

**Exam: Cognitive Psychology and Its Applications**  
**January 8, 2020**

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Please answer the questions on the separate VU-exam lined paper.

Better marks will be given to correct answers that are brief and to-the-point.  
The language of exam is English.

Make sure to put your name on all exam material you use. Hand in both this copy of the exam and the separate sheet used to answer the questions.

There are 9 questions in total, and you get max one point per question. You get one point for free!

Good luck!

1. Rapid technological advancements in the middle of 20<sup>th</sup> century have led to the idea that one needs to “design a human to fit the machine”. Describe what is meant by this principle. Explain whether it is consistent with the human factors’ approach.

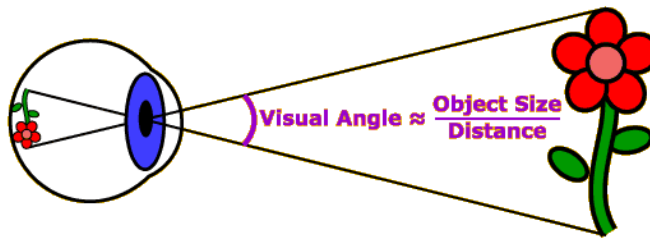
***“Human to fit the machine” principle means that the design of technology is left to engineers. This can result in sophisticated systems from the technological point of view, but the human users are not taken into account, or not taken into account enough. According to this principle, human users are presented with technology and have to use it ‘as is’. They need to be selected or trained or both, in order to be able to operate the machine. Human factors propose a radically different approach, according to which, technology is designed with a human user in mind and is taking into account the limitations of the human information processing system. This latter approach has led to a significant reduction of accidents and improved used of technology.***

2. In some countries (e.g., USA, Japan) you may find a horizontally oriented traffic light with a green light on the left (see below).
  - a. A traffic user from Europe will have difficulties with this traffic light. Name which design principle is violated.
    - i. ***Consistency principle is violated. This horizontal orientation is inconsistent with user’s experience with a vertically oriented traffic light.***
  - b. A color-blind person from Europe might not be able to use this traffic light without an explanation, while he/she can use the vertically oriented one in Europe without a problem. Which design principle ensures that this is possible?



- i. **Redundancy gain principle.** *Position and hue are redundant in the European design, with each signal coded by both. Color-blind person can use the vertical traffic light, but has to learn where the green light appears in the new design and whether it is redundantly coded, in order to start using it.*

3. In technical and scientific literature the sizes of visual stimuli are often reported in **degrees of visual angle**, and not in cm or inches.
- Why is the measure of visual dimensions in degrees of visual angle preferred?
  - Draw the visual angle of the flower in the figure below
  - How is it computed? Hint: the approximation formula is sufficient.



- The measure in degrees of visual angle is preferred because it provides an estimate of the size of the projection of an object onto the retina, e.g., the retinal size of the object. This is important, since the retinal size is dependent on the distance between the observer and the object. Reporting only the object size in cm, without the distance from the observer is not sufficient for replicating the measurements. Visual angle provides a single metric for reporting the object size and allows for replication of the measurements.*
  - See the image.*
  - Visual angle = Object Size/distance from observer. To convert the radians to degrees multiply by  $180/\pi$ .*
4. Driving is a complex task, but with the help of task analysis it can be decomposed into 3 main subprocesses as indicated below. Provide an example for each subprocess.
- Strategy:** *route planning and choice*
  - Tactics:** *Changing lanes, deciding to overtake*
  - Vehicle control:** *Longitudinal ( distance from the car upfront) and Lateral ( staying in the lane)*

5. What is the main difference between the **closed-loop** and **open-loop** control?

*In a closed loop the operator adjusts the control based on the negative feedback from his/her actions (prediction error). He continuously monitors the feedback and adjusts performance accordingly. In the open loop the operator does not pay attention to the feedback but possesses advanced knowledge or experience to be able to assess the situation and choose the right course of action.*

6. We live in times when more and more tasks performed by a human are automated. Give three reasons why a certain task should be automated (for example, the three Ds mentioned in the lecture):

- a) Dull - baggage screening at the airport*
- b) Dirty – sorting garbage*
- c) Dangerous- working at the nuclear plant*

7. In many tasks the speed and accuracy are **positively** correlated, e.g., the faster you perform the task, the fewer errors you make. However, in some cases the **speed-accuracy tradeoff** is observed.

- a. What is the speed-accuracy tradeoff?

*When performing a task, a user can implement different strategies, depending on the task demands. If a task requires speedy responses, a user can choose to prioritize speed over accuracy. If a task requires very accurate responses, a user can choose to slow down. Therefore, speed-accuracy tradeoff is a strategic trade-off between speed and accuracy of performing a task.*

- b. Why are speed and accuracy usually positively correlated?

*Typically, the user is either fast and accurate or slow and making mistakes. This has to do with the fact, that both speed and accuracy are positively correlated with the task difficulty. Therefore, they are also positively correlated with each other.*

8. Name and briefly define three main sources of **attentional control** according to Awh, Belopolsky & Theeuwes (2012):

*1. Physical salience, which is defined as a local uniqueness/contrast. A bright flash of the ambulance is a very salient stimulus.*

**2. Current goal, which is defined as a current target(s) with the highest priority at any given moment in time. An example could be an intention to find a museum on a map, which will bias selection for the icon associated with museums.**

**3. Selection history, which is defined as higher priority for objects that had been search targets before. Example: Previous searches for your car ensure that the shape and color of your car drive your attentional allocation.**

9. Does rational thinking always lead to good outcomes? Explain your answer.

***Rational thinking is defined as decision-making that follows the rules of logic and produces an optimal decision based on the provided information. However, decision-making process is not the same as decision outcome. Optimal decision process can also lead to bad outcomes, as well as non-optimal decision process can lead to good outcomes.***