Univerzitet u Beogradu
Filozofski fakultet
Odeljenje za psihologiju

PSIHOLOGIJA OPAŽANJA

Tematske celine

PSIHOFIZIKA
ČULA
PERCEPCIJA

SLUH

TEORIJE

• Kodiranje visine zvuka

TEORIJA MESTA REZONANCE

TEORIJA UČESTANOSTI (PLOTUNA)

TEORIJE

• Kodiranje visine zvuka

TEORIJA MESTA REZONANCE

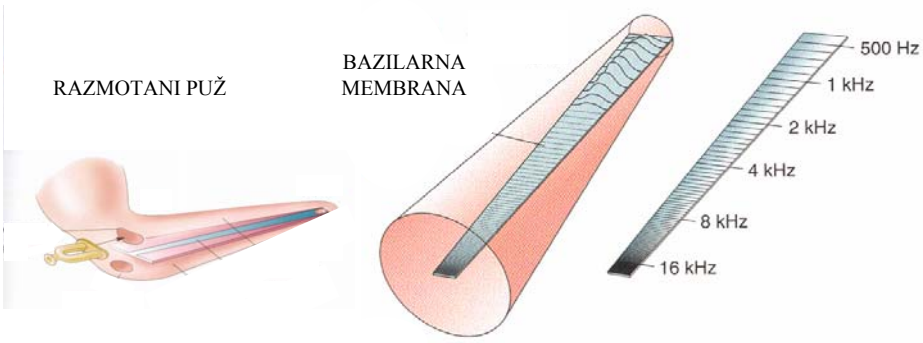
H. Helmholtz (1869-70)

Tonotopska organizacija bazilarne membrane
(Milerov z. specifične energije)

TEORIJE

• Kodiranje visine zvuka

TEORIJA MESTA REZONANCE



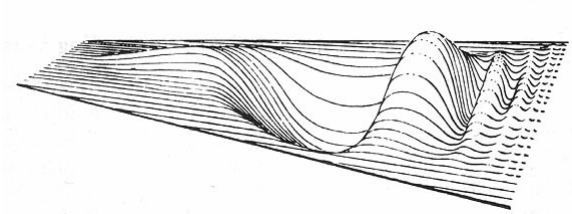
TEORIJE

• Kodiranje visine zvuka

TEORIJA MESTA REZONANCE

G. Bekesy (1928, 1961)

Putujući talas



TEORIJE

• Kodiranje visine zvuka

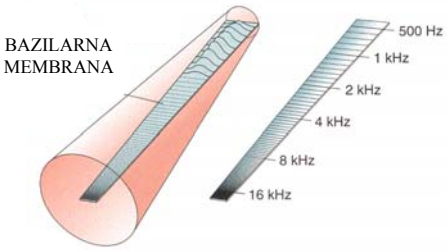
TEORIJA MESTA REZONANCE

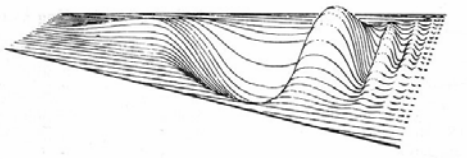
H. Helmholtz

Tonotopska organizacija b. m.

G. Bekesy

Putujući talas

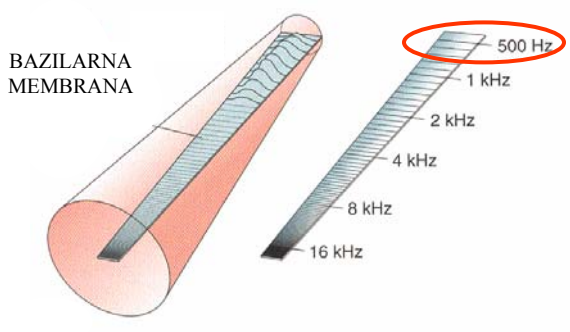




TEORIJE

• Kodiranje visine zvuka

TEORIJA MESTA REZONANCE



PROBLEM!

Niske frekvence

Malo vlakana,
a fina osetljivost

TEORIJE

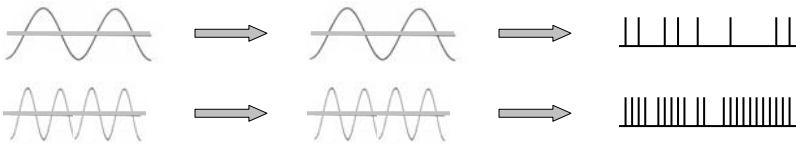
• Kodiranje visine zvuka

TEORIJA UČESTANOSTI (PLOTUNA)

Rutherford (1886) - preteča

Wever & Bray (1937)

Fr. zvuka => Fr. bazilarne membrane => Fr. nervnih impulsa



TEORIJE

• Kodiranje visine zvuka

TEORIJA UČESTANOSTI (PLOTUNA)

Rutherford (1886) - preteča

Wever & Bray (1937)

PROBLEM!

Maksimalna provodljivost nervnog vlakna **do1000 Hz**
Čuju se frekvence **iznad 1000 Hz**

TEORIJE

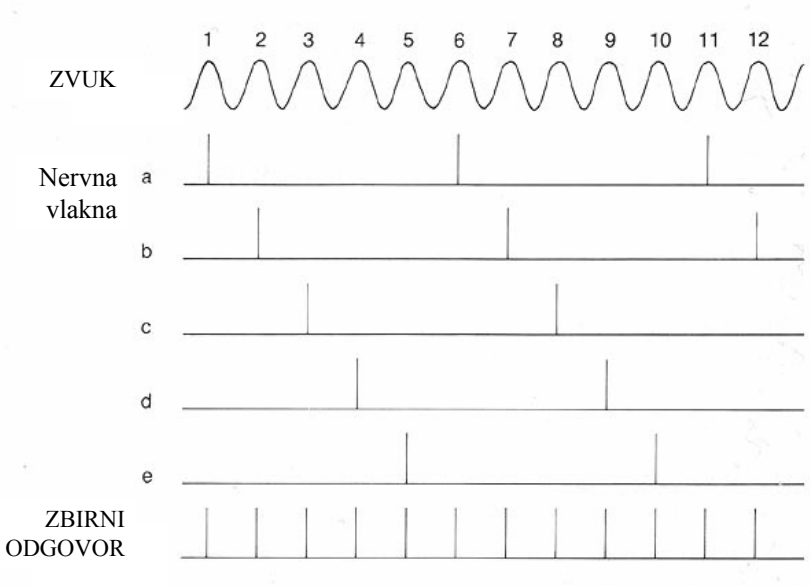
• Kodiranje visine zvuka

TEORIJA UČESTANOSTI (PLOTUNA)

Wever (1949): princip plotuna

Jedno nervno vlakno: **1000 Hz**
Ceo nerv: **5000 Hz**

Princip plotuna



TEORIJE

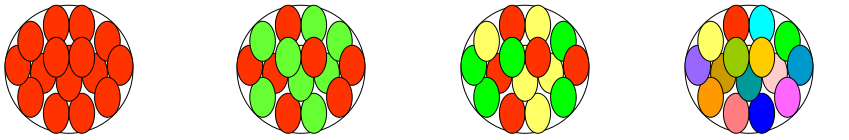
• Kodiranje visine zvuka

TEORIJA UČESTANOSTI (PLOTUNA)

Wever (1949): princip plotuna

Podela nerva na vodove vlakana različite brzine okidanja

do 1000 Hz: Jedan vod	1000-2000 Hz: Dva voda	2000-3000 Hz: Tri voda	3000-4000 Hz: Svako za sebe!



TEORIJE

• Kodiranje visine zvuka

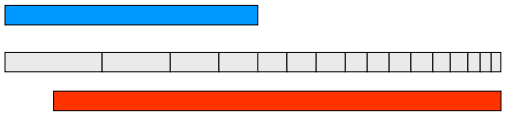
KOMBINOVANA TEORIJA

Wever & Lawrence, 1954.

Kombinacija spacijalnog i temporalnog koda!

T. UČESTANOSTI: do 4 000 Hz

T. MESTA: 500-16 000 Hz



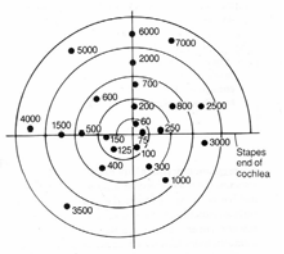
TEORIJE

• Kodiranje visine zvuka

EMPIRIJSKE STUDIJE

Elektrofiziološke studije

Culler et al. (1943): zapis sa bazilarne membrane



TEORIJE

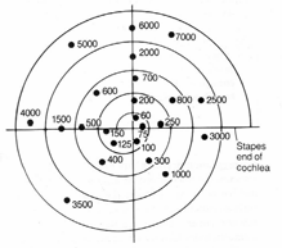
• Kodiranje visine zvuka

EMPIRIJSKE STUDIJE

Elektrofiziološke studije

Culler et al. (1943): zapis sa bazilarne membrane

PRILOG TEORIJI MESTA



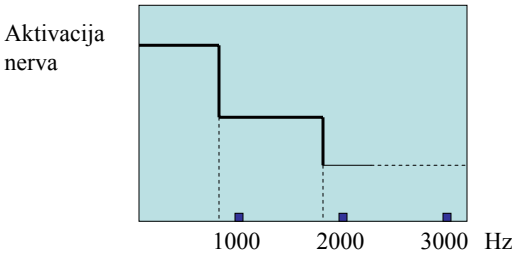
TEORIJE

• Kodiranje visine zvuka

EMPIRIJSKE STUDIJE

Elektrofiziološke studije

Derbyshyre & Davis (1943): zapis sa nerva



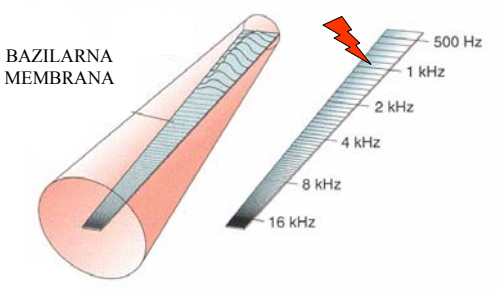
PRILOG T. PLOTUNA

TEORIJE

• Kodiranje visine zvuka

EMPIRIJSKE STUDIJE

Patološke studije



Selektivna mikrodestrukcija bazilarne membrane

Rast DP, gluvoća za zvuk određene frekvence

PRILOG TEORIJI MESTA

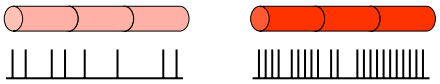
TEORIJE

• Kodiranje intenziteta zvuka

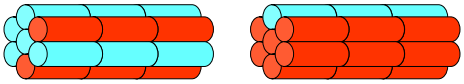
Scharf & Houtsma (1981)

Amplituda zvučnog talasa

Frekvenca n. impulsa



Broj angažovanih vlakana



PSIHOFIZIKA

Stevens (1955)

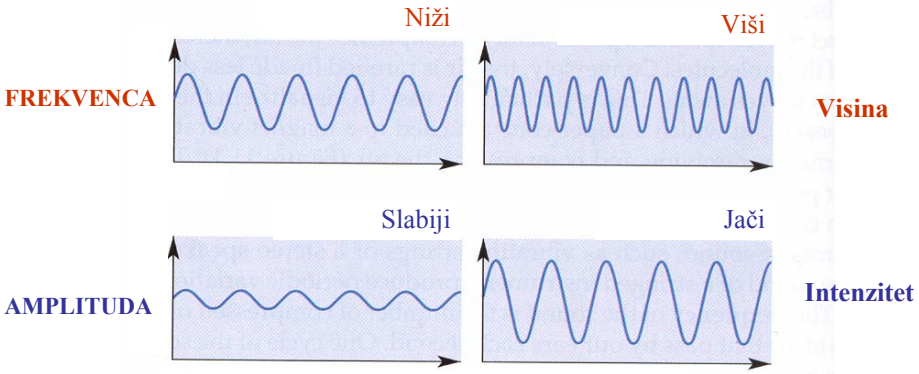
1 SON = 40 dB (1000 Hz)

Stevens, Volkman & Newman (1937)

1 000 MEL-a = 1000 Hz (60 dB)

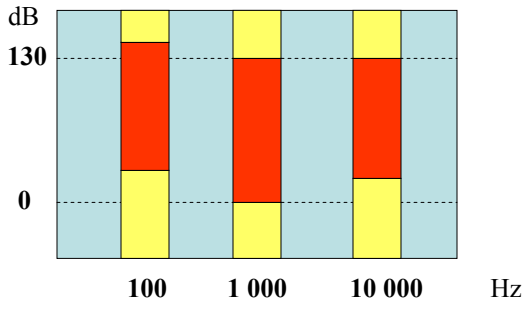
PSIHOFIZIKA

1. Amplituda => intenzitet
2. Frekvenca => visina (kvalitet)



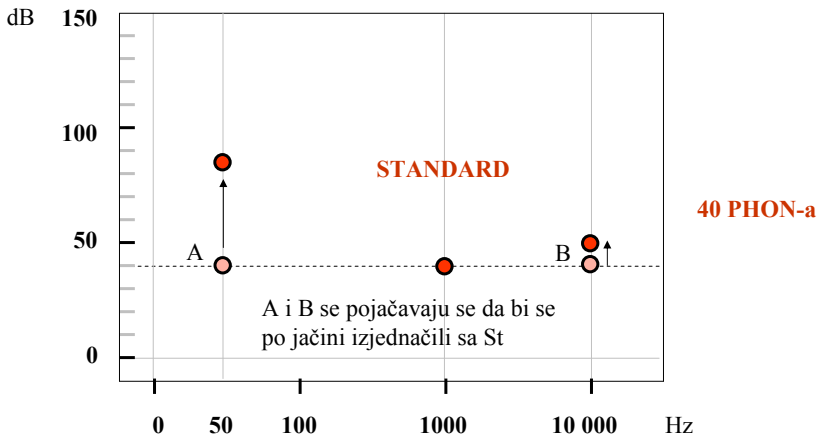
INTENZITET

1. Amplituda => intenzitet
2. Frekvenca => intenzitet



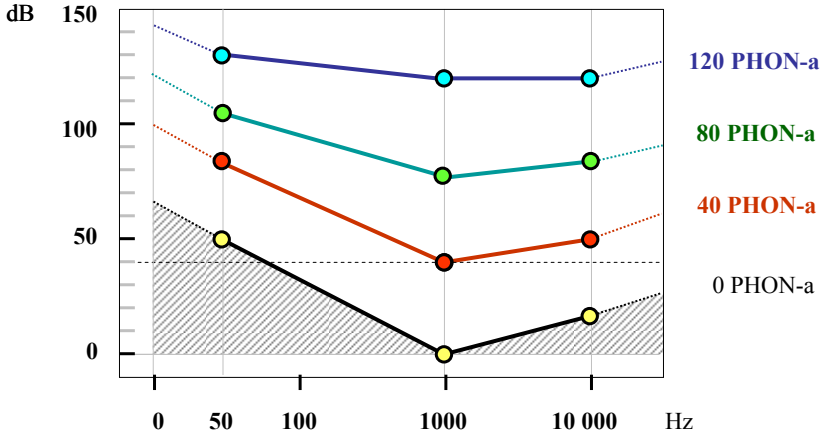
INTENZITET

Konture jednake jačine *(Wever, 1949; Gelfand, 1981)*



INTENZITET

Konture jednake jačine *(Wever, 1949; Gelfand, 1981)*

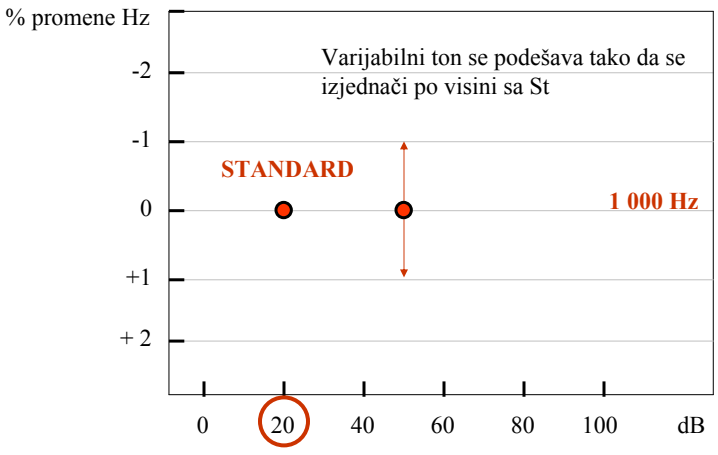


VISINA (KVALITET)

1. Frekvenca => visina
2. Amplituda => visina

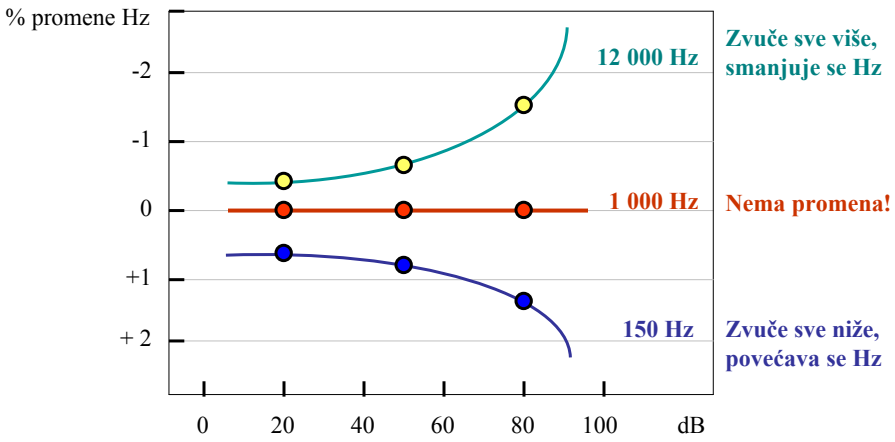
VISINA (KVALITET)

Konture jednake visine *(Stevens, 1935)*



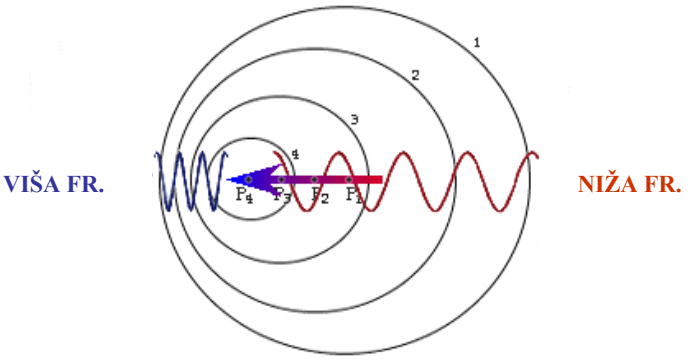
VISINA (KVALITET)

Konture jednake visine *(Stevens, 1935)*



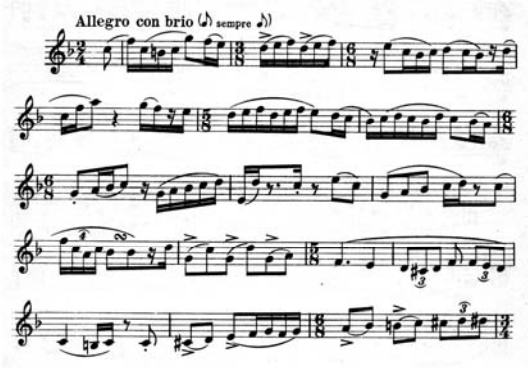
VISINA (KVALITET)

Doplerov efekat



MUZIČKI KVALITET

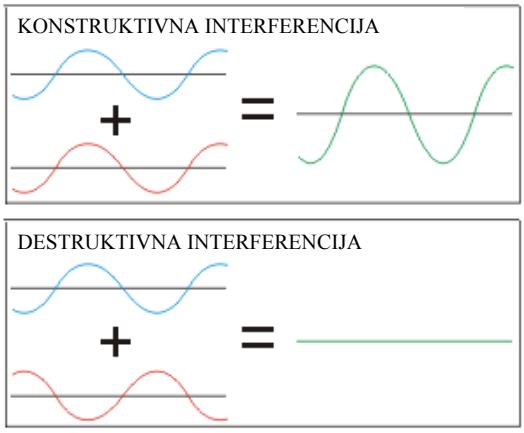
Lestvice (oktave)



Atribut senzacije ili percepcije?

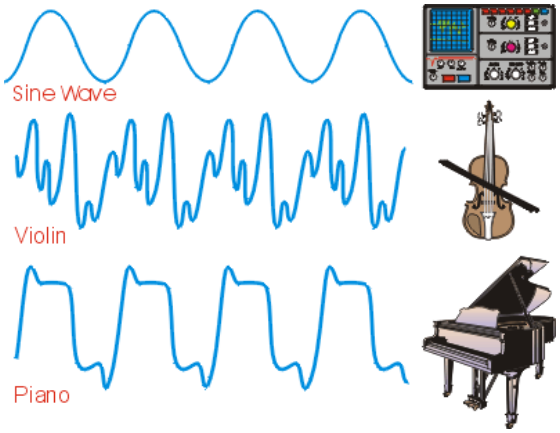
BOJA TONA

Složeni tonovi: interferencija



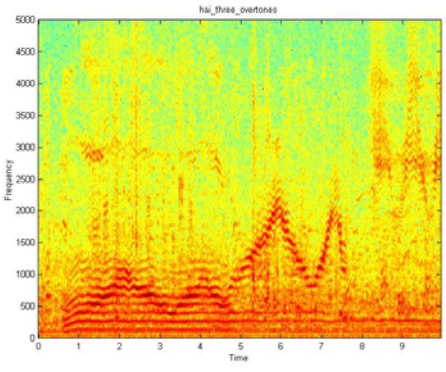
BOJA TONA

Složeni tonovi: obertonovi



BOJA TONA

Rezonatorske kutije => Obertonovi



Atribut senzacije ili percepcije?

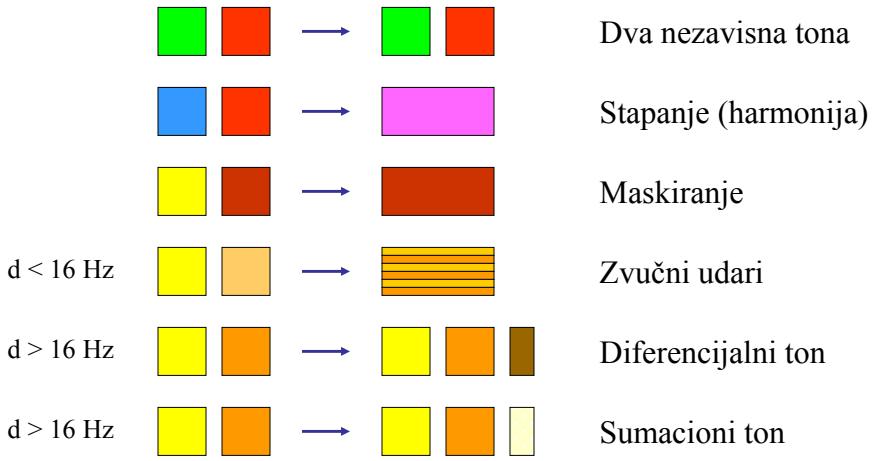
VOLUMINOZNOST

Stumpf: Nesvodivost na **intenzitet** i **visinu**

Dimick (1934): Različiti DfP za **VOL** i **INTENZITET**

Rich (1916): Različiti DfP za **VOL** i **VISINU**

DEJSTVO VIŠE ZVUČNIH IZVORA



Dva nezavisna tona

Stapanje (harmonija)

Maskiranje

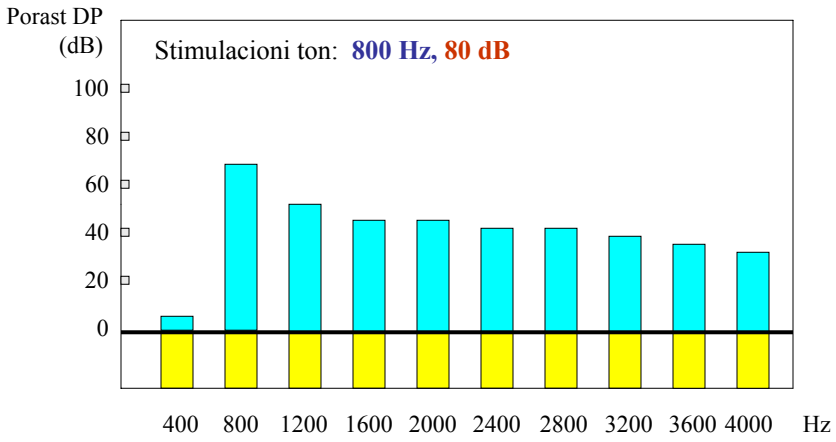
Zvučni udari

Diferencijalni ton

Sumacioni ton

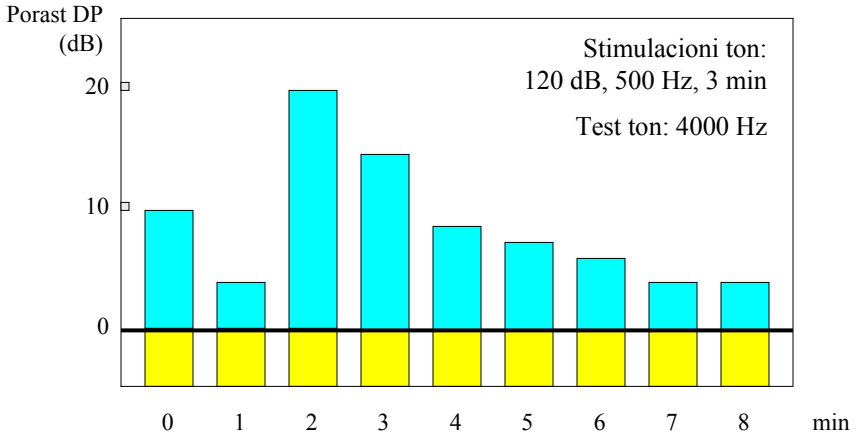
MASKIRANJE

Jači > Slabiji; Niži > Viši *(Fletcher, 1929)*



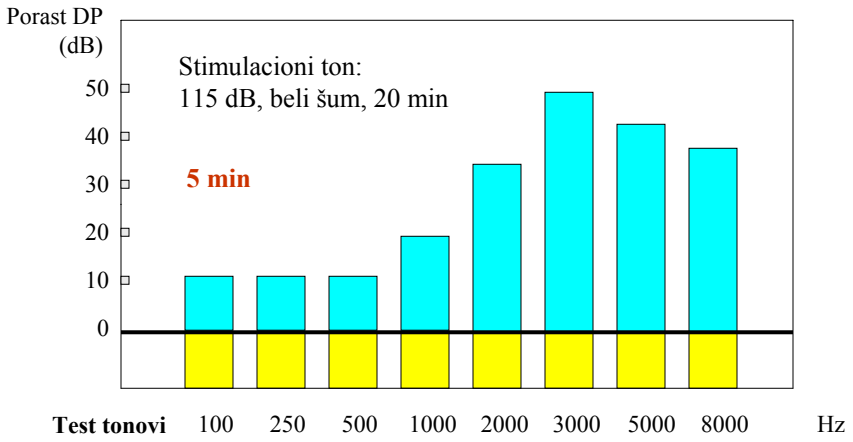
ADAPTACIJA

Kratkotrajna adaptacija *(Hirsh & Ward, 1952)*



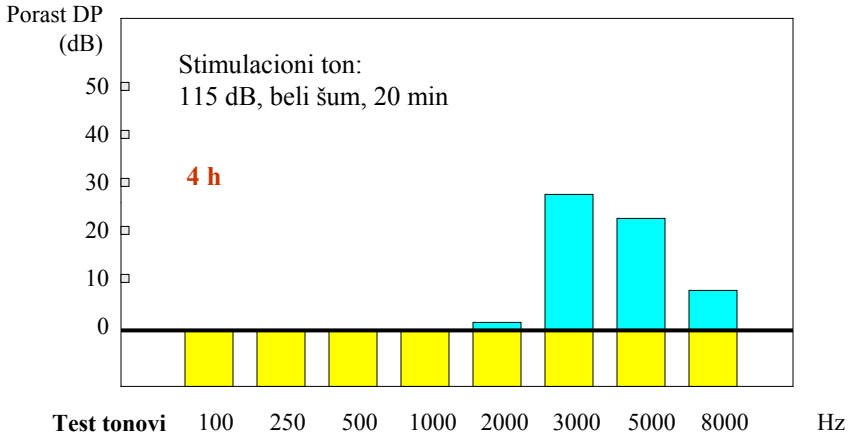
ADAPTACIJA

Dugotrajni slušni umor *(Postman & Egan, 1949)*



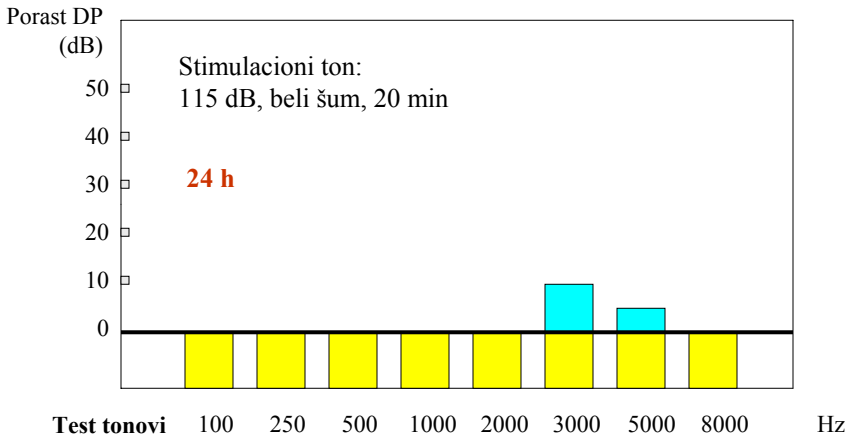
ADAPTACIJA

Dugotrajni slušni umor *(Postman & Egan, 1949)*



ADAPTACIJA

Dugotrajni slušni umor *(Postman & Egan, 1949)*



PATOLOGIJA

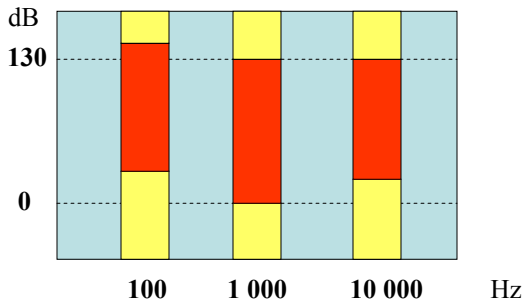
Gluvoća i nagluvost (visok DP)

STIMULACIONA ili PRIRODNA

PATOLOGIJA

Gluvoća i nagluvost (visok DP)

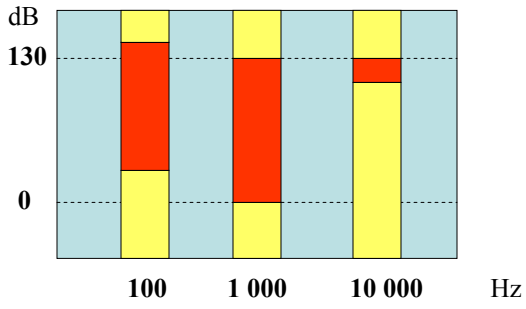
NORMALAN SLUH



PATOLOGIJA

Gluvoća i nagluvost (visok DP)

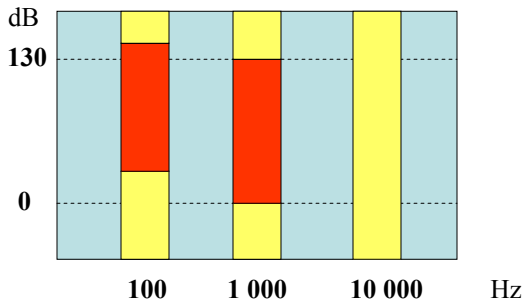
SELEKTIVNA NAGLUVOST



PATOLOGIJA

Gluvoća i nagluvost (visok DP)

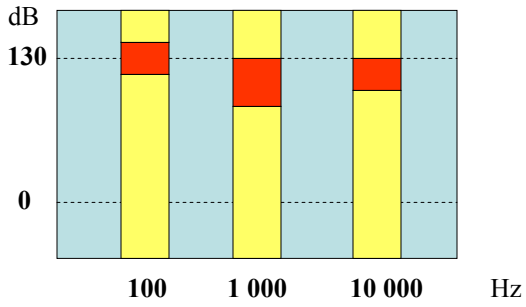
SELEKTIVNA GLUVOĆA



PATOLOGIJA

Gluvoća i nagluvost (visok DP)

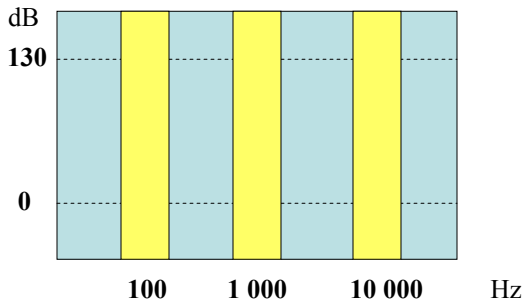
TOTALNA NAGLUVOST



PATOLOGIJA

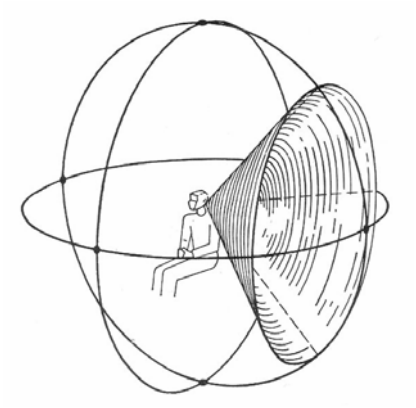
Gluvoća i nagluvost (visok DP)

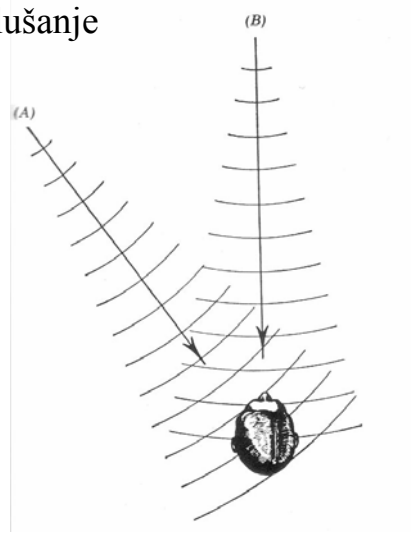
TOTALNA GLUVOĆA



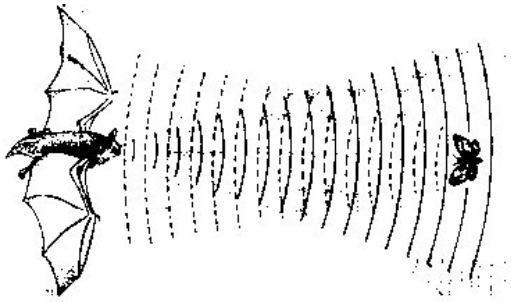
LOKALIZACIJA

Binauralno slušanje





LOKALIZACIJA



PERCEPCIJA

Muzika

KONSTANTNOST

Različite oktave => ista melodija

Govor

RAZUMEVANJE GOVORA

Psiholingvistika: fonologija