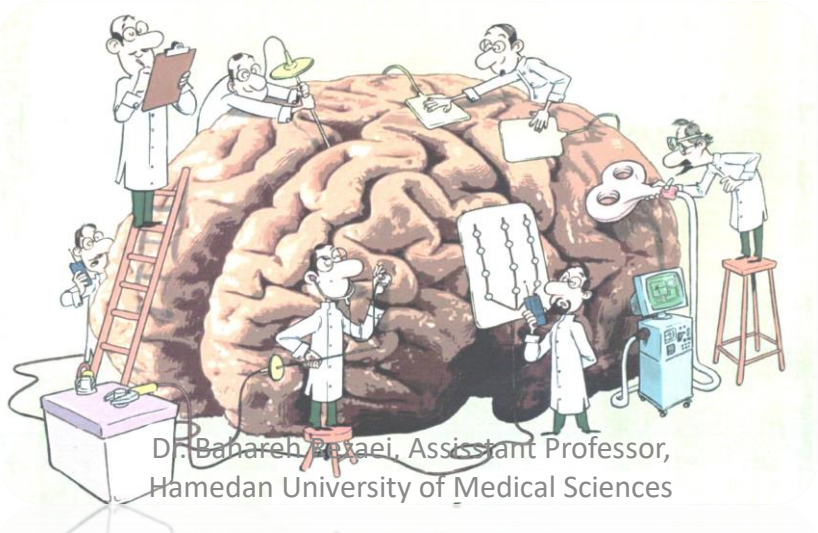
Dr. Bahareh Rezaei, Assisstant Professor,
Hamedan University of Medical Sciences

دانشگاه علوم پزشکی و
خدمات بهداشتی درمانی همدان

عنوان وبینار:

کاربرد تحریک الکتریکی فراجمجمه ای(tDCS) در علوم توانبخشی



Dr. Bahareh Pirayi, Assistant Professor,
Hamedan University of Medical Sciences

در علوم توانبخشی برنامه وبینار کاربرد تحریک الکتریکی فراجمجمه ای

	شرح برنامه	مدرس	زمان
۱	تاریخچه به کارگیری تحریک مغزی در علوم توانبخشی مکانیسم اثر tDCS و نوروپلاستیسیتی تفاوت tDCSبا سایر انواع تحریکات مغزی ملاحظات ایمنی در tDCS	خانم دکتر آیلین طلیم خانی	۸:۳۰ الی ۹:۱۵
۲	کاربرد tDCS در اختلالات مختلف، توانبخشی شناختی و افزایش عملکرد شناختی افراد عادی	آقای دکتر محمد رضایی	۹:۱۵ الی ۱۰
۳	شرح انواع پروتکل های تحریکی امکان پذیر در tDCS (انواع مونتاژ الکترودها) اصول اخلاقی در tDCS طراحی یک پروتکل درمانی فرضی با استفاده از tDCS آموزش نحوه تعیین مناطق عملکردی مغز روی جمجمه با استفاده از سیستم 10/20 EEG آموزش نحوه کار با دستگاه tDCS	خانم دکتر بهاره رضائی	۱۰ الی ۱۱

Dr. Bahareh Rezaei, Assisstant Professor,
Hamedan University of Medical Sciences

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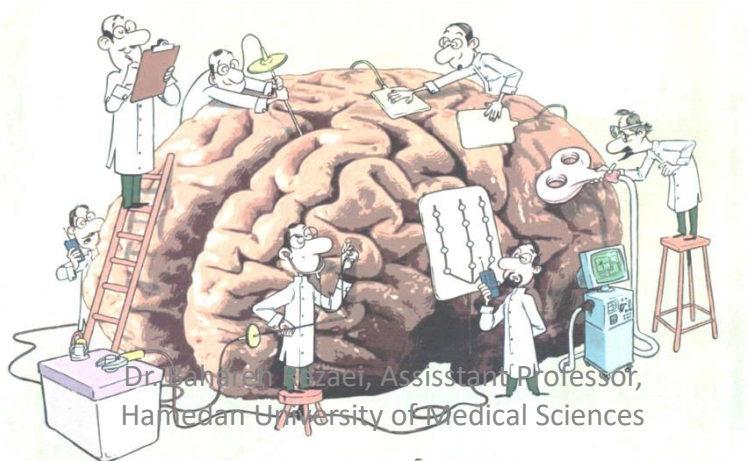
خدمات بهداشتی درمانی همدان

کاربرد تحریک الکتریکی فراجمجمه ای در علوم توانبخشی

بهاره رضائی

عضو هیأت علمی و استادیار گروه گفتار درمانی

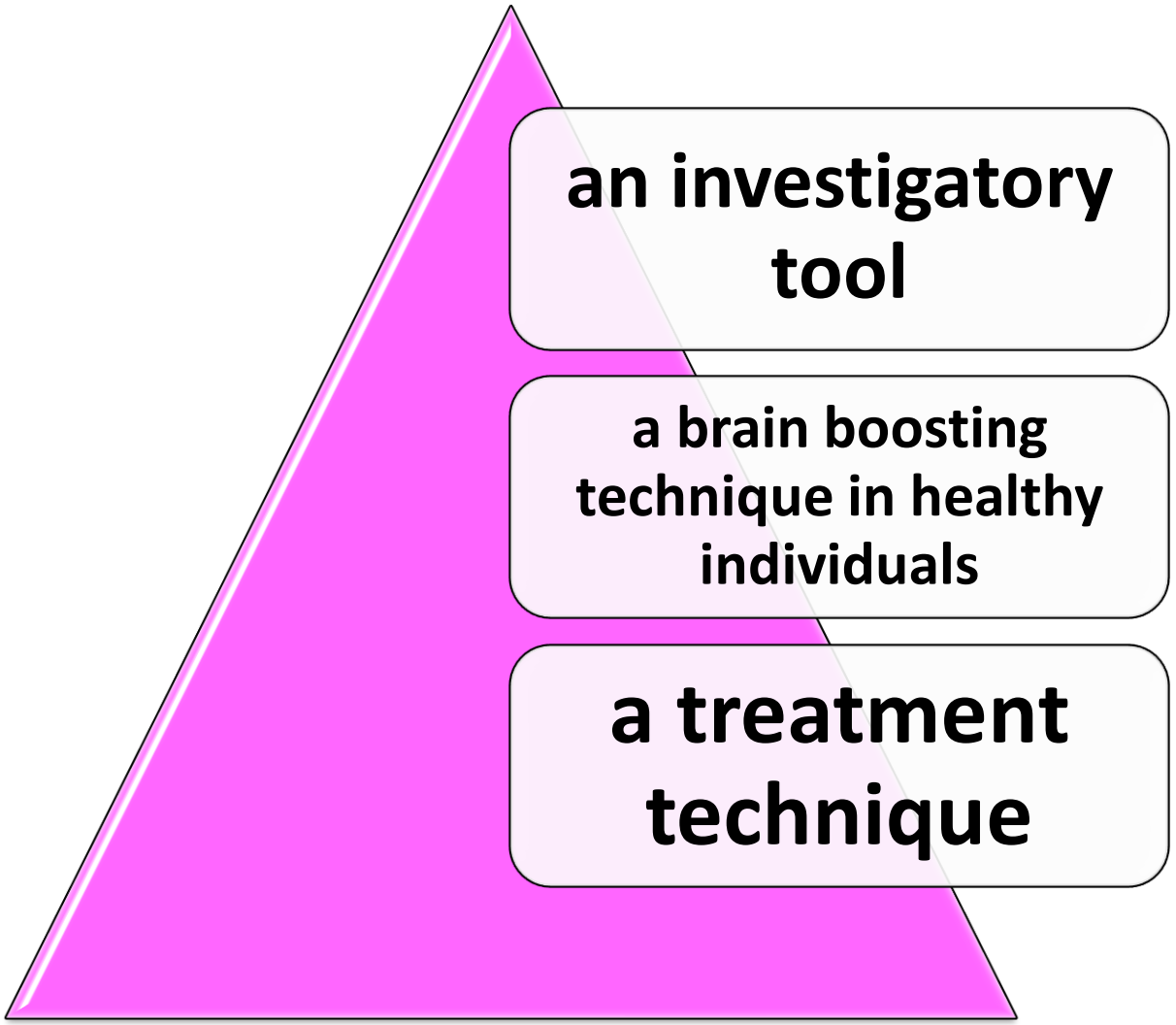
دانشکده علوم توانبخشی همدان



رئوس مطالب

- شرح انواع پروتکل های تحریکی امکان پذیر در tDCS (انواع مونتاژ الکترودها)
- طراحی یک پروتکل درمانی فرضی با استفاده از tDCS
- آموزش نحوه تعیین مناطق عملکردی مغز روی جمجمه با استفاده از سیستم 10/20 EEG
- آموزش نحوه کار با دستگاه tDCS
- اصول اخلاقی در tDCS

tDCS APPLICATIONS



Therapeutic Potentials for tDCS

- Depression
- Schizophrenia
- Acute Mania
- Bipolar Disorder
- OCD
- PTSD
- Other Anxiety Disorders
- Pain
  - Visceral pain
  - Atypical facial pain
  - Phantom pain
- Food and Drug Craving
- Alzheimer Disease
- PD
- Focal Dystonia
- Epilepsy
- Stuttering
- Tics
- Neurorehabilitation
  - Neglect
  - Aphasia
  - Hand weakness
- Migraine
- Tinnitus
- TBI

TDCS COULD BE USED:

- **As a stand alone therapeutic intervention**
- **tDCS alone**

- **As an adds-on therapeutic intervention (as a priming technique) : offline**
- **tDCS + Motor training programs : online**

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Battery Compartment
Use only 9V DC Alkaline. Ensure battery door is in place before starting treatment. Remove battery from unit when not in use.
Time Reamaining/Status
Clearly and brightly indicates the time remaining for each stimulation easily set by the duration knob.Also indiicated the status of the device, Start/Pause.
Dose/Power On-Off
Control and set the dose. Start/Pause/Stop the session.
(4 mA x 10 min = 40mA-min dose)
(2 mA x 20 min = 40 mA-min dose)
Current (mA)
Indicates the current setting of the device. Current can be adjusting by rotating the current setting kob. Maximum current is 4.0 mA.
Output Jack
Lead wire connection terminal
Status LED
Displays ON/Active and Low Battery
Dose
mA x min
Time
min : sec
Current
mA
80.0 Start 4.0


محلول نمکی
دستگاه مولد جریان
کابل ها
باند کشی
پوشش اسفنجی
متر اندازه گیری
باتری دستگاه
الکترود ها

tDCS Parameters

- Stimulation strength: 20-30 mA
- Electrode size: 5x5cm , 5x7 cm
- Duration of stimulation: 10-30 min

10/20 System Positioning

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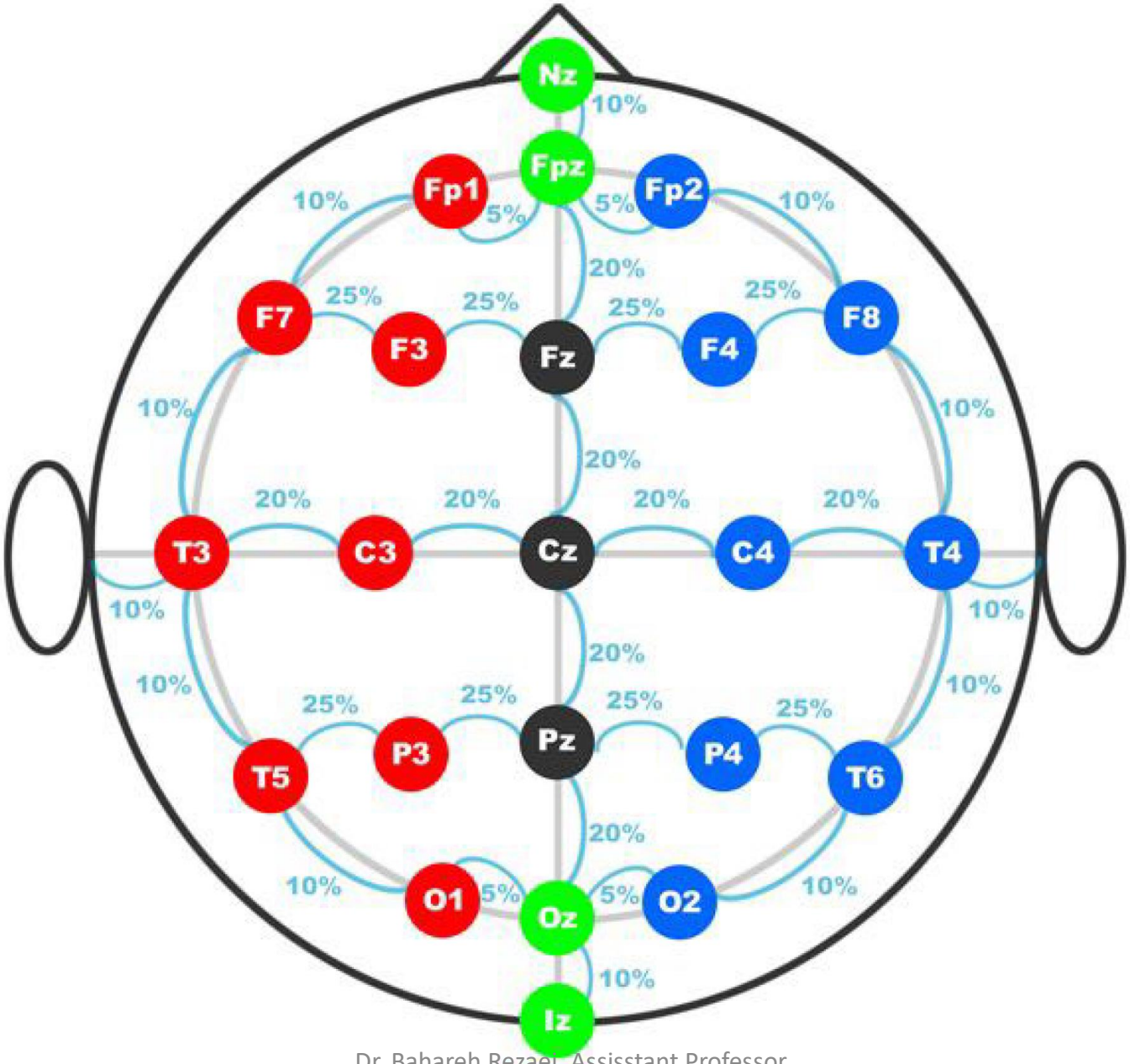
Each site has a letter to identify the lobe and a number to identify the hemisphere location.

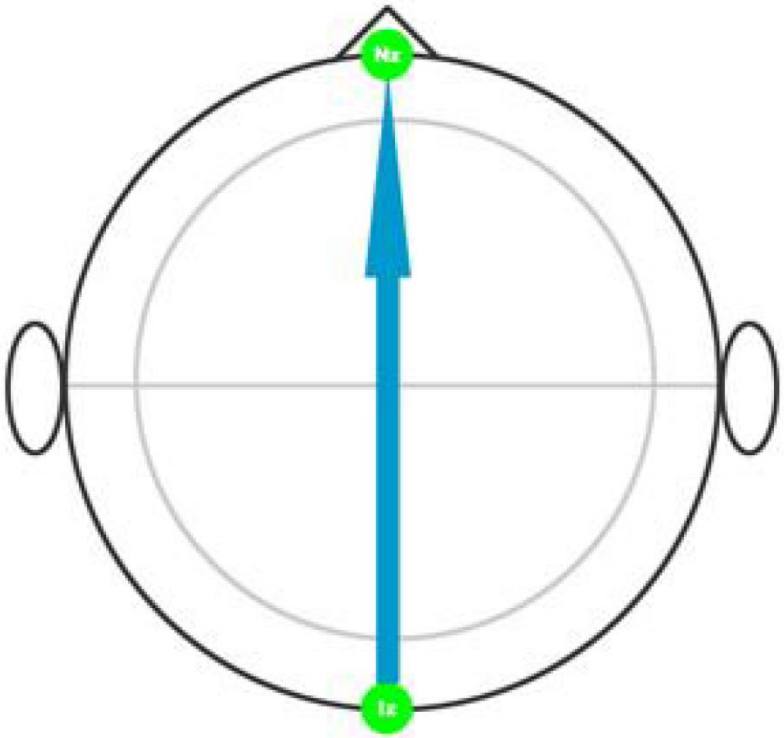
Electrode	Lobe
F	Frontal
T	Temporal
C	Central *
P	Parietal
O	Occipital

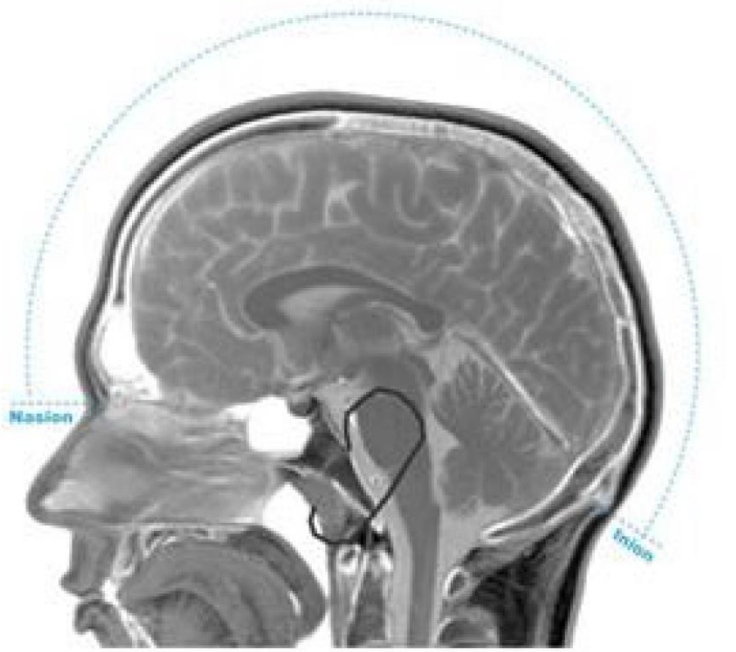

Nz
Fp1
Fpz
Fp2
F7
F3
Fz
F4
F8
T3
C3
Cz
C4
T4
T5
P3
Pz
P4
T6
O1
Oz
O2
Iz
10%
5%
20%
25%

Step 1

Take a measuring tape and use the centimeter side.
Measure over the center line of the scalp, from the Nasion (bridge of the nose) to the Inion (occipital pretuberance). Note the total length.

For our example, the total length is 36 cm.





Step 2

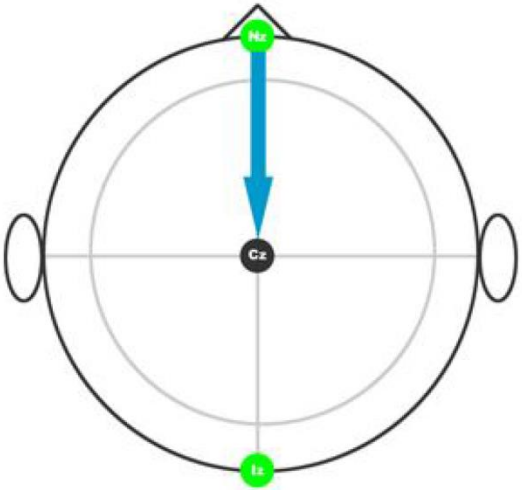
Measure and mark 50% of your total.
This is your preliminary Cz mark.

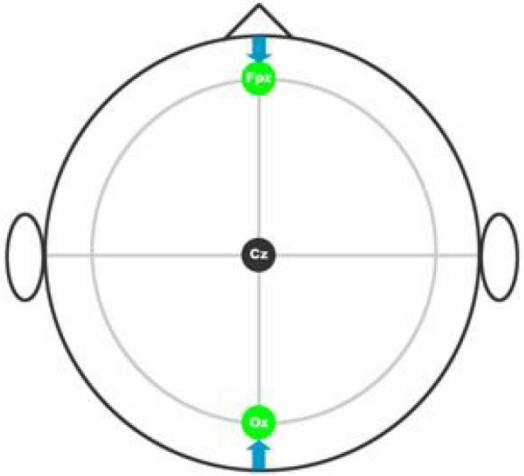
In our example 36 cm / 2 = 18 cm

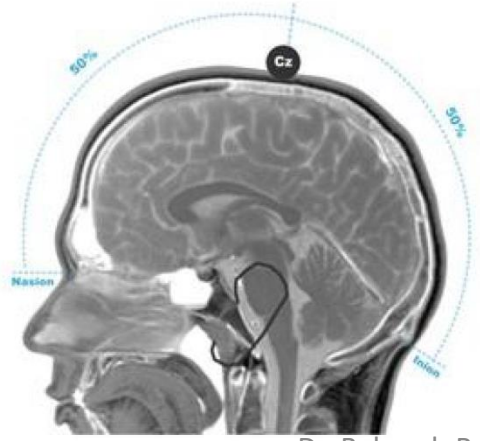
Step 3

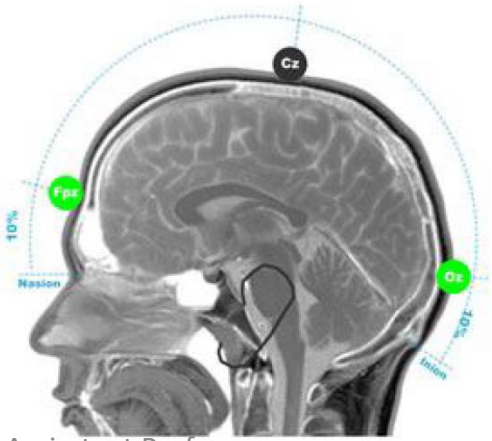
Measure and mark 10% up from the Nasion and 10% up from the Inion.
These are your preliminary mark of Fpz and Oz.

In our example 10% of 36 cm is 3.6 cm





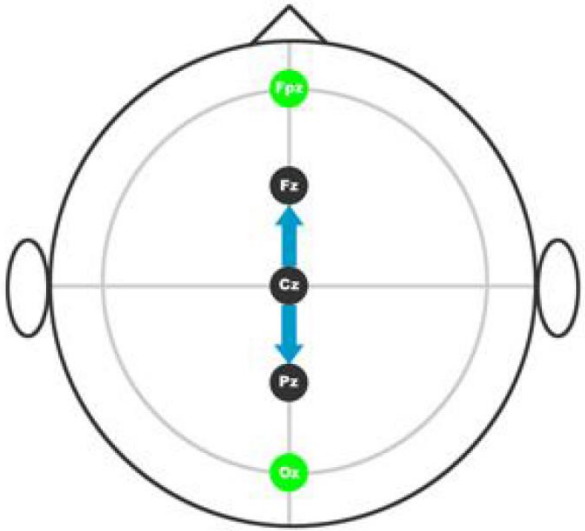


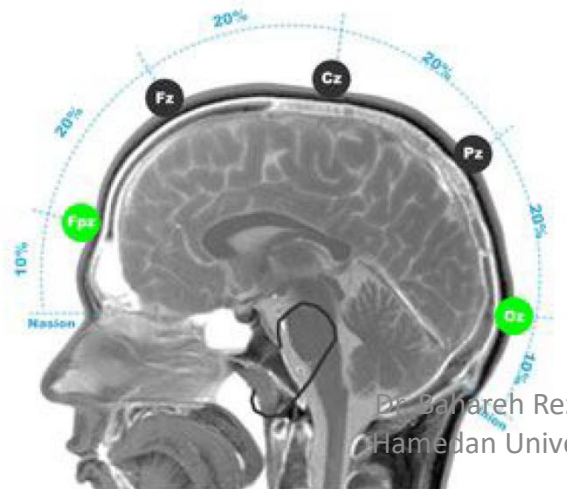


Step 4

Mark 20% from either the first mark of Fpz or Cz. These will be your preliminary marks of Fz and Pz.

In our example 20% of 36 cm is 7.2 cm

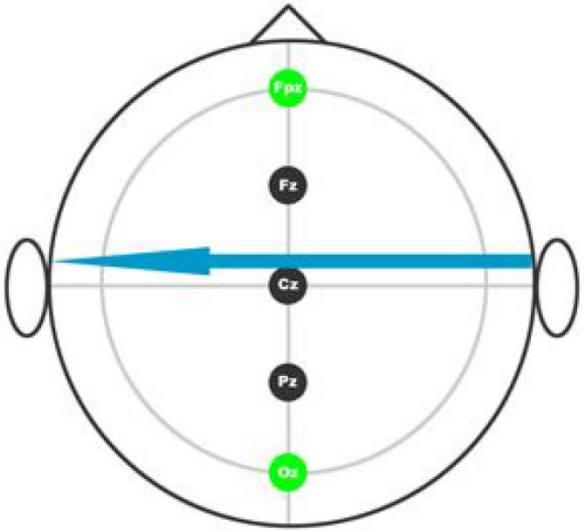




Step 5

Measure from preauricular point to preauricular-point. Lightly run your finger up and down just anterior to the ear; the indentation above the zygomatic notch is easily identified. Opening the mouth slightly makes it easier to find the exact location. Note the total length.

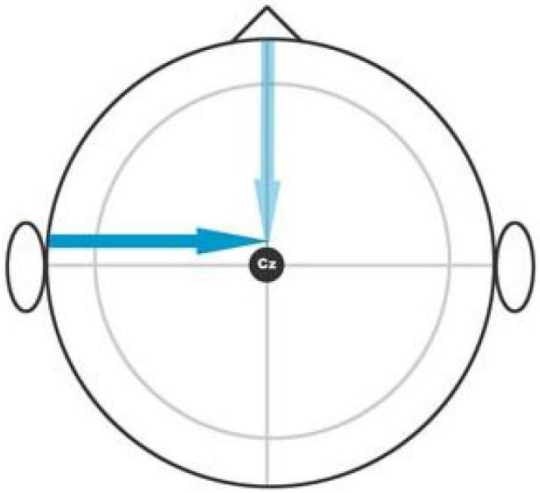
For our example it is 38 cm



Step 6

Measure and mark 50% of your total.
At the intersection with your previous 50% mark from the Nasion to the Inion is your **true** Cz mark.

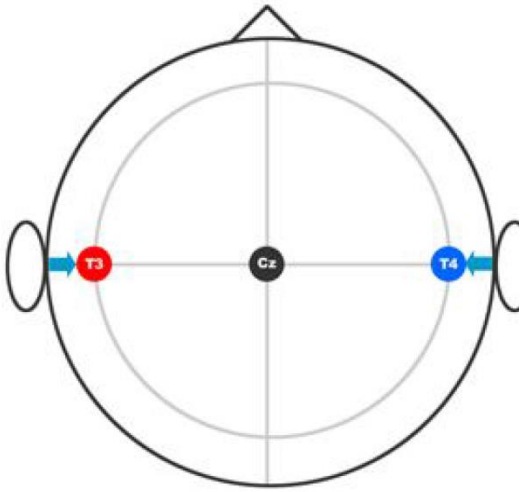
In our example 38 cm / 2 = 19 cm

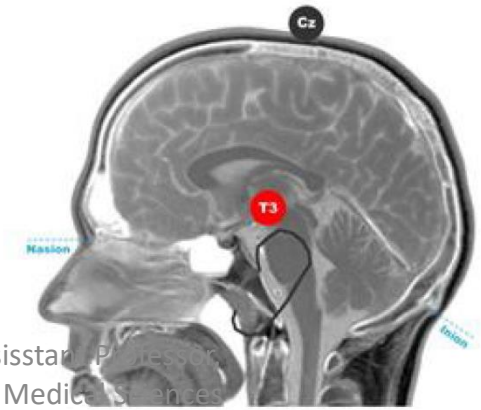


Step 7

Measure and mark 10% up from the pre auricular points. These are your preliminary marks of T3 and T4.

In our example 10% of 38 cm is 3.8 cm

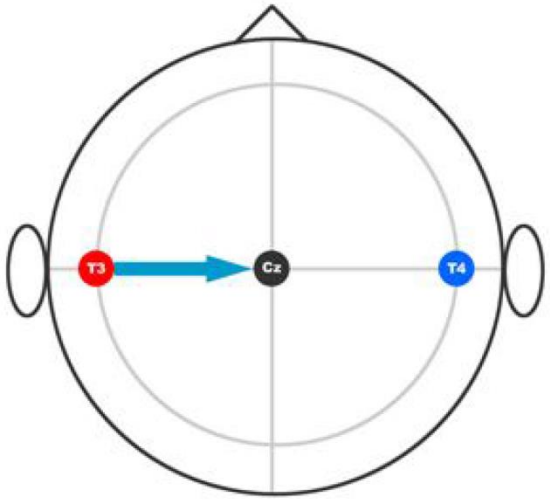




Step 8

Measure from your first mark of T3 to Cz.
Note the total length.
Measure from your first mark of T4 to Cz.
Note the total length.

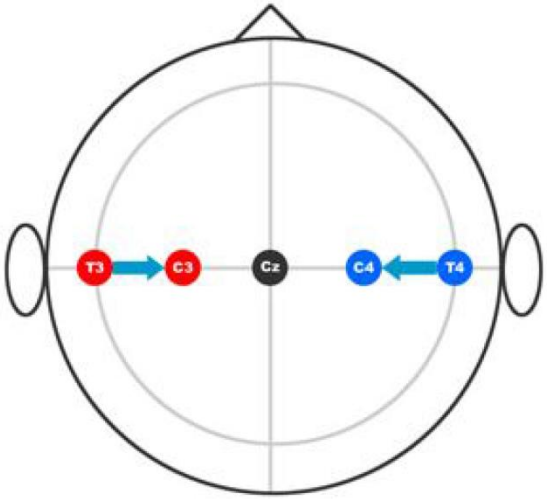
For our example 15 cm

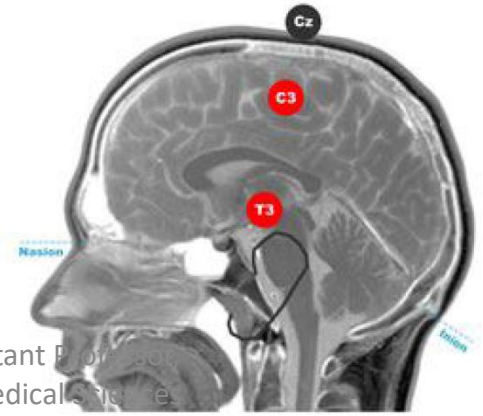


Step 9

Measure and mark 50% of the totals in the previous step. These are your preliminary marks of C3 and C4.

In our example 15 cm / 2 = 7.5 cm





Step 10

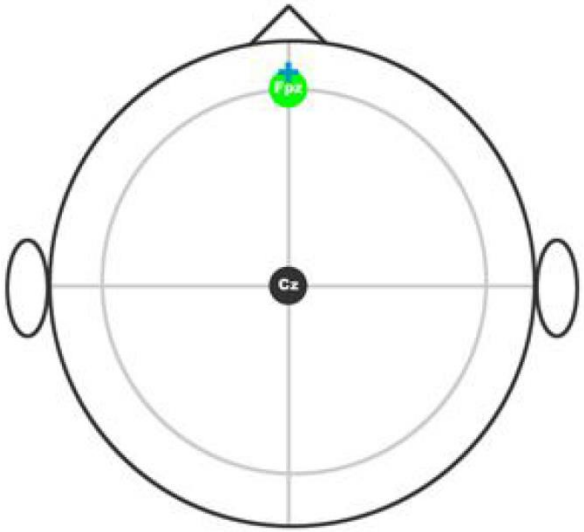
Draw a cross section mark on Fpz.
This is your **true** Fpz mark.

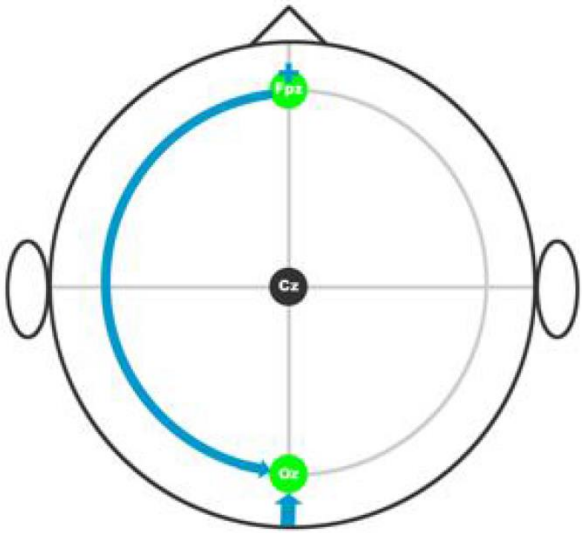
Step 11

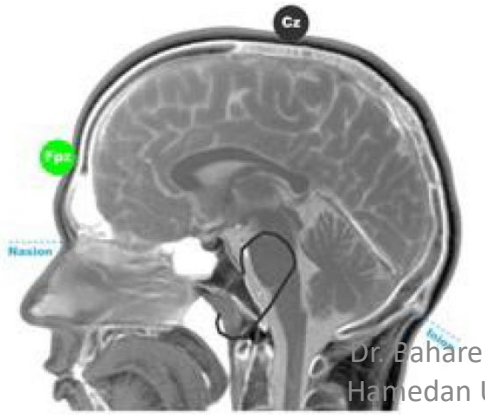
Encircle the measuring tape accross your 10% Fpz mark and the 10% Oz mark at the back of the head. Note the total circumference of the head.

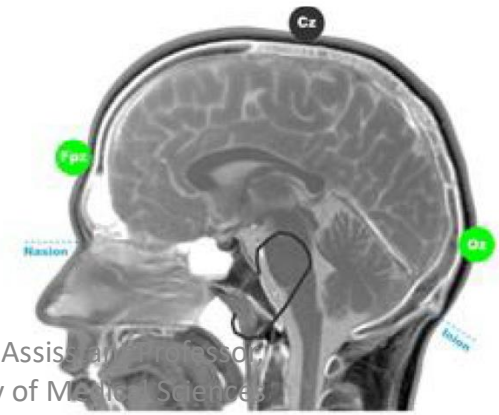
Measure 50% of the total circumference from Fpz to the back of the head. At the cross section with your preliminary Oz mark is your **true** Oz mark.

For our example 56 cm / 2 = 28 cm





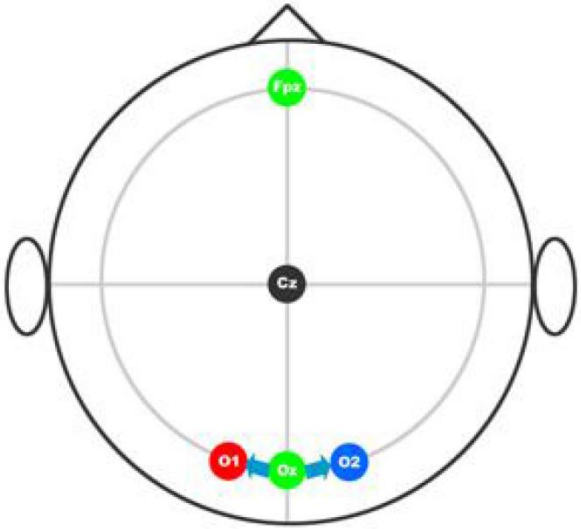


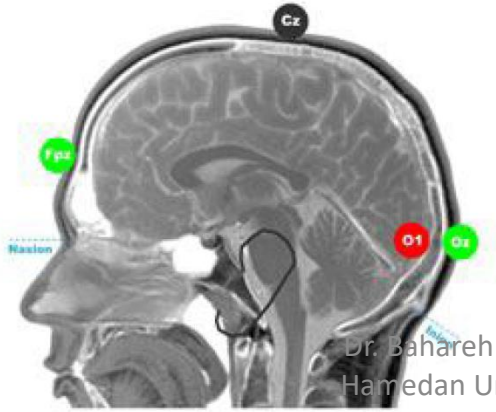


Step 12

Measure and mark 5% of total circumference to the left and right of Oz. These will be your **true** marks of O1 and O2.

In our example 5% of 56 cm = 2.8 cm

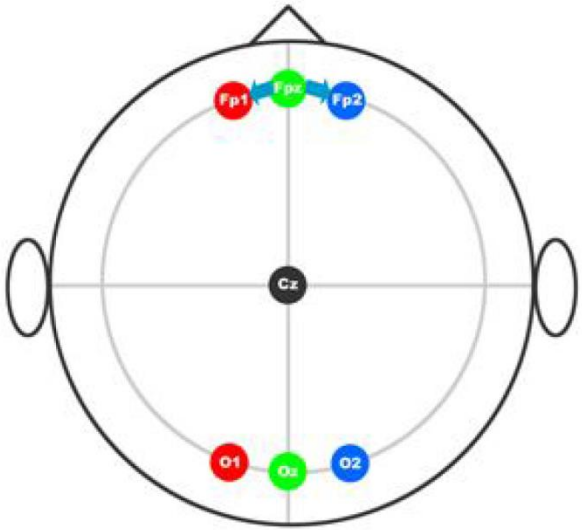


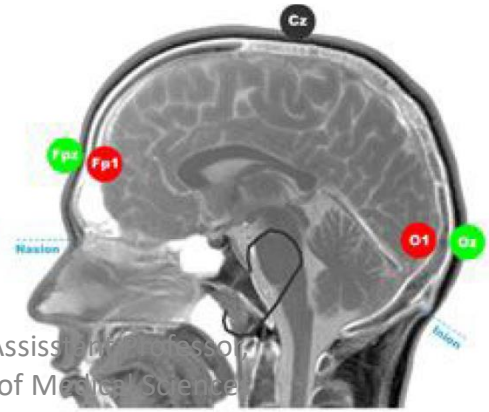


Step 13

Measure and mark 5% of total circumference to the left and right of Fpz. These will be your **true** Fp1 and Fp2 marks.

In our example 5% of 56 cm = 2.8 cm

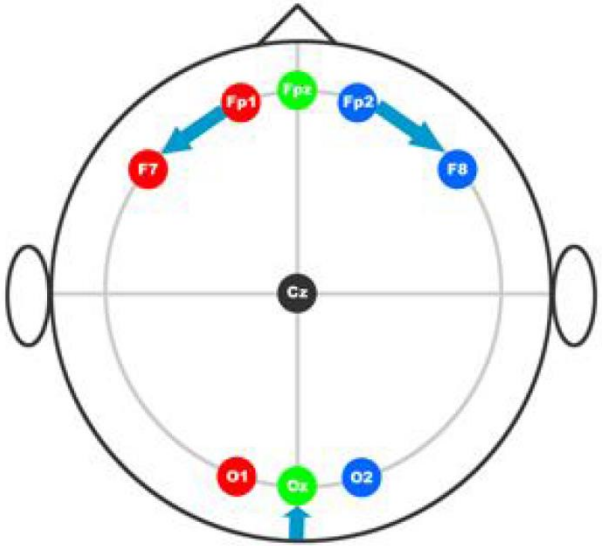




Step 14

Measure and mark 10% down from Fp1 and Fp2. These are your marks for F7 and F8.

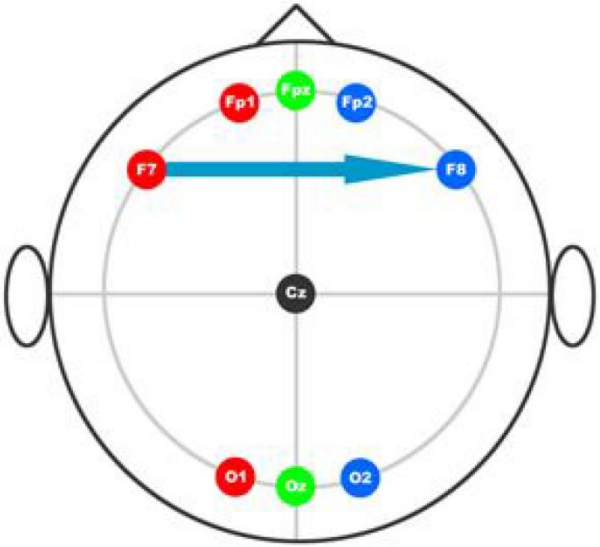
In our example 10% of 56 cm = 5.6 cm

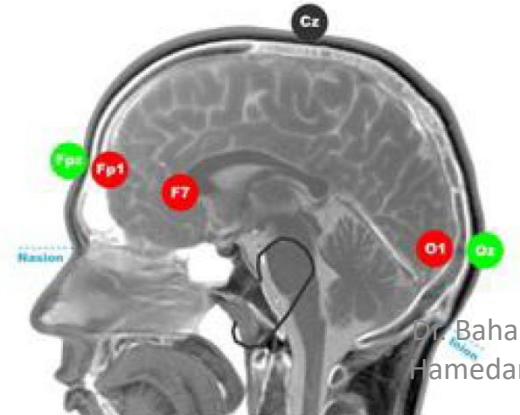


Step 15

Measure from F7 to F8 and note your distance.

For our example 32 cm





Positioning for T5 and T6 is analogous to step 14 for determining F7 and F8

Step 16

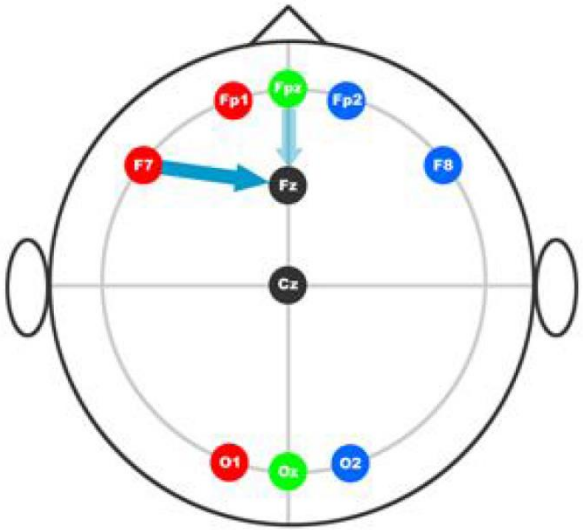
Measure and mark half of the distance between F7 and F8. At the intersection with your preliminary Fz mark is the **true** mark for Fz.

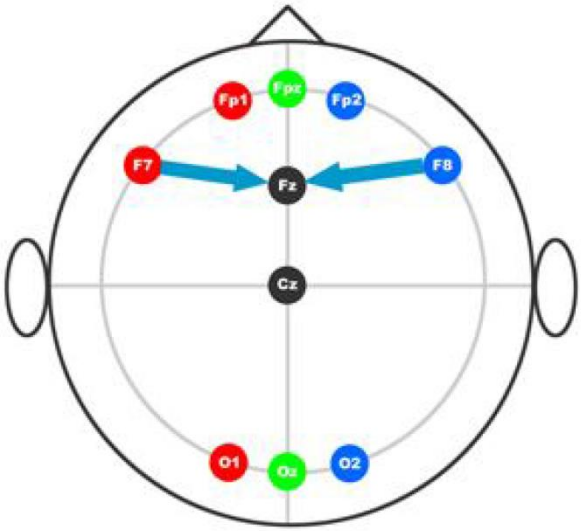
In our example 32 cm / 2 = 16 cm

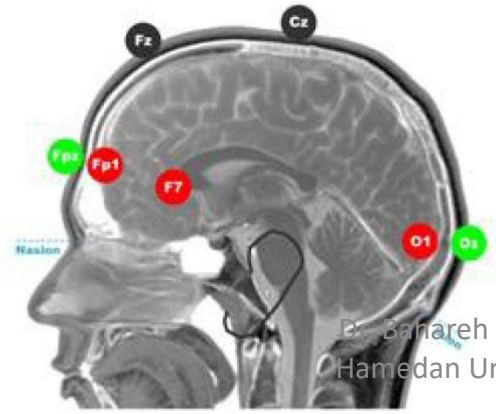
Step 17

Measure from F7 to Fz, note the distance.
Measure from F8 to Fz, note the distance.

For our example 16 cm and 16 cm





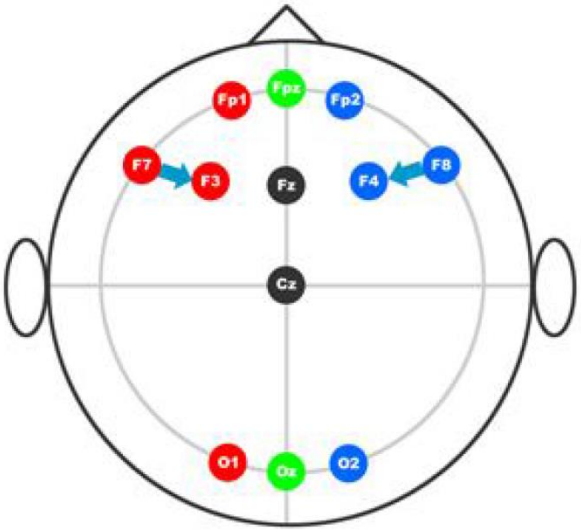


Positioning for Pz is analogous to steps 15 and 16 for determining Fz

Step 18

Measure and mark half of the distance between F7-Fz and F8-Fz. These are your preliminary marks for F3 and F4.

In our example 16 cm / 2 = 8 cm

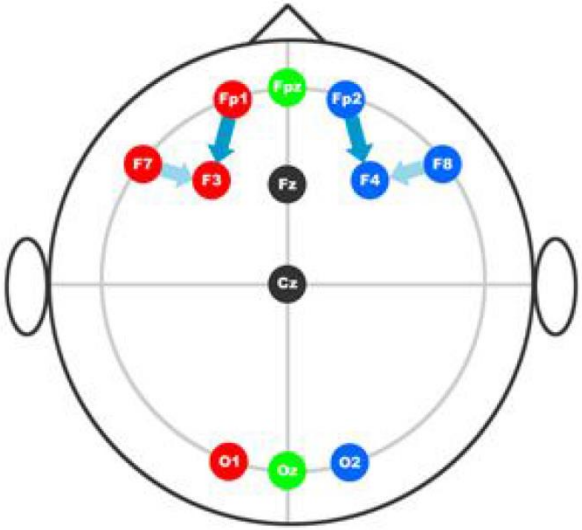


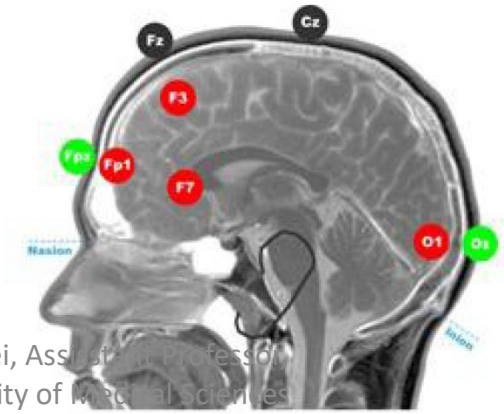
Step 19

Measure and mark 20% of the Nasion-Inion distance from FP1 to F3. At the intersection will be your **true** F3 mark.

Measure and mark 20% of the Nasion-Inion distance from FP2 to F4. At the intersection will be your **true** F4 mark.

In our example 20% of 36 cm = 7 cm





Positioning for P3 and P4 is analogous to steps 17, 18 and 19 for determining F3 and F4

Step 20

Measure from Fp1 to O1, to obtain your preliminary mark of C3.

Measure from Fp2 to O2 to obtain your preliminary mark of C3.

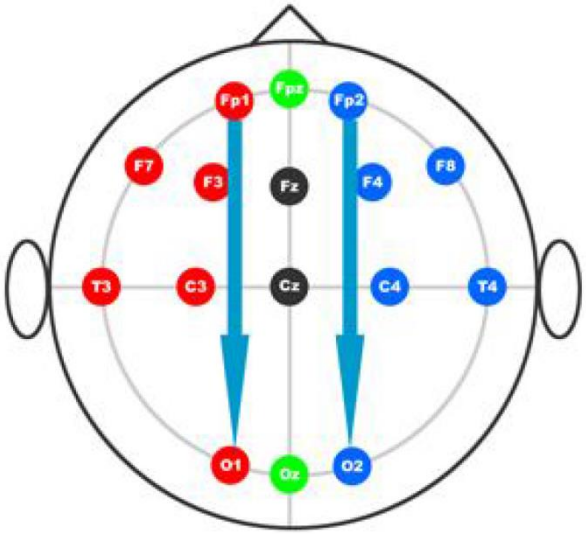
For our example 28 cm

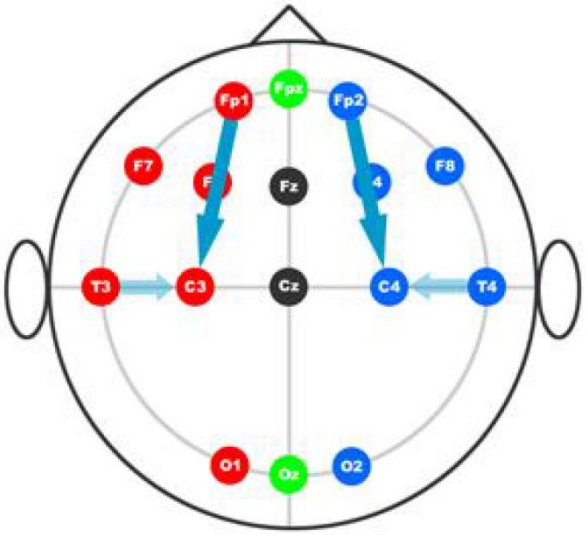
Step 21

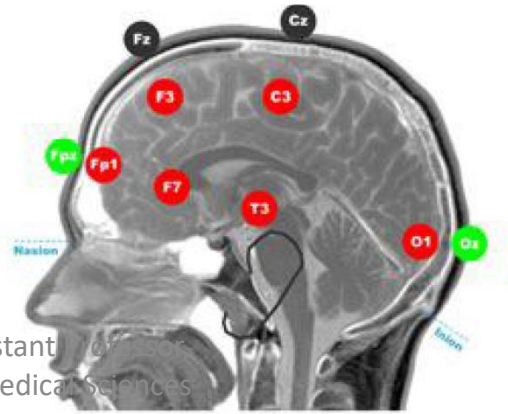
Measure and mark half of the distance Fp1-O1. Where your first and second marks intersect will be your **true** C3.

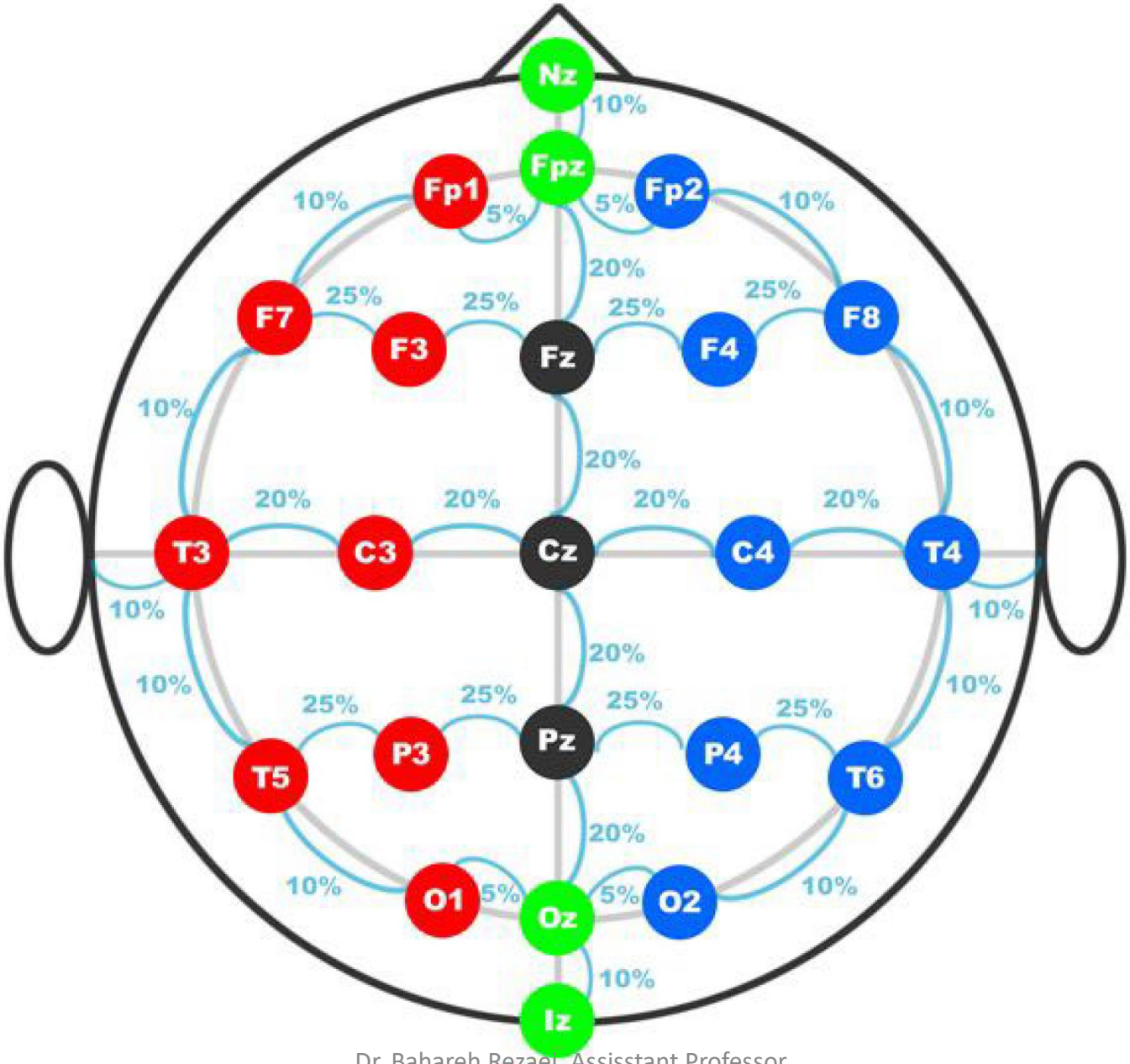
Measure and mark half of the distance Fp2-O2. Where your first and second marks intersect will be your **true** C4.

In our example 28 cm / 2 = 14 cm

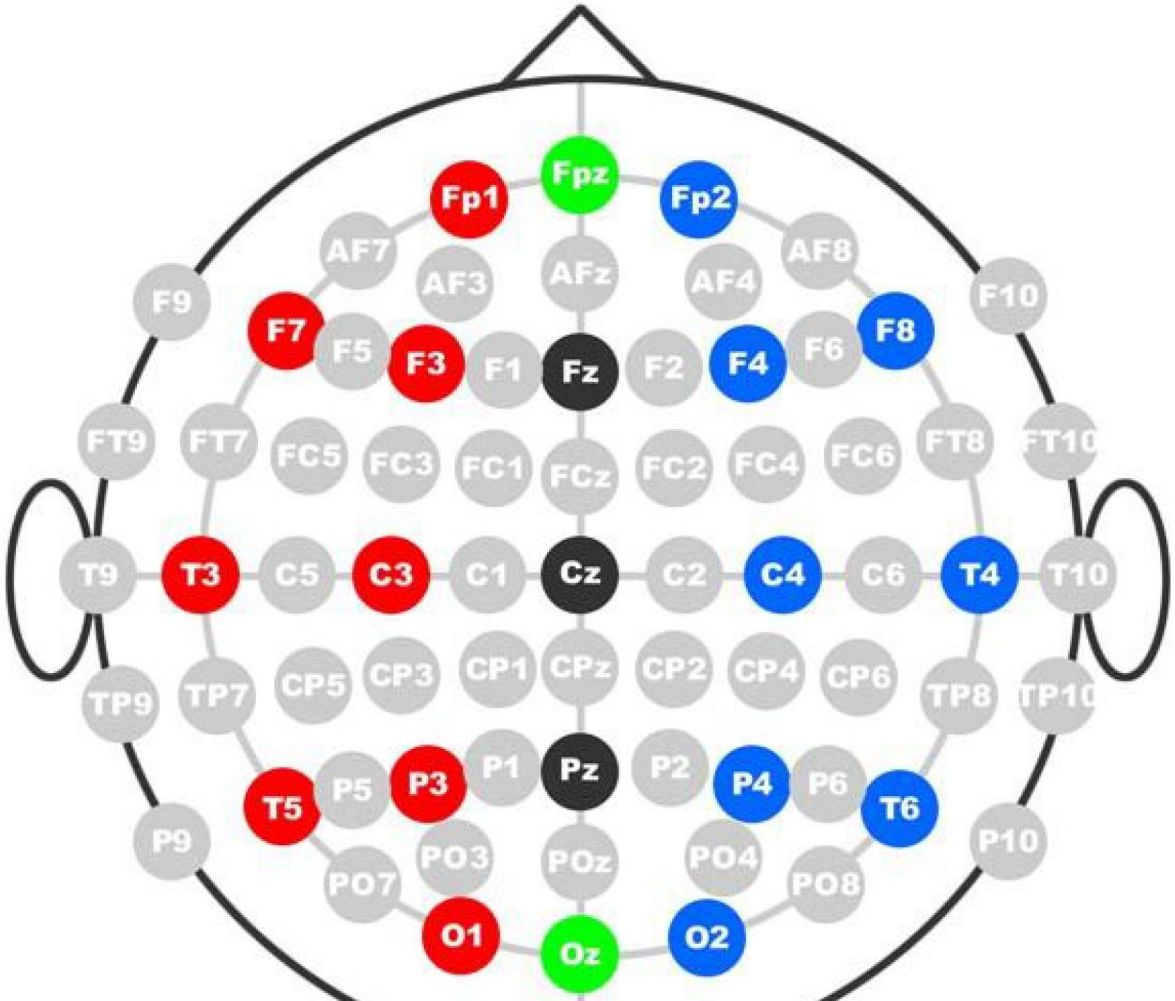




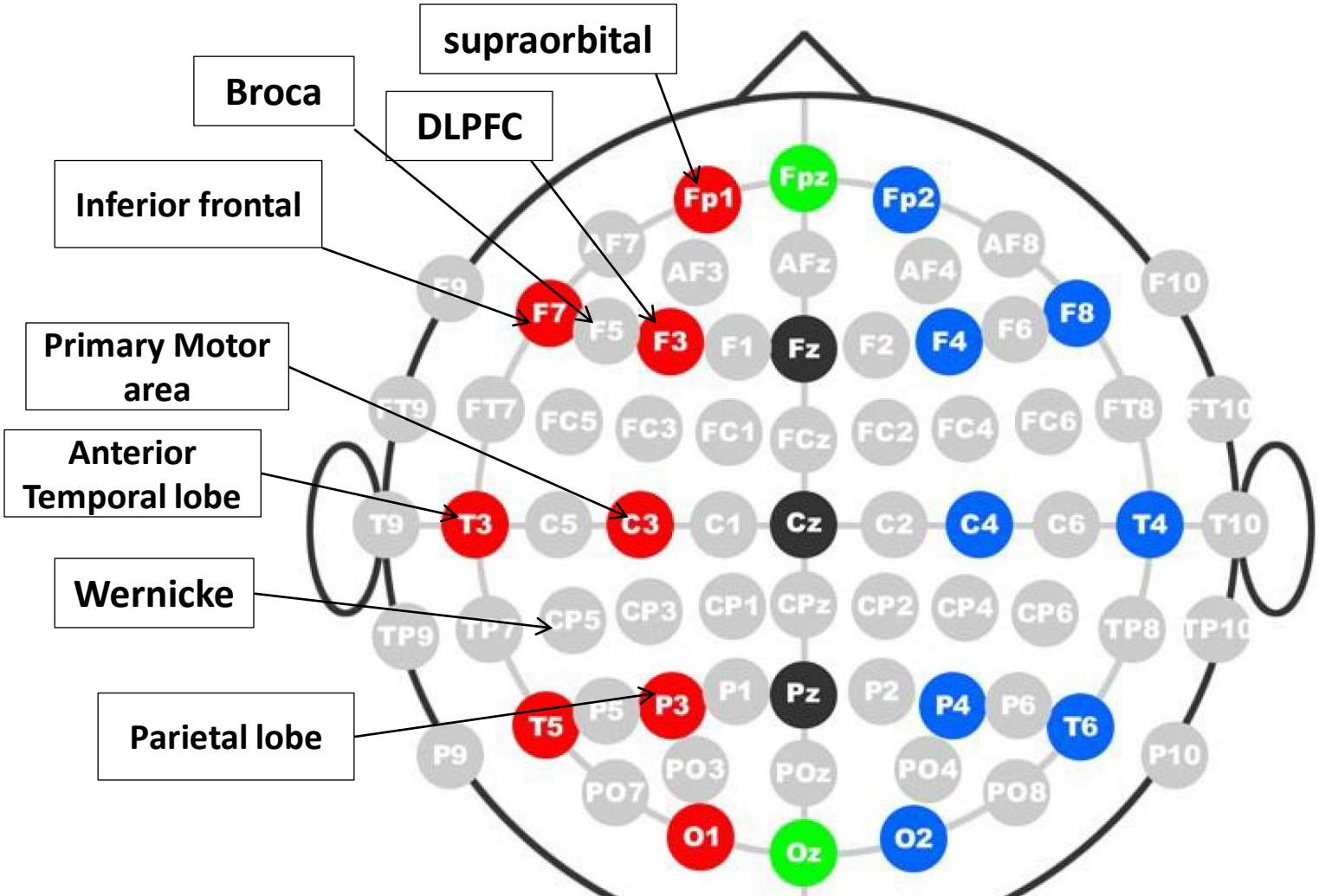



Nz
Fp1
Fpz
Fp2
F7
F3
Fz
F4
F8
T3
C3
Cz
C4
T4
T5
P3
Pz
P4
T6
O1
Oz
O2
Iz
10%
5%
20%
25%

10 / 10 System Positions



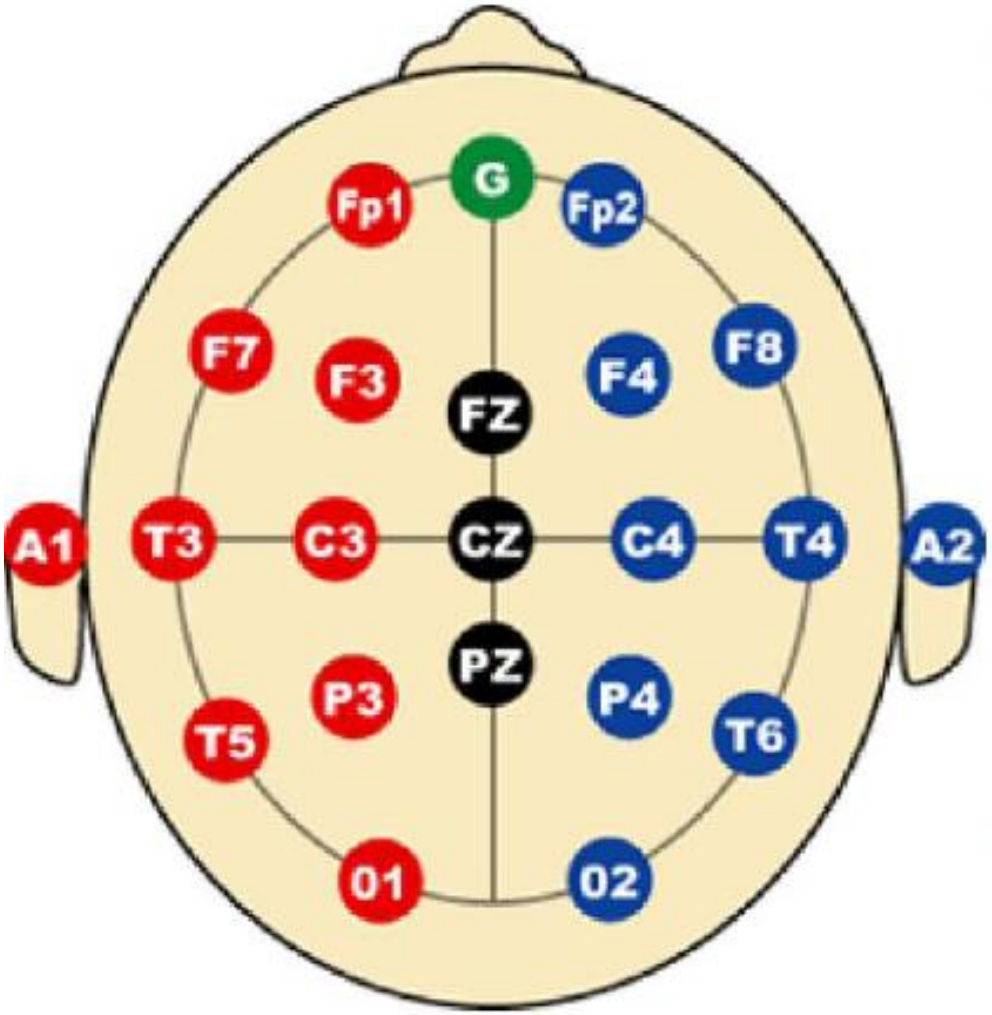
10 / 10 System Positions



Electrode Montages in Transcranial Direct Current Stimulation

Dr. Bahareh Rezaei, Assisstant Professor,
Hamedan University of Medical Sciences

Transcranial Electrical Stimulation Montages



1. **Single Channel**
   a. **Unilateral**
      i. Monopolar
      ii. Bipolar
      iii. Double Monopolar
   b. **Bilateral**
      i. Bipolar, Balanced or Non Balanced
      ii. Double Monopolar, Balanced or Non Balanced
   c. **Midline**
      i. Monopolar
      ii. Bipolar
      iii. Double Monopolar
2. **Dual Channel**
   a. Bipolar
   b. Double Monopolar

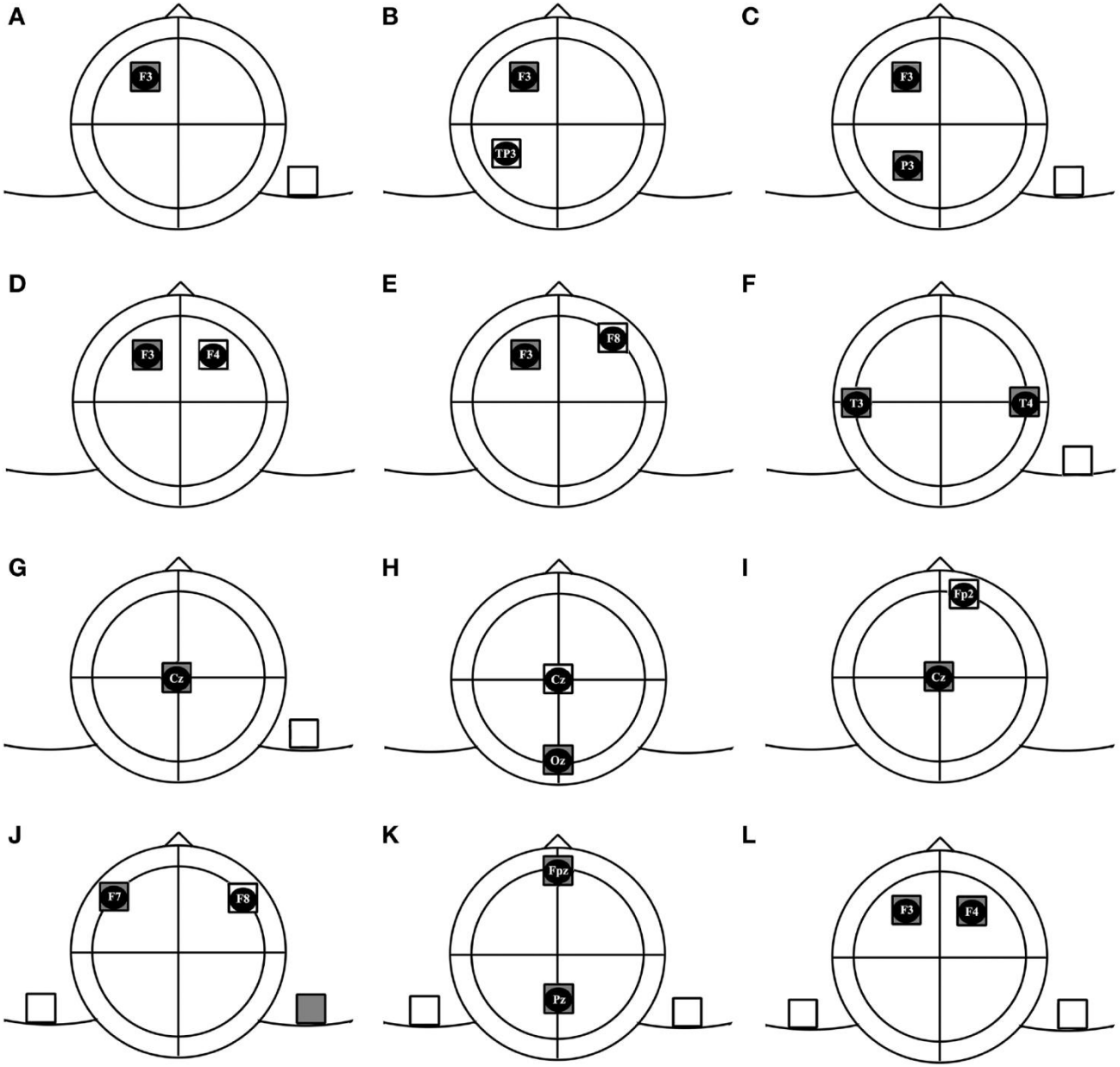
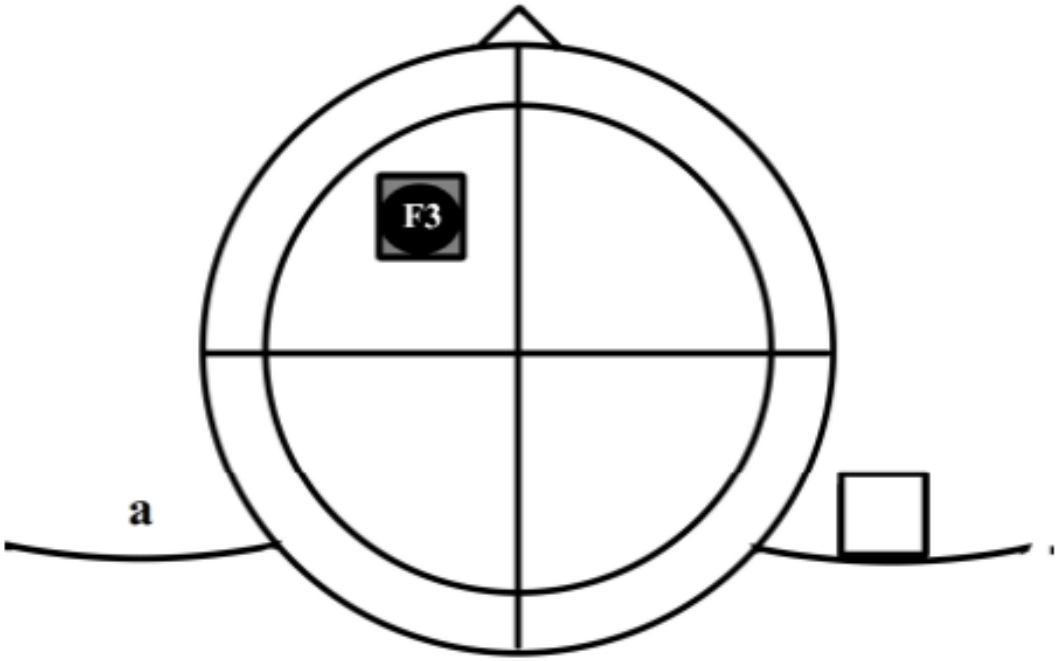


FIGURE 1 | Subgroups of tDCS montages: (A) unilateral monopolar, **(B)** unilateral bipolar, **(C)** unilateral multiple monopolar, **(D)** bilateral bipolar-balanced, **(E)** bilateral bipolar-non balanced, **(F)** bilateral multiple monopolar, **(G)** midline monopolar, **(H)** midline bipolar-balanced, **(I)** midline bipolar-non balanced, **(J)** dual channel- bipolar, **(K)** dual channel midline double monopolar, **(L)** dual channel bilateral double monopolar.

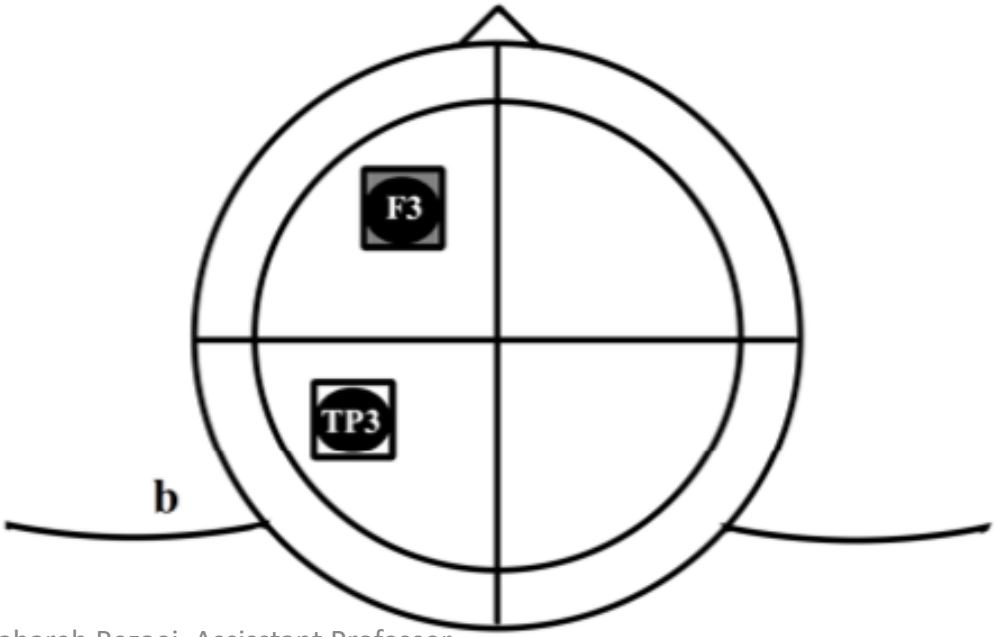
Unilateral Montages

1. Monopolar: In this montage, one electrode is positioned on the scalp and the other one is placed on any other part of the body: F3/contralateral shoulder



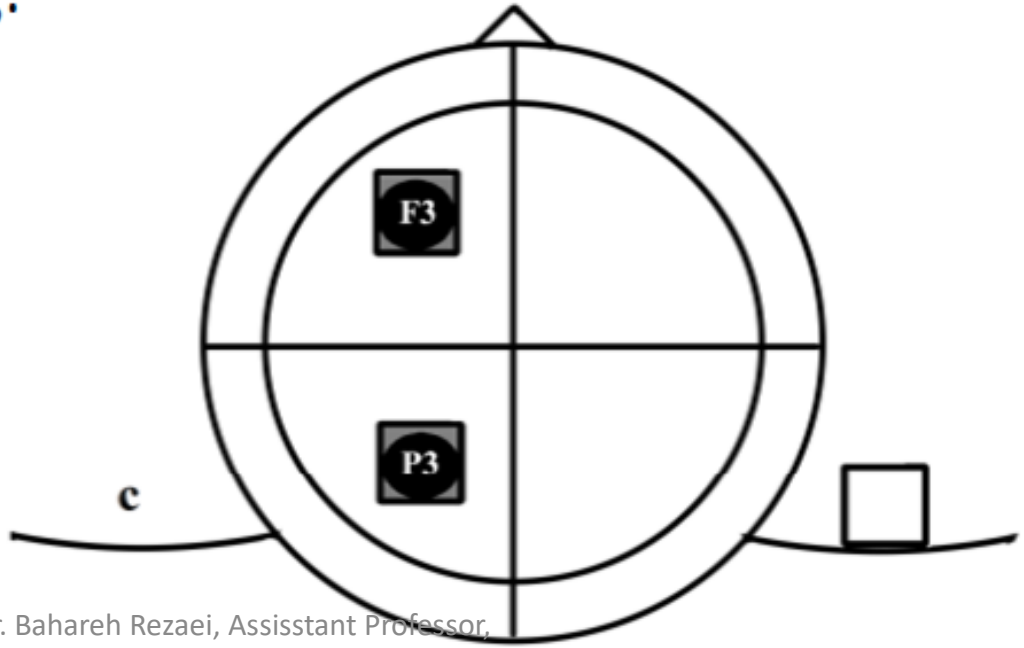
Unilateral Montages

2. Bipolar: In the unilateral bipolar subgroup, both electrodes are positioned over the same hemisphere (e.g. F3/TP3). In this condition the targeted hemisphere is modulated while the other hemisphere is supposed to remain unaffected by direct effects of stimulation.



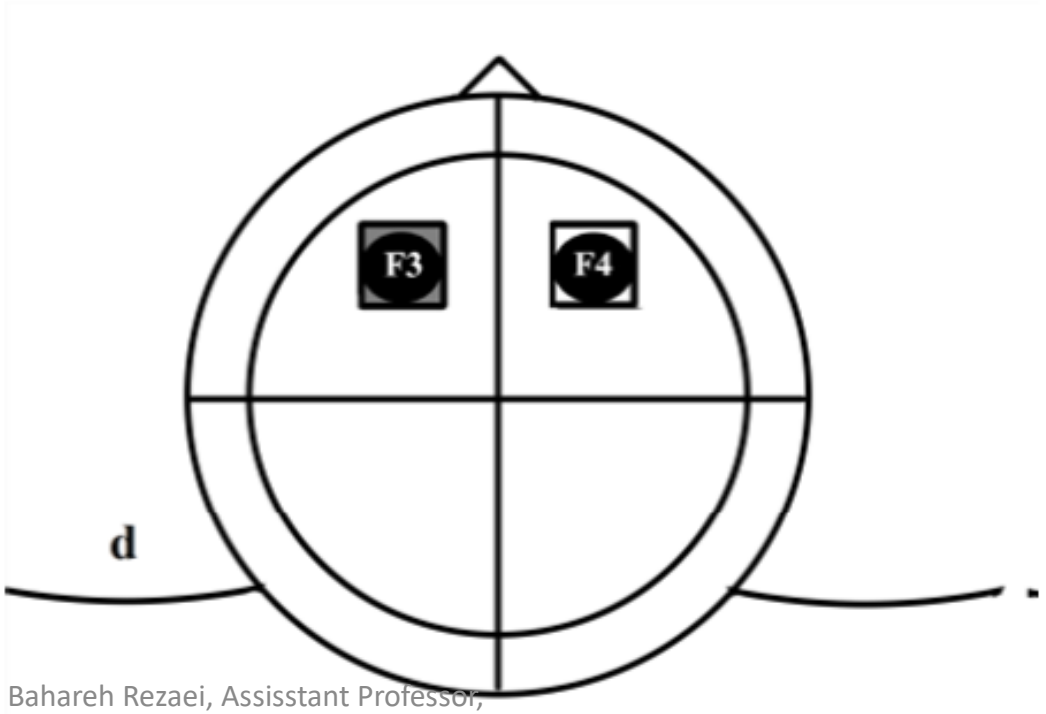
Unilateral Montages

Multiple-Monopolar: The target electrodes of identical polarity are placed over one hemisphere and the return electrode is positioned over another part of the body. An example could be F3 & P3/contralateral shoulder, to modulate frontoparietal networks contributing in attention processing.



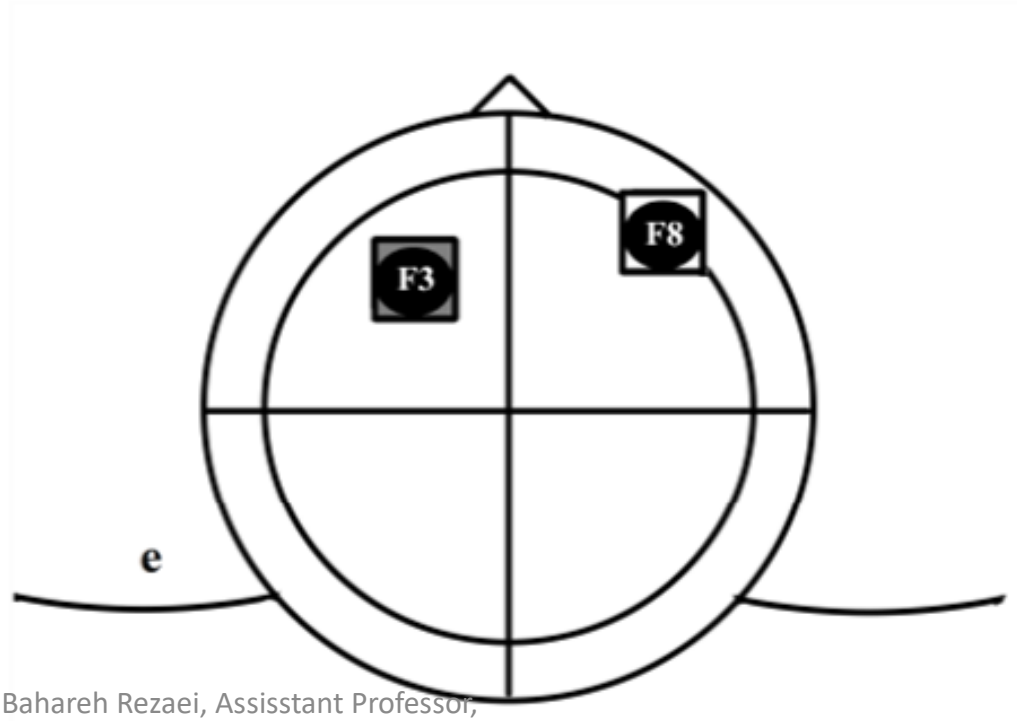
Bilateral Montages

1. Bipolar-Balanced: The electrodes are placed symmetrically. This montage is supposed to be suitable for simultaneously activating a brain region and inhibiting its contralateral counterpart. An example of this montage is F3/F4



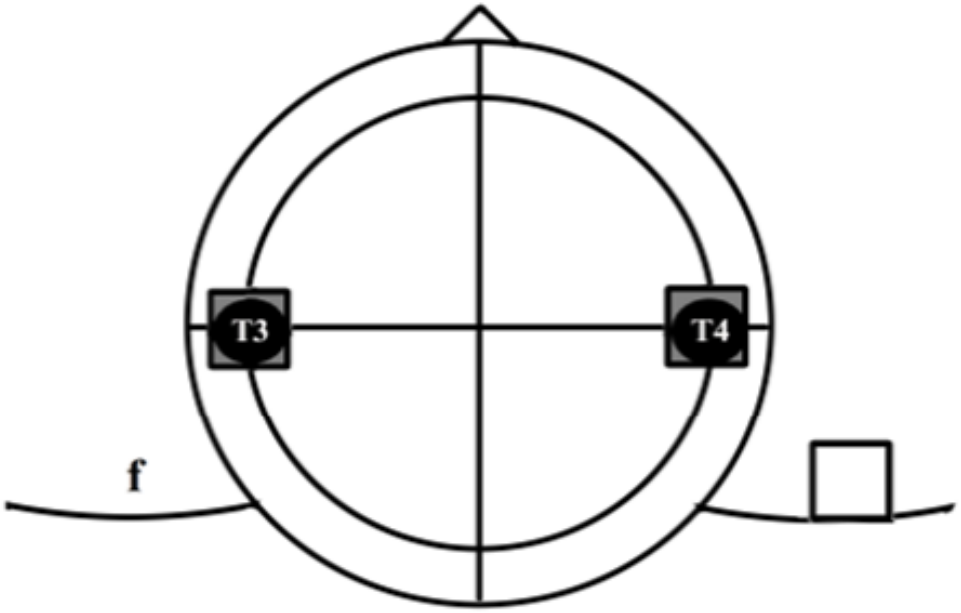
Bilateral Montages

2. Bipolar-Nonbalanced: For example, the anode could be placed over P3 and cathode over P6, which was Jacobson's montage of choice in his study on episodic memory (Jacobson, Goren, Lavidor, & Levy, 2012).



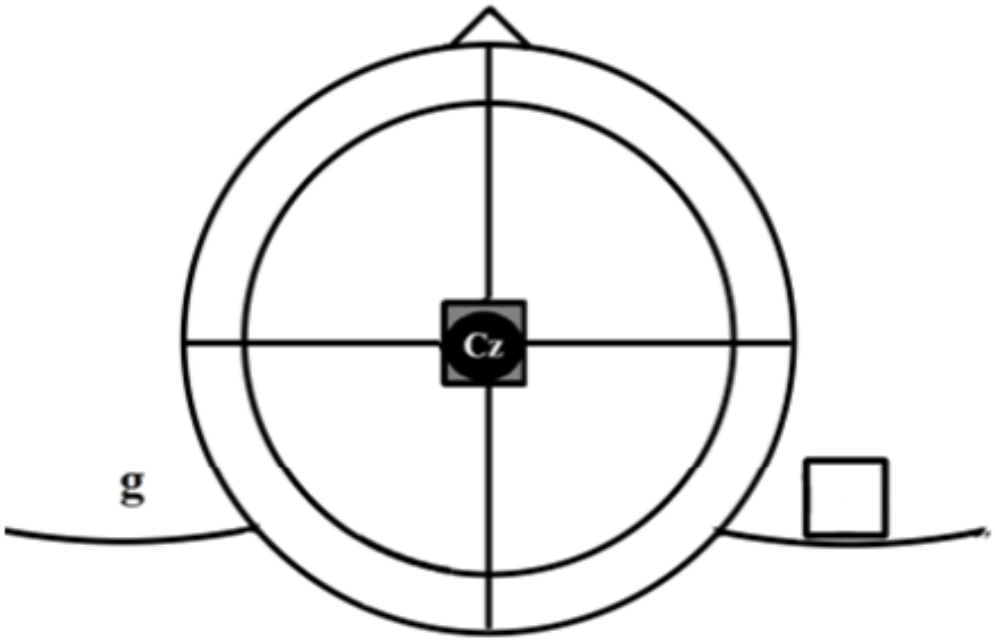
Bilateral Montages

3. Multiple-Monopolar: An example is the T3&T4/right deltoid muscle montage that was used in some protocols for enhancing visual memory (Lapenta, Fregni, Oberman, & Boggio, 2012), (Boggio, et al., 2012).



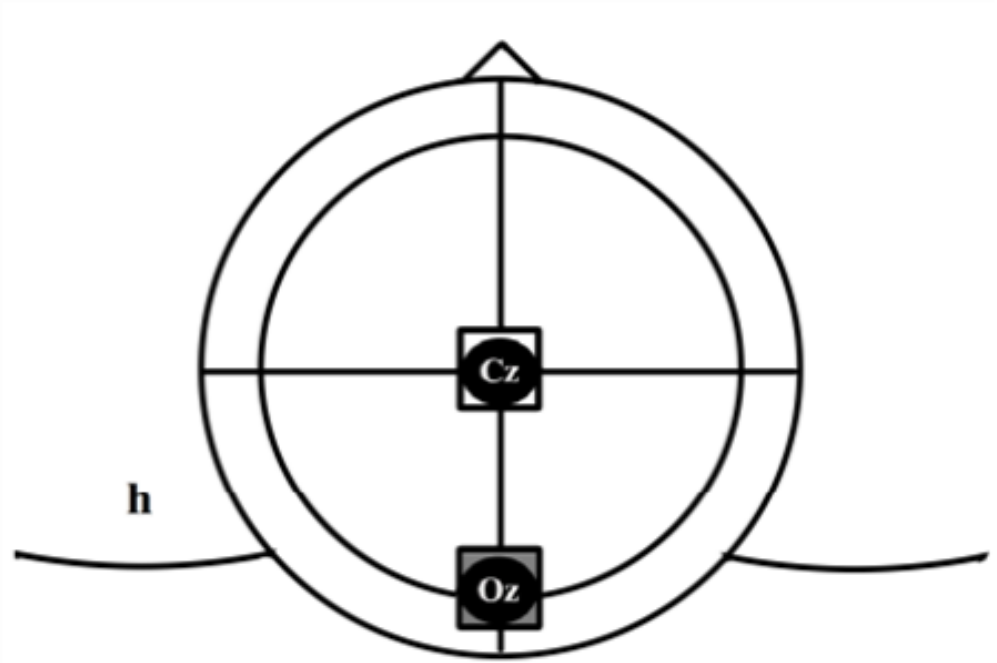
Midline Montages

1. Monopolar: In this type, the target electrode is placed over the midline area and the return electrode is placed over an extracephalic position (e.g. Fz/Left cheek to modulate inhibitory control) (Hsu, et al., 2011).



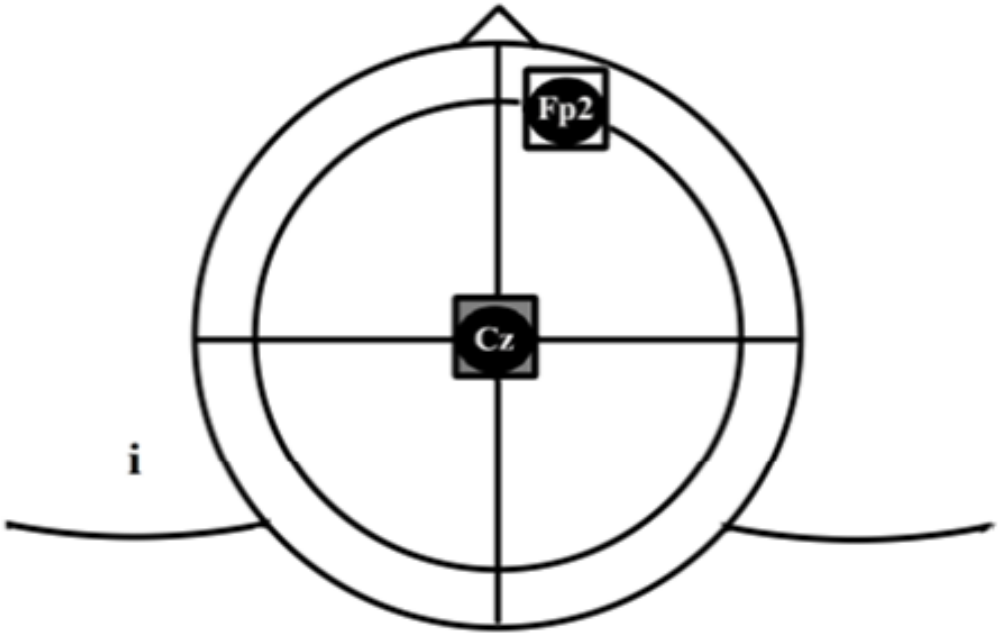
Midline Montages

2. Bipolar-Balanced: Both electrodes will be placed over midline regions. One prevalent montage of this subgroup is Oz/Cz which is common in visual studies.



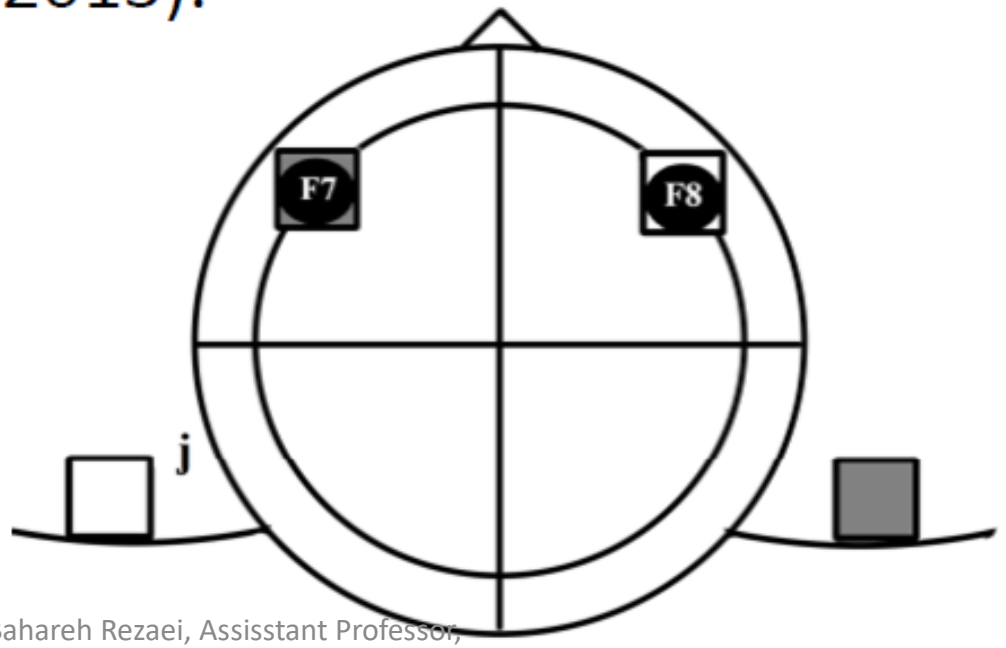
Midline Montages

3. Bipolar-Nonbalanced: The target electrode will be placed over the midline region with an intracephalic return electrode positioned over any part of scalp except midline. An example could be Cz/FP2 (Stagg, et al., 2009).



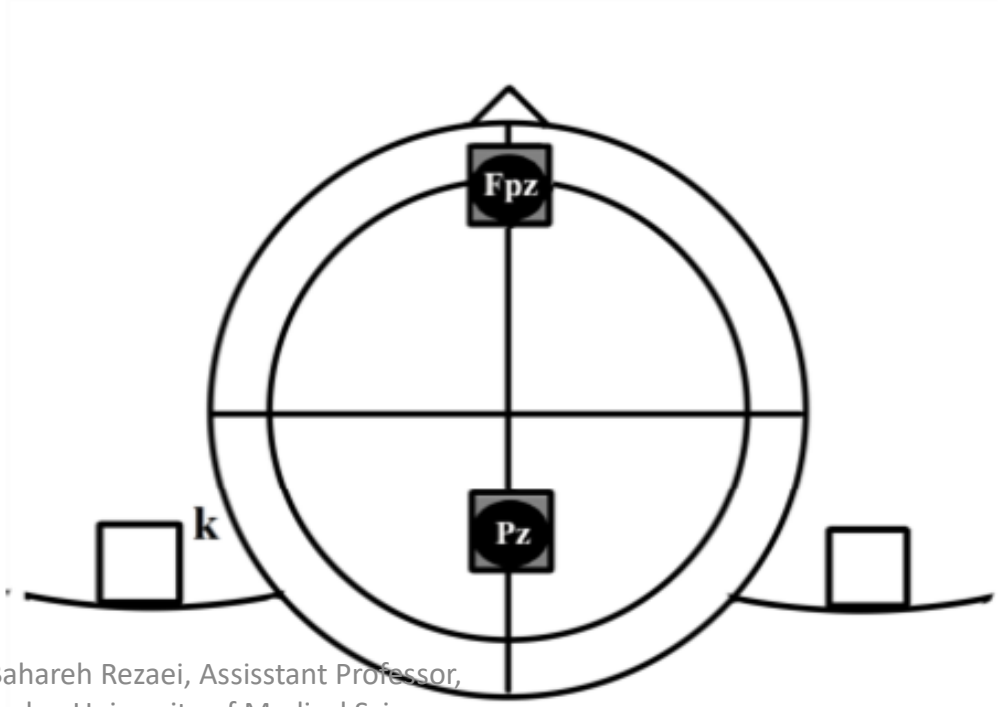
Double Channel Montages

1. Bipolar: An example would be F7/left shoulder and right shoulder/F8. This montage provides us with an opportunity to perform anodal tDCS over F7 and cathodal tDCS over F8 simultaneously (Lee, Cheon, Yoon, Chang, & Kim, 2013).



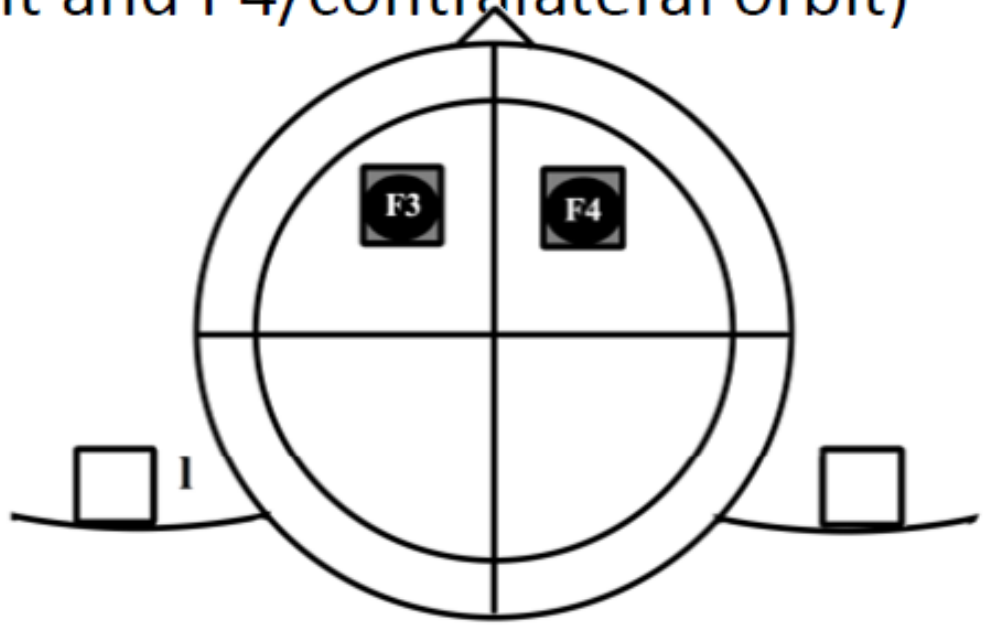
Double Channel Montages

2. Midline Double-Monopolar: The active electrodes are positioned over midline regions. An example is Fpz/right shoulder and Pz/left shoulder.

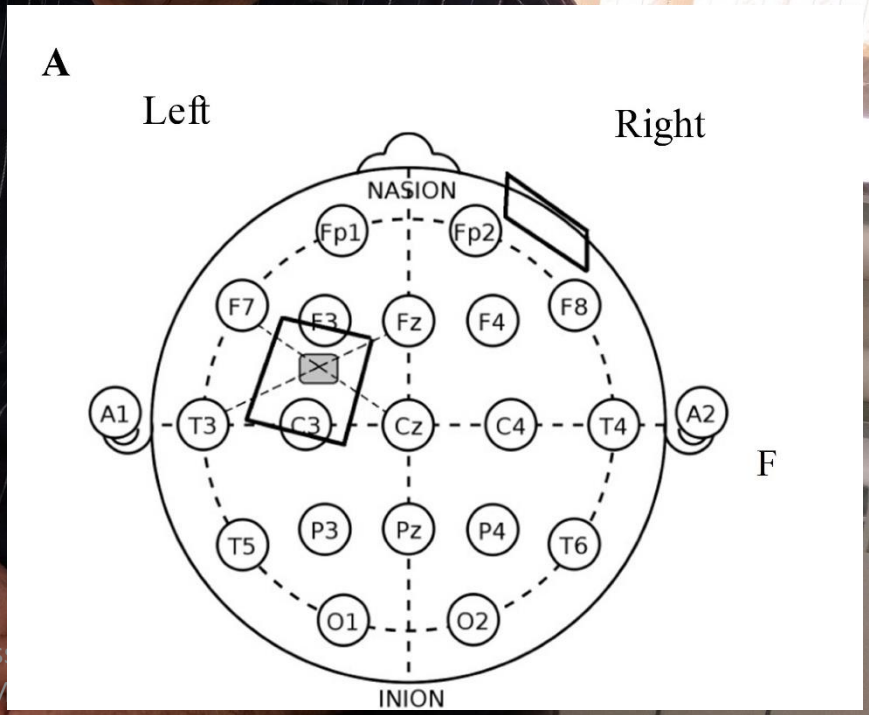


Double Channel Montages

3. Bilateral Double-Monopolar: Two electrodes of same polarity are placed over the scalp and 2 other electrodes will be positioned over the contralateral orbits or above contralateral parts of the body (e.g. P3/ contralateral orbit and P4/contralateral orbit) (Klein, et al., 2013).

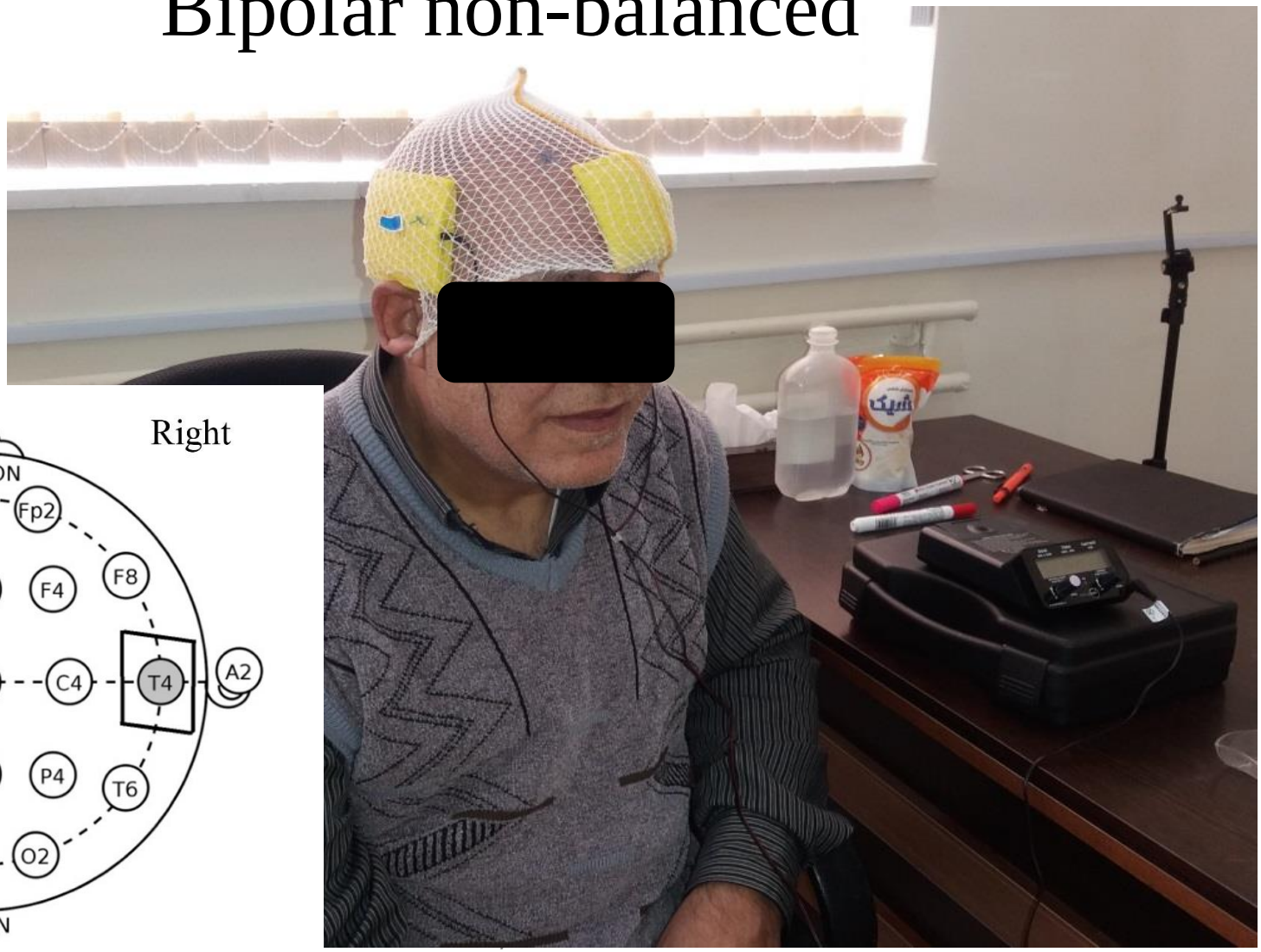


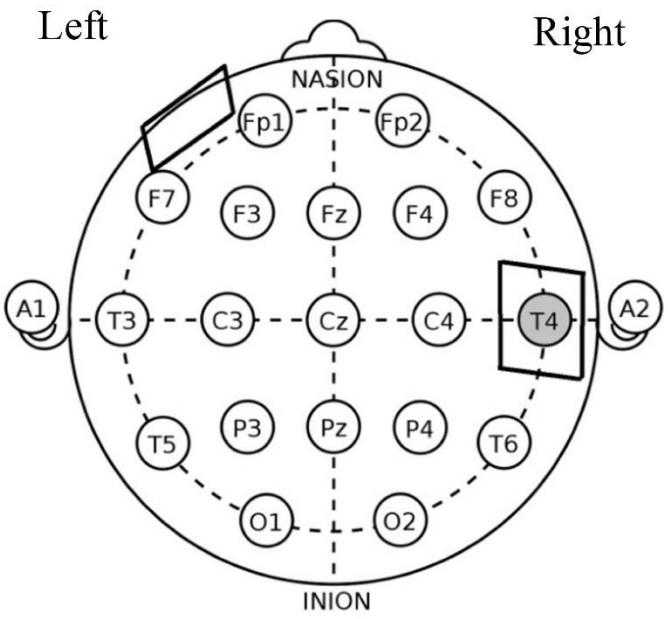
نمونه ای از پروتکل
bilateral
Bipolar non-balanced

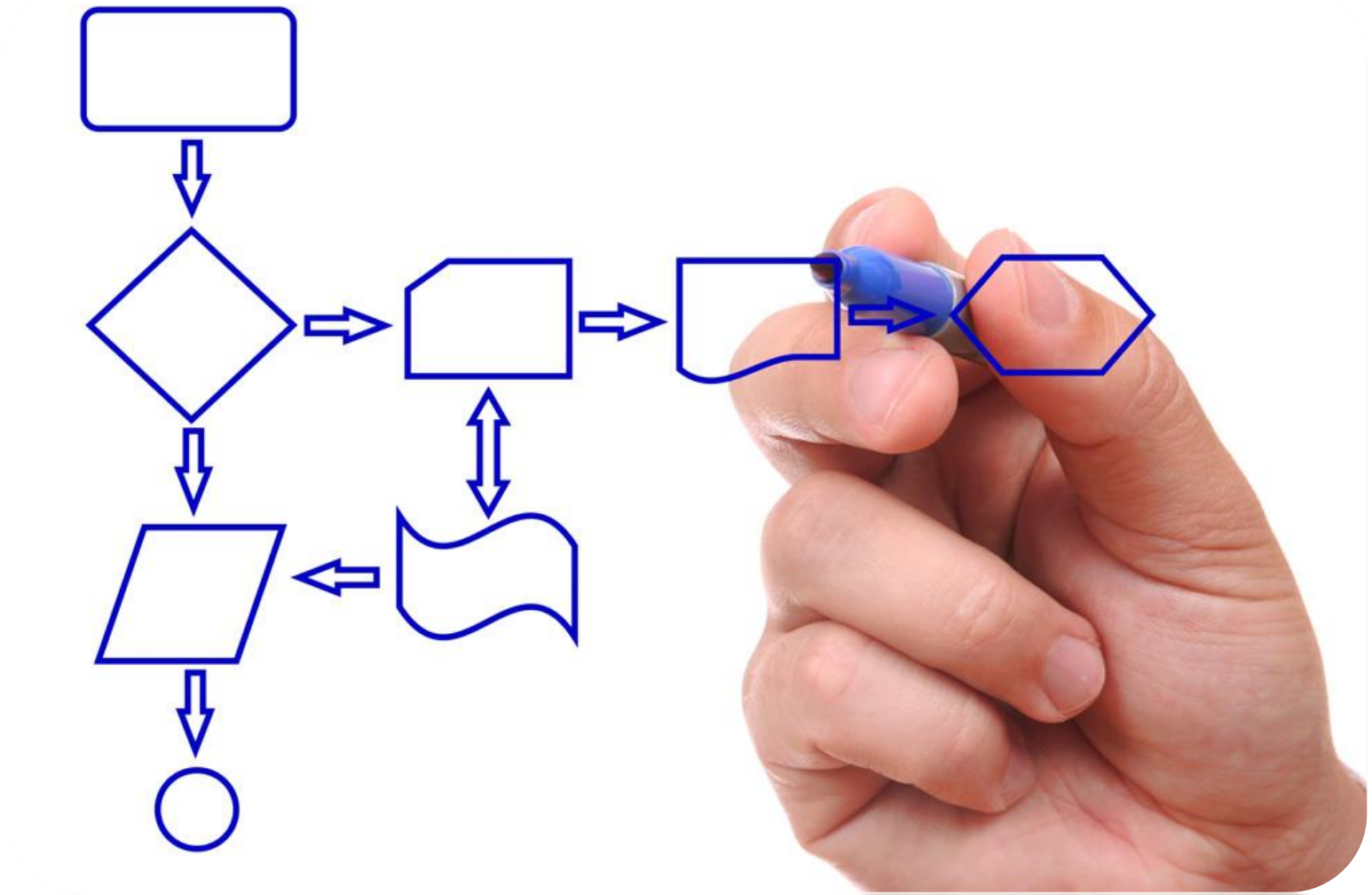


Dr. Bahareh Rezaei, Assis
Hamedan University of M

نمونه ای از پروتکل bilateral
Bipolar non-balanced

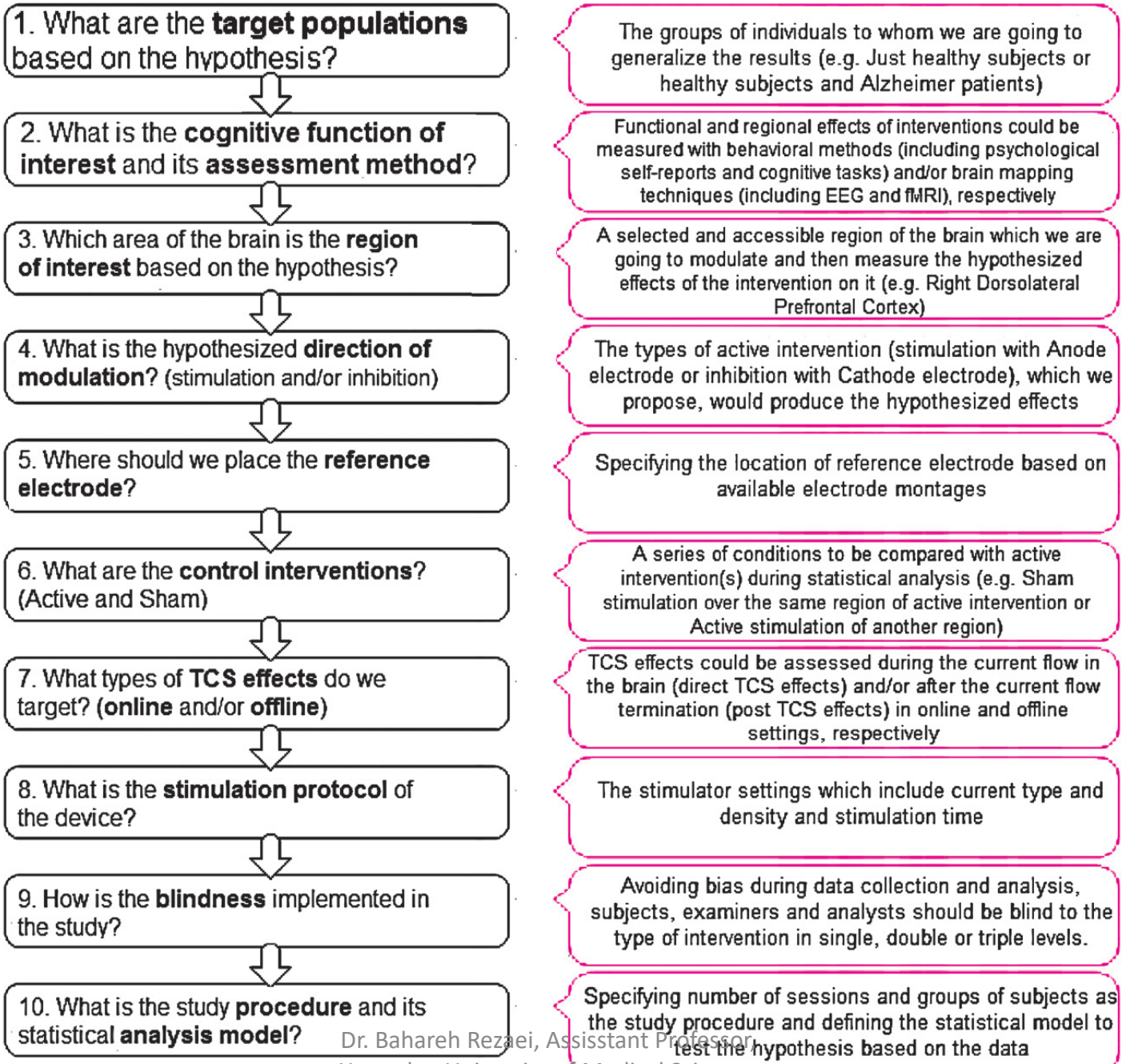


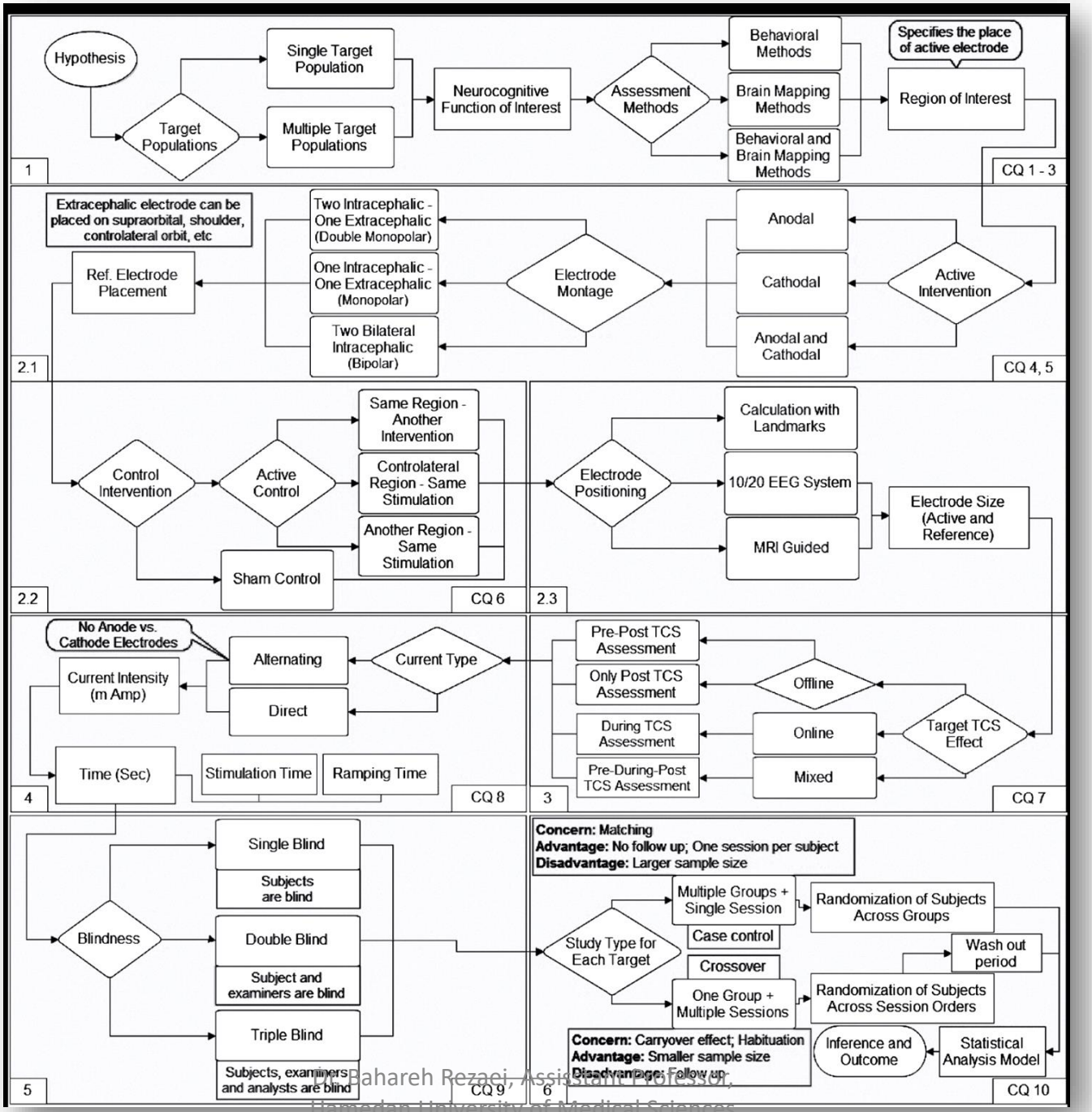




Study Design with tDCS

Dr. Bahareh Rezaei, Assisstant Professor,
Hamedan University of Medical Sciences





1. What are the **target populations** based on the hypothesis?

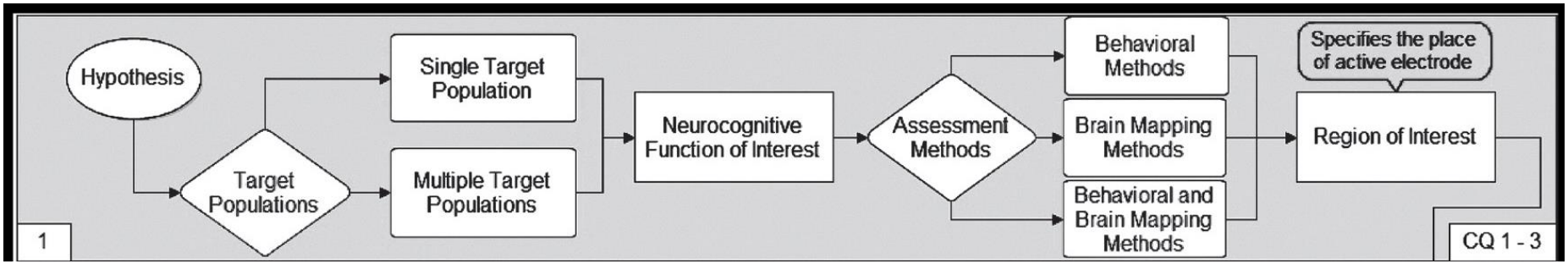
The groups of individuals to whom we are going to generalize the results (e.g. Just healthy subjects or healthy subjects and Alzheimer patients)

2. What is the **cognitive function of interest** and its **assessment method**?

Functional and regional effects of interventions could be measured with behavioral methods (including psychological self-reports and cognitive tasks) and/or brain mapping techniques (including EEG and fMRI), respectively

3. Which area of the brain is the **region of interest** based on the hypothesis?

A selected and accessible region of the brain which we are going to modulate and then measure the hypothesized effects of the intervention on it (e.g. Right Dorsolateral Prefrontal Cortex)

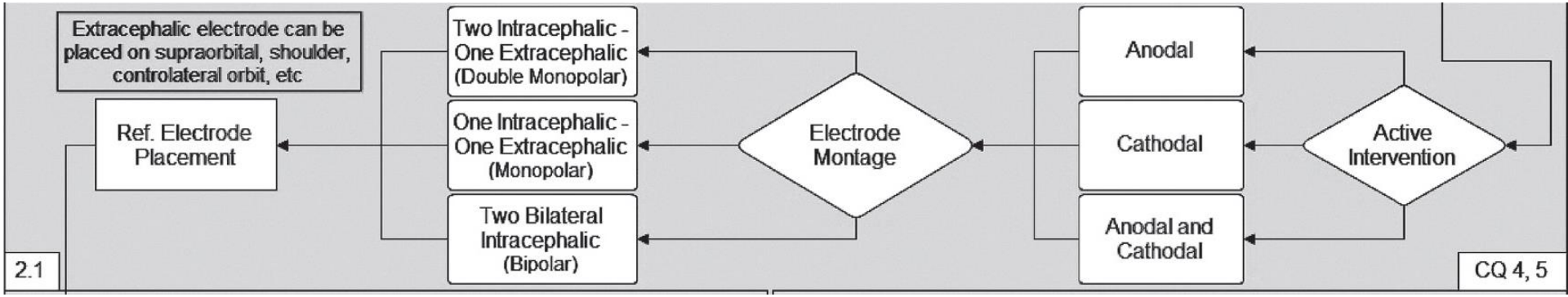


4. What is the hypothesized **direction of modulation?** (stimulation and/or inhibition)

The types of active intervention (stimulation with Anode electrode or inhibition with Cathode electrode), which we propose, would produce the hypothesized effects

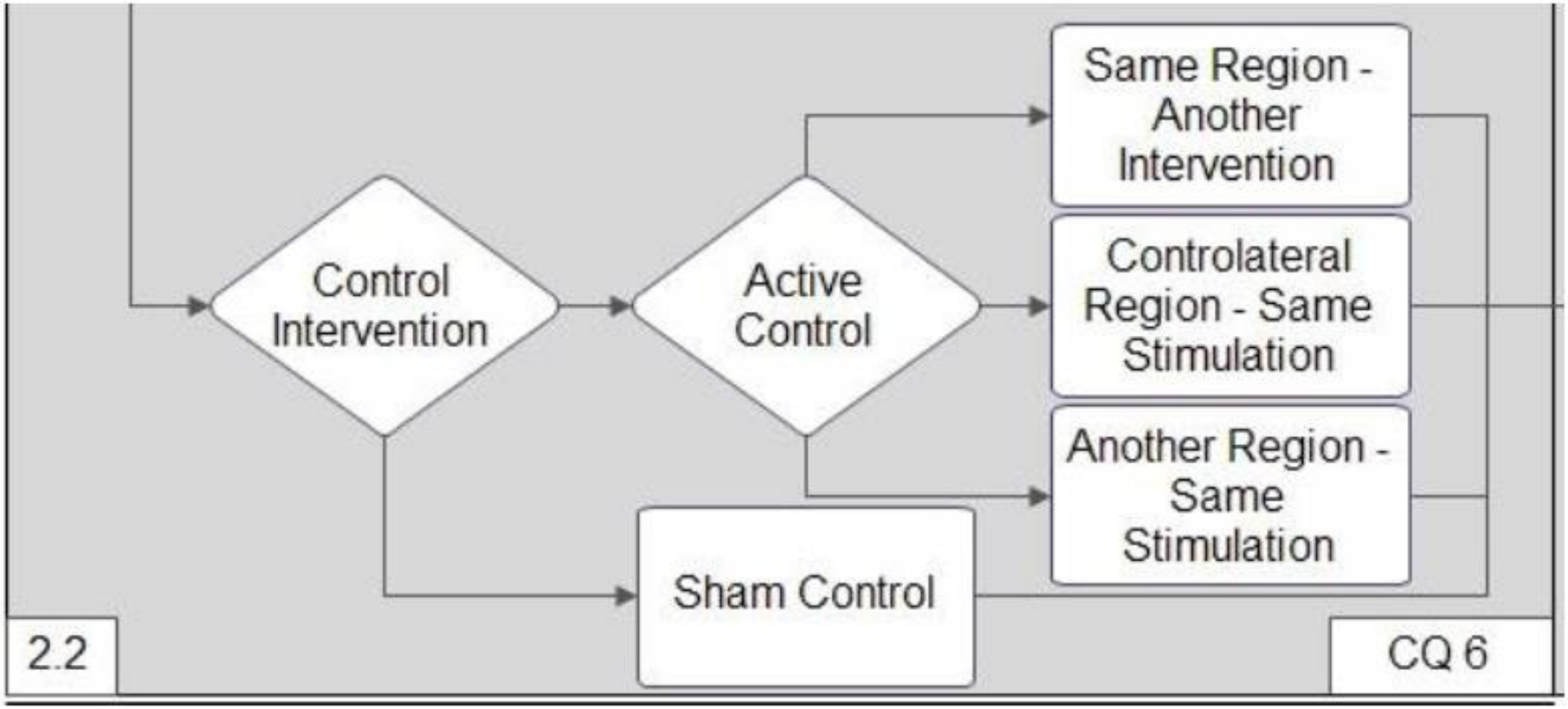
5. Where should we place the **reference electrode?**

Specifying the location of reference electrode based on available electrode montages



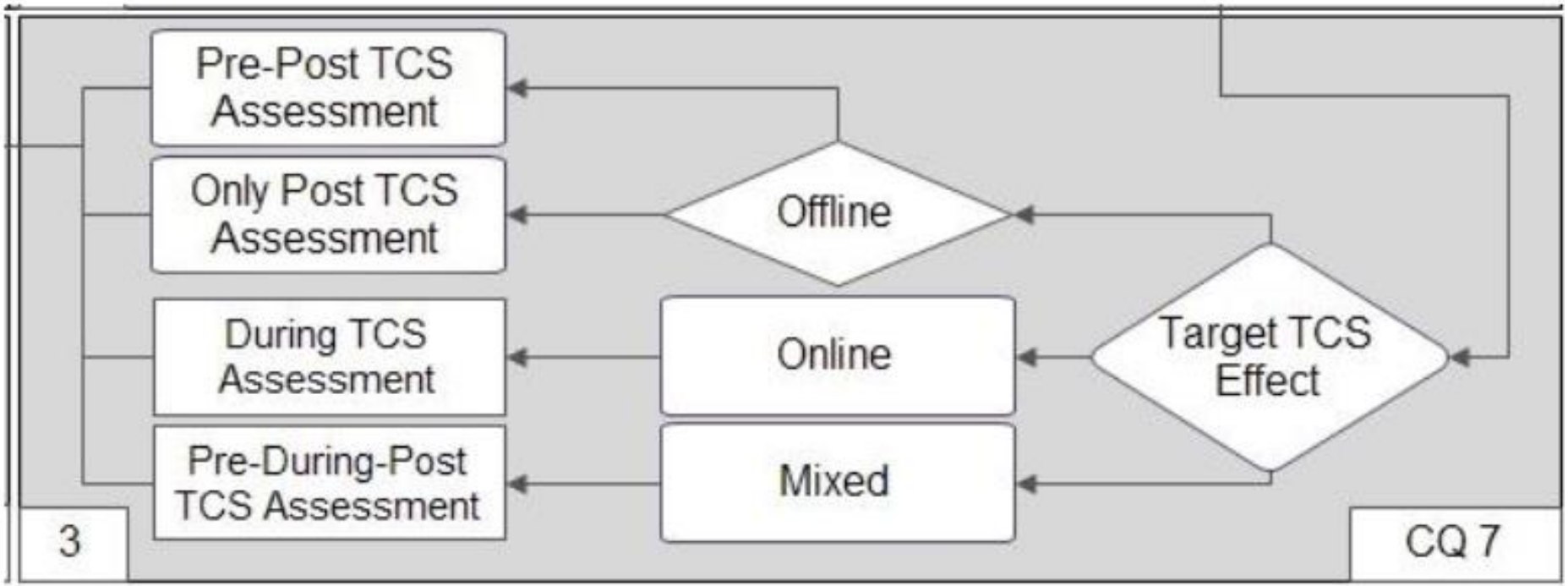
6. What are the **control interventions**? (Active and Sham)

A series of conditions to be compared with active intervention(s) during statistical analysis (e.g. Sham stimulation over the same region of active intervention or Active stimulation of another region)



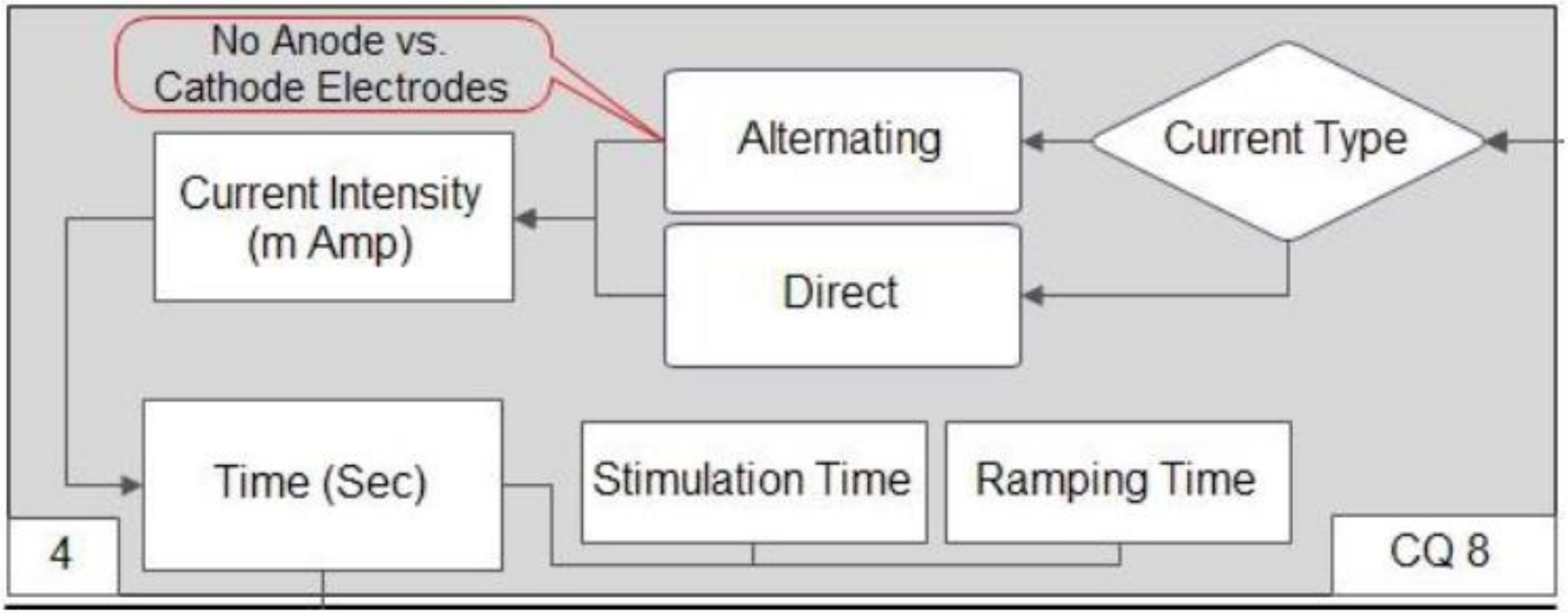
7. What types of **TCS effects** do we target? (**online** and/or **offline**)

TCS effects could be assessed during the current flow in the brain (direct TCS effects) and/or after the current flow termination (post TCS effects) in online and offline settings, respectively



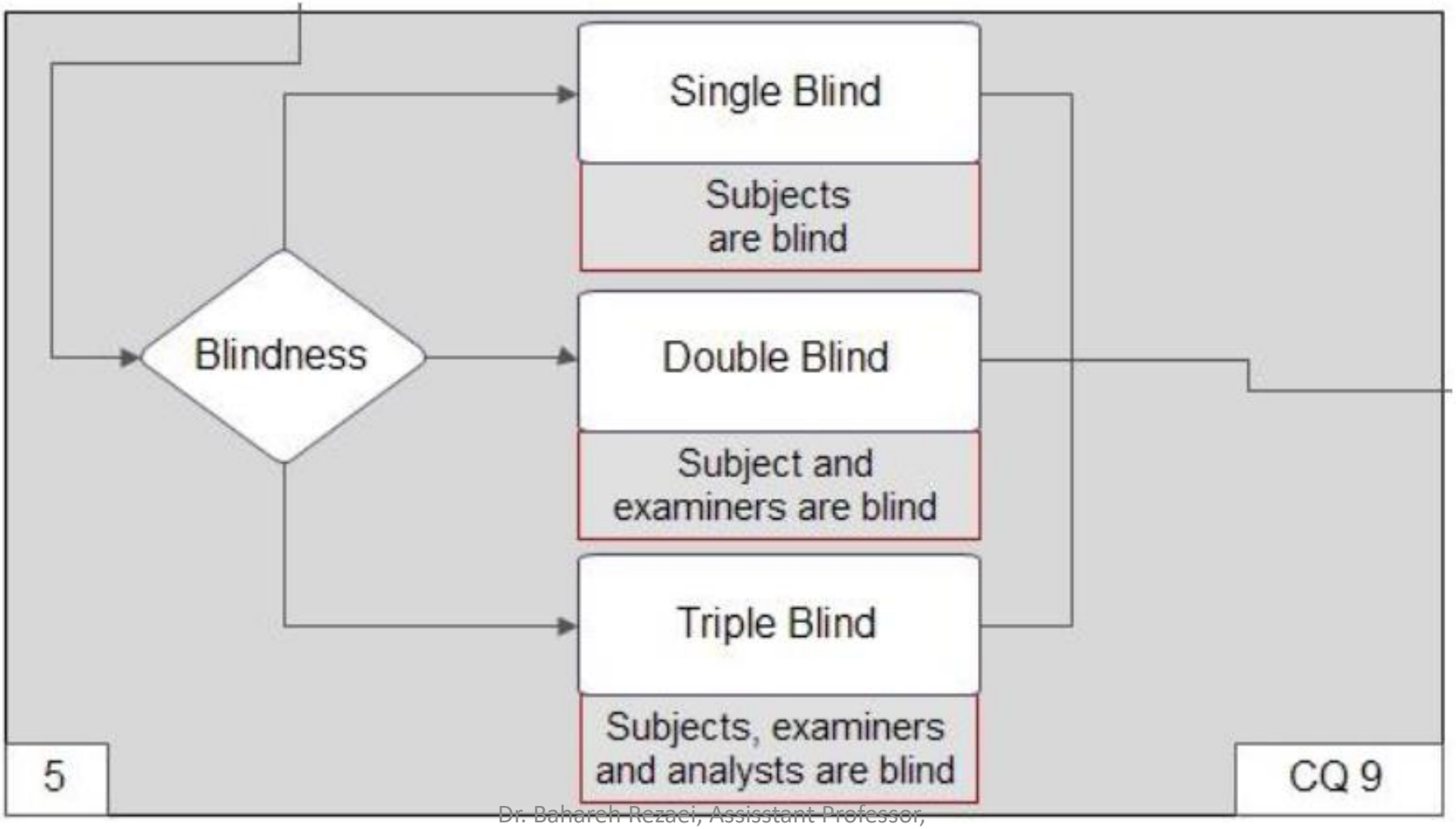
8. What is the **stimulation protocol** of the device?

The stimulator settings which include current type and density and stimulation time



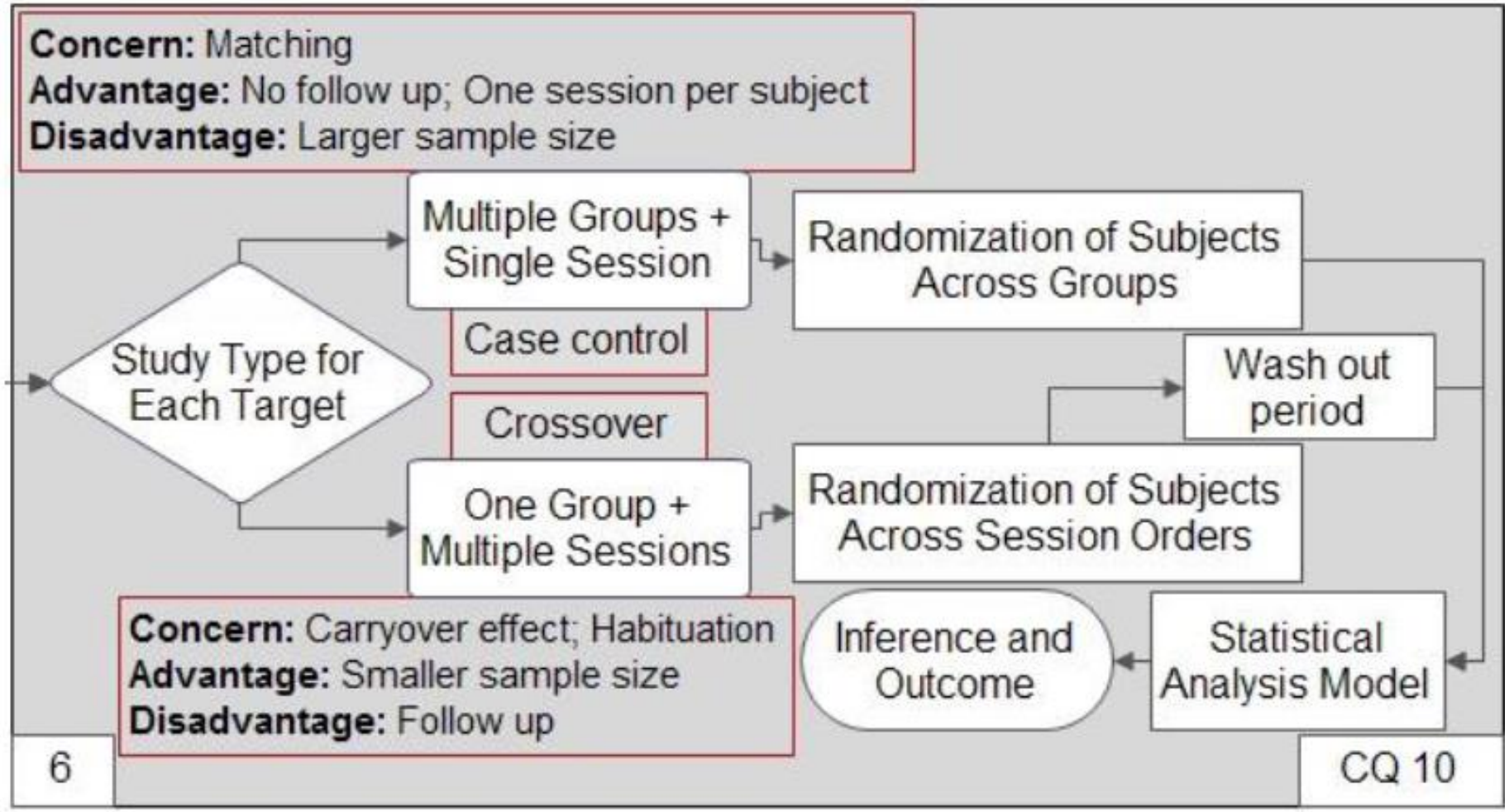
9. How is the **blindness** implemented in the study?

Avoiding bias during data collection and analysis, subjects, examiners and analysts should be blind to the type of intervention in single, double or triple levels.



10. What is the study **procedure** and its statistical **analysis model**?

Specifying number of sessions and groups of subjects as the study procedure and defining the statistical model to test the hypothesis based on the data



ملاحظات اخلاقی

Dr. Bahareh Rezaei, Assisstant Professor,
Hamedan University of Medical Sciences

نمونه رضایت نامه شرکت در پژوهش

رضایت نامه شرکت در طرح مقایسه تأثیر تحریک جریان مستقیم از روی جمجمه(tDCS) روی شکنج تحتانی فرونتال(IFG) و شکنج فوقانی تمپورال(STG) راست و چپ بر صحت و سرعت نامیدن تصویر بیماران فارسی‌زبان مبتلا به زبان‌پریشی ناشی از سکتهٔ مغزی

شرکت‌کننده محترم

لطفا متن زیر را مطالعه فرموده و هر جا سؤالی داشتید و یا متن واضح نبود، بپرسید. در انتها اگر موافق بودید که با شرکت خود در این طرح ما را یاری کنید، موافقت خود را با امضای آن در انتهای متن تأیید فرمایید. از لطف و همکاری شما کمال تشکر را داریم.

۱. هدف از این طرح، اجرای یک پژوهش علمی برای دریافت درجه دکتری است.

۲. این پژوهش به دنبال یافتن شیوه‌های درمانی جدیدی برای بیمارانی است که دچار آسیب گفتاری بعد از سکته مغزی شده اند.

۳. تحریک مغز با جریان مستقیم الکتریکی از روی جمجمه(tDCS) یک تکنیک غیر تهاجمی تحریک مغزی است در آن یک جریان الکتریکی ضعیف مستقیم روی یک ناحیه از مغز به مدت چند دقیقه منجر به تعدیل در فعالیت مغزی و نیز برخی تغییرات در پلاستیسیته نورون‌ها می‌گردد. نواحی مغزی مورد هدف در این مطالعه قشر شکنج تحتانی فرونتال و قشر شکنج فوقانی تمپورال راست و چپ است. مطالعات پیشین نشان می‌دهند که تغییر در قطبیت این ناحیه منجر به بهبود نقایص نامیدن در بیماران دچار آسیب نیمکره چپ می‌شود. علاوه بر آن مطالعات تصویربرداری مغزی نشان می‌دهند که فعالیت این ناحیه ارتباط معنی داری با عملکرد نامیدن دارد.

۴. در جریان این طرح، ما از شما انتظار داریم در ۲ جلسه ارزیابی، ۲ جلسه آزمایشی و ۱۰ جلسه درمانی شرکت کنید. هر جلسه درمانی حدود ۳۰ دقیقه طول می‌کشد. شما در ۵ جلسه درمانی یک جریان الکتریک ضعیف را دریافت می‌کنید و در ۵ جلسه درمانی دیگر، جریانی از مغز شما عبور نخواهد کرد. اما لازم به ذکر است که توالی این جلسات برای شما مشخص نمی‌شود؛ همچنین بین هر ۵ جلسه درمان، ۷ روز وقفه وجود دارد. در پایان هر دوره درمانی ۵ جلسه، ارزیابی‌های نامیدن، شناختی و زبانی نیز انجام خواهد شد.

۵. یک ماه پس از پایان جلسات درمان، یک جلسه پیگیری برای بررسی اثرات طولانی مدت تنظیم شده است که طی آن همان ارزیابی‌های قبل از شما به‌عمل خواهد آمد.

۶. جهت افزایش کارایی این روش درمانی از شما خواسته می‌شود که در تمام جلسات درمان شرکت نموده و با محقق همکاری نمایید.

۷. این روش درمانی عوارض جانبی جدی و پایداری ندارد و بر اساس گزارش استفاده کنندگان از این دستگاه در سراسر جهان، امکان بروز خارش و قرمزی پوست سر در محل قرار گیری الکترودها و حالاتی نظیر سردرد، سرگیجه، منگی و احساس حالت تهوع به صورت خفیف تا متوسط وجود دارد، که شدت آن در افراد مختلف متفاوت است. البته لازم به ذکر است معمولاً این علائم در صورت بروز، به صورت خودبخود رفع می‌گردد؛ با وجود این، در صورت بروز هر گونه عوارض جانبی و نیاز به هر گونه اقدام تسکینی و درمانی، خدمات لازم توسط تیم پژوهشی به صورت رایگان در اختیار شما قرار خواهد گرفت.

۸. ما انتظار داریم مهارت نامیدن شما پس از تحریک مغز با جریان مستقیم الکتریکی از روی جمجمه بهبود یابد.

۹. در قبال شرکت در این آزمون به شما وجهی پرداخت نمی‌شود.

۱۰. این آزمون برای شما هیچ گونه مخارجی به دنبال نخواهد داشت.

۱۱. شرکت در این طرح پژوهشی داوطلبانه بوده و شرکت کنندگان در هر مرحله از این کارآزمایی این حق را دارند که از مطالعه خارج شوند، بدون اینکه جریمه شده یا از دریافت خدمات درمانی بی بهره گردند.

۱۲. اطلاعات مربوط به آزمودنی‌ها اعم از اطلاعات شخصی و آنچه مربوط به بیماری یا روش درمان ایشان می‌گردد، صرفاً نزد پژوهشگران این تحقیق قرار دارد و این اطمینان به شما داده می‌شود که به هیچ عنوان اطلاعات شخصی شما فاش نمی‌گردد و فقط نتایج کلی این تحقیق به صورت مقاله و گزارش منتشر خواهد شد.

۱۳. اطلاعات جدید مرتبط با سلامت آزمودنی‌ها در هر زمان از پژوهش، به اطلاع شرکت‌کنندگان، همراهان یا نمایندگان قانونی آنها خواهد رسید.

۱۴.در صورت بروز هر گونه عوارض نامطلوب، شرکت شما در مطالعه خاتمه می‌یابد.

۱۵. مجری طرح خانم بهاره رضائی، دانشجوی دکتری گفتاردرمانی دانشگاه علوم بهزیستی و توانبخشی است. آدرس و شماره تماس مجری عبارت است از: تهران، اوین، بلوار دانشجو، انتهای خیابان کودکیار، دانشگاه علوم بهزیستی و توانبخشی، گروه آموزشی گفتاردرمانی، به شماره تماس ..... است. هر سؤالی در رابطه با شرکت در این پژوهش داشته باشید، می‌توانید با ایشان در میان بگذارید.

پژوهشگران:

بهاره رضائی

دکتر فریبا یادگاری

دکتر آناهیتا خرمی بنارکی

دکتر مهردخت مزده

دکتر محسن شتی

اینجانب بهاره رضائی در تاریخ ..... رضایت نامه فوق را در اختیار خانم/ آقای ..... گذاشتم.

امضای پژوهشگر

موارد ذکر شده در متن رضایت نامه مورد تأیید اینجانب ..... می باشد.

امضای شرکت کننده در طرح

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Review Paper:

Methodological Dimensions of Transcranial Brain Stimulation with the Electrical Current in Human

Maryam Rostami[1, 4], Mehrshad Golesorkhi[1, 2, 5], Hamed Ekhtiari[1, 2, 3*]

1. Translational Neuroscience Program, Institute for Cognitive Science Studies, Tehran, Iran.
2. Neuroimaging and Analysis Group, Research Center for Molecular and Cellular Imaging, Tehran University for Medical Sciences, Tehran, Iran.
3. Iranian National Center for Addiction Studies, Tehran University for Medical Sciences, Tehran, Iran.
4. Department of Biomedical Engineering, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran.
5. Department of Computer Science, School of Mathematics, Statistics and Computer Science, University of Tehran, Tehran, Iran.

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Transcranial Electrical Stimulation (tES),
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Transcranial Alternating Current Stimulation (tACS),
Non Invasive Brain Stimulation (NIBS).

ABSTRACT

Transcranial current stimulation (TCS) is a neuromodulation method in which the patient is exposed to a mild electric current (direct or alternating) at 1-2 mA, resulting in an increase or a decrease in the brain excitability. This modification in neural activities can be used as a method for functional human brain mapping with causal inferences. This method might also facilitate the treatments of many neuropsychiatric disorders based on its inexpensive, simple, safe, noninvasive, painless, semi-focal excitatory and inhibitory effects. Given this, a comparison amongst different brain stimulation modalities has been made to determine the potential advantages of the TCS method. In addition, considerable methodological details on using TCS in basic and clinical neuroscience studies in human subjects have been introduced. Technical characteristics of TCS devices and their related accessories with regard to safety concerns have also been well articulated. Finally, some TCS application opportunities have been emphasized, including its potential use in the near future.

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Video Article

Electrode Positioning and Montage in Transcranial Direct Current Stimulation

Alexandre F. DaSilva[1], Magdalena Sarah Volz[2,3], Marom Bikson[4], Felipe Fregni[2]

[1]Headache & Orofacial Pain Effort (H.O.P.E.), Biologic & Material Sciences, School of Dentistry, University of Michigan

[2]Laboratory of Neuromodulation, Department of Physical Medicine & Rehabilitation, Spaulding Rehabilitation Hospital and Massachusetts General Hospital, Harvard Medical School

[3]Charité, University Medicine Berlin

[4]Department of Biomedical Engineering, The City College of New York

Correspondence to: Alexandre F. DaSilva at adasilva@umich.edu, Felipe Fregni at fregni.felipe@mgh.harvard.edu

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Abstract

Transcranial direct current stimulation (tDCS) is a technique that has been intensively investigated in the past decade as this method offers a non-invasive and safe alternative to change cortical excitability[2]. The effects of one session of tDCS can last for several minutes, and its effects depend on polarity of stimulation, such as that cathodal stimulation induces a decrease in cortical excitability, and anodal stimulation induces

Dr. Bahareh Rezaei, Assisstant Professor,
Hamedan University of Medical Sciences