

### 3.1.1.(b) Dement and Kleitman (sleep and dreams)

the **psychology** that is being investigated

#### 1. Relationship between **Dreaming and Stages of Sleep**;

- Dreaming = sensations, emotions, ideas and images that occur involuntarily during sleep;
- **Two broad stages** of sleep in humans, characterized by **frequency and amplitude (height)** of sleep waves as observed on an EEG machine-
  - **NREM** = non-rapid eye movement sleep;
    - slow activity of neurons (brain cells) in brain;
    - stage of deep sleep;
    - **dreaming does not occur** at this stage;
    - **low amplitude** sleep with **sleep spindles** (short-lived, high frequency waves) occurring intermittently;
    - divided into four sub-stages
  - **REM** = rapid eye movement sleep;
    - faster activity of neurons in brain;
    - stage of shallow sleep;
    - **dreaming occurs** during this stage
    - **high amplitude** sleep

#### 2. **EEG and EOG Measurement Technology**

- **electro-encephalography (EEG)** technique performed using EEG machine (electroencephalogram);
  - requires **electrodes** (small metal discs with wires connected to EEG machine) to be attached to a person's scalp;
  - electrodes **detect activity of neurons on surface** of brain and send information about rate of activity to EEG machine;
  - help **detect stage of sleep** that a person is in

- **electro-oculography** (EOG) technique performed using EOG machine (electrooculogram);
  - requires **electrodes** (small metal discs with wires connected to EEG machine) to be attached near a person's eyes;
  - electrodes **detect activity of neurons on the surface** of the eyes and send information about rate and direction of movements to EOG machine;
  - help **detect direction and speed of movement of eyes** while a person is sleeping

#### the **background** to the study

- Study of dreams subjective as it requires relying on reports by participants;
  - Need felt for **objective measure of dreaming**;
- One previous study used EEG technology to objectively measure which stage sleeping occurs in;
  - Present study employed **more rigorous method** -
    - **no contact between experimenter and participant** during dream reporting;
    - establishment of **correlation between duration of eye movements and reported length** of dreaming;
    - investigation of **relation between reported dream activity and direction of eye movement** to investigate meaningfulness of activity in dreams

the **aim(s)** of the study

1. to investigate in **which stage of sleep dreaming occurs** - REM or nREM stage;
2. to investigate the **relationship between duration of sleep and duration of dreaming**;
3. to investigate the **relationship between direction of eye movement during sleep and direction of activity in dreaming**

the **procedure** of the study

**research method** used -

- **laboratory experiment** (*quasi/correlational in reality*)

**sample size and demographics**

- N = 9,
  - 7 males, 2 females
  - **all adults**
  - studied in detail = **5**, used to confirm results = 4;
  - 2 dropped out after two nights of participation - then, 5 left to be studied in detail and 2 to confirm results

*\*sufficient details not available for detailed evaluation*

**strengths** -

*indeterminable*

**limitations** -

- very **small sample size**, likely to be less representative;
  - therefore, **less generalizable** results

**sampling technique**

*unspecified*

**experimental design -**

- **repeated measures design**

**strengths -**

- **elimination of individual differences;**
  - same participants exposed to **both stages of sleep, various durations of REM sleep and dream activity of different directions;**
  - **increased validity**
- **requirement of lesser number of participants;**
  - difficult to find participants for **EEG based experiment** demanding that participants **sleep in the lab for several days;**
  - **practically more viable**

**limitations -**

- possible **fatigue effect;**
  - participants had to **abstain from coffee and alcohol and sleep in the lab for several nights,** being awakened from time to time;
  - this could have disturbed sleep quality or reporting performance with time;
  - possibly **reduced validity**
- possible **demand characteristics;**
  - slight possibility of participants **understanding the difference between awakened from deep or superficial sleep** and reporting dreaming accordingly;
  - possibly **reduced validity**



**independent variables**

1. **stage of sleep;**
2. **duration of sleep;**
3. **direction of eye movements**

**operational definitions**

1. **measurement of stage of sleep using EEG** at two levels -
  - a. **nREM** stage of sleep
  - b. **REM** stage of sleep
2. **measurement of duration of sleep using EEG** at two levels\*-
  - a. **five minutes** of REM sleep;
  - b. **fifteen minutes** of REM sleep
3. **measurement of eye movement direction using EOG** at two levels-
  - a. **vertical** eye movement ;
  - b. **horizontal** eye movement;
  - c. **vertical and horizontal** eye movements;
  - d. **little or no** eye movements

**strengths -**

- **highly standardized**
  - all measurements done precisely with the help of **sophisticated EEG and EOG technology**;
  - **fixed patterns and durations** measured for every participant;
  - therefore, **highly reliable** measurement
- **high internal validity**
  - measurements done by technology like **EEG and EOG** have minimum error;

**limitations**

- **difficult to establish cause-effect relationship**
  - **none** of the IVs **manipulated by researchers**;
  - possibly all only **correlates** and not determinants of dream related activity
  
- **human error** possible in measurement
  - measurement by EEG and EOG machines but **recording done by experimenters**;
  - **possible reduction in validity**

*\*initially, participants were asked to estimate exact duration of dreaming. But since this proved to be too difficult, five and fifteen minute periods were selected which were **randomly selected** to awaken participants*

**dependent variables**

1. **dream report** by participants;
2. **length of dream report** by participants;
3. **direction of movement of activity in dreams** reported by participants

**operational definition**

1. **statement by participants** on the recording device of whether they had been dreaming or not;
2. **number of words** stated by participants while reporting their dream;
3. **direction of activity** in dreams as reported by participants

**strengths -**

- **direct measurement;**
  - **dreaming highly private activity** that only participants can report about;
  - therefore, more **valid** results
- collection of **quantitative data**
  - simple **dichotomous**, yes or no measurement taken for measuring occurrence of dreaming;
  - **number of words** of dream report taken as measure of length of dream;
  - more **valid** results
- **no experimenter influence** while reporting dreams;
  - participants recorded dreams privately into the recording device;
  - therefore, more **valid** results



***limitations***

- reliance on **self-report** for results;
  - participants likely to **forget or incorrectly recall** portions of dreams;
  - likely to **withhold potentially embarrassing material**;
  - likely to have **filled in gaps** of what they could not remember without realizing it;
  - could **reduce validity** of findings
  
- possible **demand characteristics**;
  - at times, participants may have **reported dreams because they felt they should** report something when asked;
  - could **reduce validity** of findings
  
- results subject to **interpretation by researcher**
  - report of **direction in dream activity** subject to indirect analysis by researchers;
  - **possible reduction in validity**

### procedure/tasks

- participants made to arrive to laboratory a **little before bedtime**;
- **two or more electrodes** attached near the eyes; **two or three electrodes** attached on the scalp;
- then asked to **sleep**;
- researchers in adjoining room with EEG and EOG machines;
- participants **awakened at various times** with a bell to report dreams into a **recording device**;
  - Average sleep time and awakening of participants reported in *figure V*;
- earlier instructed to **first report whether they had been dreaming or not**; and if they had, to **report the content of the dream**, also asked to estimate duration of dreaming - five or fifteen minutes;
- earlier instructed to **then go off to sleep again**
- **awoken after one minute** of showing some particular direction of eye movements to report content of dream activity

*\*The five participants studied in detail were referred to as - DN, IR, KC, WD and PM*

**controls** (*selected examples*)

- participants instructed to avoid taking **alcohol and caffeine** before coming to lab;
  - to assure that participants' **sleeping patterns are not** disrupted in any way;
- **no contact between experimenter and participant** as participants reported their dreams;
  - to prevent experimenter's presence from creating **demand characteristics**;
- **room** for sleeping kept **quiet and dark**;
  - to assure that participants' **sleeping patterns are not** disrupted in any way by the environment;
- **electrodes** attached to participants tied neatly behind their heads and taken through **single cord till the machines** in the other room;
  - to prevent any **entanglement with wires** of participants that could disrupt recording
- **only coherent dreams** by participants analysed;
  - unclear and/or unsure reports discarded
- **five experimental and a few naive participants** made to view **close and distant activity while awake**;
  - to confirm the eye movements that people show while watching different types of activities at different distances;
  - eye movements **found to be the same**, with **minimum vertical movements** and except for blinking
- participants were **never informed** about **when they had been awoken or how their eyes had been moving**;
  - to prevent them from showing **demand characteristics**, that is, from purposely reporting their dreams in certain ways that they thought were appropriate

- dreams that were **not clearly recorded were not analysed** because they could not be transcribed correctly;
  - to **prevent incorrect results** from being drawn

### *Awakening of Participants-*

- **Awakenings of two participants - KC and PM** - from REM or NREM sleep was done according to a **table of random numbers**;
  - to prevent participants from **developing a set pattern** of awakening and estimating whether they have been awoken from REM or NREM sleep;
- For awakening of participant **DN**, pattern of first **three NREM awakenings followed by three REM awakenings** used;
  - to check whether a **pattern developed** of awakening would result in **better remembering** of dreams;
  - results showed that this was **not the case**
- For awakening of participant **WD**, he was **told that he would be awakened only when he was dreaming but then** he was awoken **randomly**;
  - to check whether **development of expectation** of a pattern of awakening would result in **better or worse remembering** of dreams;
  - results showed that this was **not the case**
- For awakening of participant **IR**, he was awoken **whenever the experimenter felt like awakening him**;
  - to check whether **deliberate awakening** by the researcher would result in **better or worse remembering** of dreams;
  - results showed that this was **not the case**



#### material\*

- **EEG and EOG machine;**
  - placed in a room separate from where participants were sleeping
  - run continuously as participants slept;
  - paper speed of 3 to 6 mm per second;
- **bell** to awaken participants;
  - placed **near bed** of participants;
  - **sufficiently loud to ensure immediate awakening** of participants;
- **recording device**
  - placed **near the bed** of participants;
  - experimenter could hear the recording simultaneously and ask questions to the participant if absolutely necessary

#### standardization (*selected examples*)

- all participants made to **abstain from alcohol and caffeine;**
- all participants placed in a **quiet and dark room** for sleeping;
- all participants **awoken with a bell;**
- all participants made to report having had a **dream or not first and then to guess duration of dreaming and narrate dreaming content**

#### data analysis\*

- **frequencies of dream recall** and no recall calculated for each participant;
  - **comparison** of dream recall **during the first and second half** of awakenings;
- **frequencies of estimates of duration of dreaming** calculated for each participant;
- **correlation between duration of REM sleep and number of words in dream recall** calculated for each participant;
- **description of direction of activity** in dream recall noted



**ethical issues** regarding the study

- **informed consent** assumed as **obtained**;
  - participants appear to be **volunteers** given the elaborate nature of the experiment;
  - however, how much they were told about the study is not mentioned
- **right to withdraw** maintained;
  - mentioned that **two participants used their right to withdraw** at the beginning to leave the study after participating for two nights
- **confidentiality** maintained;
  - **initials only of each participant used** to present results throughout the report of the study
- **right to privacy** maintained;
  - participants made to sleep in a **room separate from experimenters**;
  - made to sleep in a **quiet and dark room**;
  - made to **report dream content by themselves**, thus, could have filtered out any private dream content
- **protection from harm** partially maintained;
  - **physical harm prevented**
    - participants made to sleep with EEG **wires tugged away neatly in a ponytail from their head** to prevent entanglement and disruption during sleeping;
    - **EEG non-invasive** and safe technique of measuring activity of neurons
  - **psychological harm unavoidable**
    - participants made to sleep in **unfamiliar setting for several nights**;
    - **repeatedly disrupted while sleeping** to become active and report their dreams;
    - made to **abstain from alcohol and caffeine** for all the nights
- **lack of deception** unspecified;
  - not clear how much participants were informed about the study before participation

- **debriefing not mentioned;**
  - unspecified in report
  - **counseling** was required to deal with any psychological harm

the **results** of the study\*

### **Quantitative Results**

- **frequencies of dream recall** and no recall calculated for each participant (*see figure I for details*);
  - for all participants combined -
    - **152 dream recalls** when awoken from **REM** sleep;
    - **39 no dream recalls** when awoken from **REM** sleep;
    - **11 dream recalls** when awoken from **nREM** sleep;
    - **149 no dream recalls** when awoken from **nREM** sleep
- **comparison** of dream recall **during the first and second half** of awakenings (*see figure II for details*);
  - of 39 negative reports in the entire study -
    - **19** occurred after awakenings during REM periods falling in the **first two hours** of sleep;
    - **11** occurred after REM awakenings during the **second hour**;
    - **5** in the **third second hour**; and
    - **4** occurred in the **last second hour**
- **frequencies of estimates of duration of dreaming** calculated for each participant (*see figure III for details*);
  - for all participants combined -
    - **45 right** and **6 wrong** estimates of 5-minute REM sleep duration;
    - **47 right** and **13 wrong** estimates of 15-minute REM sleep duration
- **correlation between duration of REM sleep and number of words in dream recall** calculated for each participant (*see figure IV for details*);
  - for all participants combined-
    - correlation coefficients **ranging from .40 to .71**;
    - all **marginally significant or significant**
    - narratives for dreams **recalled after 30 or 40 minutes** of sleeping were **not longer than that recalled after 15 minutes** of sleeping; although participants felt they had been sleeping for long



### *Qualitative Results*

- **frequencies of dream recall** and no recall calculated for each participant;
  - Participants **confidently stated that they had not been dreaming** when they were awoken from beginning stages of **NREM sleep**;
  - However, when they were awoken from **later stages of NREM sleep**, they were **confused**;
  - **Some** believed they had **not been sleeping at all**;
  - **Some** reported a **number of emotions** like pleasantness, anxiety, detachment, etc. but no specific dream content
  - These findings added to evidence that dreaming does not occur during NREM stage of sleep
  
- **description of direction of activity** in dream recall noted;
  - **chronological reporting** of dream content found to be **impossible** for participants;
    - therefore, awakened after one minute of showing either vertical, horizontal, vertical and horizontal, or no movement;
  - periods of **purely vertical or purely horizontal** eye movements found to be **very rare**;
    - from all participants -
      - **only 3** dreams of **purely vertical** movement reported;
      - **only 1** dream of **purely horizontal** movement reported;
      - **10** dreams of no movement reported;
      - **21** dreams of mixed movements reported
  - **direction of dream activity** found to **correspond to direction of eye movements**;
    - e.g. after **vertical** eye movements, participants reported having seen dreams such as -
      - seeing a **hoist operating** from the bottom of a tall cliff;
      - seeing themselves climbing up and down a **series of ladders**;
      - seeing themselves **playing basketball** - shooting and looking and the net, and again looking down to pick another ball;
    - e.g. after **horizontal** eye movements, participants reported having seen dreams such as -
      - seeing two people **throwing tomatoes** at each other
    - e.g. after **no** eye movements, participants reported having seen dreams such as -

- **just staring** at some object continuously;
- in 2 such dreams, in which there were some **sudden movements of eyes before awakening** of participants -
  - one dream was about the participant driving, staring straight at the road before a **car was suddenly speeding** at him;
  - one dream was about a participant driving, staring straight at the road before a **man waved at him** from the left side;
- e.g. after **mixed** eye movements, participants reported having dreams of **activity of people close to them** such as -
  - **talking, looking, fighting** with someone, etc.
  - there were **no vertical movements or distant observations** in such dreams

*\*diagrams below show exact quantitative findings. all figures reproduced from Dement and Kleitman (1957)*



figure I.

S	Rapid Eye Movements		No Rapid Eye Movements	
	Dream Recall	No Recall	Dream Recall	No Recall
DN	17	9	3	21
IR	26	8	2	29
KC	36	4	3	31
WD	37	5	1	34
PM	24	6	2	23
KK	4	1	0	5
SM	2	2	0	2
DM	2	1	0	1
MG	4	3	0	3
Totals	152	39	11	149

figure II.

S	First Half		Second Half	
	Dream Recall	No Recall	Dream Recall	No Recall
DN	12	1	5	8
IR	12	5	14	3
KC	18	2	18	2
WD	19	2	18	3
PM	12	3	12	3
Total	73	13	67	19

figure III.

S	5 Minutes		15 Minutes	
	Right	Wrong	Right	Wrong
DN	8	2	5	5
IR	11	1	7	3
KC	7	0	12	1
WD	13	1	15	1
PM	6	2	8	3
Total	45	6	47	13

figure IV.

Subjects	Number of Dreams	r	P
DN	15	.60	< .02
IR	25	.68	<< .001
KC	31	.40	<< .05
WD	35	.71	<< .001
PM	20	.53	< .02

figure V.

Ss	Nights Slept	Awakenings	Average Nightly Awakenings	Average Sleeping Time
DN	6	50	8.3	7:50
IR	12	65	5.4	4:20
KC	17	74	4.4	6:00
WD	11	77	7.0	6:30
PM	9	55	6.1	6:20
KK	2	10	5.0	6:00
SM	1	6	6.0	6:40
DM	1	4	4.0	7:00
MG	2	10	5.0	6:10
Totals	61	351	5.7	6:00

the **conclusion(s)** the psychologist(s) drew from the study

1. **dreaming occurs more commonly during the REM stage of sleep** than during the nREM stages of sleep;
2. there is a **positive correlation between duration of sleep and duration of dreaming**;
3. there is a **positive correlation between direction of eye movement during sleep and direction of activity in dreaming**

description and evaluation of the **research methods** used

- **laboratory experiment** (*actually quasi/correlational*)

**justification**

- **controlled settings**
  - *see controls section above*
- **standardized conditions**
  - *see standardization section above*

**strengths**

- **high internal validity**;
  - *see controls and standardization sections above*
- **high reliability and possibility of replication**
  - *see standardization section above*

**limitations**

- **poor ecological validity**
  - **artificial** situation in which participants had to sleep - too quiet, dark, attached to electrodes, no caffeine and alcohol consumption;
  - does not resemble real sleeping conditions

- **reductionist investigation**
  - **sleep and dreams** likely to be **correlated** and not **causatively related**;
  - dreams likely to be determined by real life experiences, thoughts, wishes etc.;
  - largely **limited quantitative analysis** in present study

consideration of how the study relates to psychological **issues and debates**

**application of psychology to everyday life (application of the findings of the study to the real world) -**

- to help people suffering from sleep disorders like **night terrors** by regulating their REM sleep stage through **intervention**;
- to **diagnose** people suffering from **sleep or dream related disorders** by checking using EEG and EOG whether their REM and nREM stages of sleep are occurring normally

**individual versus situational explanation -**

*individual explanation*

- **neuronal activity and eye movements** part of **individual physiology**;
  - **subjective differences in** duration, time of dreaming, frequency of sleep stages, etc.

*situational explanation*

- **laboratory environment**
  - dark and quiet room, abstaining instructions, etc. could have influenced sleeping patterns and dream activity



**nature versus nurture;**

*nature*

- **sleep patterns** i.e. nREM and REM stages found in **all people**;
  - appear to be inherited
- **all participants** of the study showed at least some **dreaming behaviour**;
  - same pattern of dreaming and non-dreaming in REM and nREM stages found in all participants

*nurture*

- **differences between participants** regarding dream duration, sleep patterns, sleep activity, etc. could be because of personal experiences, health and development, lifestyle, etc.

**use of children in psychological research;**

- same experiment can be done in children **to study developmental patterns** in sleep and dream activity;
- **no ethical issues in EEG** as it is non-invasive;
- however, procedure requires revision as sleeping in a **quiet and dark laboratory** away from home can be perceived as threatening by children and can cause **psychological harm**;
- being **interrupted in between sleeping** repeatedly could cause them **physical harm** as their developing body is sensitive;
- methodology not appropriate since **self-report is difficult for children**, that too while in a sleepy state

**use of animals in psychological research**

- dreaming activity research **not possible with animals** because of **need for self-report**;
  - more ingenious research methods required
  
- **EEG** sleep pattern studies can be done for **simple comparison of human and animal sleep behaviour**;
  - to study whether sleep patterns of REM and nREM sleep are unique in humans are found in animals as well