THE TIMES THE SUNDAY TIMES
GOOD UNIVERSITY GUIDE 2020
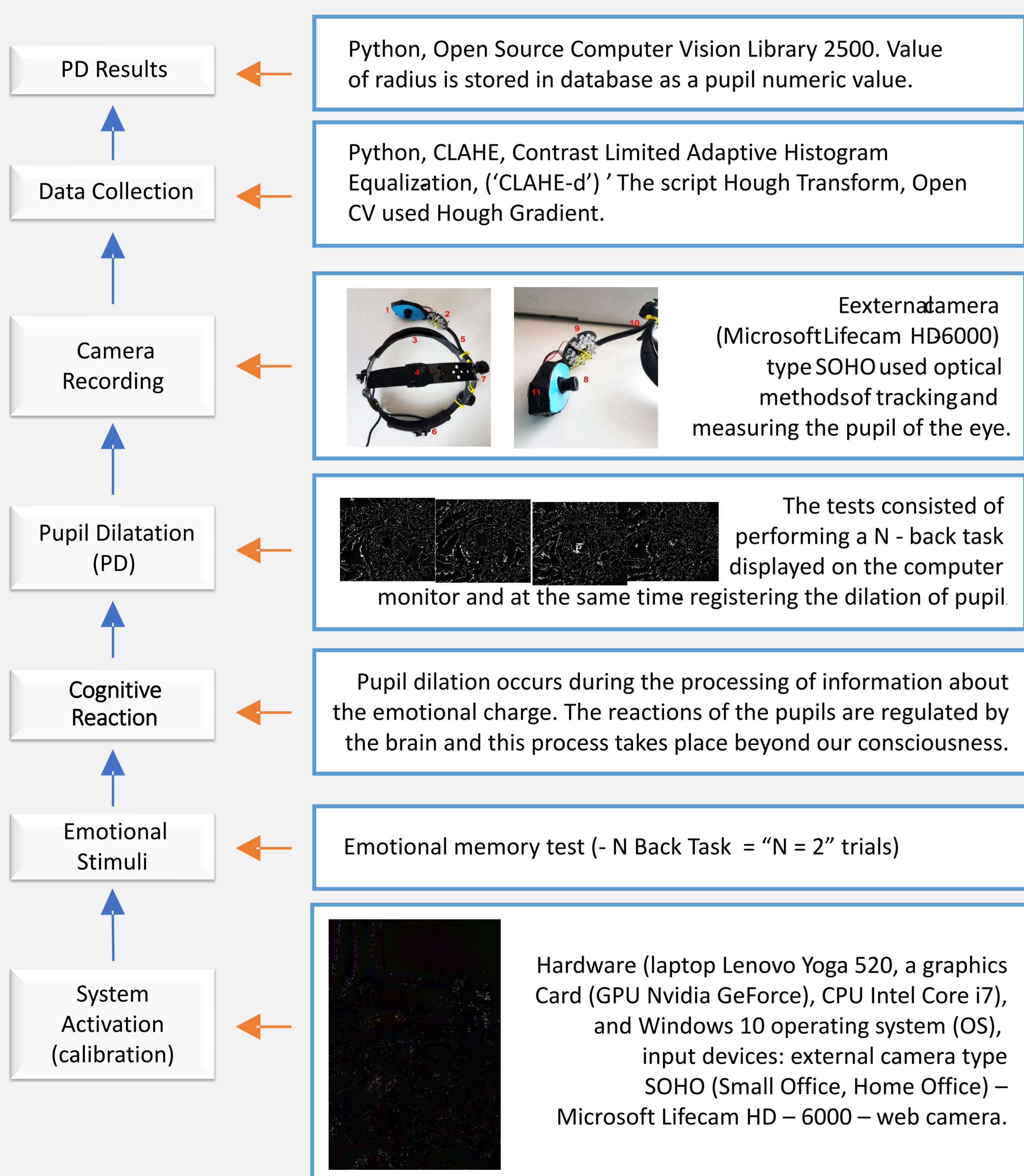**INSTITUTE OF TECHNOLOGY OF THE YEAR**

The effects of emotional manipulations on working memory and pupil dilation as an index of effort in cognitive processing.

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Introduction

Aim: Working Memory (WM) is a psychological system having a processual character responsible for stored and processed information. The aim of this research study was to analyse WM in the emotional context and to measure cognitive overload using non-invasive methods such as pupillometry. The primary for this study was the issue of WM in relation to non-controlled Pupil Dilatation (PD) reaction. WM is particularly important for performing complex cognitive processes especially in the presence of different distractors or time pressure. In this area the possible consequences of the impact of emotions on the functioning of WM and using non-invasive measurement PD are of particular interest. The study shows currently the existence of a two-way relationship between WM and emotion. On one hand WM affects the perception of emotions and selection strategies, progress and efficiency of emotions, on the other hand emotions modify the functioning of memory.

Process

PD Results	Python, Open Source Computer Vision Library 2500. Value of radius is stored in database as a pupil numeric value.
Data Collection	Python, CLAHE, Contrast Limited Adaptive Histogram Equalization, ('CLAHE-d') ' The script Hough Transform, Open CV used Hough Gradient.
Camera Recording	Eexternal camera (Microsoft Lifecam HD6000) type SOHO used optical methods of tracking and measuring the pupil of the eye.
Pupil Dilatation (PD)	The tests consisted of performing a N - back task displayed on the computer monitor and at the same time registering the dilation of pupil
Cognitive Reaction	Pupil dilation occurs during the processing of information about the emotional charge. The reactions of the pupils are regulated by the brain and this process takes place beyond our consciousness.
Emotional Stimuli	Emotional memory test (- N Back Task = "N = 2" trials)
System Activation (calibration)	Hardware (laptop Lenovo Yoga 520, a graphics Card (GPU Nvidia GeForce), CPU Intel Core i7), and Windows 10 operating system (OS), input devices: external camera type SOHO (Small Office, Home Office) – Microsoft Lifecam HD – 6000 – web camera.

Methods

Two-way Anova analysis of variation in the model multidirectional performed in the 2x3 scheme with repeated measurement of 2 assumptions for words and images and with three emotional factors was applied and in the scheme with repeated measurement of 3x2 attempts (neutral - negative - positive) and correctness of the given answers.
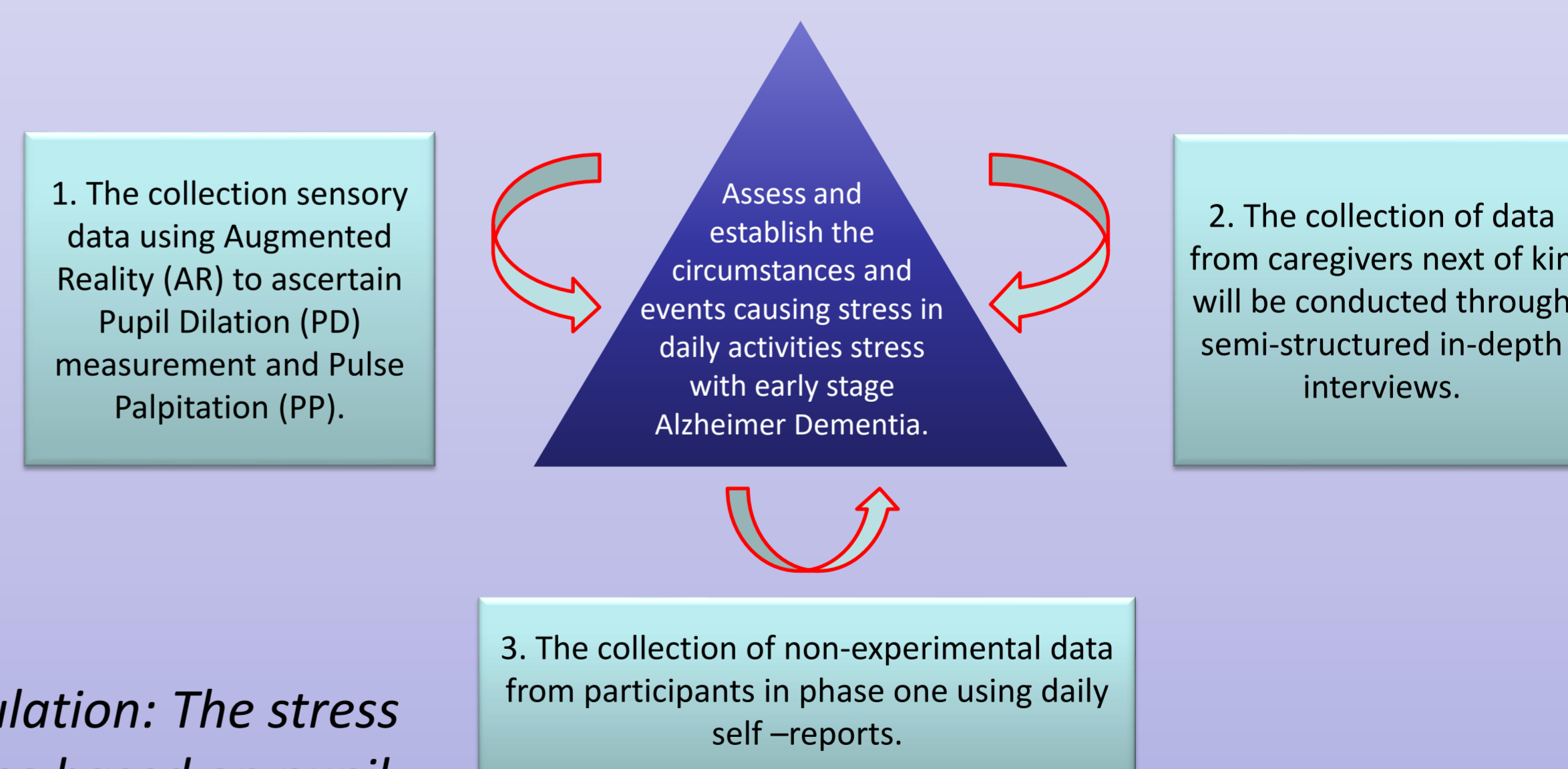
Result and Discussion: In the present study we have used a specially developed test based on the principles appropriate for the N-back task with the main goal to measure WM capacity. This test has been provided with emotionally valence of words and images - International Affective Picture System (IAPS). Emotional stimuli that contained words and images made it easier for study participants to make choice decisions and referred to the context for emotional arousal, giving researchers some control over stimuli. Ultimately the photos of the pupil obtained during the test were transferred to the CLAHE process equalizes the histogram of a grayscale image using Contrast Limited Adaptive Histogram Equalization, then to the numerical data using the Python algorithm (BGR2Grey). For the correlation between the influence of the emotional factor as well as the performance of the memory test for words and image expressions and the response of the pupil during testing we found a strong correlation between the results collected with the web camera.

Future Work

Title: Strategies to evaluate and reduce stress among clients (people) with early stage AD which may reduce or slow down the progression of disease (SERSAD).
Aim: To elicit the ques through pupillary response which may indicate stress and negative emotions among clients (people) with early stage AD which may reduce or slow down the progression of disease in AD patients.
Methods: A mixed method approach will be used to meet the aim of this study and this will involve three phases.

Assess and establish the circumstances and events causing stress in daily activities stress with early stage Alzheimer Dementia.

1. The collection sensory data using Augmented Reality (AR) to ascertain Pupil Dilation (PD) measurement and Pulse Palpitation (PP).

2. The collection of data from caregivers next of kin will be conducted through semi-structured in-depth interviews.

3. The collection of non-experimental data from participants in phase one using daily self –reports.

Triangulation: The stress response based on pupil dilation and sensory biomarkers measurements and as the self-daily observations and relatives or caregivers' semi-structured interview.

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