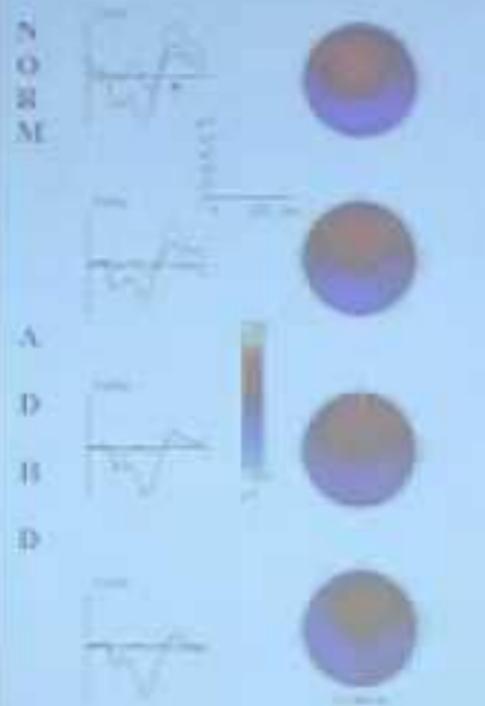


## Mismatched Negativity (MMN): GO/NOGO ERPs

- Amplitude of MMN difference wave is larger in normal clients, and is linearly related to attention.
- The location remains the same for normal and ADHD children (age 12-14).

*John D. Kover et al., 2004*



1  
00:00:03,590 --> 00:00:01,829  
seconds we just discussed that the

2  
00:00:05,269 --> 00:00:03,600  
sensory information arrives at the back

3  
00:00:07,349 --> 00:00:05,279  
of your head

4  
00:00:09,669 --> 00:00:07,359  
at about 200 milliseconds it arrives in

5  
00:00:11,430 --> 00:00:09,679  
the front of your head

6  
00:00:13,749 --> 00:00:11,440  
when you pers when it hit the back of

7  
00:00:15,190 --> 00:00:13,759  
your head you had a perceptual detection

8  
00:00:16,950 --> 00:00:15,200  
but you didn't know what it was you

9  
00:00:18,710 --> 00:00:16,960  
perceived

10  
00:00:20,470 --> 00:00:18,720  
at 200 milliseconds when it hits the

11  
00:00:21,750 --> 00:00:20,480  
frontal lobe this corresponds with

12  
00:00:23,109 --> 00:00:21,760  
awareness

13  
00:00:25,349 --> 00:00:23,119

you're aware that you perceived

14

00:00:27,029 --> 00:00:25,359

something but you don't know what it was

15

00:00:29,990 --> 00:00:27,039

because you still can't differentiate

16

00:00:32,069 --> 00:00:30,000

that perception from another perception

17

00:00:34,389 --> 00:00:32,079

it takes

18

00:00:37,510 --> 00:00:34,399

another 100 milliseconds for that to

19

00:00:39,990 --> 00:00:37,520

occur and phase lock gamma activity

20

00:00:41,270 --> 00:00:40,000

actually bursts um

21

00:00:47,110 --> 00:00:41,280

in the

22

00:00:49,830 --> 00:00:47,120

180 and about 230 milliseconds

23

00:00:50,790 --> 00:00:49,840

but only in a cognitive task it doesn't

24

00:00:53,430 --> 00:00:50,800

just

25

00:00:55,510 --> 00:00:53,440

pop any old time it only happens when

26

00:00:56,869 --> 00:00:55,520

there's a relevant

27

00:00:59,189 --> 00:00:56,879

task

28

00:01:01,430 --> 00:00:59,199

and this phase lock gamma

29

00:01:03,510 --> 00:01:01,440

ends up being seen over the posterior

30

00:01:06,070 --> 00:01:03,520

temporal cortex with respect to the

31

00:01:07,830 --> 00:01:06,080

frontal areas as well again at about 200

32

00:01:10,310 --> 00:01:07,840

milliseconds and you'll see that all of

33

00:01:12,710 --> 00:01:10,320

these statements have references and if

34

00:01:14,789 --> 00:01:12,720

anyone wants the powerpoint presentation

35

00:01:16,390 --> 00:01:14,799

email me and i'll be more than happy to

36

00:01:18,469 --> 00:01:16,400

send it to you and it's got

37

00:01:20,230 --> 00:01:18,479

two pages of references and fairly small

38

00:01:21,670 --> 00:01:20,240

font at the end don't try and copy them

39

00:01:24,390 --> 00:01:21,680

down

40

00:01:25,910 --> 00:01:24,400

the p300 is the 300 millisecond

41

00:01:28,630 --> 00:01:25,920

occurrence back in the back of the head

42

00:01:31,109 --> 00:01:28,640

so 100 milliseconds is perception

43

00:01:32,710 --> 00:01:31,119

200 milliseconds is awareness 300

44

00:01:35,429 --> 00:01:32,720

milliseconds is now the ability to

45

00:01:36,390 --> 00:01:35,439

differentiate two stimuli one from the

46

00:01:38,630 --> 00:01:36,400

other

47

00:01:41,109 --> 00:01:38,640

but you're still not consciously aware

48

00:01:45,270 --> 00:01:41,119

of what it is you've now differentiated

49

00:01:47,429 --> 00:01:45,280

it we can get p300s out of coma patients

50

00:01:48,950 --> 00:01:47,439

i work with a very large group

51  
00:01:50,069 --> 00:01:48,960  
called the international brain research

52  
00:01:53,109 --> 00:01:50,079  
foundation

53  
00:01:54,469 --> 00:01:53,119  
we we do coma recovery work

54  
00:01:57,910 --> 00:01:54,479  
and

55  
00:02:01,190 --> 00:01:57,920  
just did a very nice study we woke up

56  
00:02:02,950 --> 00:02:01,200  
27 out of 33 people that were in coma

57  
00:02:05,429 --> 00:02:02,960  
but to get into the study they had to be

58  
00:02:07,429 --> 00:02:05,439  
in a coma for over a year with a glasgow

59  
00:02:09,830 --> 00:02:07,439  
coma scale of less than eight which

60  
00:02:12,309 --> 00:02:09,840  
basically means bye-bye

61  
00:02:14,790 --> 00:02:12,319  
it's a grave prognosis as they say in

62  
00:02:16,869 --> 00:02:14,800  
medicine the next stop is going to be in

63  
00:02:20,229 --> 00:02:16,879

the grave

64

00:02:23,830 --> 00:02:20,239

but this uh this group basically woke up

65

00:02:25,750 --> 00:02:23,840

very effectively using our approach so

66

00:02:27,589 --> 00:02:25,760

we're well aware that you can get these

67

00:02:28,949 --> 00:02:27,599

wave shapes out of people that are in a

68

00:02:31,350 --> 00:02:28,959

coma

69

00:02:33,750 --> 00:02:31,360

it's a good prognosis if you see it

70

00:02:36,390 --> 00:02:33,760

if you don't see this this response in a

71

00:02:38,949 --> 00:02:36,400

coma it's not a bad prognosis but seeing

72

00:02:43,430 --> 00:02:38,959

it is is a very good sign

73

00:02:45,910 --> 00:02:43,440

so this this 100 200 300 millisecond

74

00:02:47,110 --> 00:02:45,920

cycle of perception

75

00:02:50,229 --> 00:02:47,120

is only

76

00:02:53,509 --> 00:02:50,239

really one frame in the construction of

77

00:02:55,270 --> 00:02:53,519

a conscious awareness perception

78

00:02:56,630 --> 00:02:55,280

again by 300 milliseconds you're

79

00:02:58,229 --> 00:02:56,640

differentiating but you're not

80

00:03:00,630 --> 00:02:58,239

consciously aware

81

00:03:03,270 --> 00:03:00,640

because you haven't got what it takes to

82

00:03:05,750 --> 00:03:03,280

have consciousness yet

83

00:03:08,470 --> 00:03:05,760

and

84

00:03:11,910 --> 00:03:08,480

basically we identified in in neurology

85

00:03:14,949 --> 00:03:11,920

that if you pair two stimuli

86

00:03:16,470 --> 00:03:14,959

that when the second pair of the stimuli

87

00:03:18,229 --> 00:03:16,480

ends up differing

88

00:03:21,030 --> 00:03:18,239

you can end up seeing an enhancement of

89

00:03:23,830 --> 00:03:21,040

the event-related potential and this is

90

00:03:24,949 --> 00:03:23,840

called a mismatch negativity for you

91

00:03:26,470 --> 00:03:24,959

any of you who are looking to the

92

00:03:28,630 --> 00:03:26,480

literature

93

00:03:31,350 --> 00:03:28,640

but it's a linearly

94

00:03:33,910 --> 00:03:31,360

related to attention

95

00:03:36,149 --> 00:03:33,920

let's take a quick look at some data

96

00:03:37,750 --> 00:03:36,159

what we have here is a normal person a

97

00:03:39,910 --> 00:03:37,760

high functioning middle functioning and

98

00:03:40,789 --> 00:03:39,920

low functioning add

99

00:03:43,270 --> 00:03:40,799

case

100

00:03:45,750 --> 00:03:43,280

and what we have here is a go no go test

101

00:03:49,350 --> 00:03:45,760

where they've they receive

102

00:03:52,229 --> 00:03:49,360

paired stimuli and with one stimulus

103

00:03:54,309 --> 00:03:52,239

priming and the second stimulus and

104

00:03:55,990 --> 00:03:54,319

during that paradigm

105

00:03:57,750 --> 00:03:56,000

when they receive a stimulus that tells

106

00:03:59,190 --> 00:03:57,760

them they shouldn't respond you get a

107

00:04:01,190 --> 00:03:59,200

different wave shape than when they

108

00:04:03,190 --> 00:04:01,200

receive a stimulus that indicates they

109

00:04:05,670 --> 00:04:03,200

should respond the difference between

110

00:04:07,270 --> 00:04:05,680

those two is linearly related to your

111

00:04:09,589 --> 00:04:07,280

attentional skills

112

00:04:11,990 --> 00:04:09,599

you can see that they use the same basic

113

00:04:13,509 --> 00:04:12,000

neural network it's not that add is

114

00:04:16,469 --> 00:04:13,519

using the temporal lobe instead of the

115

00:04:18,310 --> 00:04:16,479

frontal lobe to try and

116

00:04:19,909 --> 00:04:18,320

regulate attention

117

00:04:21,909 --> 00:04:19,919

but literally the difference between the

118

00:04:24,070 --> 00:04:21,919

green wave and the red wave here the

119

00:04:25,909 --> 00:04:24,080

green is go the red is stop

120

00:04:27,590 --> 00:04:25,919

you know standard color conventions and

121

00:04:30,150 --> 00:04:27,600

the little black line here ends up being

122

00:04:32,070 --> 00:04:30,160

the difference wave and

123

00:04:33,990 --> 00:04:32,080

the difference wave here ends up

124

00:04:36,550 --> 00:04:34,000

dropping and dropping and dropping so

125

00:04:39,110 --> 00:04:36,560

mismatch negativity is is a linearly

126  
00:04:42,550 --> 00:04:39,120  
related uh phenomenon to attention and

127  
00:04:44,710 --> 00:04:42,560  
here the the 80d people were classified

128  
00:04:47,430 --> 00:04:44,720  
as high middle and low 80d based on

129  
00:04:50,230 --> 00:04:47,440  
their continuous performance uh test

130  
00:04:52,230 --> 00:04:50,240  
results not not based on somebody's

131  
00:04:53,270 --> 00:04:52,240  
subjective assessment of their their

132  
00:04:59,430 --> 00:04:53,280  
work or

133  
00:05:03,030 --> 00:05:01,030  
essentially

134  
00:05:04,790 --> 00:05:03,040  
i mentioned this already you generate

135  
00:05:08,150 --> 00:05:04,800  
the erp

136  
00:05:11,270 --> 00:05:08,160  
morphology by phase locking uh theta and

137  
00:05:12,950 --> 00:05:11,280  
and alpha and this uh time series

138  
00:05:14,150 --> 00:05:12,960

represents the interaction between

139

00:05:18,390 --> 00:05:14,160

episodic

140

00:05:22,870 --> 00:05:20,629

in a conscious person

141

00:05:25,270 --> 00:05:22,880

you compare your recent

142

00:05:26,870 --> 00:05:25,280

past experience

143

00:05:28,629 --> 00:05:26,880

continuously with your current

144

00:05:30,950 --> 00:05:28,639

perception

145

00:05:33,990 --> 00:05:30,960

and your first event related potential

146

00:05:36,070 --> 00:05:34,000

lays down a memory trace

147

00:05:38,950 --> 00:05:36,080

that your next perception then compares

148

00:05:41,430 --> 00:05:38,960

it against and unless you have this

149

00:05:43,749 --> 00:05:41,440

first memory trace to compare your

150

00:05:45,350 --> 00:05:43,759

ongoing perception with you don't have

151

00:05:47,350 --> 00:05:45,360

conscious awareness

152

00:05:50,469 --> 00:05:47,360

literally consciousness according to

153

00:05:51,670 --> 00:05:50,479

edelman in 2001 is the remembered

154

00:05:53,670 --> 00:05:51,680

present

155

00:05:55,990 --> 00:05:53,680

now if your semantic non-sequitur

156

00:05:59,270 --> 00:05:56,000

detector went off based on that tense

157

00:06:01,749 --> 00:05:59,280

shift uh perhaps uh it's an indication

158

00:06:04,870 --> 00:06:01,759

that consciousness exists at

159

00:06:06,390 --> 00:06:04,880

9 40 in the morning here so

160

00:06:09,350 --> 00:06:06,400

but the implication here is that

161

00:06:11,270 --> 00:06:09,360

consciousness literally takes two cycles

162

00:06:13,670 --> 00:06:11,280

one to lay down a memory trace and the

163

00:06:17,110 --> 00:06:13,680

other one to compare against it until

164

00:06:19,430 --> 00:06:17,120

you have that uh double cycle you don't

165

00:06:21,510 --> 00:06:19,440

have conscious awareness the second

166

00:06:23,430 --> 00:06:21,520

cycle

167

00:06:24,469 --> 00:06:23,440

these are essentially 300 millisecond

168

00:06:27,270 --> 00:06:24,479

cycles

169

00:06:31,189 --> 00:06:27,280

but conscious awareness in libid's work

170

00:06:33,189 --> 00:06:31,199

out of san francisco in 1979 indicated

171

00:06:35,270 --> 00:06:33,199

that conscious awareness takes about 500

172

00:06:37,110 --> 00:06:35,280

milliseconds now if you do the math in

173

00:06:40,550 --> 00:06:37,120

your head you'll say well jay

174

00:06:42,469 --> 00:06:40,560

goodness 300 plus 300 is 600 not 500

175

00:06:45,189 --> 00:06:42,479

your theory can't possibly be correct

176  
00:06:46,390 --> 00:06:45,199  
it's 100 milliseconds off well not

177  
00:06:48,150 --> 00:06:46,400  
exactly

178  
00:06:50,309 --> 00:06:48,160  
remember the first time it got to the

179  
00:06:51,909 --> 00:06:50,319  
frontal lobe was awareness the second

180  
00:06:54,150 --> 00:06:51,919  
time it gets to the frontal lobe is

181  
00:06:56,070 --> 00:06:54,160  
conscious awareness and it only takes

182  
00:06:58,390 --> 00:06:56,080  
200 milliseconds to get to the frontal

183  
00:07:00,230 --> 00:06:58,400  
lobe so the first cycle took 300

184  
00:07:03,029 --> 00:07:00,240  
milliseconds to lay down the memory

185  
00:07:05,990 --> 00:07:03,039  
substrate the second cycle only took 200

186  
00:07:07,670 --> 00:07:06,000  
milliseconds to get to the frontal lobe

187  
00:07:09,990 --> 00:07:07,680  
and that's when conscious awareness

188  
00:07:11,189 --> 00:07:10,000

occurs so the math even works out very

189

00:07:12,550 --> 00:07:11,199

nicely

190

00:07:14,629 --> 00:07:12,560

and when the math works you got to

191

00:07:17,029 --> 00:07:14,639

wonder you know