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Amnesic Aphasia in Patients of Cerebrovascular Accident- A Hospital Based Study from Kashmir Valley.

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Abstract:
Amnesic aphasia is a disorder in which a person feels difficulty in retrieving words or naming objects/things, or expressing oneself. The inability varies from patient to patient or may even vary within the same patient. Cerebrovascular accidents or stroke is a major cause of aphasia and the amnesic aphasia also called anomia is a form of aphasia found in these patients. We, in this study aimed to find the presence of anomia in aphasia due to stroke in patients who are natives of Kashmir (Kashmiri speakers) and also see the severity of anomia in the same. We used Philadelphia Naming Test and Action Naming Test for the study. The results showed the varied degree of anomia in stroke patients and the severity varied from patient to patient. The noun retrieval was more severely affected as compared to the verb retrieval. The severity decreased with the increase in time since stroke. Our study can help neurologists to better understand the aphasia as a result of stroke and help in planning better treatment strategies for effective management of the problem.

Introduction:
Anomia is a naming impairment, a neurological deficit characterized by the inability to retrieve intended words from one's mental lexicon. The literal meaning of anomia is 'without name'. It is also described as a language dysfunction in which the subject is not able to recall the names of people, events, objects etc. When the patient fails to find the exact word, he/she may substitute some other alternative word for the intended word. If this alternative word is similar to the intended one, or from the same semantic field, it is called semantic paraphasia, if the word is completely different then it is called verbal or global paraphasia.[1] Sometimes, the patients may also describe the objects, explain their uses, functions or appearance. This act of describing the features of an object without saying the exact word is known as circumlocution. Anomia occurs due to damage to the language dominant areas of the brain, occurring as a result of neurological disorders like stroke, traumatic head injury, brain tumour etc. However, stroke is the most common cause. A stroke or cerebrovascular accident is a brain dysfunction in which the blood supply to a part of the brain is blocked. The diagnosis of stroke is done by various brain imaging techniques like computed tomography (CT) scans and magnetic resonance imaging (MRI). The impairments occurring as a result of stroke vary in terms of severity which is determined by the severity of stroke and its location in the brain. Stroke can have a devastating effect on one's ability to communicate. After suffering from stroke one finds it difficult to retrieve the names of even simple things, a disorder known as anomia.

"After motor problems, language function impairment (aphasia) is one of the most common and devastating cognitive deficits caused by stroke lesions". [2,3]. Anomia is the most common symptom of aphasia and the people suffering from anomia also have other symptoms of aphasia. It is estimated that one-third of people with vascular cerebral lesions suffer from aphasia [4]. Thus, anomia is a characteristic of stroke and aphasia. The 'cerebral stroke patients' in this study will therefore refer to 'post-stroke aphasics'. The right cerebral hemisphere controls temporal and spatial relationships, analysis of non verbal information and communicates emotions while left hemisphere is specialized to perform linguistic functions (in 97% of right-handed individuals). This lateralization was first of all discovered by French physicists Paul Broca and Carl Wernicke who performed autopsies on patients who had language problems. They found that those patients had problems in specific areas of left hemisphere which are named after them as Broca's area and Wernicke's area respectively.

In this study we aimed to analyze the linguistic data collected from the post-stroke aphasic patients and to find the extent (level of severity) to which anomia is prevalent among the patients of Kashmiri origin.

Methodology:

The sample for the study has been taken from Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Soura, Srinagar. The number of patients taken for the study are seven (five males and two females) and the equal number of normal controls is the same as the patients. The controls participated in this research on a voluntary basis. In the case of patients, consent was obtained from one of the patient's family members before including him/her in the study. The study was also approved by the Institutional Ethical Committee of SKIMS.

Inclusion Criteria

The inclusion criteria were as follows:

- Left Hemisphere Stroke (documented by CT or MRI)
- Aphasia (mild to moderate) as a result of stroke
- No other neurological disease
- Free from severe motor speech disorders like dysarthria/apraxia.
- Right handedness
- Monolingual native speakers of Kashmiri
- Data collection within one month from the onset of stroke

The presence of aphasia was clinically ascertained by the consulting neurologist. CT/MRI reports were also obtained from the SKIMS authorities to confirm the diagnosis of stroke.

Exclusion Criteria

The characteristics that disqualified the patients from being included in the study are as follows:

- Visual perception deficit
- Auditory comprehension deficit
- Memory loss
- Severe expressive language disorder (not even able to utter a single word as in Global aphasia)
- Cognitive dysfunctioning

The patients are also compared with normal controls, matching their age, education and gender. The controls taken for the study are healthy and free from psychological and neurological illness. They are also right-handed, monolingual native speakers of Kashmiri and are administered with the same tests as the clinical subjects.

Tests Used for the Present Study

The tests used for eliciting the data are as follows:

1. Philadelphia Naming Test (PNT): PNT was developed in the Language and Aphasia Lab of Moss Rehabilitation and Research Institute (MRRI) [5]. It was developed for studying word retrieval in clinical/non-clinical population. It consists of 175 low, medium and high frequency nouns (concrete nouns). The lexical items are

presented to the subjects in the form of pictorial stimuli (black and white line drawings) and these items fall within the subject's vocabulary prior to the onset of neurological disease or illness. "From a clinical standpoint, an important property of PNT is that it is highly correlated with measures of aphasia severity"[6]. In order to administer this test to the post-stroke aphasic patients who are the native speakers of Kashmiri, the targets of PNT are first translated into Kashmiri. The test has also been validated on a normative group of twenty-five people before using it with the patients and normal controls included in this study. The list of pictures of Philadelphia Naming Test is shown in Appendix I. The test was administered to the study subjects and later the responses were scored as per the detailed instructions given by the developers. [5]

2. Action Naming Test (ANT): ANT was designed by Obler and Albert in 1979.[7] It is similar to Boston Naming Test, but it evokes verb responses instead of nouns. It consists of 57 actions which are pictured in black and white line drawings (e.g. sitting, reading, etc). In order to adopt this test for use in Kashmiri language, these 57 action words are translated from English to Kashmiri. The test was administered manually. Like PNT, ANT has also been validated on a normative group of twenty-five people before using it with the patients and normal controls included in this study. The list of pictures of Action Naming Test is shown in Appendix II. The test was administered to the study subjects (cases & controls) and then scoring was done as per developers' protocol.

Results:

The data collected from the post-stroke aphasic patients was first presented and scored as per the guidelines of PNT and ANT respectively. This is further followed by analysis which is based on interactive two-step model of lexical access (effect of frequency and role of cues on word retrieval, severity of anomia, nature of anomic impairments, strategies used by the patients to overcome the loss of words, and noun versus verb retrieval. The patients are also compared with normal controls matching their age, education and gender.

The key to the scores on PNT and ANT is shown below:

Table 1: Key to the Scores on PNT

√	Correct
S	Semantic
M	Mixed/ phonological and semantic
U	Unrelated
N	Non words related phonologically
F	Real words related phonologically
D	Description
NR	No Response
Misc	Miscellaneous (blends, non words unrelated phonologically, picture parts)

Table 2: Key to the Scores on ANT

CWC	Correct without cue
CFS	Correct with false start
CSC	Correct with semantic cue

CPC	Correct with phonemic cue
CVCC	Correct with verbal context cue
CSP	Correct with semantic + phonemic cues
ISP	Incorrect with semantic + phonemic cues
IPC	Incorrect with phonemic cue
NR	No response

The analysis of data reveals that the pictures elicited few correct responses. The patients have word retrieval deficits as is evident from confrontational naming task. Fig.1 depicts the mean percentage of all the types of responses by all the patients on PNT.

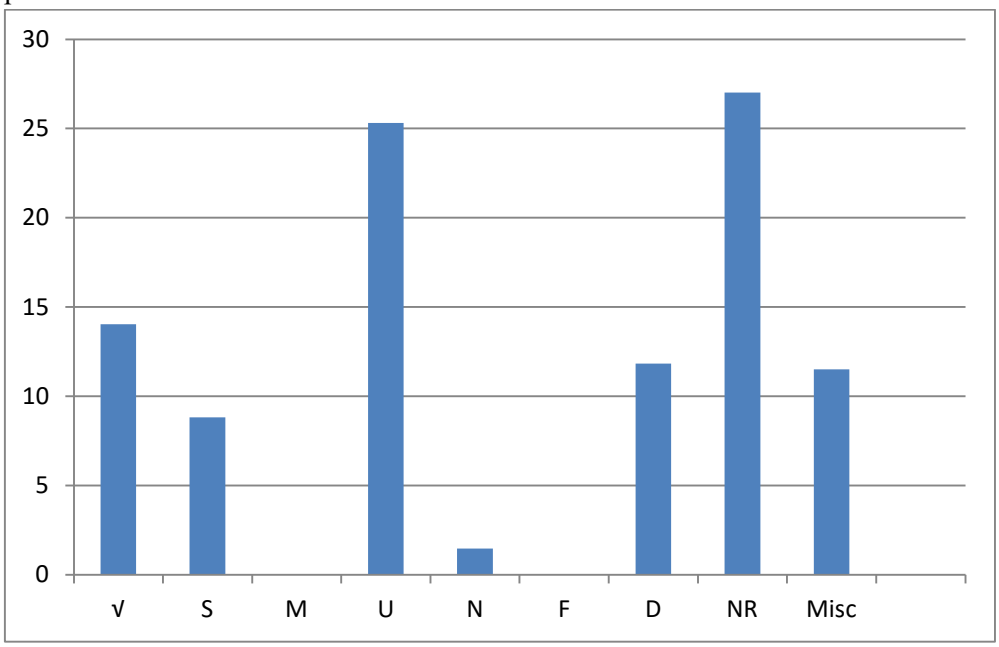

Fig. 1: Mean (%) of Responses by the Patients on PNT

As can be seen from the graph above, the two most dominant error types by the patients are 'No Response (NR)' followed by 'Unrelated (U)'. They constitute 52.31% of the total responses (27.01% and 25.30% respectively). The mean percentage of 'Correct responses (√)' is 14.04%. The two other types of errors which are less frequent are 'Description (D)' and 'Miscellaneous (Misc)' (11.83% and 11.50% respectively) followed by 'Semantic Error (S)' (8.81%). The type of error which is least frequently found among the patients is 'Non-word related phonologically (N)' which constitutes 1.46% of the total responses. However, none of the patients gave any response in the category of 'Mixed (M)' and 'Formal errors (F)'.

Comparison of Patients and Normal Controls on Philadelphia Naming Test

The controls performed significantly better in naming the targets on PNT. Fig 2 represents overall picture of the mean percentage of responses by all the patients and normal control on PNT.

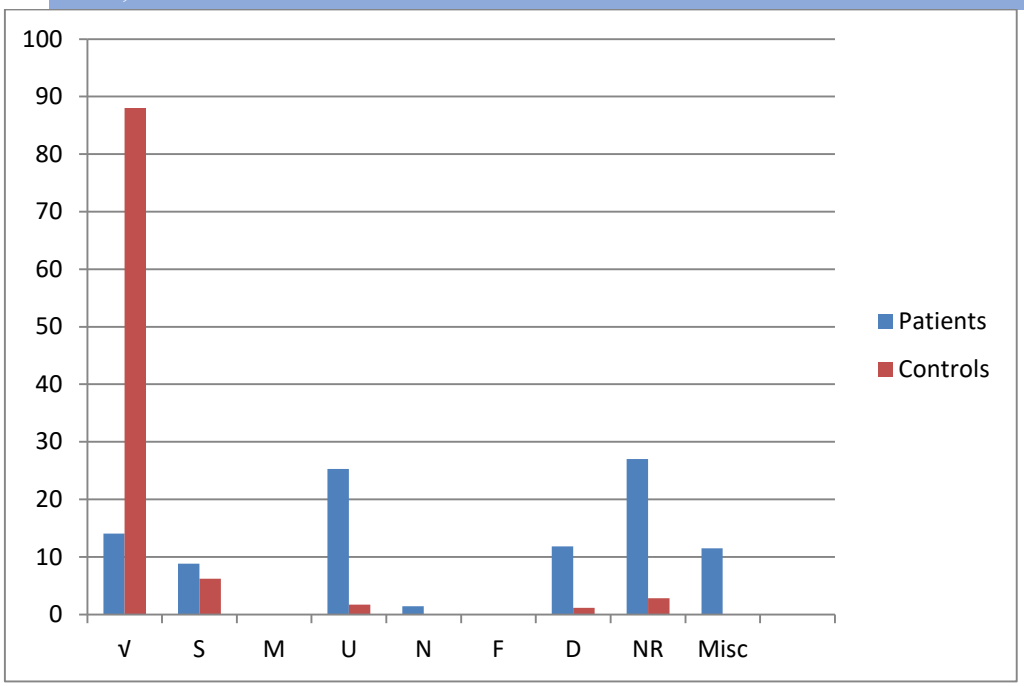

Fig. 2: Mean (%) of Responses across all the Targets by all the Patients and Normal Controls on PNT

The graph above shows that the 'Correct responses (√)' (14.04%) of patients are considerably lesser as compared to the normal controls (88%). The 'Semantic errors (S)' made by the control group constitute 6.2% while for patients they are 8.81%, 'No Responses (NR)' for control group are 2.85% and for patients they are 27.01%, 'Unrelated errors (U)'for control group are 1.71% and for patients they are 25.30%, 'Description (D)' for control group are 1.14% and for patients they are 11.83%. However, no response from the control group is found to occur within the category of 'Mixed (M)', 'Formal (F)', 'Miscellaneous (Misc)' and 'Non words related phonologically (N)'. It appears that the naming abilities of control group are intact with the result they do not produce any response in these error categories. Thus, the overall naming accuracy for controls is higher than the patients.

Analysis of Data on Action Naming Test

The analysis of data on ANT reveals that the patients have impaired verb retrieval though it is not as severe as noun retrieval. Thus, the patients performed relatively well in retrieving of verbs. The mean percentage of all the types of responses by all the patients on ANT is shown in the Fig 4.6 below:

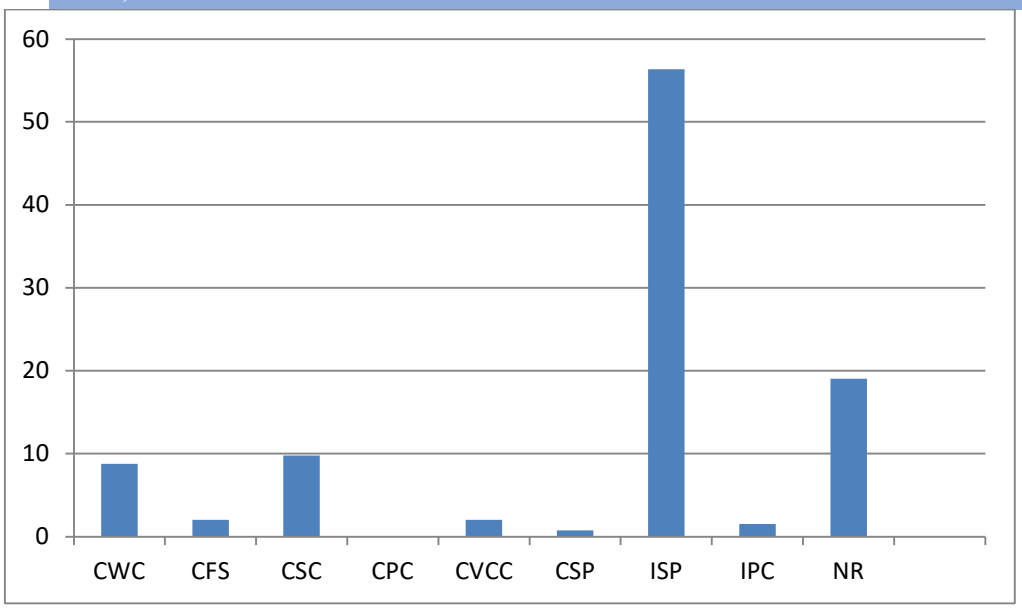

Fig. 6: Mean (%) of Responses by the Patients on ANT

As can be seen from the graph above, the most dominant response type given by the patients is 'ISP' (Incorrect with semantic + phonemic cues) which is 56.36%. Thus, the patients responded incorrectly to a large number of targets, even after giving semantic plus phonemic cues. The second dominant response type given by the patients is 'Correct response' which constitutes 23.28% of the total responses. The 'Correct response' category for the patients includes 'CWC' (correct without cue), 'CFS' (correct with false start), 'CSC' (correct with semantic cue), 'CVCC' (correct with verbal context cue) and 'CSP' (correct with semantic + phonemic cues). The 'NR' (No Responses) from the patients are 19.04% and 1.50% responses are 'IPC' (incorrect with phonemic cue). However, no response from the patients is recorded in 'CPC' (correct with phonemic cue) category which indicates that the phonemic cues do not help the patients in retrieving words from mental lexicon.

The maximum incorrect responses given by patients on ANT are found to occur at the word retrieval stage and a very small number of errors occur at the phonological stage of lexical retrieval. Thus, again, the patients on ANT (like PNT) made errors predominantly at the lexical level. The reason for this dissociation may be that the damage to the left hemisphere impairs the process of lexical selection while as the lesser effect on phonological selection may be because the cerebral component associated with it may be comparatively less impaired.

Comparison of Patients and Normal Controls on Action Naming Test

The control group performed significantly better in naming the targets on ANT. Fig 7 depicts the mean percentage of responses by all the patients and normal controls on ANT.

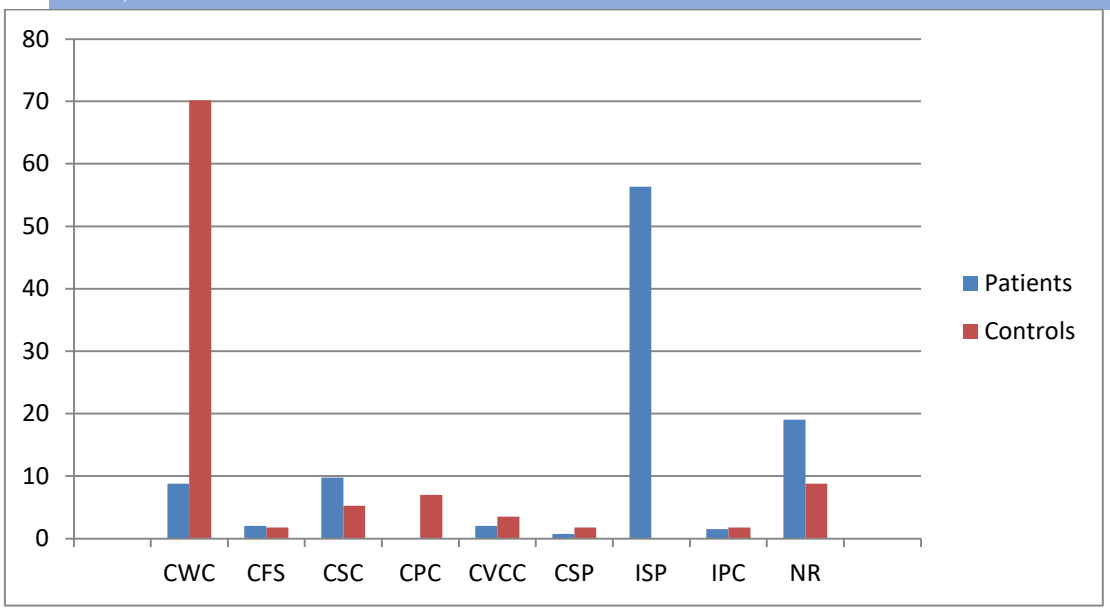

Fig. 7: Mean (%) of Responses across all the Targets by all the Patients and Normal Controls on ANT

The graph shows that the patients' 'Correct responses', which includes, 'CWC' (correct without cue), 'CFS' (correct with false start), 'CSC' (correct with semantic cue), 'CVCC' (correct with verbal context cue), 'CSP' (correct with semantic + phonemic cues) is 23.28%. On the other hand, the percentage of correct responses for the control group including 'CWC' (correct without cue), 'CFS' (correct with false start), 'CSC' (correct with semantic cue), 'CPC' (correct with phonemic cue), 'CVCC' (correct with verbal context cue), 'CSP' (correct with semantic + phonemic cues) is 89.44%, which is significantly higher as compared to patients. However, no response from control group is found to occur within the category 'ISP' (Incorrect with semantic + phonemic cues). This indicates that, as expected, the naming abilities of normal controls are significantly higher as compared to patients. On the other hand, no response from the patients is found to occur within the category 'CPC' (correct with phonemic cue). It appears that the phonemic cues alone do not help the patients in retrieving words from mental lexicon. This may be due to the fact that in such instances, patients failed to select words from lexicon in the first step of lexical retrieval and did not reach the phonological step of word retrieval. Furthermore, a general increase in patients correct responses, after being provided with semantic cues is an indicator that the semantic system after priming shows an increase in correct elicitation. On the whole, the naming accuracy for controls over all the targets of ANT is significantly higher than the patients.

Severity of Anomia

The severity of anomia varies from patient to patient (mild to severe) and this can be due to differences in the severity of brain damage and most importantly the differences in the onset of stroke. The percentage of correct responses (i.e. the severity of anomia) from all the patients is shown in Fig 10

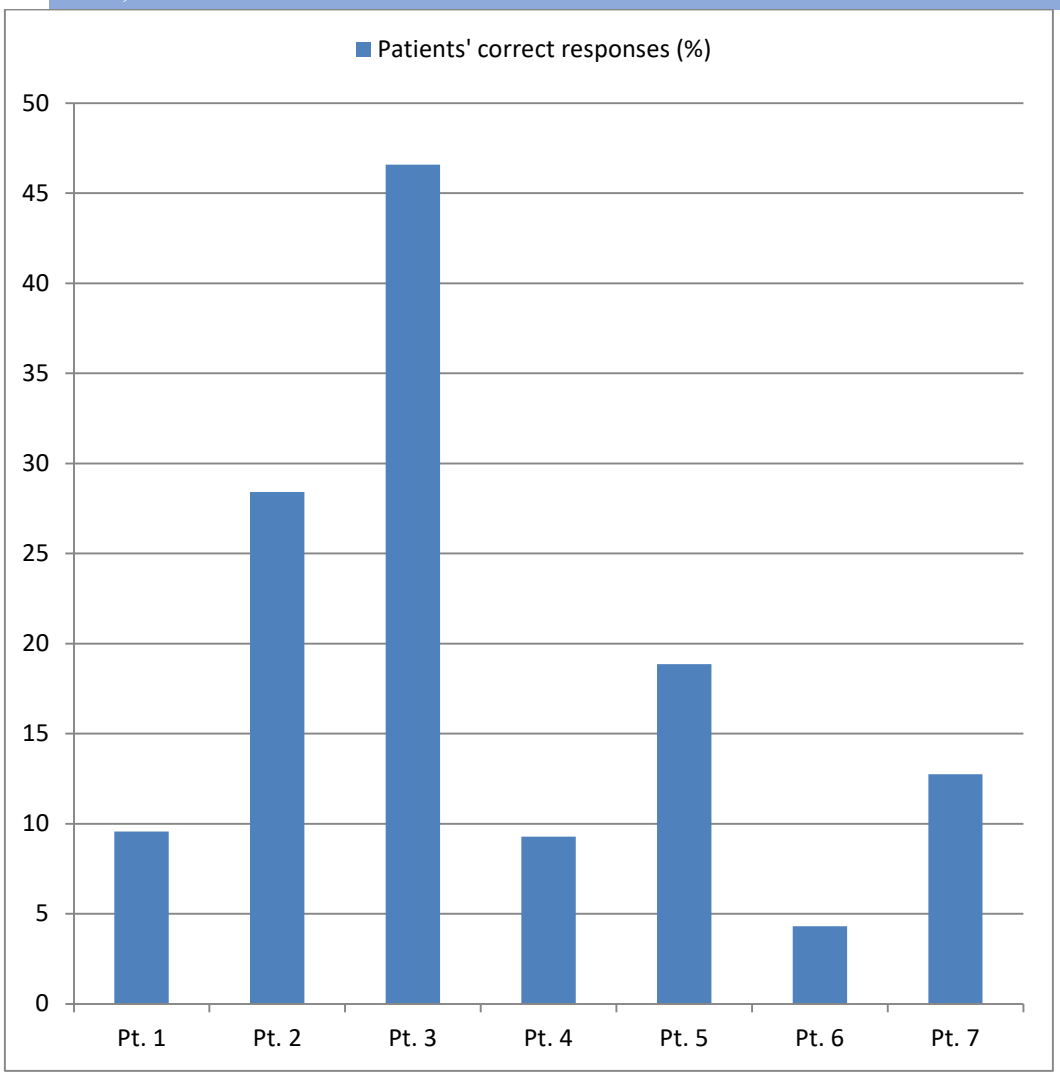

Fig. 10: Severity of Anomia of all the Patients

As is clear from the above graph, the maximum number of correct responses are given by Pt.3. Thus, among all the patients, Pt.3 has relatively mild anomia. Similarly, Pt.2 and Pt.5 have moderate anomia while Pt.1, Pt.4, Pt.6 and Pt.7 have severe anomia. This difference in severity is probably due to the differences in the onset of stroke. The data from Pt. 3 is recorded on the twenty fifth day of his stroke, Pt. 2 and Pt. 5 had fourteenth and twelfth day of stroke respectively while Pt.1, Pt.4, Pt.6 and Pt.7 had the very first or second day of stroke at the time of data collection. Thus, it can be concluded that the severity of anomia decreases with the increase in time since stroke.

Noun versus Verb Retrieval

The normal controls responded almost equally to both the categories of words (nouns and verbs). However, in the case of patients, a difference in the retrieval patterns is observed. The mean percentage of correct responses to nouns on PNT and verbs on ANT from patients as well as normal controls is depicted in Fig. 4.13 below:

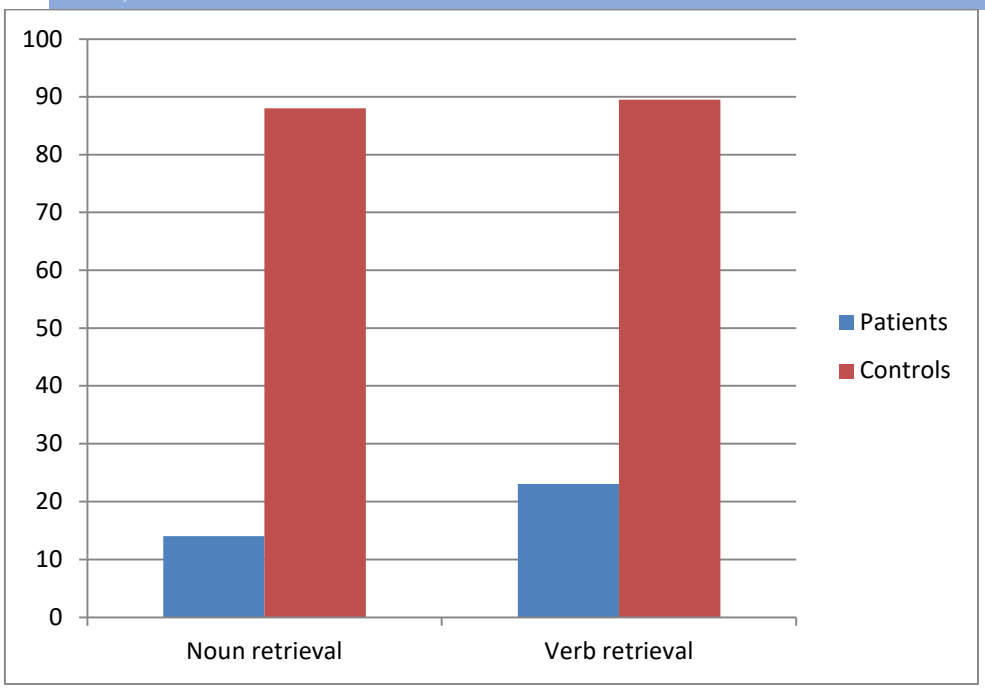

Fig. 4.13: Retrieval of Nouns versus Verbs by Patients and Controls

As is clear from the graph above, the normal controls performed well in naming nouns as well as verbs. For them, there is almost no difference in retrieving both the classes of words. The patients, on the other hand, have difficulties in naming both the categories of words and their noun retrieval is more impaired as compared to verb retrieval. Therefore, the patients have nominal anomia and averbia but nominal anomia is more prevalent as compared to averbia. The patients, therefore, exhibited differences in processing and retrieving of two grammatical categories. Thus, the result from the present study is in consonance with noun and verb dissociation studies which state that two classes of words are processed separately in separate neural structures.

Discussion:

The present research was a Neurolinguistic exploration which aimed to study anomia in post-stroke aphasic patients who were native speakers of Kashmiri. The patients were taken from the department of Neurology Sher-I-Kashmir Institute of Medical Sciences (SKIMS), Soura, Srinagar. The number of normal controls included in this study was same as the patients. Also, the patients as well as the normal controls were administered the same tests (Philadelphia Naming Test and Action Naming Test).

The study revealed that all the patients had anomia and their word retrieval deficits were evident on the confrontational naming tasks. On the other hand, the normal controls, as expected, performed equally well across both the levels of lexical retrieval. There can be a difference in processing different types of nouns as well. For example, aphasic patients with damage to left cerebrum are poor in retrieving the names of non-living things [9].

The correct responses from both the groups i.e. patients and normal controls on PNT were maximum with high frequency words followed by mid frequency, while they were minimum with low frequency words. Thus, the degree of retrieval of objects decreased from high frequency to low frequency words. Therefore, frequency appears to play an important role in word retrieval, both in clinical and non-clinical subjects, though the performance by normal controls was significantly higher at all the levels of frequency. Out of the nine response types of PNT, patients made seven types of responses in the following sequence of decreasing order-No Response (NR)>'Unrelated (U)'>'Correct (√)'>'Description (D)'>'Miscellaneous (Misc)'>'Semantic (S)'>'Non-word related phonologically (N)'. While responding to the targets on PNT, the patients made errors at both the steps of retrieval. This may be due to the fact that, non-target words and

phonemes as well as the correct ones received activation and non-target units were highly activated because they were connected to the activated target. According to the two-step interactive model of lexical access, the process of word retrieval begins as a result of activation to the semantic features of the target word. This activation extends bi-directionally throughout the network (a three level network of semantic features, words and phonemes) and it ends when the most active word gets selected. The next step i.e. the phonological step begins with a jolt of activation to the word which is selected in the first step. Again, this activation spreads throughout the network and the most activated set of phonemes are selected.

The maximum incorrect responses given by patients on ANT are found to occur at the word retrieval stage and a very small number of errors occur at the phonological stage of lexical retrieval. Thus, again, the patients on ANT (like PNT) made errors predominantly at the lexical level. The reason for this dissociation may be that the damage to the left hemisphere impairs the process of lexical selection while as the lesser effect on phonological selection may be because the cerebral component associated with it may be comparatively less impaired.[10]

The severity of anomia varied from patient to patient (mild to severe). This difference in severity was probably due to the difference in the onset of stroke. It appears that the severity of anomia decreased with the increase in time since stroke.[11]

In case of action naming, the patients sometimes failed to name the action, instead they named the agent in the picture. An interesting finding was that all the patients responded correctly to the picture depicting prayer (*Salah*) irrespective of their severity of anomia. This may be due to meaningful identification a person may derive from having a connection with both an established system and a system of beliefs which are reinforced by the community.[12]

Another important observation was the difference in noun versus verb retrieval. The normal controls performed significantly well in naming nouns as well as verbs. For them there was almost no difference in retrieving both the classes of words. The patients, on the other hand, had difficulties in naming both the categories of words and their noun retrieval was more impaired as compared to verb retrieval. Therefore, patients had nominal anomia and averbia but nominal anomia was more prevalent as compared to averbia. The patients, thus, exhibited differences in processing and retrieving of two grammatical categories. The result from the present study is in consonance with noun and verb dissociation studies, including studies from Italian populations which state that different classes of words are processed separately in separate neural structures. [13] Thus, the result from the present study adds to the literature that supports the double dissociation of nouns and verbs in separate areas of the brain.

Conclusion:

All the patients have anomia and their errors occur predominantly at the semantic level while a small number of errors occur at the phonological level. On the other hand, the performance of normal controls is considerably higher at all the levels over all targets on both the tests. The severity of anomia varies from patient to patient and this severity has a relation with the onset of stroke. The severity of anomia is found to decrease with the increase in time since stroke. The patients have impaired recall for both the classes of words; however, their noun retrieval is more impaired as compared to verb retrieval. The patients, therefore, exhibited differences in processing and retrieving of two grammatical categories. To sum up, the naming impairments outlined in this study can be a basis for further research in this area. The study has a practical importance as well, wherein identifying the loss of language elements in the patients can help health care workers in planning appropriate therapy. The study overall is another step towards understanding the organization and processing of natural language in human brain.

The sample of our study was small, we recommend large sample studies in which the degree of stroke/ cerebral hemorrhage or infarction is also taken into consideration.

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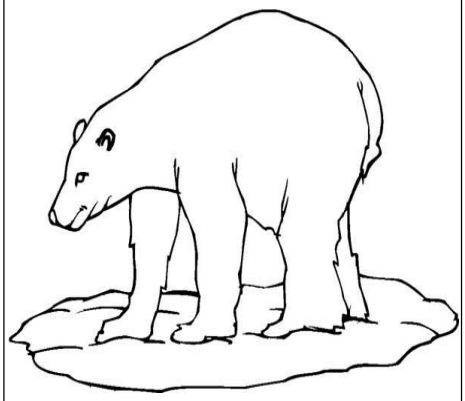
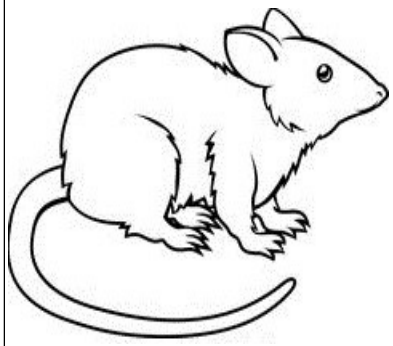
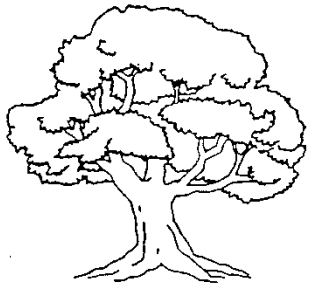
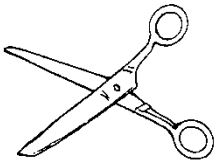
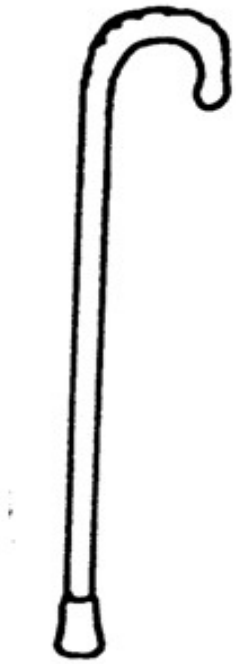
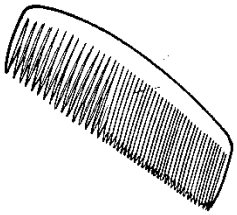
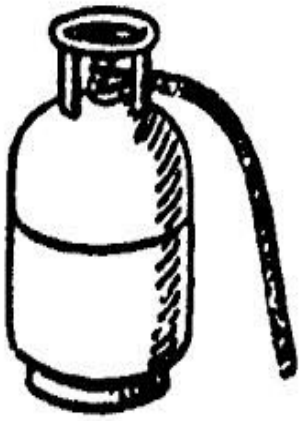
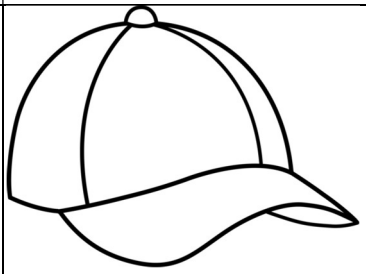
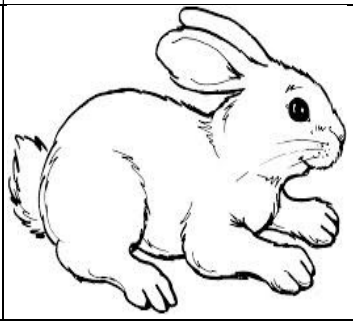
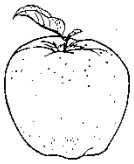
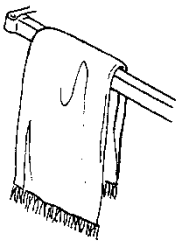
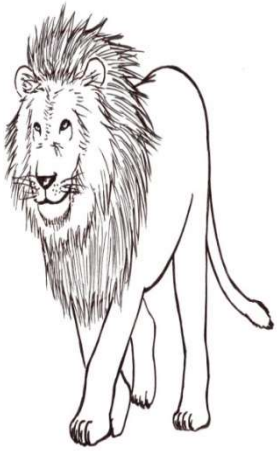
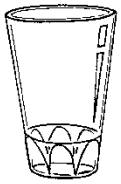
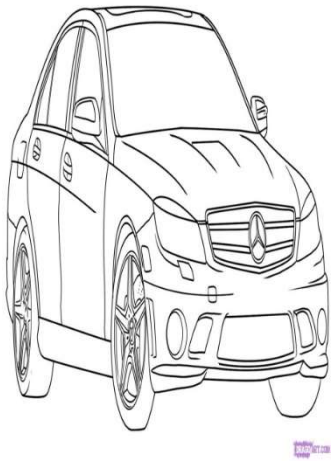
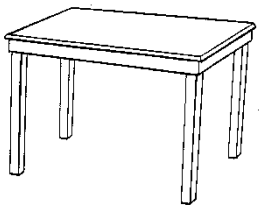
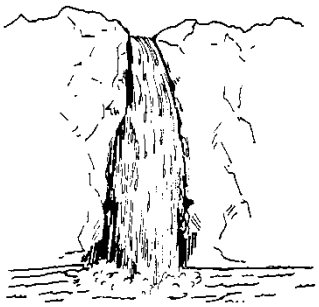
Annexure I

		2		3	
		5		6	

		8		9	
		11		12	
		14		15	

		17		18	
		20		21	
		23		24	

		26		27	
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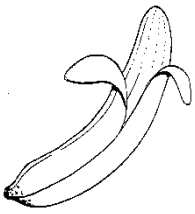
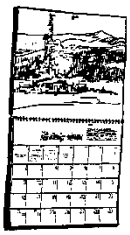
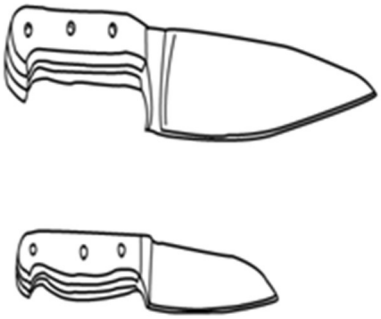
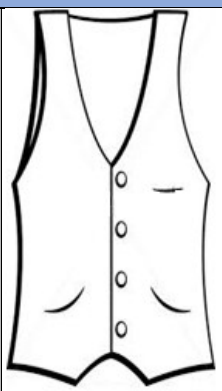
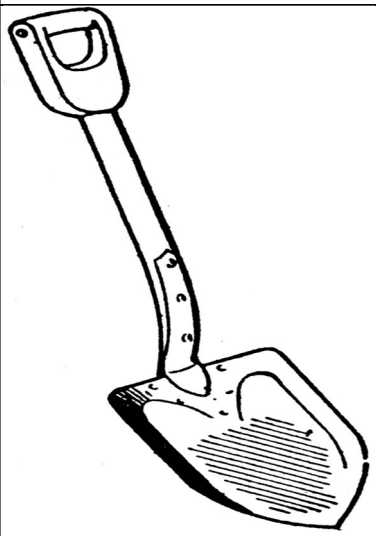
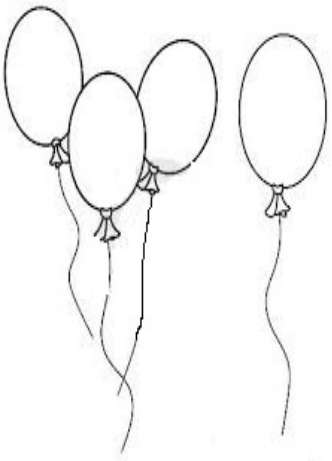
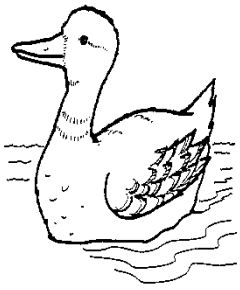
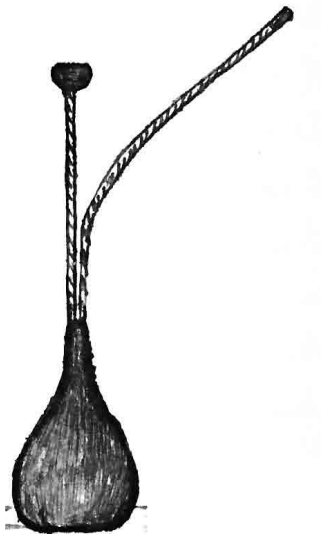
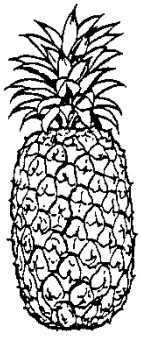
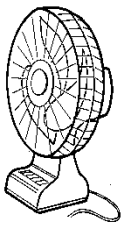
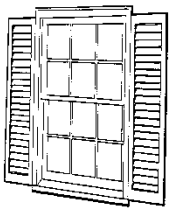
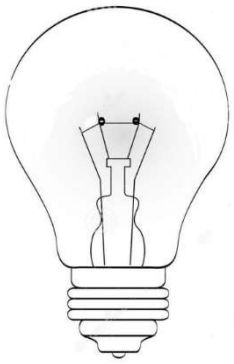
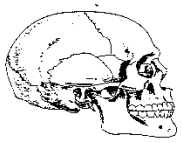
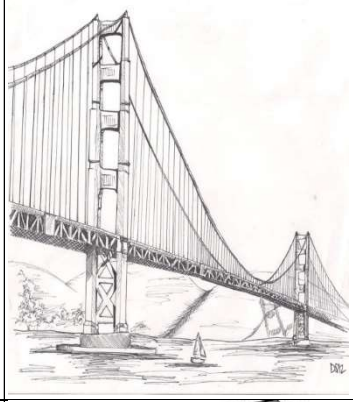
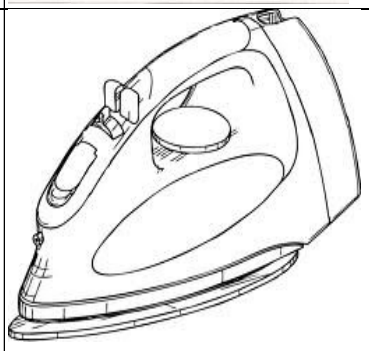
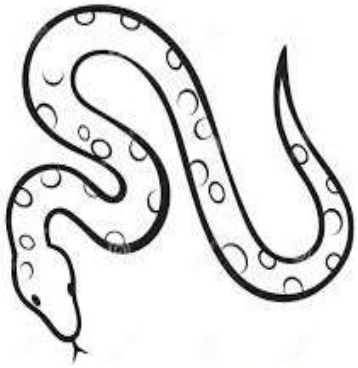
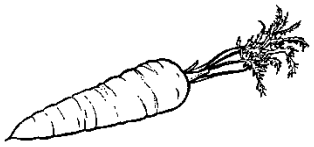
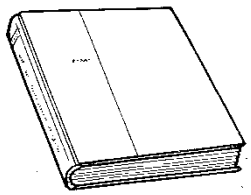
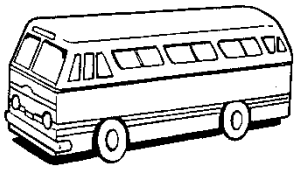
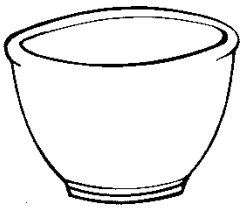
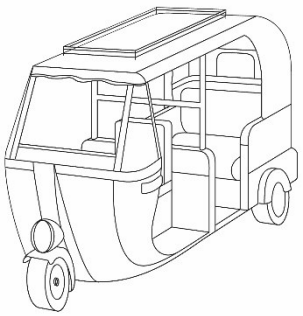
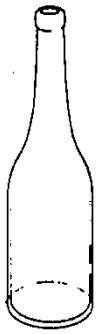
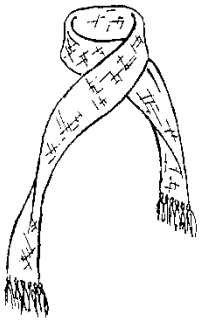
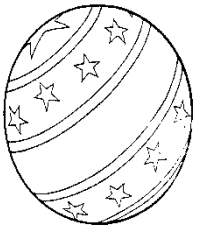
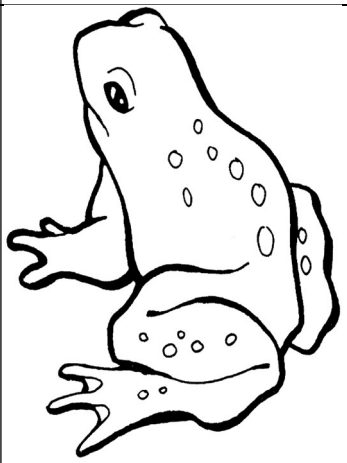
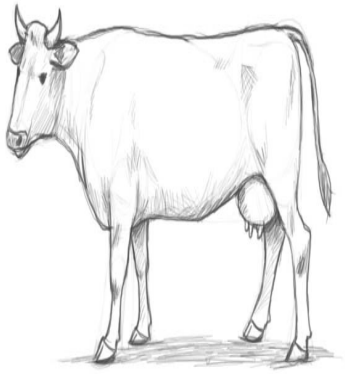
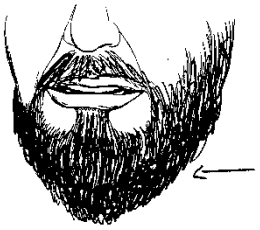
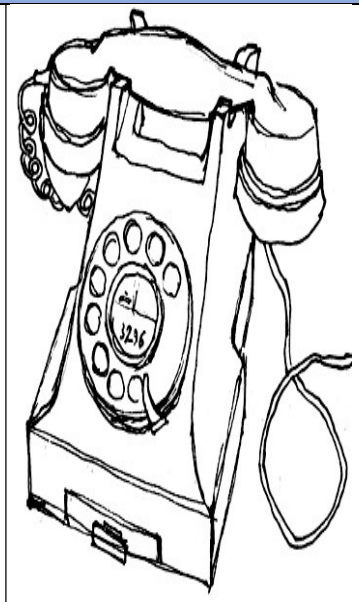
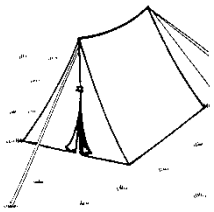
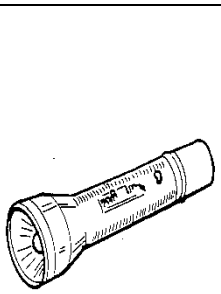
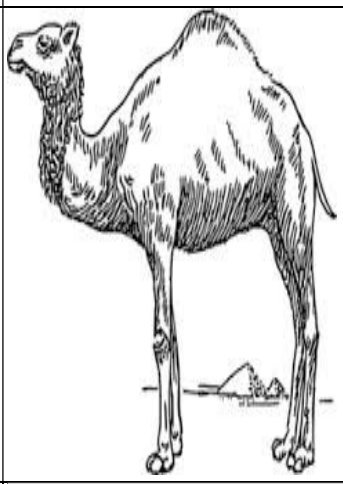
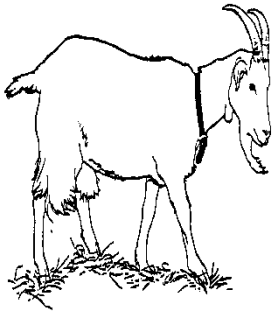
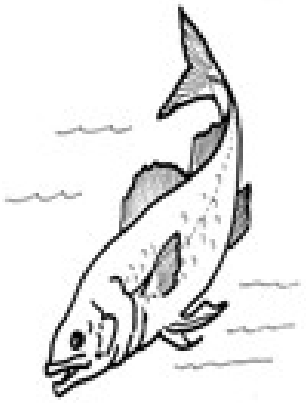
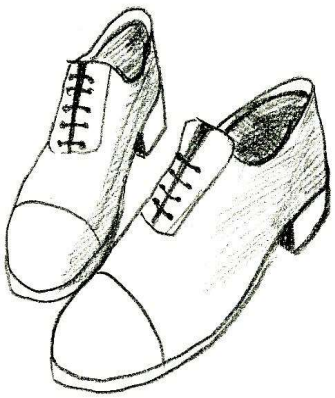
		32		33	

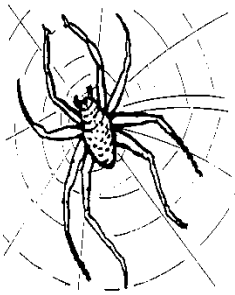
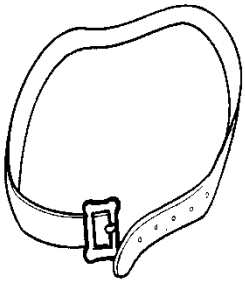
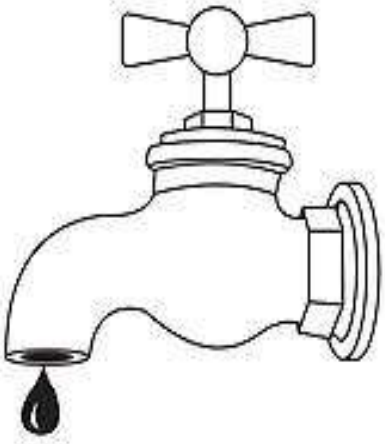
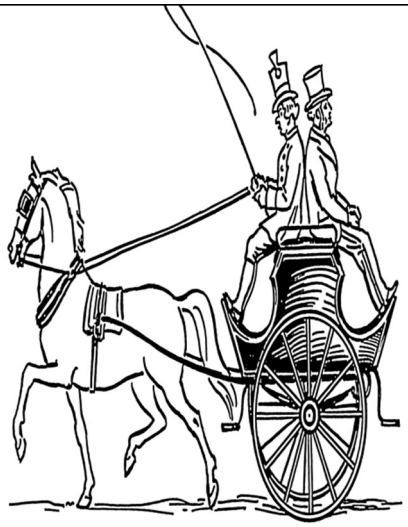
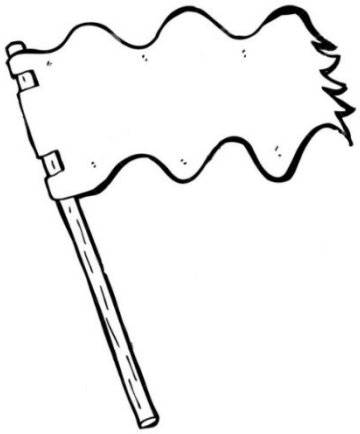
		35		36	
		38		39	
		41		42	

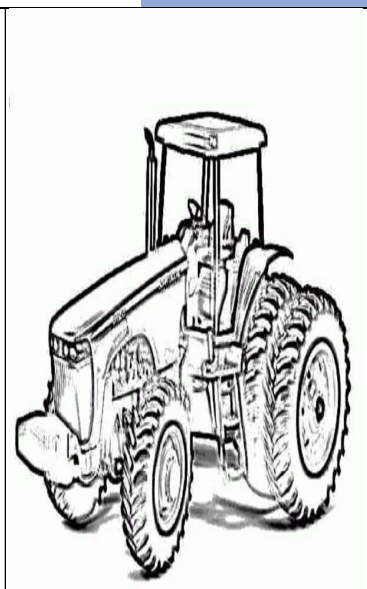
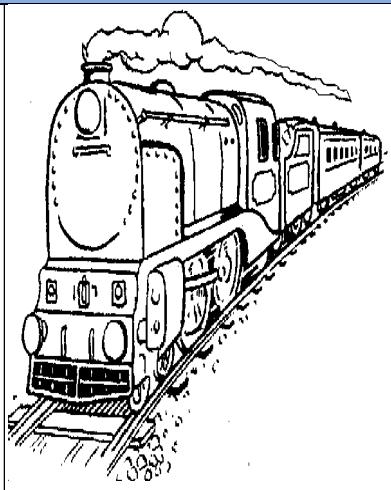
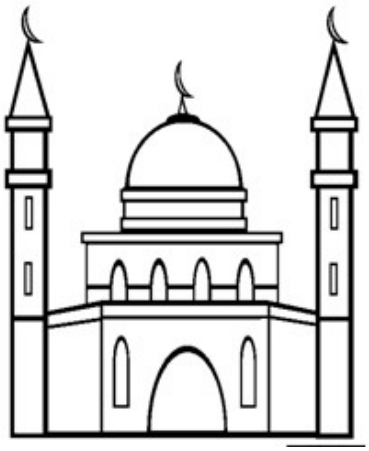
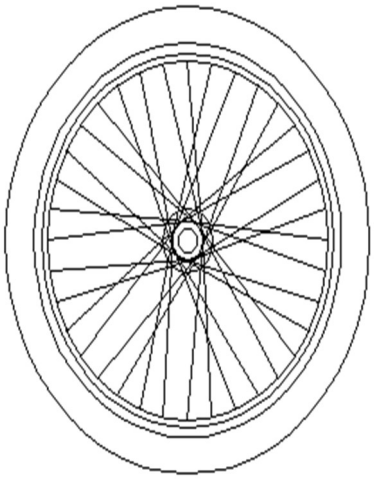
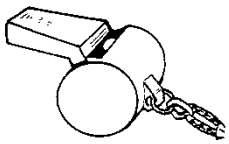
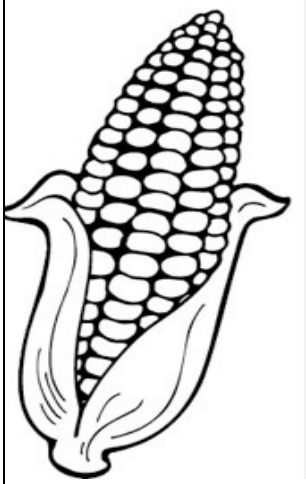
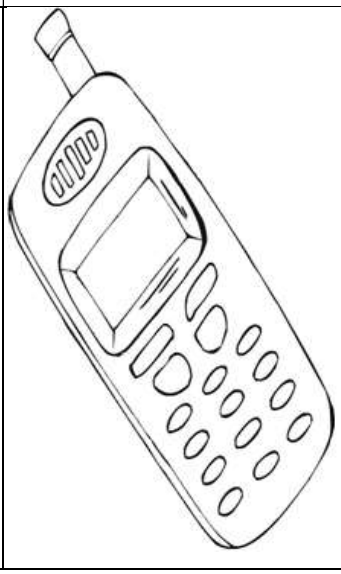
		44		45	
		47		48	
		50		51	
		53		54	

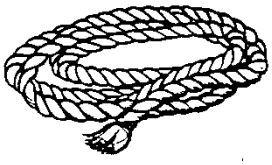
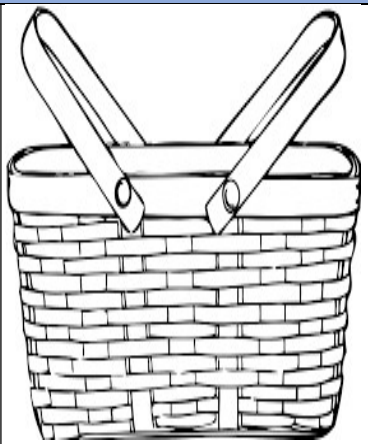
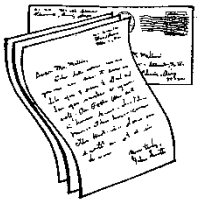
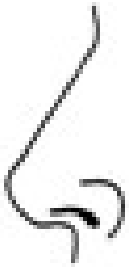
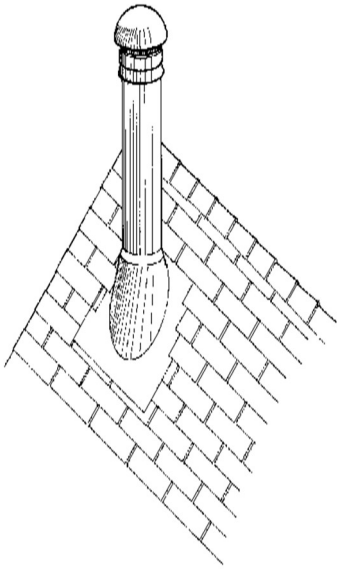
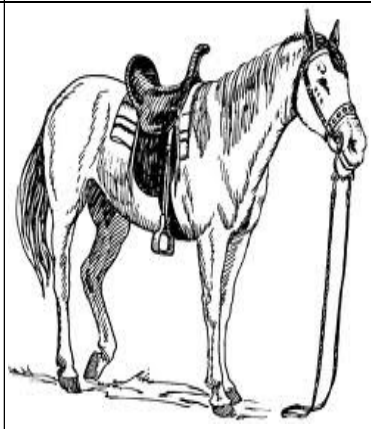
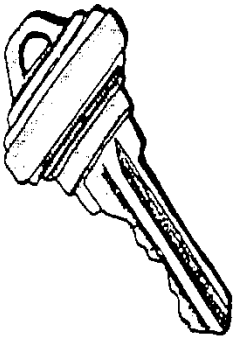
		56		57	
		59		60	
		62		63	

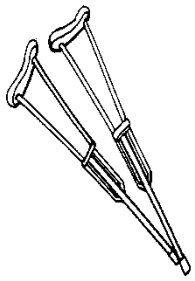
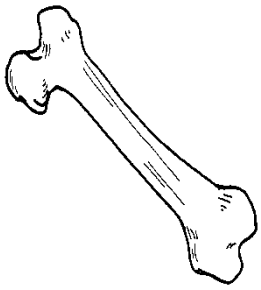
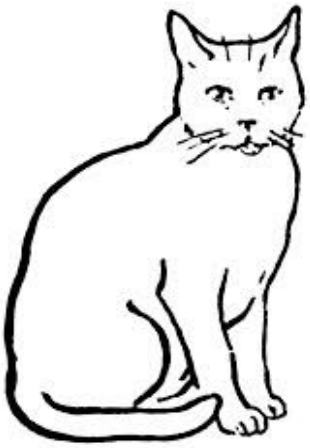
		65		66	
		68		69	
		71		72	

	74		75	
	77		78	
	80		81	

		83		84	
		86		87	

		89		90	
		92		93	
		95		96	

		98		99	
0		101		102	
3		104		105	

6		107		108	
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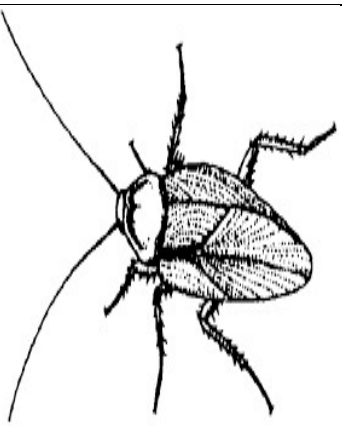
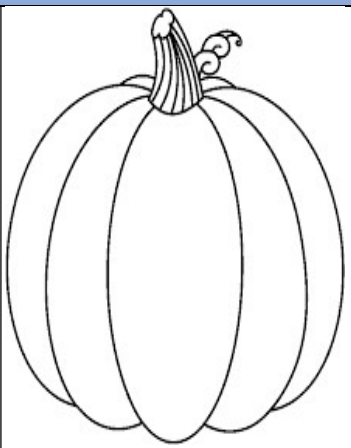
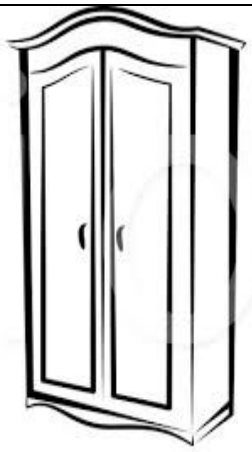
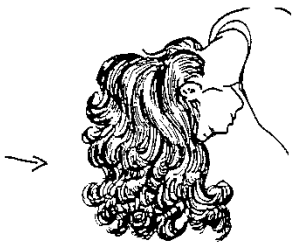
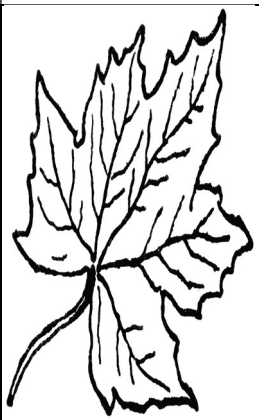
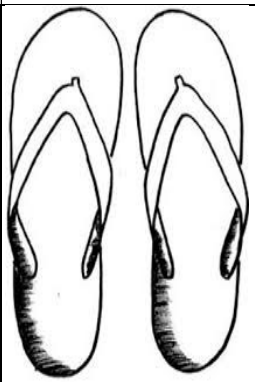
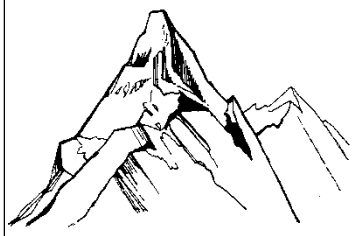
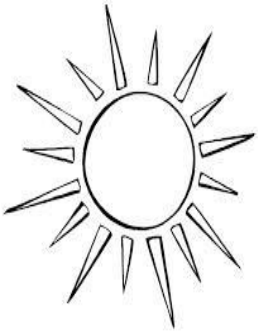
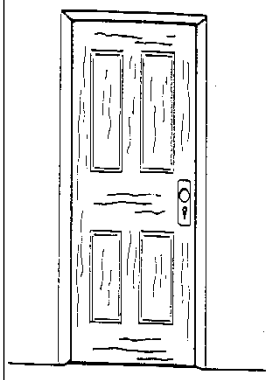
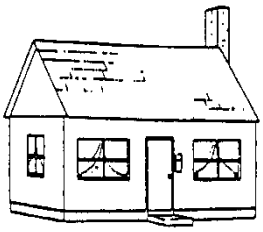
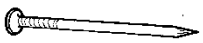
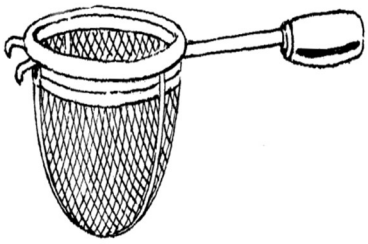
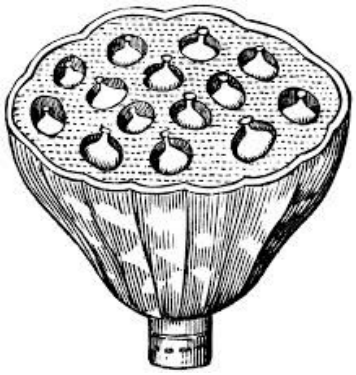
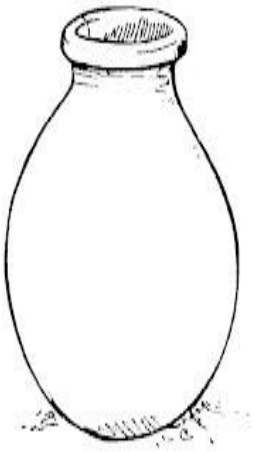
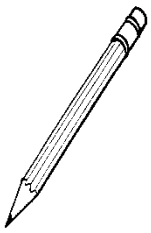
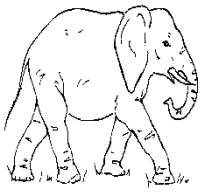
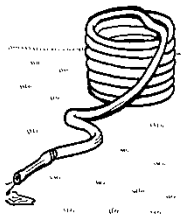
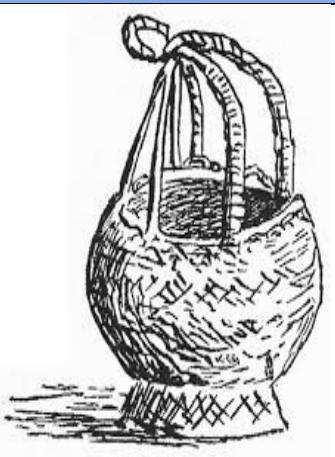
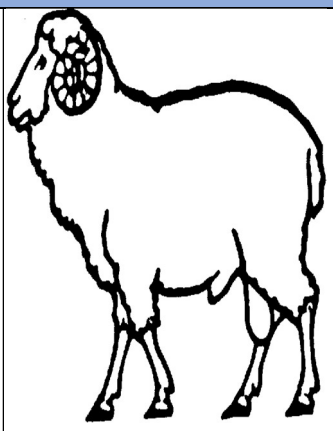
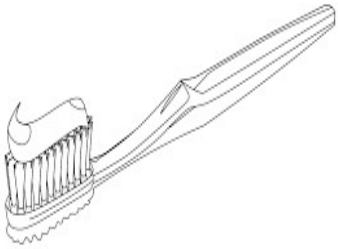
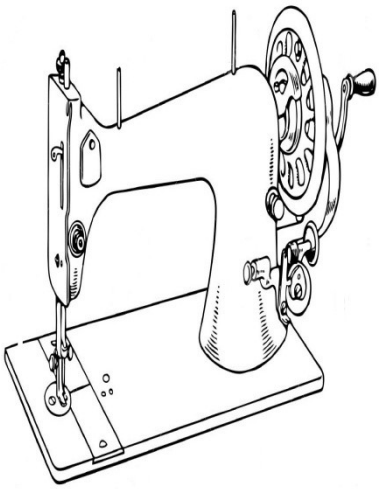
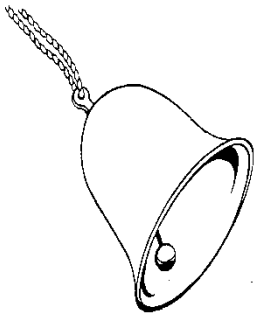
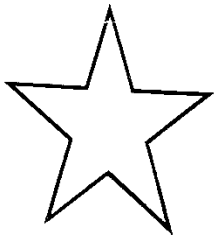
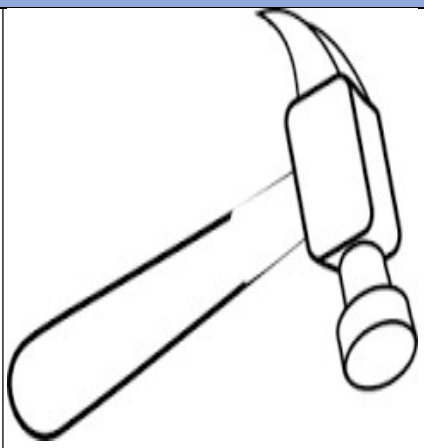
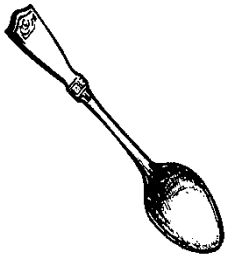
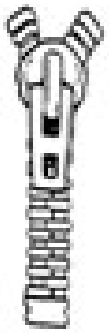
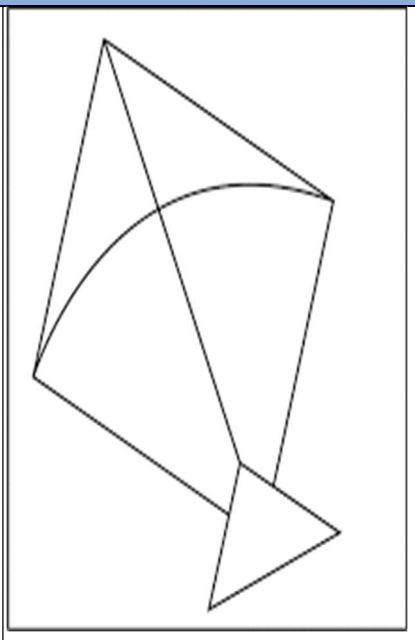
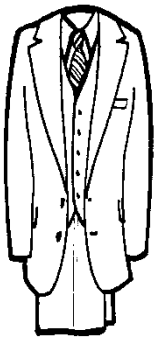
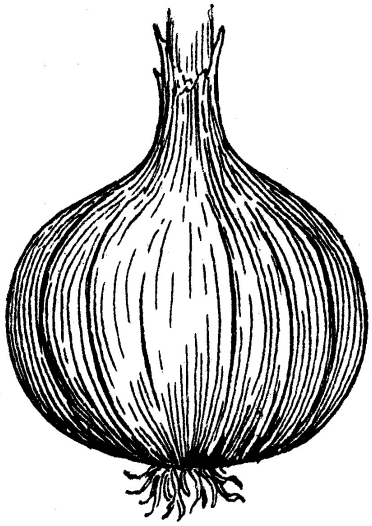
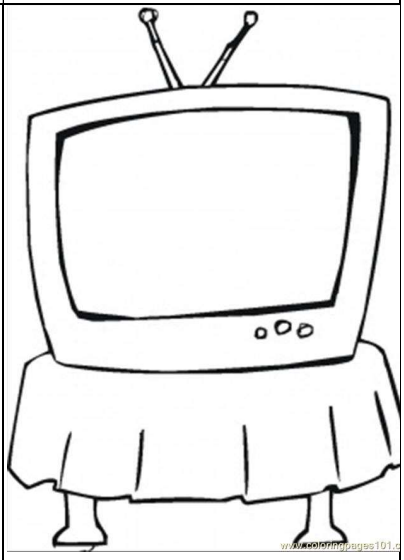
2		113		114	

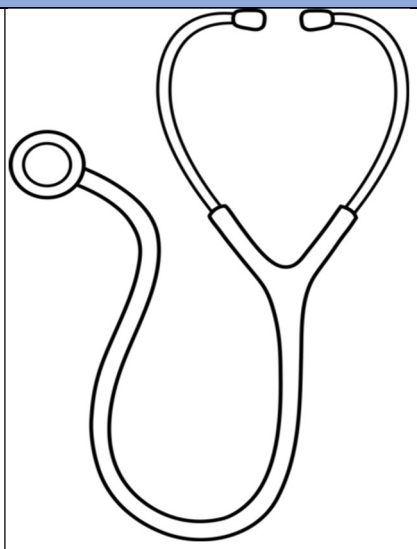
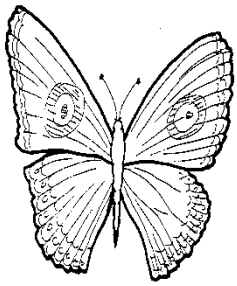
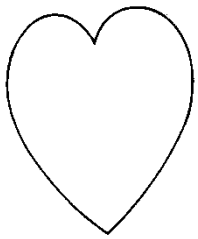
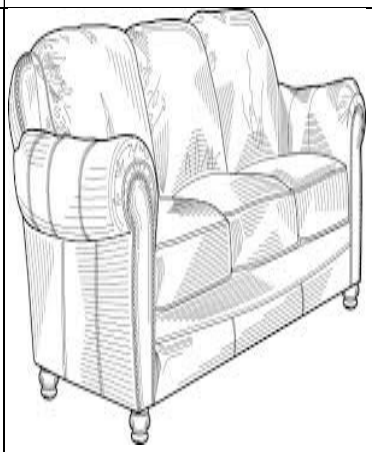
5		116		117	
8		119		120	
1		122		123	

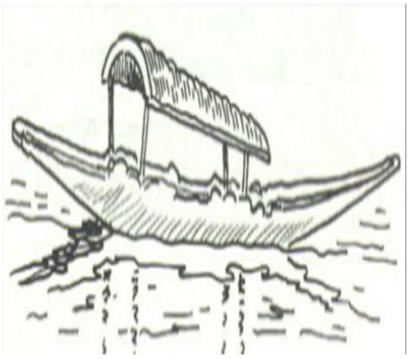
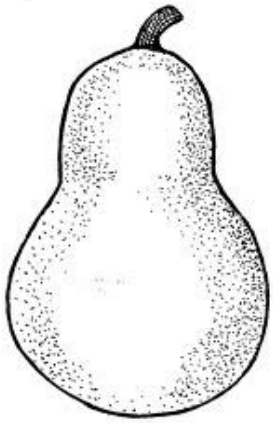
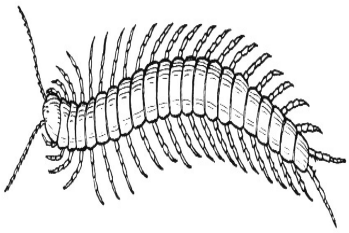
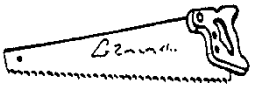
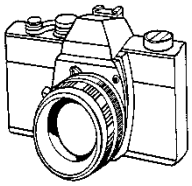
4		125		126	
7		128		129	
0		131		132	
3		134		135	

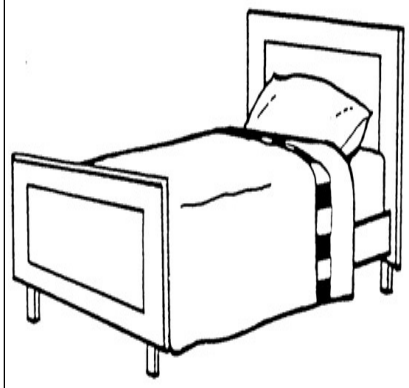
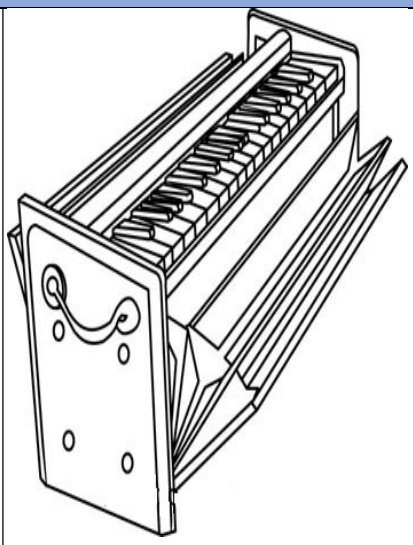
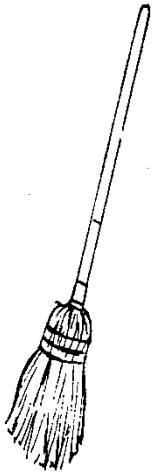
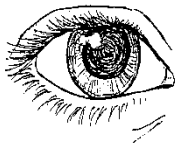
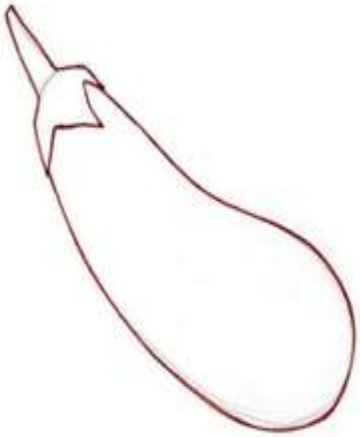
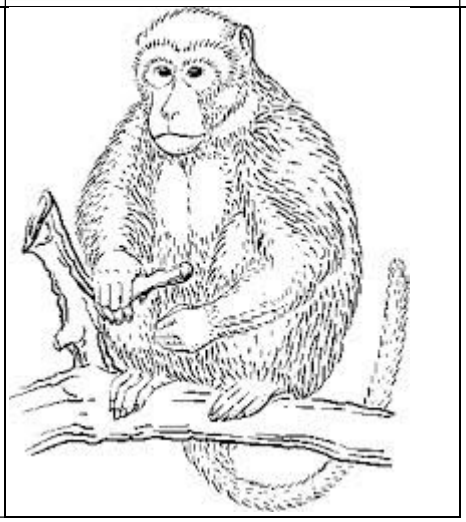
6		137		138	
9		140		141	
2		143		144	

5		146		147	
8		149		150	

1		152		153	
4		155		156	

7		158		159	
0		161		162	

3		164		165	
6		167		168	

9		170		171	
2		173		174	
5					

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Annexure II

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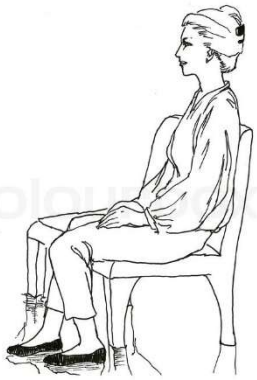
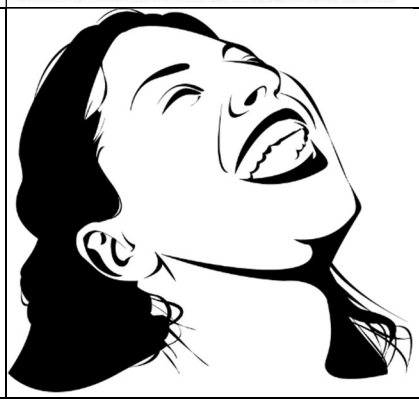
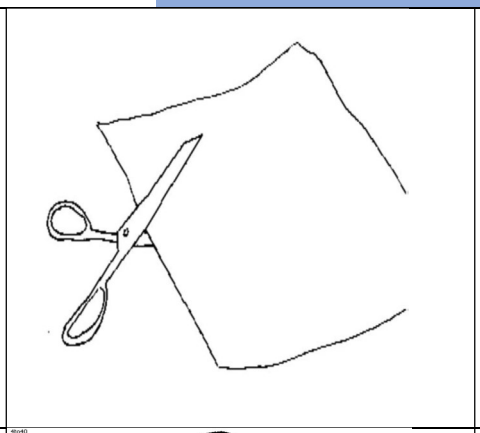
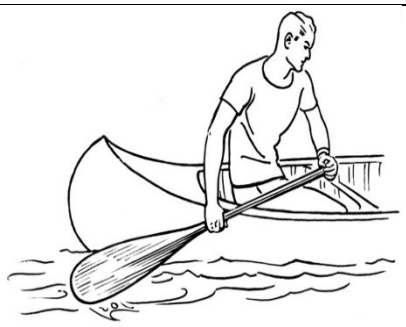
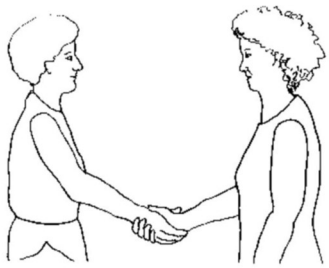
	5 	6 
	8 	9 

		11		12	
		14		15	
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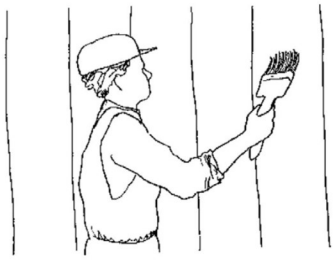
	20		21		
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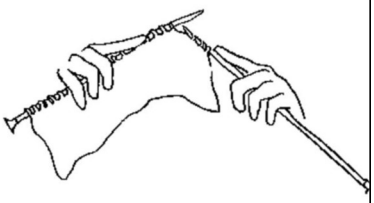
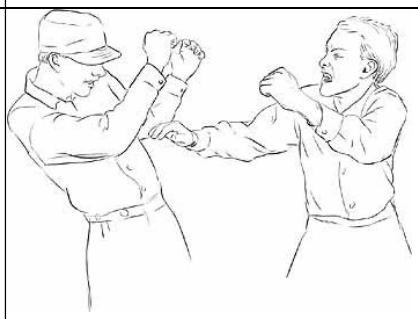
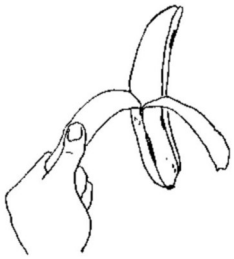
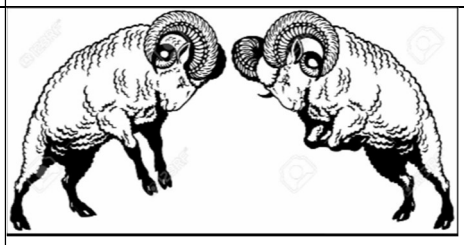
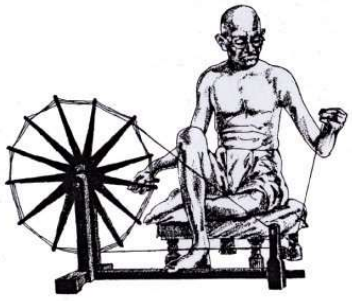
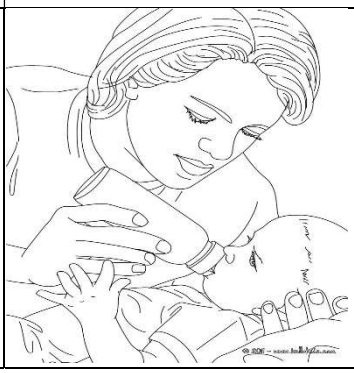
		32		33	
		35		36	
		38		39	
		41		42	

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	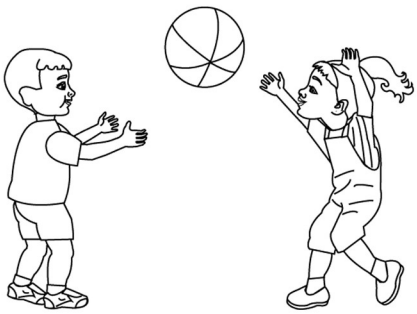	56		57