1,361) = 6.19, p < .01$, and married subjects sought more guidance and support than single respondents, $F(1,361) = 17.78, p < .0001$. As with the original scales, no significant results were obtained for age group.

Discriminant Validity

Students demonstrated good variability of scores on the social desirability measure, yet no significant correlations with the original scale, the revised scales or the adapted scales were found (See Tables 3).

DISCUSSION

Without reliable and valid assessment instruments, there is a slim chance of achieving the goal of understanding how coping and other psychosocial factors affect the health and psychological well-being of individuals. It is thus imperative that research studies be directed toward evaluating coping questionnaires in different populations across a

variety of settings. In this connection, the present study serves to extend past findings on the CRI with non-Iranian populations to the Iranian context.

Analysis of the endorsement of coping activities indicated that, for the present sample of Iranian college students, all the CRI coping activities were used in their coping with events in daily living. Although this random sample of Iranian college students may not be representative of the Iranian population, the results did indicate that the CRI activities were used by Iranian subjects of different ages (from 18 to 40 years). When activities were assembled into the eight categories or scales, the most commonly used scale was Logical Analysis and the least commonly used scale was Emotional Discharge. When the eight coping scales were evaluated psychometrically, they were demonstrated to be moderately low internally consistent. Moreover, most of these scales had substantial correlations with each other, making them less desirable for assessing coping multidimensionally.

The results of the factor analyses did not provide evidence for the construct validity of the eight coping scales for this sample of Iranian respondents. The results also indicated that the seven factors that emerged, reflected somewhat less correlated dimensions of coping. Furthermore, the eight original coping scales had only moderately low internal consistency reliabilities, in comparison with the high and moderate internal consistency reliabilities of the adapted scales.

Despite the differences, the original eight scales of 48 items and the adapted seven scales of 63 items, were found to assess very similar aspects of coping. Thus, it appeared that the adapted scales offered viable alternatives to the eight original scales in multidimensional assessment of coping for the Iranian population



Regarding the effects of new context-specific items in the factor structure of the CRI, it can be said that only after new items were included in the analysis, additional dimensions of coping were obtained. This is significant finding and accomplishment because each dimension of coping operationalized by different scales in the CRI, represent conceptually different constructs with differential clinical significance. Of course, it must be emphasized that, besides enhancing the replicability of CRI scales, this research has discovered one new dimension of coping which has been incorporated in the adapted version of the CRI for use in and Iranian context. In a recent, separate research religious coping was useful in discriminating subjects based on event controllability, an important moderator variable in the adaptive process. Therefore coping activities not tapped by the eight categories of the CRI coping strategies and that are commonly used by the Iranians, have been disclosed in the present study.

Traditionally, one main point of divergence of in coping research has been the preference for orthogonal as opposed to correlated dimensions of coping (Moos, 1993); however, the present study suggests additional culturally based reasons for theoretical differences. Although in general, the coping activities covered by the CRI appear adequate for the Iranian population, the present study indicated that the eight-factor solution allowing for correlated dimensions also failed to replicate the eight factors, suggesting that the Iranian may organize their coping activities somewhat differently from the theoretically based organization of CRI coping scales. The classification of religious coping according to main axes of *focus* and *method* of coping remains to be pursued in future studies.

Because significant improvements in scale replicability were obtained after addition of new items, a model of coping can be tested in the future which includes original CRI items plus newly validated Iranian items. This procedure may secure

not only higher reliabilities, but also increase the ecological validity of the test. Future research needs to deliberately consider additional new items in the categories of Acceptance or Resignation and Emotional Discharge. The lack of new items in the present study regarding these categories can be considered one limitation of the present research. If this mode of coping is present in the Iranian population, the inclusion of context-specific items to measure it should optimize its assessment.

The seven adapted CRI factor analyzed categories of coping appear to describe adequately the coping strategies of the Iranian respondents. Nonetheless, the stability of the seven adapted factors for the Iranian population has to be replicated in future confirmatory analysis.

The findings of gender difference were consistent with past findings in non-Iranian populations, Pargament et al. (1990).

The present findings also have implications for understanding the patterns of coping most prevalent in non-psychiatric community samples. The present research also provided evidence for the discriminant validity of the original CRI and adapted scales with respect to the finding that neither original CRI scales nor adapted CRI scales were correlated with a measure of social desirability.

In sum, further research is warranted to see whether the construct validity of the CRI was strengthened by addition of new Iranian items. The newly developed scales indicate that the nature and meaning of coping in the Iranian setting is different from that of coping in Western cultures. Religious coping was found to be an important component of coping for Iranian college students, but considering the novelty of this finding, its role in the adaptive process need to be further clarified. This research revealed strong relationships of religious coping with approach strategies and independence from avoidant strategies, which challenges those views of religious coping as an avoidant coping strategy and therefore detrimental for mental health.

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Phonology & Morphology Meet: Interface Assigns Persian Stress

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In this Paper, word stress in Persian is investigated within the constraint-based framework of Optimality Theory (Price & Smolensky, 1993). Earlier studies show that the default stress pattern assigns stress to the rightmost syllable of a word (ke. 'tAb, ge.' reft); however, in the presence of certain affixes, the stress pattern changes (ke. 'tab-am,' na-gereft, na-raft-' an), implying that stress assignment is not a purely phonological phenomenon (Samei, 1991; Ferguson, 1957). I propose that stressable affixes belong to special morphological classes (apectual, derivational, etc.), that have a corresponding constraint in the grammar which outranks the conflicting phonological constraints, implying that phonology is not blind to morphology. This study is important to cognitive science because it explores the constraint conflicts between different interfaces of the grammar and the interaction between modules.

Introduction

One of many theoretical debates in linguistics centers around the degree of overlap of different grammatical modules (phonology, morphology, syntax, etc). Interesting data can be accrued from phenomena that occur at the interface of these stipulated levels. Stress in Persian (Farsi) is generally assigned to the final syllable of a word by prosodic criteria, but the appearances of certain morphemes shifts stress to non-final positions. In some instances, two phonetically similar words can contrast through stress; for example, *mard-i* 'manliness (man-NOM)' and *márd-i* 'a man (man-INDEF)'. In the case where a word consists only of a root, the final syllable is stressed. However, these roots can receive derivational and inflectional affixes. Depending on the type of morpheme that attaches to the root, the stress of the word could shift. While some morphemes are never stressed, others attract stress which produces an array of different possible patterns in the right-ward default. This paper uncovers the interactions which cause these deviations from the default pattern. The constraints involved in producing the correct forms are either purely phonological or purely morphological, but

incorporate elements from both modules.

Many attempts have been made by linguists to accurately define stress. Phonetic correlates of stress include intensity, duration, and pitch; some also relate it to muscular contractions and breath pulses. In Metrical Stress Theory, Hayes (1995) refers to stress as "the manifestation of rhythmic structure". However, not all stress represents underlying rhythmic structure, but can result from the presence of a lexical accent. In phonological terms, an underlying accent can be realized as stress in the surface form. Lexical accents, directly linked to a specific morpheme, are not assigned through phonological criteria. The accents of words can be divided into levels of prominence; some beats may be stronger than others and yet others might not have any stress at all.

The Optimality Theory (OT) framework is advantageous because it naturally allows interaction between different aspects of the grammar. OT has been successfully employed in many areas of linguistic research. It has been especially successful in phonological studies, specifically in studies of prosodic structure.

This paper is organized as follows: second Section gives a brief background on the Persian



language and an overview of previous studies done on Persian stress. Section 3 presents the data to be accounted for. Section 4 provides an analysis of Persian stress couched in OT terms. Section 5 concludes this paper.

A Brief Overview of Persian Grammar and Earlier Studies

Background Information

The Persian language is the national language of Iran. The modern Persian language, derived from Old Persian, has been in use since the ninth century. A few different registers have developed, each diverging grammatically from the others. The standard language register, predominant in Tehran and used in media broadcasts and in formal speeches and lectures, is the most rigidly structured. The colloquial and poetic registers, apart from being more 'lax' in regard to word order, frequently employ forms that are excluded from the formal style and would require a separate analysis (Mahoutian, 1997; Lazard, 1992).

Differentiating grammatical classes, especially nouns, adjectives, and adverbs, is often a difficult task when categorizing Persian words (Rastorgueva, 1964). Words from one category often take affixes from the other categories in order to appear in sentence and phrasal constructions. For example, as an adjective *dzæván* 'young' is invariable, but used as a noun, it can take nominal suffixes like the plural to yield *dzævan-há* 'the young ones'. Verbs, however, are easier to distinguish, partly because certain stress attracting morphemes that only attach to verbs. Roots in Persian are words, and derivational suffixed combine with roots to form stems. Roots and stems can be inflected. Inflectional morphemes don't receive stress, unless they have underlying accents, which require to be realized as stress in the surface forms. The following two sets of examples demonstrate the shift of word final stress with the addition of certain morphemes.

Persian words have one predominant syllable, which is stressed in the output form. When roots appear as words, as in the examples in (1), the final syllable of the word receives stress.

- (1) geréft
'get'

kæbutær
'pigeon'

dzæván
'young'

But, with the addition of certain prefixes and suffixes, this pattern changes, as shown in (2).

- (2) mí-gereft-æm
PROG-get-1SG
'I got'
kæbutær-i
pigeon-INDEF
'a pigeon'

dzaván-e
young-EZ
'the young man/woman of'

The inflected forms of the words presented in (2) do not acquire the expected final syllable stress. There is a split in the accentuation of suffixes. Some are neutral with respect to stress, others are not. As we will see, this shift in stress provides evidence that phonology is not blind to morphology. The study of stress displays the property of Persian being a system shaped at the interface of these two modules.

A Survey of Earlier Studies

Earlier studies on the Persian language have been primarily descriptive text about the grammar. Many of these grammars dedicate a section to describe stress assignment, but only two scholars have done significant and comprehensive research on this subject. Ferguson, the first linguist to study this topic, infers that the only cases of non-final stress are due to underlying lexical accents or due to inflection. He contrasts noun forms, "where the stress tends to be near the end of the word" with verb forms, which have "recessive stress" (Ferguson, 1951). Though his work does not stem from any modern generative theories, he informally proposes some rule-like indications on the assignment of stress, and his study is a concise preliminary inquiry about the variations of stress in Persian.

An analytical account of Persian stress was presented more recently by Samei (1991). In this paper on verbal stress patterns, he proposes two



rules, listed in (3). These rules can account for stress assignment in verbs.

(3) Verbal Stress Rules:

- If a verb form is non-negative, the stress is placed on the last syllable of the first element of the verb form.
- If a verb form is negative, the stress is placed on the negative morpheme.

By elements, Samei (personal communication) is referring to a formative in the structure of verbal forms. A formative is discerned by its function within the verbal form. According to Samei, participial forms are constructed by the addition of the suffix /-e/ to the past root of the verb (e.g. *ræft-é*, *gereft-é*, etc.), but when used as an element in verb structure, it should be considered a single element (e.g. *ræfté bud-æm*, etc.). This concise rule-based analysis seems to explain the majority of the data, such as the verbal constructions in (4).

- (4) m-gereft-m
PROG-get-1SG)
'I got'
- bim-mi-kefid- m
out-PROG-pull-1SG
'I pulled out'
- foru-n-mi-rft-m
in-NEG-PROG-go-1SG
'I didn't sink in'

However, Samei's analysis doesn't shed any insight on why the stress structure of verbs obeys these rules and it is not clear why the grammar would consider a multi-morphemic word as one unit. Also, it is interesting to explore the effects of an analysis in other grammatical categories, discretely and in relation to others.

The Data

In this section, I present all the different cases of stress patterns in Farsi. The analysis follows in Section 4.

In cases where the word consists of only a root (doesn't have any affixes), the stress falls on the final syllable of the word, as displayed in (5).

- (5) geréft abí værzéʃ
'got (V.)' 'blue (A.)' 'exercise(N.)'
- búd kohné kæbutær
'be (V.)' 'old (A.)' 'pigeon (N.)'

When these forms acquire derivational affixes (discussed in the next section) which are always in the form of suffixes, the stress again falls on the final syllable of the new word, regardless of the number of derivational suffixes. This is displayed in (6).

- (6) gereft-egí abi-t'ær værzeʃ- gáh
get-PART-ABST blue-SUP exercise-PLA
'gotten' 'more blue' 'gym'
- bud-æn kohné-gí kæbutær-ané
be-INF old-ABST pigeon-MAN
'to be' 'oldness' 'pigeon-like'

When inflection suffixes (discussed in the next section) attach to words, the stress does not shift to the end of the new word, but remains on the final syllable of the original word, some examples are displayed in (7). It seems that stress assignment 'ignores' inflectional morphology.

- (7) værzeʃ- gáh-æʃ kæbut'ær-e
exercise -PLA-3SG pigeon-EZ
'his/her, gym' 'the pigeon of'
- geréft-i-æʃ búd-æm
get-2SG-3SG(DO) be-1SG
'you got it' 'I was'

However, the plural suffix, an inflectional morpheme, always attracts stress when added to a noun. Examples are shown in (8). This affix always appears after any derivational morphology and before inflectional.

- (8) værzeʃ- gáh-há-æʃ kæbutær-há-e
exercise-PLA-PL-3SG pigeon-PL-EZ
'his/her gym' 'the pigeon of'
- miz- há sændæli-há
table-PL chair-PL
'tables' 'chairs'

In verbs, though the agreement suffixes (for subject and direct object) do not receive stress, the inflectional prefixes always attracts stress. The maximum number of prefixes that a verb can take is two. When there are two suffixes, the first receives the stress. Examples appear in (9) and will



be discussed in detail in the analysis.

- | | |
|---|---|
| (9) mī-gereft-i
PROG-get-2SG
'you were getting' | nē-mi-gereft-i
NEG-PROG-get-2SG
'you weren't getting' |
| bē-kef-Ø
IMP-pull-2SG
'pull!' | n'æ-kef- Ø
NEG-pull-2SG
'don't pull!' |

An interesting shift occurs when derivational morphology is added to an inflected verbal root. This occurs, for example, when a negative infinitive is expressed. Examples are shown in (10). As seen in (9), conjugated verbal forms receive stress on the negation morpheme if the form is negative. Here, it seems stress is reassigned to the final syllable of the new word.

- | | |
|---|---|
| (10) nā-gereft-ʔæn
NEG-get-INF
'to not get' | nā- keʔid-é
NEG-pull-PART
'not pulled' |
| nā-fost-é
NEG- clean-PART
'uncleaned' | nā-xabid-ʔæn
NEG-sleep-INF
'to not sleep' |

In the future tense, which is formed by adding the auxiliary form of the verb 'to want' to the root, the agreement marker receives stress. Examples are shown in (11).

- | | |
|--|---|
| (11) xah- í gereft
want-2SG get
'you will get' | xah- ædkeʔid
want-3SG pull
's/he will pull' |
|--|---|

In aspectual and progressive forms, the stress again shifts. In the present tense, It shifts to the agreement marker, and in the past, it remains on the final syllable of the root, even with the presence of the progressive prefix which attracted stress in (9). These verb forms are shown in (12).

- | | |
|---|---|
| (12) dáʔt-æm ...
have-1SG
'I was ...' | dar-æm ...
have-1SG
'I am ...' |
| mi-xást-æm ...
PROG-want-1SG
'I was going to ...' | mi-xah-æm ...
PROG-want-1SG
'I am going to ...' |

Some phrasal verb forms are presented in (13). These are formed by the addition of either a conjugated form of the auxiliary 'to be', or by the addition of the enclitic form of the auxiliary, to the participial of the main verb.

- | | |
|--|--|
| (13) gereft-ébud-æm
get-PART be-1SG
'I had gotten' | grefet-é-im
get-PART CLITIC [be] 2 PL
'we have gotten' |
|--|--|

Finally, there are some words that have word initial stress. These forms, some of which appear in (14), are all invariable (they don't accept affixation).

- | | |
|---|--|
| (14) bæle
ævælæn
æmma
áya
xéili | 'yes'
'firstly'
'but'
'whether'
'alot, very (adj)' |
|---|--|

The above examples are representative of all the stress patterns found in Persian. In the next section, I propose an analysis that describes most of the patterns, and in the conclusion I discuss the problematic cases.

Optimality Theory Analysis

The accentuation of Nouns, Adjectives, and Adverbs

Nouns, adjectives, and adverbs are not always easily distinguished from each other. In fact, words from one category may take affixes from another and be used as such in a sentence or phrase. For example, *dzæván* (A.) 'young' can take the nominal suffix */-i/* producing the word *dzævan-i* (N.) 'a young man/woman'. Following examples like this, "there is a large group of substantives which, outside the clause, cannot be classified either with nouns or with adjectives" (Rastorguava, 1964). However, within a clause, these words can be classified through their positions relative to other words, or through affixation. Though they can take derivational affixes, adjectives are invariable (don't show number, definiteness, indefiniteness, etc). The adverbial category stands out weakly from the adjectival category, but characteristically found in certain positions in a phrase. Further discussion of these categories can be found in Persian reference grammars (e.g. Mahoutian, 1997; Rastorgueva, 1964; Jazayery, 1961; Lazard; 1992).

With regard to stress, these words display similar patterns. Non-inflected forms are shown in (15), derived forms in (16), and forms that carry inflectional morphemes in (17). Inflectional morphemes are affixes, which don't change the grammatical class of the word, but signal grammatical relationships (agreement, plurality,



tense, etc.). On the other hand, derivational affixes are morphemes that change properties like grammatical class, count, and animacy of the stem to which they attach.

(15) *tærbij'æt*
'manners'

xáb
'sleep'

fæmá
'order'

Here, the root receives stress on the final syllable. Since these forms are neither derived or inflected, they most clearly display the default direction of stress assignment. In the derived words in (16), stress again falls on the final syllable, enforcing the rightward direction of the default, as seen in (15).

(16) *bi- tærbij'æt-i*
WITHOUT-manners-NOM
'rudeness'

xab-gáh
sleep-PLA
'dormitory'

færma-yéj
order-NOM
'order(N.)'

(17) *bi- tærbij'æt-i-æj*
WITHOUT-manners-NOM-3SG
'his/her rudeness'

xab- gáh-i
sleep-PLA-INDEF
'a dormitory'

færma-yéj-e
order-NOM-EZ
'the order of'

In (17), the inflected forms display a somewhat different pattern. In these cases, the stress falls on the last syllable before the inflectional marker. From these preliminary observations, we can demark a morphological structure of these forms (singular nouns and adjectives), in (18).

(18) [prefix [[[root] derivational suffix]]
inflectional suffix] + enclitic]

I propose that the stem of a word in Persian consists of the root in addition to any prefixes and derivational suffixes. Following the discussion in Kiparsky (1998), inflexible lexical items are stems. In other words, the stem consists of all the elements other than inflectional or enclitic morphology.

From the morphological structure in (18), we observe that stress is always on a morphological head. In (16), the root is the head of the word, in (17), the rightmost derivational suffix is the head, and the inflectional morphemes added in (18) do not project functional heads. Following the

discussion of morphological heads in 'Inflection and Derivation', derivational affixes are morphological heads, and inflectional affixes are not (Scalise, 1988). In cases where there is no affixation, the root itself is the head. Williams (1981) describes the notion of head as determining "the properties [of the word] as a whole". And as mentioned above, derivational morphology changes the grammatical category of the word, and inflectional morphology does not. Derivational morphemes can all be heads, but only few inflectional morphemes can be functional heads.

Following Revithiadou (1999), I propose a constraint (19) that requires the most prominent syllable, or the peak of the word, to be within the morphological head of the word.

(19) HEADSTRESS: Morphological heads are stressed.

Furthermore, from (17), we observe that when a head is longer than one syllable, as in multi syllable roots, the stress falls on the rightmost syllable of a word. I posit another constraint, in (20), for the directionality of the stress. This constraint can be expressed by means of an alignment constraint following McCarthy and Prince (1993).

(20) ALIGN (Pk, PrWd, R): Align the peak to the right edge of a prosodic word.

The ranking of these two constraints is shown in (21). The HEADSTRESS constraint must rank above the ALIGN constraint in order to limit the boundary of the stress to the morphological head.

(21) HEADSTRESS >> ALIGN(Pk, PrWd, R)

In addition, the data presented in (22) further supports the above mentioned constraints. Here, the plural morpheme attracts stress from the stem. The plural suffix is normally considered to be an inflectional morpheme, however, in Persian, the plural morpheme can act as a derivational morpheme.

(22) *banu-án*
woman-PL
'women'

pedær-há
father-PL
'fathers'

banu- án-e
woman-PL-EZ
'the women of ...'

pedær-há-ejan
father-PL-3PL
'their fathers'



Note, that the plural marker has two allomorphs which alternate according to the semantics of the root. /-án/ morpheme attaches to animate nouns, whereas /-há/ can be used for any noun. This contrast, prevalent mostly in the literary language, and other functions of the plural like emphasis and extension provide evidence for the intermediary status of this morpheme. The plural morpheme always occurs after any derivational morphemes and before any other inflectional morphemes or enclitics. In Scalise (1988), one of the differences between derivational and inflectional morphology is the marking of animacy. Though it is normally an inflectional morpheme, I argue that word stress in Persian further supports the claim that the plural morpheme is considered a derivational morpheme, and hence a head, in Persian grammar.

The alignment constraint displays the difference between a purely phonological system and a system formed at an interface between morphology and phonology. The constraint (ALIGN) presented in this section was originally formulated by Prince and McCarthy (1993) as a tool to account for the morphology-phonology interaction, which frequently surfaces in many languages.

The tableau in (23) displays the ranking logic presented in (21). Each syllable the stress deviates from the right edge of the word markers one violation of the ALIGN constraint. Here, the word *varze[-gah-ha-jæ]* 'his/her gym' is used to demonstrate the ranking.

(23)

/varze[-gah-ha-jæ]/	HEADSTRESS	ALIGN(R)
a. varze[-gah-ha-jæ]	*!	***
b. varze[-gáh-ha-jæ]	*!	**
c. varze[-gah-há-jæ]		*
d. varze[-gah-ha-j'æ]	*!	

Though candidates (c) violates the ALIGN constraint, it is the only candidate left the effects of the HEADSTRESS constraint. If ALIGN were ranked above HEADSTRESS, candidate (d) would have been selected as optimal, since it has word final stress and does not violate ALIGN.

The Accentuation of Verbs

Verbs in Persian have rich inflectional morphology and the types of affixation in verbs seems to give them "recessive stress" (Ferguson, 1951). Samei (1991) provides a simple rule analysis to account for verbal stress. I propose a set

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of constraints that help explain the dynamics of the assignment of stress in Persian. Below, I begin with the simpler cases and in consequent subsections, I discuss the more complex ones.

Affirmative

Persian verbs have two roots, a present and a past: tense is encoded in the root. In some cases, the transformation between the two forms is phonologically systematic, but in most the differences between the two forms have historical sources which leads to the conclusion that the two roots are separate lexemes. However, the past root always ends in /-t/ or /-d/; for example the roots of 'get' are /gir/ (present) and /gereft/ (past), and the roots of 'pull' are /kef/ (present) and /kefid/ (past). Further discussion of present and past roots appear in reference grammars (Mahoutian, 1997; Rastorguava, 1964; Jazayery, 1961; Lazard, 1992); for the purposes of this paper, each of the roots is considered a single morpheme.

For verbs, which are not compounds or complex predicates, the morphological structure follows the hierarchy in (24).

(24) [negative [aspect [[[root] personal ending] DO marker]]

The most simple conjugations are the simple present and the simple past. These verb forms consist of the relevant verb root and an agreement suffix which encodes person and number. The personal suffix paradigms for the two roots differ only in the form for the third person singular (present: /-æ/, past: /-æ/). Verb forms can also receive a personal suffix marking the direct object, which would be placed after the pronominal affix. Aspect and negation are expressed by prefixation.

Possible verb forms in simple tenses appear in (25), and progressive forms appear in (26).

(25) geréft-æm
get-1SG
'I got'

xán-i
read-2SG
'you read'

kefid-im
pulled-2PL
'we pulled'

(26) mí-gereft-æm
PROG-got- 1SG
'I got'

bé-xan-i
SUBJ-get-2SG
'if you read'

mí-kefid-im
PROG-pulled-2PL
'we pulled'



These forms can be accounted for by the ALIGN constraint presented in (22). The root of the verb is the head of the word in (25), and the agreement markers are not. The forms in (26) all have an aspect marker. Persian has two aspect markers /mi-/ 'progressive' and /be-/ 'imperative/subjunctive'. The aspect markers are functional heads, though they are inflectional affixes, because they form their own functional projection.

Negation

The negation of a verb is expressed through the prefix /næ-/, which is the morphological head of negated verb forms. In progressive forms, the allomorph /ne-/ appears before the /mi-/ aspect marker. Furthermore, negation doesn't appear simultaneously with the aspect prefix /be-/. In these cases, the aspect prefix is deleted. In simple verbal constructions, the negation prefix occurs as the leftmost element. As seen in the examples in (27), the negation prefix receives stress, regardless of the word construction, unconditionally receiving stress.

- (27) n'æ-gereft-i
NEG-get-2SG
'you didn't get'
- n'æ-xan-i
read-2SG
'if you don't read'
- né-mi-kef-id
NEG-PROG-pull-2PL
'you don't pull'

The negative morpheme acts as the morphological head of the word in verbal forms, because it changes the word's selectional features and has semantic scope over the whole utterance. Like the aspectual maker, the negative prefix is a functional head that forms a functional projection.

Again, these forms are the result of the HEADMOST and ALIGN constraints. The negative morpheme is the head of the word because it is the rightmost prefix, and the highest morphological element. The tableau in (30) shows that though the negative morpheme is the first syllable of the word ' and violates ALIGN.

(28)

/ne-mi- gereft-æm/	HEADSTRESS	ALIGN(R)
a./ne-mi- geréft-æm	*!	*
b./ne-mi- gereft-æm	*!	***
c./ne-mi- gereft-æm	*!	
d./né-mi- gereft-æm/		****

Infinitives and participles

An interesting stress shift occurs in the cases of infinitives or participles and their negations. A few examples of affirmative infinitives are listed in (29). These forms are constructed by the addition of the infinitival suffix /-æn/ or the participial suffix /-e/ to the verbal stem. Infinitives and participles do not fall distinctly in the nominal or verbal categories. they can take nominal morphology and they can take objects and subjects as verbs do.

- (29) gereft-æm
get-INF
'to get'
- ke id-é
pull-PART
'pulled'
- fost-é
clean-PART
'cleaned'
- xabid-æm
sleep-INF
'to sleep'

The suffixes /-æn/and/-e/ are derivational morphemes that change the syntactic category of the word from verb to noun or adjective respectively. These derivational morphemes act as the head of these words. The stress in these words falls on the last syllable, which is the head of the word.

Some examples of negatives infinitives and participles are listed in (30). In these cases, the stress again falls on the derivational infinitival or participial suffix which is the head of the word since it is the last morpheme to be added to the word and therefore the highest morphological element. These forms can also be accounted for by the ALIGN constraint.

- (30) næ-gereft- æn
NEG-get-INF
'to not get'
- næ-kef-id-é
NEG-pull-PART
'not pulled'
- næ-fost-e-há
NEG-clean-PART
'uncleaned'
- næ-xabid-æm
NEG-sleep-INF
'to not sleep'

Furthermore, in the plural forms of these infinitives and participles, in (31), the plural morpheme attracts stress. This is expected, as



discussed in section 4.1, because the plural morpheme in these cases acts as a morphological head.

- (31) næ-fost-e-há
NEG-clean-PART-PL
'the unclean ones'

næ-xabid-æn-há
NEG-sleep-INF-PL
'the lack of sleep'

Thought normally, the rightmost prefix is the head and receives stress, in the cases of infinitives and participles and their plurals, the stress falls on the 'outermost' affix. The head is the last morpheme to be added to the word which in these cases is the derivational morphemes and the plural.

Other Cases

There is set of words which do not conform to any of the patterns we have seen so far, namely, they always have stress on the initial syllable. These include words that are normally uttered in isolation, like interjections, or words like conjunctions roughly meaning 'however' or 'perhaps', and ordinal adverbs (Ferguson, 1950), examples are listed in (32). These words might have retained as accent through diachronic development. This could be because of historical stress, Ferguson mentions that Old Iranian had a weight-sensitive stress, and some patterns might have carried over through time.

- (32) b'æle 'yes'
'ævælæn 'firstly'
'æmma 'but'
áya 'whether'
xéili 'alot, very (adj)'

These words are exceptions to any of the aforementioned patterns accounted for by the interaction of the two constraints. To account for the initial position of stress in these words, I propose that these words have underlying accents which are realized through the faithfulness constraint in (33) requiring the output to be faithful to the input. Because there are only a handful of such words, such an analysis is possible. Also, These words are all invariable (they do not receive affixation).

- (33) FAITH (ACCENT): Preserve underlying accents in the output.

This constraint is not ranked in relation to the HEADSTRESS constraint, because these words can be head and neither constraint eliminates the optimal candidate. Recall that HEADSTRESS does not propose a constraint on the directionality of the stress. However, the FAITH constraint necessarily ranks above the ALIGN(R) constraint, since ALIGN(R) requires all stress to fall on the final syllable of a word. This ranking is presented in (34).

- (34) HEADSTRESS, FAITH (ACCENT) >> ALIGN (Pk, PrWd, R)

the tableau in (35) shows the ranking of these constraints dynamically for the grammar to select the correct form 'ævælæn 'firstly'.

- (35)

/ævælæn /	HEADSTRESS	FAITH	ALIGN(R)
a. 'ævælæn			**
b. ævæl'æn		*!	
c. æv'ælæn		*!	*

Testing our ranking for some of the earlier forms presented in this section, we seen that the higher ranking of the FAITH constraint does not effect the grammatical output of elements with no underlying stress. In (36), the optimal form *mi-gereft-æm* 'I didn't get' result from the same ranking.

- (36)

/mi-gereft-æm /	HEADSTRESS	FAITH	ALIGN(R)
a. mi-gereft-æm	*!		*
b. mi-géref-t-æm	*!		**
c. mi-gereft-'æm	*!		
d. mi-gereft-æm			***

Recalling the Constraints

The three constraints, repeated in (37), relevant to the stress system of Persian have been presented in this section. HEADSTRESS maps a phonological feature to a morphologically defined element, ALIGN maps stress to a larger morphological constituent, and FAITH preserves a prosodic feature belonging to a particular morpheme. These constraints support the conclusion that stress in Persian emerges at the interface and through the interaction of morphology



and phonology.

(37) HEADSTRESS: Morphological heads are stressed

ALIGN (Pk, PrWd, R): Align the peak to the right edge of a prosodic word.

FAITH (ACCENT): Preserve underlying accents in the output.

Conclusion

Some Remark

The constraints I have proposed in this analysis efficiently capture the different pressures that factor in for the final stress assignment in Persian. The effects of morphology and phonology are blended and their individual pressures are not clearly defined. The extent of one module's power over the other becomes fuzzy when analyzing stress. This paper has exposed the dynamics of stress assignment in Persian. The constraints which produce grammatical forms are neither purely phonological, but occur at the interface of these two modules.

I have shown that the ALIGN constraint dictates the default rightward direction of stress in a word. But this doesn't always result in word final stress: the HEADSTRESS constraint draws a boundary within the head of the word. Then there is the FAITH constraint which requires prespecified accents on particular morphemes to realized.

In summary, the position of stress in Persian does not shift for purely phonological reasons, but is concerned with the morphological structure of the word. Also, my analysis takes into account the fact that it is impossible to find word stress on a morpheme that is not a head. Unless the accent is prespecified as in the handful of cases presented at the end of the analysis section, the stress is aligned as rightmost as possible.

A few subjects arise as directions for future research. There are some areas of Farsi stress that the present analysis cannot account for. These issues are presented in the following subsections. But first, I describe other possible analysis.

Other Possible Approaches

One possible approach to stress assignment in Persian is extrametricality (Hayes, 1995). Extrametricality principles suggest that prosody can

'ignore' certain syllables, while abiding by the following guidelines: "constituents may only be extrametrical when located at a specified edge, the unmarked edge in the right one, and extrametricality may not exhaust the domain of the stress slues" (Hayes, 1995: 106). Applied to Persian words, we can analyze certain cases of non-final stress, by proposing that some suffixes are extrametrical. In (38), the extrametrical element is included in the angled brackets ($\langle \rangle$), and syllables are represented by σ .

(38) σ $\langle \sigma \rangle$ σ σ $\langle \sigma \rangle$
márd - $\langle j \rangle$ geréft - $\langle æm \rangle$

However this analysis runs into problems. Extrametricality applies to word final constituents, such as the final syllable. This type of analysis could not account for the stress of words like *koláh-ejan* (hat-POS-2PL), because the suffix in consideration is disyllabic. Additionally, only words that cannot accept multiple syllables can be analyzed through extrametricality, again because only one syllable can constitute a domain for extrametricality, which leaves out words like *geréft-æm-etan* (got-1SG-DO 2PL). Likewise, if we propose that the extrametrical element is a foot, the above example (*geréft-æm-etan*) would again be problematic, since there are three full syllables ignored by stress assignment.

Another approach to the account of non-final stress is underlying lexical accents. As seen in the few examples above, there is an apparent tendency for stress to fall on the final syllable of a word. For example, if we were to propose that *færmá* 'to say (V.)' has an underlying lexical accent, then we would not be able to explain the disappearance of stress in the derived form *færma-jéj* 'request (N.)'. Furthermore, looking at the data presented thus far and additional data in the analysis section reflect some phonological tendencies overlapping with morphological ones. The presented analysis spares the superfluous requirement for so many underlying accents, providing an elegant alternative.

In this study, I have proposed a set of ranked constraints that yield a comprehensive analysis of the stress system. The constraints I employ in this analysis have been argued to be universal, as they have been borrowed and adapted from theoretical literature in generative linguistics.



Domains of Future Research

Stress assignment in Persian follows from a system of interface constraints. It is the consilience of the different modules that allow for the diversity of stress patterns found in the language. In the remainder of this section, I address some interests as domains for future research and some preliminary ideas. Some interesting phenomena occur in the progressive and aspectual verb forms and in phrasal verb forms like the future and some complex past expressions.

Future

An interesting case arises in the formation of the future tense. The future form is expressed with the simple present form of the auxiliary verb /xah-/ (present stem of the verb meaning 'want') with the appropriate personal suffix, added to the past root of the main verb. Some examples are shown in (39).

- (39) xah-ʔæm ræft
want-1 SG go
'I will go'
- xah-i keʃid
want-2 SG pull
'you will pull'
- xah-ʔæm gereft
want-1 SG get
'I will get'

Notice that the stress falls on the last syllable of the auxiliary form, which includes the personal ending. This is surprising because the personal endings are inflectional and this is the only case we see them receive stress. The future tense formation is a special case, others have also commented on the special nature of the future auxiliary (Goldberg 1996). I propose that the future auxiliary root have an underlying specification which accents the syllable immediately following the root; in other words, it is a post accenting morpheme. The prosodic structure of the auxiliary is presented in (40). Following the discussion in Revithiadou (1999), the accent above the auxiliary root is a 'floating accent', and the landing site of this underlying accent is the following syllable which is always an agreement suffix.

- (40) *
xah-σ → *
xah-σ

As we will explore further in the next subsection, the verb *xah-* 'to want' is special in Persian. I propose that different forms of this word have underlying accents which are realized through the requirement of the FAITH constraint.

Progressive and Aspectual Phrases

Other than its use in the formation of the future tense, the verb *xast-* is also used in progressive and aspectual phrases. These are modal forms of the auxiliary verbs *xast-* 'to want', and *dašt-* 'to have'. In phrases and sentences, these two verbs serve to express willingness to do something and emphasizing progressive actions. These forms occur at the beginning of a phrase and can be separated from the main verb with a number of elements. As displayed in (41), they have a unique stress pattern.

- (41) dáʃt-m... dar-ʔæm
have-1SG have-1SG
'I was...' 'I am...'
- mi-xást-æm ... mi-xah-ʔæm ...
PROG-want-1SG PROG-want-1SG
'I was going to ...' 'I am going to ...'

These are special cases, firstly because these forms normally occur at the beginning of utterances and might be followed by direct objects or other elements; and secondly, there is a marked difference in stress assignment in the present and in the past. Sentence stress differs from isolated stress, because other elements in the sentence compete for focus and the pragmatic uses of tone make stress difficult to distinguish. These modal forms occur in phrasal constructions, which as seen in the last section, have a different structure than the simple prosodic word. I propose that they are accented underlyingly and are accounted for through the FAITH constraint presented in the previous section.

Stress in Complex Words

Some interesting stress shifts occur in the cases of complex formations similar to the formation of the future tense. These verbal phrases are usually composed of two prosodic words, including constructions in which the participial form of the



verb appear, and forms that use an auxiliary. The participial form of a verb is constructed by the addition of the participial morpheme /-e/ to the past root of a verb. Listed in (41) are a couple of complex forms of the verb 'to get', expressing different tenses. The past root of the verb 'to be' /bud-/ and its clitic form which is similar in form to the person suffixes appear in certain tenses.

(41) gereft-é bud-æm	gereft-é-im
get-PART be-1SG	get-PART CLITIC [be] 2PL
'I had gotten'	'we have gotten'

These types of formations count as a single domain for stress assignment. As seen in the above examples, the stress falls on the participial ending of the form. These morphemes are heads and these forms can be accounted for by our constraints. I did not include them in the analysis because they are composed of two prosodic words and not isolated words. Another possibility is that the auxiliary of the form of the verb 'to be' is not stressable. If this were the case, it would be assumed that the

auxiliary form of this verb is a separate lexical item as the main verb.

Stress on the Initial Syllable

In the final section of the analysis, I presented a set of words that always take stress on the initial syllable. It is interesting to observe that, like other words in Persian, the stress is again aligned with the one of the edges of the word. Until further research is done to determine why these words might have evolved with stress on the initial syllable, despite the ALIGN(R) constraint in the grammar which aligns stress to the rightmost edge, it is plausible that these words have underlying stress. Also, this subset of lexical items is quite small, so underlying stress is not an unfeasible hypothesis.

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Is There a Memory Deficit in Parkinson's Disease?

Explicit and Implicit Memory for Verbal and Action Events

Three experiments examined both encoding and test variable whether there is any memory deficit in patients with Parkinson's disease (PD) in comparison with normal controls. In Experiment 1, the effect of encoding enactment was tested in free recall and cued recall. In Experiment 2, the combinations of enactment/non enactment and well/poorly integration variables were used at encoding. Again, the subjects were tested by free and cued recall. In Experiment 3, recognition memory and sentence-fragment completion tests were used with the same encoding manipulations as in Experiment 2. In general, the results of all three experiments showed no difference between PD patients and normal controls indicating that there is no memory deficit for PD patients. However, it was observed that there was some recognition deficit (especially for well-integrated and verbal items) in Parkinson patients. It was suggested that the similarity between encoding and retrieval and the stage of disease should be considered as important factors for any possible memory deficit in Parkinsonian patients. It was also concluded that Parkinson patients are less well able to utilize cognitive support.

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Clinical studies have reported that, aside from perceptual and motor impairment, Parkinson's disease (PD) patients have cognitive deficits particularly for those processes involving memory and learning (e.g., Reitan and Boll, 1971; Boller, 1980; Mortimer et al., 1982). Experimental studies of memory function in PD patients (compared with normal controls) on the other hand give a rather mixed picture. It is still unclear whether there is a memory deficit in PD patients, and if so the degree of the impairment and the specific nature of the impairment remain poorly understood.

For example, Flowers et al. (1984) examined immediate and delayed recognition memory for verbal and visual material. Half of the items were easy to verbalize, whereas the other half were hard to name or describe. The results showed no

significant differences between PD patients and controls in their recognition memory. PD patients showed the same drop in delayed recognition accuracy as controls. In both Parkinsonian and control groups, there was a marked drop for verbal materials, but only a small drop for visual materials. The results also showed that the patient group was not different from the control group with respect to difficult items, compared to easy items; i.e., difficult items did not produce any greater recognition difficulty in patients than did the easier items. Thus, the data of this study suggested that Parkinsonian recognition memory is normal over a range of measures and materials. Flowers et al. (1984) concluded that if there is a memory deficit in PD patients it must begin at retrieval or a higher level processing, and not at the time of registration



and retention.

Weingartner et al. (1984) used semantic and episodic memory tasks with different types of materials, verbal and visual, related and unrelated. Semantic memory was tested by completion of stems (letters) and superordinate categories (words), whereas episodic memory was tested by free recall and recognition. The results were the same for both PD patients and controls in semantic memory (in both their response to letter stimuli and categories) and in distinguishing the occurrence of frequent and infrequent events and in identification of modality (word versus picture). In free recall test, for highly related words, there was no significant difference between the PD patients and the controls, whereas, for unrelated items (word and pictures), PD patients were impaired compared to normal subjects. Weingartner et al. (1984) suggested that PD patients have difficulty with effort-demanding as opposed to automatic-cognitive processing; i.e., automatic processing is intact in PD patients. They suggest that although PD patients can use associations between items if these are available, they appear to have difficulties producing their own association when there are no obvious links between the items to be remembered.

In a more recent study, Breen (1993) used unrelated words to compare recall and recognition performance in PD group to that of a control group. The primacy and recency effects were also compared between the two groups. Whereas a significant between-group difference was found in the free recall data, no significant difference was found in the recognition data. The two groups were not different with respect to the primacy and recency effects. The impaired recall of the Parkinson group was proposed to be due to mental slowness (a limited capacity on the number of items that can be actively processed), but no qualitative differences were suggested between the two groups (because both groups showed a primacy and recency effect in the free recall data). It was also suggested that the impaired recall of the patient group was due to difficulties occurring at encoding rather than at retrieval.

Appollonio et al. (1994) examined both explicit and implicit memory on verbal and visual tasks requiring different levels of effort. As in the Weingartner et al. (1984) study, frequency estimation and modality monitoring were indicated as automatic processing, whereas recognition, cued recall and free recall of items were seen as effortful processing (with different levels of effort). Word-

and picture-fragment completions were used as implicit tests. It was found that there was no difference between a PD group and a control group with respect to word or picture priming. The two groups did not differ in frequency estimation and modality presentation (automatic memory). No between-group differences were found for recognition and cued recall data (for demented patients, there was a difference). For free-recall data, there was no significant difference between the two groups (nondemented patients and controls) in a paired-association test, but for free recall of monitoring task there was a difference. No significant interactions for groups and type of stimuli (word and picture), as well as for groups and within-pair relatedness were found. The authors suggested that the PD patients were not impaired in automatic and implicit memory, but they were impaired in effortful explicit memory tasks.

One concern in the above-mentioned studies was whether memory deficit occurs at encoding or at retrieval. From the results of these studies it is not entirely clear at what stage in the process memory deficit may occur. Flowers et al. (1984) suggested that memory deficit may occur at retrieval, whereas Breen (1993) suggested that the memory deficit may occur at encoding. The other two studies (Weingartner et al., 1984; Appollonio et al., 1994) did not explicitly declare their view on this issue. The second concern was task effortfulness. Weingartner et al. (1984) found that an effortful task (compared to easy task) affects a PD group more than a control group, whereas Flowers et al. (1984) failed to find such a difference between the two groups. In the Appollonio et al. (1994) study, nondemented PD patients were different from the control subjects only in free recall of monitoring task as a more effortful task, but not in free recall of paired-association task as a less effortful task. In the present study, we have addressed both issues to compare memory performance in PD patients and control subjects. We used two types of encoding tasks: (1) encoding with enactment versus encoding without enactment, and (2) encoding of well-integrated item versus encoding of poorly integrated items. At retrieval, different types of test (i.e., free recall, cued recall, recognition, sentence-fragment completion) were used.

Encoding enactment is a new line of memory research, which was simultaneously and



independently developed by Cohen (1981), Engelkamp and Krumnacker (1980), and Saltz and Donnenwerth-Nolan (1981). Encoding enactment is usually referred to as subject-performed tasks (SPTs), in which subjects perform minitasks (e.g., roll the ball, lift the pen) at encoding. SPTs are compared to traditional verbal tasks (VTs), in which subjects hear or read the same commands without performing them. Following the presentation of tasks, subjects receive a test: free recall or cued recall or recognition to assess memory performance of SPTs and VTs. The typical results in SPT experiments show that recall and recognition of SPTs is superior to recall and recognition of VTs. This superiority is usually referred to as the enactment effect or as the SPT effect. This effect has been obtained in a variety of experimental settings (see Cohen, 1989, and Nilsson, 2000, for reviews).

There is a wide agreement that the main reason for the enactment effect is encoding support (Backman and Nilsson, 1984, 1985; Engelkamp and Zimmer, 1994; Helstrup, 1986; Nyberg, 1993; Kormi-Nouri et al, 1994; Kormi-Nouri, 1995), although there are different explanations for this encoding support. In the present study, we explored whether this encoding support would be as effective in PD patients as in normal controls. More specifically, the prediction was that if PD patients are impaired at encoding, they would benefit from encoding enactment more than controls. The prediction can also be expressed as whereas PD patients are impaired at encoding of nonenacted events (as a more effortful task), they are not impaired at encoding of enacted events (as a less effortful task). It should be noted that the motor memory task used in the enactment condition required manipulation of materials, and this might be thought as a disadvantage for PD patients who have motor impairment. However, an attempt was made to select simple action events, which could be performed in a everyday life. The objects used in the actions were handed over by the experimenter to the subjects and were then taken away by the experimenter. A pilot study of the PD patients showed that they had no difficulty to perform the actions at the specified time (8 seconds), compared to control subjects.

The second variable of interest at encoding was level of integration within item. For both SPTs and VTs, Kormi-Nouri (1995) distinguished between two types of items: well-integrated and poorly integrated items. In

well-integrated items, there is a strong conceptual link between the verb component and the noun component of items (e.g., read the book, write with the pen). In poorly integrated items, there is a low conceptual link between the verbs and the nouns (e.g., lift the book, touch the pen). In the Kormi-Nouri (1995) and Kormi-Nouri and Nilsson (1998) studies, it was found that well-integrated items produce a better memory performance in different types of test (free recall, cued recall, and recognition), although this effect was different for SPTs and VTs in different test conditions. Encoding enactment of well-integrated items produced the best memory performance, whereas encoding of poorly integrated items without enactment produced the least memory performance. Encoding of enacted/poorly integrated items and nonenacted/well-integrated items produced moderate memory performances. In the present study, it was expected that the level of integration should affect PD patients more than normal controls. Moreover, taking the two encoding variables together, one might expect that the combination of enactment and high level of integration to have an additional positive effect on PD patients, compared to controls. It was also predicted that, in PD patients, most memory impairment occurs for nonenacted/poorly integrated items (as a most effortful task), compared to enacted/poorly integrated and nonenacted/well-integrated items (as moderate effortful tasks) and to enacted/well-integrated items (as a less effortful task).

Test condition was studied by using different types of memory test. Explicit memory was tested by free recall, cued recall, and recognition tested explicit memory, whereas implicit memory was tested by sentence-fragment completion. In the cued recall and sentence-fragment completion tests, verbs were given to subjects to complete the other part (noun) of sentence. Based on the previous studies, it was expected that the more effortful test (comparisons between free recall, cued recall, recognition and implicit test from the most to the least effortful test) used, the more memory deficit would be observed in PD patients. An interaction between group, encoding and test was also expected. In PD patients, it was expected that the more



effortful test used with the less memory support at encoding, results in a more pronounced memory deficit.

Experiment 1

Method

Design: The design was a 2[group (Parkinson vs. control)] x 2[type of encoding (SPT vs. VT)] x 2[type of test (free recall vs. cued recall)] mixed design. The first factor was a between-subject variable, whereas the second and third factors were within-subjects variables

Subjects: Sixteen patients who regularly attended the Neurology Outpatient Clinic at the University in Hospital Umea were selected on the

basis of information in their medical notes. The average age of the Parkinson patients (8 males and 8 females) was 60.80 ranging from 42 to 77 years of age. The average age of onset of disease was 55.30 years, and the mean duration of illness 5.5 years, with a range from 2 to 13 years. The characteristics of PD patients are shown in Table 1. The control subjects (8males and 8 females) were randomly selected from the Umea population through the database information. The average age of control subjects was 61.88 ranging from 46 to 74 years. Normal subjects had no history of neurological or psychiatric illness. The two groups were matched for their educational level.

Materials: The to-be-remembered materials used in this experiment were 24 commands (e.g., fold the napkin, give me the bottle). half of the

Table 1: Characteristics of PD patients in Experiment 1

Nr	Age Years	Sex	Dur.PD Years	L-dopa mg	DA-agonist mg	MAOB-I mg	UPDRS		Comments
							H&Y	S&E%	
1	71	F	5	500	15		2.5	75	Depression
2	42	F	13	700	25		2.5	75	Motor fluctuations
3	61	M	3	600	20	10	2.0	80	Depression and cognitive deficit
4	66	M	5	400	15		2.0	90	Significant tremor
5	52	F	9	300		10	1.5	90	
6	60	F	5	600	30	10	2.0	90	
7	51	M	2	300			2.0	80	
8	68	F	7	1000			2.0	80	Depression
9	72	M	4	200	7.5		2.0	80	
10	66	F	4	400		10	2.0	80	
11	60	M	3	450		10	2.0	90	Left thalamotomy (PD-tremor)-1991
12	57	M	2	0			1.0	90	Significant tremor
13	77	F	2	400			2.00	80	
14	51	M	7	300	15	10	2.00	80	
15	48	M	5	800	30	10	2.0	80	Motor fluctuations
16	71	F	12	450		10	2.0	80	Motor fluctuations

Note: L-dopa: Madopark or Sinemet; DA-agonist: Dopaminagonist; MAOB: Monoaminoxidase-B inhibitor: Selegilin (Eldepry); UPDR S: Unified Parkinson Disease Rating Scale (Fahn et al., 1987); H & Y: Modified Hoehn and Yahr Staging; S & E: Schwab and England Activity of Daily Living Scale

Depression means slight depression and cognitive deficit means incipient cognitive deficit.



items were encoded as SPTs and the other half as VTs. Each command included one imperative verb (e.g., fold, give) and one noun (e.g., napkin, bottle). The physical objects were presented together with each command.

Procedure: Each subject was tested individually. All subjects learned SPTs and VTs, each typed on a separate card. the items were shown at a rate of one every 8 seconds and the duration of interval was 3 seconds. SPTs and VTs were randomly mixed and counterbalanced in two study lists. The order of SPTs and VTs were also varied in the two study lists. In each study list, not more than two SPTs or two VTs were allowed to appear in succession. The experimenter said "sentence" before presenting VTs. In the SPT encoding, subjects were instructed to read the commands and perform the action indicated by the commands, and to try to remember the whole command (verb and noun) for an unspecified subsequent test. The objects included in SPTs were handed over by the experimenter during the

were given a 30-item vocabulary test. The main purpose of administering this test was to eliminate any effect of short-term memory. Another purpose was however to assess subjects' word comprehension in the patient and control groups. Mean performances were 21.56 and 22.60 for the patient and control groups, respectively. The two groups were not significantly different with respect to the vocabulary test ($P > .50$).

At retrieval, subjects received two recall tests, first a free recall test followed by a cued recall test (unpacked time). To eliminate any disadvantage of writing for PD patients, both patient and control subjects were instructed to recall the items orally. In the free recall test, the subjects were asked to recall orally the whole commands. In the cued recall test, each verb cue, typed on a separate card, was shown to the subjects, and they were asked to recall orally the correct noun paired with the verb at the study list. All responses were taped by a tape recorder.

Table 2:

Mean proportion of correctly remembered items as a function of groups of subjects, encoding conditions, and type of test in Experiment 1.

<u>Parkinson group</u>	<u>free recall</u>	<u>cued recall</u>
<u>SPT</u>		
M	.30	.42
SD	.18	.31
<u>VT</u>		
M	.08	.12
SD	.08	.15
<u>Control group</u>		
<u>SPT</u>		
M	.31	.37
SD	.14	.23
<u>VT</u>		
M	.08	.11
SD	.05	.13

presentation of items, and were immediately hidden after the presentation. In the VT encoding, subjects were instructed to read commands aloud without performing them, and, as in the SPT encoding, to try to remember the whole command for an unspecified subsequent test. Before the presentation of the study list, two examples of SPTs and VTs, not included in the study list, were shown to all subjects.

After the presentation of the study list, subjects

Results

A strict procedure of scoring recall of nouns was used; responses were accepted only if they were exactly the same as those presented in the study list. The mean proportions of SPTs and VTs recalled by subjects in the two groups are shown in table 2.

A 2(sex) x 2(group) x 2(encoding) x 2(test) analysis of variance was conducted for the data



shown in the table. The first two factors varied between subjects whereas the last two factors varied within subjects. Since there was no main effect ($P > .20$) and no interactions with regard to sex variable, the data were collapsed across this factor. The analysis yield significant effects of type of encoding [$F(1, 30) = 67.36$, $MSe = 4.41$, $P < .001$] and type of test [$F(1, 30) = 4.90$, $MSe = 3.52$, $P < .05$], but no between-group difference ($P < .70$). None of the interactions was statistically significant. Thus, this experiment, unexpectedly, revealed no memory deficit in the PD patients,

(Kormi-Nouri, 1995; Kormi-Nouri and Nilsson, 1998). It was found that the encoding enactment of well-integrated item resulted in the best memory performance, whereas verbal encoding of poorly integrated items resulted in the lowest memory performance. In the present study, it was explored whether these two encoding supports (i.e., enactment and integration) would be effective for old adults as they were for young adults. More specifically, it was expected that PD patients would benefit from double encoding supports more than controls. One the other hand, in the absence of

Table 3: Characteristics of PD patients in Experiment 2

Nr	Age Years	Sex	Dur.PD Years	L-dopa mg	DA-agonist mg	MAOB-I mg	UPDRS		Comments
							H&Y	S&E%	
1	72	M	2	150			1.5	90	
2	71	F	1	0			1.0	90	
3	59	M	4	1100		10	2.0	80	Motor fluctuations
4	48	M	12	500			2.5	75	Motor fluctuations
5	66	M	13	1800	15				Op. thalamotomy-1980
6	73	M	5	600			2.0	80	
7	59	F	1	200			1.0	90	Hemiparkinsonism
8	69	M	7	450			2.0	75	Cognitive deficit
9	56	M	9	550	20		2.0	90	Motor fluctuations
10	43	M	3	600		10	2.0	80	
11	73	M	6	400	7.5	10	2.0	80	Depression, Motor fluctuations, and Cognitive deficit
12	66	M	8	400	2.5	5	2.0	80	

compared to the normal controls, and the enactment effects, in both free recall and cued recall data, were identical in the two groups. Moreover, although a simple effect comparison showed that the cueing effect was different for SPTs ($P < .05$) and VTs ($P < .14$), this was not different between the two groups.

Experiment 2

The integration between the two components of each item (verb and noun) was used as an additional encoding support for young adults

these two encoding supports, memory deficit of PD patients would be more visible.

Method

Design: The design was a 2[group (Parkinson vs. control)] x 2[type of encoding (SPT vs. VT)] x 2[type of item (well integrated vs. poorly integrated)] x 2[type of test (free recall vs. cued recall)] mixed design. The first factor was a between-subject variable, whereas the remaining factors varied within subjects.



Subjects: Twelve parkinsonian subjects (10 males and 2 females) were from the Neurological wards and Outpatient Clinic of university Hospital in Umea. The average age of Parkinson patients was 62.90 years and ranged from 43 to 73 years. The average age of onset of disease was 57.00 years, and the mean duration of illness 5.80 years, with a range from 1 to 13 years. The characteristics

group = 22.83 and control group = 24.33) ($P < .10$). It should be also noted that sex was not controlled in this experiment, since there was no sex differences in Experiment 1.

Materials: A new list of 48 commands with two presentations with respect to order and counterbalancing between SPTs and VTs was used as to-be-remembered items. The items were

Table 4:

Mean proportion of correctly remembered items as a function of groups of subjects, encoding conditions, and type of test in Experiment 2.

<u>Parkinson group</u>	<u>free recall</u>	<u>cued recall</u>
<u>SPT-well integrated</u>		
M	.26	.87
SD	.14	.14
<u>SP-poorly integrated</u>		
M	.09	.21
SD	.10	.16
<u>VT-well integrated</u>		
M	.10	.71
SD	.13	.19
<u>VT-poorly integrated</u>		
M	0.00	.05
SD	0.00	.08
<u>Control group</u>		
<u>SPT-well integrated</u>		
M	.31	.90
SD	.15	.07
<u>SP-poorly integrated</u>		
M	.15	.33
SD	.11	.16
<u>VT-well integrated</u>		
M	.10	.76
SD	.15	.14
<u>VT-poorly integrated</u>		
M	.01	.06
SD	.03	.08

of PD patients are shown in Table 3.

The control group (7 males and 5 females) was selected from a pool of subjects received from a database information. The control subjects were selected to be equated as nearly as possible to those in the parkinsonian group with respect to age and education. None of the controls had a history of neurological or psychiatric disease. The average age of the controls was 60.42, ranging from 44 to 71 years. It should be noted that none of the parkinsonian and control subjects participated in the previous experiment.

It should be noted that the two groups were not different with respect to the vocabulary test (patient

selected from those used in the Kormi-Nouri (1995) study. Half of the items were well-integrated items (e.g., write with pen, read the book) and half of the items were poorly integrated items (lift the paper, point at the wallet). For each type of item, half were used as SPTs and half as VTs. Not more than two well-integrated or poorly integrated, and SPTs or VTs appeared in succession.

Procedure: The procedure both at encoding and at test was identical to those in Experiment 1.

Result

The results are shown in Table 4. These data were statistically evaluated in a 2 (group)



Table 5: Characteristics of PD patients in Experiment 3

Nr	Age	Sex Years	Dur.PD Years	L-dopa mg	DA-agonist mg	MAOB-I mg	UPDRS H&Y	S&E%	Comments
1	61	F	3	600	20	10	2.0	80	Depression, Cognitive deficit
2	71	M	10	400	5	10	2.0	85	
3	71	M	6	200		10	2.0	80	CVS (SAB)-1978
4	63	M	7	500			1.5	90	
5	77	F	12	200		10	2.00	80	Cognitive deficit
6	72	M	11	500			2.0	80	
7	78	M	7	700			2.0	75	Cognitive deficit
8	60	M	6	450			1.5	85	Depression
9	64	F	2	300			1.5	85	Depression
10	63	M	3	300			2.0	80	Cognitive deficit
11	62	M	6	400			1.0	90	Depression, Cognitive deficit
12	68	F	13	700			2.0	80	Motor fluctuations
13	72	F	16	250			2.0	80	Op. thalamotomy- 1990
14	69	F	15	800	20		2.5	75	Motor fluctuations
15	68	M	5	500	7.5		2.0	80	Depression
16	68	F	9	400			2.0	85	

Note: CVS (SAB): Cerbovascular disease in the form of subarachnoidal bleeding

x 2 (encoding) x 2 (type of item) x 2 (test) analysis of variance. Again, there was no between-group difference ($P < .10$). The main effect of type of encoding [$F(1, 22) = 87.49$, $MSe = 2.13$, $P < .001$], type of item [$F(1, 22) = 429.36$, $MSe = 2.42$, $P < .001$] and type of test [$F(1, 22) = 402.37$, $MSe = 2.21$, $P < .001$] were significant. The three-way interaction of encoding x item x test was significant [$F(1, 22) = 6.51$, $MSe = 1.10$, $P < .05$]; For well-integrated items, the cueing effect was similar in SPTs and VT, whereas, for poorly integrated items, it was more pronounced for SPT than for VTs. None of interactions involving group factor was statistically significant.

Thus, contrary to the predictions, the combination of enactment and improvement of level of integration at encoding did not affect differently the PD patients compared to

normal controls. Furthermore, the cueing effect was not different for the two groups.

Experiment 3

In Experiment 1 and 2, encoding variable was examined in recall tests to explore the source of possible memory deficit for PD patients. In Experiment 3, we used two different types of memory test: recognition memory test and sentence-fragment completion as less effortful tests compared to free recall and cued recall test.

Method

Subjects: Sixteen PD patients (9males and 7 females) with the same selection criteria as Experiments 1 and 2 participated in Experiment 3. Half of the patients were from the Neurological ward and Outpatient Clinic of University Hospital



in Umea, and the other half were from the Neurological ward and Outpatient Clinic of Sabbatsberg Hospital in Stockholm. Age ranges were 60-76 (Mean = 68.31). The average age of onset of disease was 59.75 years, and the mean duration of illness 8.19 years, with a range from 2

that of Experiment 2. The difference was at retrieval: Free recall and cued recall tests were changed to recognition and sentence-completion test. The lists of Experiment 2 were used as to-be-remembered items.

Procedure: The procedure for the presentation

Table 6:

Mean proportion of correctly remembered items as a function of groups of subjects, encoding conditions, and type of test in Experiment 3.

<u>Parkinson group</u>	<u>Hit rates</u>	<u>False alarms</u>	<u>H - F</u>
<u>SPT-well integrated</u>			
M	.84	.21	.63
SD	.14	.18	
<u>SP-poorly integrated</u>			
M	.73	.04	.69
SD	.26	.08	
<u>VT-well integrated</u>			
M	.64	.15	.48
SD	.29	.17	
<u>VT-poorly integrated</u>			
M	.45	.03	.42
SD	.29	.07	
<u>Control group</u>			
<u>SPT-well integrated</u>			
M	.88	.16	.72
SD	.18	.20	
<u>SP-poorly integrated</u>			
M	.75	.08	.67
SD	.22	.11	
<u>VT-well integrated</u>			
M	.80	.26	.54
SD	.25	.25	
<u>VT-poorly integrated</u>			
M	.69	.05	.64
SD	.26	.10	

to 16 years. The characteristics of the PD patients are shown in Table 5.

The control subjects were selected from the same population (half from the city of Umea, and the other half from the city of Stockholm) with regard to age and education through the database information. Age ranges were 60-76 (Mean = 68.13). The controls had no history of neurological or psychiatric disease. It should be noted of the parkinsonian and control subjects participated in the previous experiments.

Note that the two groups were not different with respect to the vocabulary test (PD patients = 22.63 and controls = 25.18) ($P < .10$).

Design and materials: The design was similar to

of study list was the same as that used in Experiment 2. The main difference between Experiments 2 and 3 was at test. In Experiment 2, the first test was free recall and the second test was cued recall, whereas, in Experiment 3, the first test was recognition and the second test was sentence-fragment completion. At recognition, the subjects were asked to recognize half (24) of the SPTs and VTs used in the study list (i.e., old items) mixing with the same number of distractors (i.e., 24 new items); the new items were selected so as to be similar to the old items (e.g., speak to the phone, talk to the microphone; turn the flower, rotate the rose). The old and new items were randomly presented and counterbalanced across the subjects. The items were shown one by one to the subjects



for a yes-no decision, whether the items had been presented in the study list. The second test was the sentence-completion test in which the subjects were shown verb cues and were asked to say the first noun coming to mind. To avoid any contamination between the first and the second's test, the other half of SPTs and VTs (not used in the recognition test) were used in the sentence-completion test. Again, the old items were randomly combined with the same number of new items. It should be noted that the two halves of old items used in the first and the second test were counterbalanced across the two test conditions.

Results

Recognition data: The proportion of items correctly recognized and false alarms are shown in Table 6. A $2 \times 2 \times 2$ (Group x Encoding x Item) analysis of variance performed on the Hit rate-False alarm (H-F) data produced no between-group difference and no Group x Encoding interaction ($P > .10$). Type of encoding was significant [$F(1, 30) = 16.30$, $MSe = 1.73$, $P < .001$], but type of item was not significant ($P > .80$). The interaction of Group x Encoding x Item was marginally significant [$F(1, 30) = 3.63$, $MSe = 43.69$, $P = .07$]; reflecting that, for the control subjects, the enactment was more pronounced for the well-integrated items than for the poorly integrated items, whereas, for the PD patients, the opposite pattern was the case.

It should be noted that there was no difference between the groups with respect to the false alarm data ($P > .40$). There was also a marginal significant effect for the Group x Encoding x Item ($P = .05$); For the PD patients, there was more false alarms for SPT/Well-integrated items than for VT/Well-integrated items, whereas the opposite was true for the control subjects.

Since d' represents a measure of memory sensitivity for yes-no recognition test, the values of d' were obtained from hits and false alarms for the Parkinsonian and control subject (e.g., Ratcliff, 1978; Hirshman, 1995). The same ANOVA as for hit-false alarm data was conducted for the d' data. The same pattern of results was obtained, except that the difference between two groups was marginally significant [$F(1, 30) = 3.72$, $MSe = 1.88$, $P = .06$] and the Group x Encoding x Item interaction was significant [$F(1, 30) = 4.77$, $MSe = 1.03$, $P < .05$].

Sentence completion data: The priming values

were calculated by subtracting the baseline values from the studied items (old items) values. A $2 \times 2 \times 2$ (group x Encoding x Item) analysis of variance was performed on the priming data. The analysis revealed no between-group difference ($P > .80$). Type of encoding was not significant ($P > .20$), but type of item was significant [$F(1, 30) = 8.92$, $MSe = 2.85$, $P < .01$]; there was more priming for well-integrated items than for poorly integrated items. Group x Encoding x Item interactions were not significant ($P > .70$). There was only a tendency effect for Encoding x Item interaction [$F(1, 30) = 3.42$, $MSe = 1.01$, $P = .07$], reflecting that the level of integration affected priming more for VTs than for SPTs.

It should be noted that there was no between-group baseline difference ($P > .90$) and no interaction effect was found for the baseline data.

Although the overall data of recognition and priming showed no between-group difference, there was a tendency difference for recognition data according to the d' valued. More specifically, the Group x Encoding x Item interaction showed that the benefit of the enactment for poorly integrated items was more pronounced for the PD patients than for the control subjects, whereas the enactment effect for well-integrated items was more pronounced for the controls than for the PD patients. This will be discussed further in the next section.

Discussion

In all three experiments the most notable finding is how closely PD patients resemble control subjects in their memory performance. We examined both encoding and retrieval variables to search for a memory deficit in PD patients. However, none of the encoding or retrieval variables was generally different for the PD patients than for the controls. Although memory performance of PD patients was slightly lower than that of controls (in Experiments 2 and 3), the differences were not reliable to indicate an impairment in memory associated with Parkinson disease. Over a range of measures and materials parkinsonian memory appears quite normal. There are about the same difference, relative to controls, between nonenacted (verbal) and enacted (action) events, and between well- and poorly integrated items. They show the similar enactment and similar integration effects at encoding as controls. The overall enactment effects were: in Experiment 1:



.26 and .25; in Experiment 2: .14 and .19; in Experiment 3, at priming: -.04 (negative enactment effects) for the PD patients and the controls, respectively. The overall integration effects were: in Experiment 2, .39 and .38; in Experiment 3, at recognition (H-F data), .01 and .03, at priming, .16, for the PD patients and the controls, respectively. When both enactment and integration variables were combined, compared to no enactment and poor integration, the overall effects were: in Experiment 2, .54 and .57; in Experiment 3, at priming, .12 for the PD patients and the controls, respectively. In general, These results show that encoding support does not differently improve memory performance for parkinsonian patients, and they have a normal encoding. However, especially at recognition test, there were some specific differences. We return to this point later.

It should be noted that, in Experiment 1, there were 24 items as TBR items, whereas, in Experiment 2, there were 48 items. A comparison between these two experiments show that, for both groups from Experiment 1 to Experiment 2 there was the same drop in the free recall test (.08 and .06 for the PD patients and controls, respectively) and the same increment in the cued recall test (.08 and .13 for the PD patients and controls, respectively). These results also show that the list length has the same effect on both groups. List length affected the free recall tests negatively, whereas it affected the cued recall tests positively. The former effect was more associated with poorly integrated items, whereas the effect was more associated with well integrated items.

The comparison between the present study (Experiment 2) and the Kormi-Nouri (1995) study (Experiment 3) showed that there is a larger enactment effect for younger subjects (age mean = 21.75) than for the elderly subjects (both PD patients and controls) (.26 versus .17). In the Kormi-Nouri (1995) study, in free recall, the effect of enactment was more pronounced for well-integrated items than for poorly integrated items, whereas in cued recall, the enactment effect was more pronounced for poorly integrated items than for well-integrated items. In the present study, the controls showed exactly the same pattern of data, but PD patients did not show a better efficiency of enactment in cued recall of poorly integrated items. Furthermore, the Kormi-Nouri and Nilsson (1998) study showed that, in recognition, the enactment effect was more pronounced for well-integrated items than for poorly integrated items. Again, in the

present study, the same pattern of data was observed for the controls, but PD patients showed the opposite pattern: the enactment effect was more pronounced for poorly integrated items than for well-integrated items. Thus, for poorly integrated items, there is a differential enactment effect in cued recall and recognition test for PD patients, relative to controls: a larger enactment effect for cued recall of poorly integrated items (shown by both young and elderly control subjects) was not shown by PD patients, whereas a larger enactment effect for recognition of poorly integrated items (not shown by both young and elderly subjects) was shown by PD patients. These findings indicate that cognitive support provided in different encoding and retrieval conditions act differently for PD patients than for controls.

More specifically, the various encoding and retrieval conditions used in the present experiments provide different degrees of cognitive support. With respect to the main encoding manipulation made, enactment provide more cognitive support than verbal encoding by means of rehearsal. At retrieval, there is more cognitive support provided in cued recall and recognition than in free recall. Thus, the retrieval aid provided by the cues in cued recall and the copy cues in recognition after enacted encoding should be the most supportive conditions and free recall after non-enacted encoding should be the least supportive condition.

A comparison between PD patients and controls for the least supportive condition reveals no performance difference (free recall in Experiments 1 and 2), although due to floor effects for both PD patients and controls we can not draw a proper conclusion in this respect. For one of the most supportive conditions, cued recall of enacted items in Experiment 2 there is nominally a lower performance for PD patients, irrespective of type of items. This difference is largely for poorly integrated items and relatively small for well-integrated items, perhaps due to ceiling effects for these later items. For the other optimally supported condition, recognition after enacted encoding in Experiment 3, a lower performance was obtained for PD patients than for controls, for well-integration items but not for poorly integrated items. All in all, this pattern of data suggests that PD patients are less well apt than control to utilize the cognitive support provided by the cues in cued recall and the copy cues in recognition.

The cued recall data in Experiment 1 deviate



from this pattern; there was no difference between PD patients and controls. If anything, there was a slight advantage for PD patients. No explanation for this deviation in data pattern is readily available. It might be the case that Experiment 1 was in general too insensitive because of the relatively short list length.

The most profound difference between PD patients and controls in ability to utilize cognitive support was found in recognition after non-enacted encoding in Experiment 3, especially so for poorly integrated items. This might be interpreted as a result showing that the ability to utilize the cognitive support provided by the copy cues in the recognition test is most vulnerable after an effortful, non-supportive encoding. Adding up these impressions of the data, it may be argued that PD patients have greater difficulties than controls to utilize cognitive support provided at test, especially so after a demanding, effortful, non-supportive encoding.

The interpretation of these data in terms of greater difficulties to utilize cognitive support for PD patients is compatible with interpretations of memory data in other studies comparing advantaged and potentially less advantaged

subjects. For example, Craik, Byrd and Swanson (1987) demonstrated that low-verbal old adults were less efficient than high-verbal old adults in utilizing cognitive support. In another study, Herlitz, Hill, Fratiglioni and Backman (1995) found that supported tasks like recognition of faces and words, and cued recall of organizable words were better discriminators between normal adults with mild dementia than were test conditions using free recall. Similarly, Amall, Herlitz, Fratiglioni, Almkvist and Backman (1997) demonstrated that supportive memory tasks were more salient predictors of incident dementia than memory tasks that offer less supportive encoding or retrieval conditions. The same data pattern has also been demonstrated in ongoing research on the effect of genetic markers on episodic memory. Nilsson et al. (2000) demonstrated that e4 allele of Apolipoprotein E revealed the strongest negative effect in a non-demented sample in supportive memory tasks. The e4 allele of ApoE is previously known as a risk factor for Alzheimer's disease (Corder et al., 1993).

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