

Supporting Information

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Supplementary Data: No Strong Evidence for Selectivity for Other Visual Categories

The time course of response of each electrode to each category (Fig. 2) reveals that none of the sites that were stimulated in our experiments responded specifically to just digit strings or to just words (kanji or kana), although two electrodes (124 and 180) showed some preference for both. Several other electrodes (131, 165, and 176) showed weak preferences for bodies. Finally, three electrodes responded more strongly to photographic stimuli (faces, bodies, and objects), a response profile that could reflect a preference for 3D shape information, texture/materials or surface properties, or simply the more complete retinotopic coverage of the photographic stimuli compared with line-based stimuli.

Transcript of Entire Stimulation Session

Note: As part of clinical mapping, multiple pairs of fusiform electrodes were stimulated on the day before this experiment was run, although only while the patient was viewing faces or kanji characters (not the box or ball). For several of these pairs the patient reported illusory percepts of eyes, faces, or colors; these are indicated in Fig. 1. Below we report the transcript from the main testing session.

Electrodes 173–174.

- Box.**
Experimenter (E): “Did anything change?”
Subject (S): “No ... I’m ok.”
E: “Nothing really changes?” (tells other experimenter: “No change.”)
S: “Can you do it again?”
E: “How is it?”
S: “Ahh, when I blink and reset it just looks like a box, but when it began for the first 3 s, how do I say this ...?”
E: “Do you see a face? Or no? Does it look distorted? The color changes?”
S: “No, the color doesn’t change but, for example, the pattern right here ... it’s kind of forcing me to see an eye ... to see an eye ... how do I say this? Maybe it’s forcing me to see a face.”
E: “The pattern’s impression changes?”
S: “For a brief moment it changes, but when I blink it just looks like a box.”
E: “Ok. Once again.” (Repositions box.)
E: “How is it?”
E: “Are you ok?”
S: “I’m ok.”
- Ball.**
E: “How is it?”
S: “The shape doesn’t change at all.”
- Face.**
E: “How is it? Does it change?”
S: “Ahh ...”
E: “Does it look like cartoonish like before?”
S: “For a brief moment his impression changed.”
E: “But not a huge change?”
S: “Right.”
S: “The features of his face doesn’t [sic] change, but the impression changed for a brief moment.”
E: “Ok if it’s just a brief moment, that’s ok” (as if he doesn’t care). “Only if it stays for a while.”
E: (English explanation)
- Kanji character.**
E: “Let’s start the kanji character.”
S: “Ok.”
- E: “Any change?”
S: “No ... no cha...” (cut off by experimenter)
E: “If it doesn’t change, you can say it doesn’t change.”
S: “For a brief second at the very beginning, I felt like it was going to start changing, but after seconds, nothing had really changed.”
- Electrodes 171–172.** The video camera battery ran out during stimulation of electrodes 171–172. Thus, the video and the verbatim text of the patient’s report from the stimulation of these electrodes were lost. However, notes taken at the time indicate that the patient reported for each of the four stimuli viewed that he saw eyes or a face.
- Electrodes 169–170.**
- Box.**
E: “Did it change?”
S: “What is this, you see the small patterns here looked like a landscape scenery painting.”
E: (explains in English)
E: “Not a face?”
S: “No, not a face.”
E: “The shape doesn’t change?”
S: “The shape doesn’t change.”
(English conversation)
E: “The color?”
S: “The color changed a bit. Not like rainbow colors, how would I say it ... what color was it ...?”
E: “White?”
S: “No.”
S: “Can you do it again?”
E: “Again?”
(stimulation)
S: “The color didn’t change.”
E: “Green black?”
S: (nods)
E: “Landscape colors?”
S: “Landscape ... this time it was more like a pattern ... pattern ... landscape ... not like a landscape, more like patterns. How do I explain ...?”
E: (English explanation)
- Ball.**
S: “There’s a familiar ... like a pattern I’ve seen before right here. The color doesn’t change much.”
E: “Not a face?”
S: “No, not like a face.”
E: (in English) “Not face?”
S: “Like a pattern.”
E: “Like colored dots?”
S: “Yea, kind of like those put together.”
E: (English explanation)
- Face.**
S: “How do I explain ... it changed. Just the eye changed ... the eye changed ... picture? Like a picture or like a drawing. The shape of the eye didn’t change, but it just looked different.”
E: “Like a cartoon character?”
S: “Maybe it’s like that.”
E: “Both eyes?”
S: “No, just that side.”
E: (English explanation)
- Kanji character.**
S: “What is this ... I can’t put it in words at all. Can you do it again?”
E: “Again.”
S: “This part and the lines right here. The shape doesn’t change, and the color doesn’t change, but how do I say this ...? It almost looks

like it was written by hand. It changed like that just around here. The way I see it changes. The shape and color doesn't [sic] change."

E: "Like the font changed?"

S: "Yea, kind of like that ... maybe."

E: (English explanation.)

(Note: "Shodo" is Japanese calligraphy.)

Electrodes 167–168.

Box.

E: "How is it?"

S: "Just like before, part of it looks like there's rainbow colors, but once I start focusing on it, the colors shift to the left."

E: (English explanation)

Ball.

E: "How is it?"

S: "Kind of like before, when I start focusing on the rainbow colors, it starts shifting to the left. It moves like this."

Face.

S: "Same as before. When I focus on the colors, it starts moving gradually."

E: (starts English explanation)

E: "This way, right?"

S: "Yes."

E: (English explanation)

Kanji character.

S: "Same as before. The rainbow colors move."

Electrodes 165–166.

Box.

S: "Totally different from before."

E: "Different."

S: "There's something blinking ... What does it look like? ... Like really shiny blinking flashes, and it starts moving upwards."

E: "Do you feel nauseous?"

S: "It's still continuing."

E: "Getting better?"

S: "Just now, its going away."

E: "Feels weird?"

S: "Yea, blinking flashes."

E: "Do you feel nauseous?"

S: "No, feeling-wise, it's fine."

E: (English explanation)

Ball.

S: "So if I keep following it, it gradually moves to the left."

E: "Blinking like boom, boom, boom?"

S: "If I look at the ball, it's shining over here, but if I look at it, it keeps moving."

E: (English explanation)

E: "Are you ok?"

S: "I'm ok."

E: (English)

Face.

S: "So if I look at your eyes, your forehead is flashing."

E: "Like right here?"

S: "Over there, above your eye is flashing when I look at your eyes. And if I try to look at the blinking light, it starts moving up again."

Kanji character.

S: "Yup. The same. Just like before, if I look at the middle, there's [sic] blinking lights in the upper left, and if I look at it, it starts moving up."

E: (English explanation)

Electrodes 175–176.

Box.

S: "Similar to before. You know how I said the light moves to the upper left? Like a flashing light. It's like that, but a smaller light, but it moves similarly. If I chase it, it keeps moving toward the left."

E: (English explanation)

E: "How big?"

S: "One ... the one before was like this size, but this time was like this size."

E: "So, like half the size?"

S: "Yes, probably about this size."

Ball.

E: "Same?"

S: "Same."

E: "Haha same?"

S: "Like it moves."

Face.

S: "You know how I said the size was half of what it was before on the last one? Well, looking at your face, it hasn't changed much. The size."

E: (English explanation that the light was the same large size as with the previous electrode stimulation)

Kanji character.

S: "For the kanji, the size (of the light) hasn't changed much from before. Yea ... its the same as before."

E: (English explanation)

Electrodes 177–178.

Box.

S: "So ... if I stare at the center of the box, this half over here is brightly lit rainbow colors."

E: "So the color changes over here."

S: "Yes."

E: (English explanations)

Ball.

S: "So if I stare at the lights and chase it, it feels like it starts moving to the left."

E: "What about the color?"

S: "So when I look at the ball, there's [sic] flashing rainbow lights that expands [sic] wider than the ball."

E: "Did it not blink before?"

S: "No, it blinked before too. Like that box right?"

E: "When this side was rainbow colors?"

S: "Yes, it was blinking."

E: "Was it moving?"

S: "Last time I was only staring at the center, but now over here (the ball) when I stared at the center, I saw the blinking and chased it with my eyes, and it started moving to the left."

E: (English explanation)

Face.

S: "I was staring right around your nose, and again that side of the face is flashing rainbow colors, and if I chase it, it moves to the left. Like this size of rainbow flashes moved gradually."

E: (English explanations)

Kanji character.

S: "Similar as before. This half."

E: "Colorful this side."

S: "And if I chase it, it moved to the left gradually."

Electrodes 179–180.

Box.

E: "How is it?"

S: "I can't say it changed much."

E: "No change?"

S: "Can you do it again? I kind of blinked at a bad timing. Can you do it again?"

E: "How is it?"

S: "What kind of picture is this ...? very faint, but I saw a familiar-looking weird picture that I can't put in words. Sort of comes out right here."

E: (English explanation)

Ball.

E: "How is it?"

S: "Similar to the box. I see an unexplainable picture right around here, about this size."

E: (English explanation)
E: "What kind of picture?"
S: "What ... what kind of ... How do I say it ...? I can't put it in words."
E: "Stripes? Dots?"
S: "Can you do it again?"
E: "How is it?"
S: "It's like a small eye that appears several times over here."
E: (English explanation)

Face.

S: "Slightly flashing rainbow colors and again those little eyes I saw with the ball ... um ... not cartoons, but really small ... um ..."
E: "Like right here?"
S: "Yes. There's [sic] eyes. Like two or three of them like this."
E: "What about the color? Over here?"
S: "Yea, kind of rainbow colors ..."
E: (English explanation)

Kanji character.

E: "How is it?"
S: "Like before, there's [sic] those small eyes, but when I chase them they moved up."
E: "Could you read the kanji?"
S: "Yes."
E: "Color?"
S: "Very slightly rainbow like."
E: "Around here?"
S: "The eyes here and rainbow ..." (points to left)
E: (English explanations)

Electrodes 181–182.

Box.

S: "It doesn't change much. But for the first second, just for the very first second after it started I saw an eye, and eye, and a mouth for a bit but I started thinking 'what is this?' but the next thing I noticed was just looking at this box."

Ball.

S: "How do I explain this ... just like the previous one, I see an eye, an eye and a mouth, sideways."
E: "What kind of face was it?"
S: "Just now? What's that cartoon character? ... Not sure what, but some sort of cartoon character."

Face.

S: "Your face completely changed."
E: "Oh, how did it change?"
S: "I don't know what's going on. Your eyes change."
E: "Everything?"
S: "Yes."
E: "I change into a completely different person?"
S: "Your hair stays the same, but your eyes and your nose ... I can't describe it with words. Can you do it again?"
(second stimulation)
"Just this area of your face. Your face turns into a cartoon character that I might see in an anime."
E: "What about my mouth?"
S: "Your mouth doesn't really change, but the nose and eyes, this area changed."

Kanji character.

S: "Hmm ... am I just imagining things? Can you do it again?"
(second stimulation)
"Ok. Just as I thought, I see a face. An eye, an eye, and mouth around here. I don't really know, but something that looks kind of like an anime character."
E: "Was there color?"
S: "Just a bit, I saw a purplish color."

Electrodes 183–184.

Box.

No change

Ball.

S: "Why is this? The letter (character) right here appeared to have eyes, but after two seconds I couldn't see it anymore."

(Note: the soccer ball has some letters on it)

E: "Ok. Maybe not the letters." (Switches the direction of the ball to where there are no letters)

(Second stimulation)

S: "For a second I see an eye an eye, and I think that's a mouth."
E: "Like an anime character?"
S: "Yes, the shape is just in the shape of this ball with an eye, an eye, and a mouth."

E: "What about the color?"

S: "The color doesn't change."

Face.

S: "Your facial expression changed."
E: "What changes?"
S: "From your eyes to your mouth, your face kind of changes into an anime character."

Kanji character.

(First stimulation)

"Can you do it again?"

(Second stimulation)

"Oh ... this area felt like a face for a bit. It's not that I could see the eyes, nose, and mouth or anything, but it just felt like that was a face right there, and I felt like there was a hand there."

E: "Like an anime?"

S: "Yea, something like that."

Electrodes 127–128.

Box.

E: "How was it?"

S: "Didn't change much."

Ball.

S: "Doesn't really change."

E: "Doesn't change?"

Face.

E: "No change?"

S: "So your face and the color doesn't [sic] change, but for a brief moment, like very brief ... even for the box and the ball, and this time with your face, I saw a flash of a face right next to it, and disappeared."

E: "A face right here?"

S: "A brief moment."

E: "Like a picture?"

S: "Well ... it just appeared ... how can I explain it? ... A face ... I mean, not a big change."

E: (English explanation)

Kanji character.

E: "How is it?"

S: "The face is ... (inaudible). I see an upper body faintly right over here on the right for a brief moment."

E: "Can you read the kanji character?"

S: "Yes, I can totally read the character."

E: (English explanation)

E: "Just the upper body, right?"

S: "Yes."

Electrodes 125–126.

Box.

E: "Are you ok?"

S: "Yes."

E: "How is it?"

S: "For a second it seemed blurry."

E: "It hurts? Can't bear it anymore?"

S: "No, it's not like that, but it hurt a bit at the beginning. But I'm ok."

E: "No big change?"

S: "How can I say this? It got blurry right here and moved toward the right."

E: "The shape."

S: "The shape doesn't change."

Ball.

S: "It wasn't very clear, but very faintly I saw a picture. Not sure who's pictured, but some picture appeared right there."

E: "A face?"

S: "Upper body. Couldn't see the face clearly. It was just very faint."

E: "In the middle?"

S: "Over here."

E: (English explanation)

E: "Color?"

S: "Blackish, especially the person in it."

E: (English explanations)

Face.

S: "Your face doesn't really change, but over here around your right ear, I don't know who it is, but I see an upper body and face."

E: (English explanation)

E: "Right here?"

S: "Yes."

E: "In my ear?"

S: "Well ... just around your ear."

E: (English explanation)

S: "The face was the size of your ear."

Kanji character.

S: "I see a face that I just saw right next to your ear. I don't know who it is but just right here. One person is facing the other way, and there's a person next to it facing this way."

E: "Two people?"

S: "Yes, it actually kind of looks like someone similar to you."

E: "Could you read the character?"

S: "Yes, I could read it."

(English conversation)

E: "Is it always the same picture?"

S: "Yes."

Electrodes 123–124.

Box.

S: "I faintly saw some blinking lights, and then it moved."

E: (English explanation)

Ball.

S: "Just like before, very faintly I see blinking lights that move."

E: (English explanation)

Face.

S: "So when I chase it, it moves."

E: (English explanation)

Kanji character.

S: "Over here."

E: "Can you read it?"

S: "Yes."

E: (English explanation)

Electrodes 115–116.

Box.

E: "How is it?"

S: "This doesn't change."

E: (English explanation)

Ball.

E: "How is it?"

S: "No change."

E: (English explanation)

Face.

S: "Doesn't change at all."

E: (English explanation)

Kanji character.

S: "Doesn't change at all."

E: (English explanation)

Electrodes 117–118.

Box.

E: "How is it?"

S: "No change."

E: (English explanation)

Ball.

E: "How is it?"

S: "No change."

E: (English explanation)

Face.

S: "Doesn't change at all."

E: (English explanation)

Kanji character.

S: "This doesn't change either."

E: (English explanation)

Electrodes 113–114.

Box.

E: "How is it?"

S: "No change."

E: (English explanation)

Ball.

S: "No change again."

E: (English explanation)

Face.

S: "Doesn't change at all."

E: (English explanation)

Kanji character.

S: "No change again."

E: (English explanation)

Electrodes 181–182.

Box.

E: "How is it?"

S: "Can you do it again?"

S: "What is this? ... I see something cartoon-like character with an eye, an eye, and mouth ... what kind of character is this ...?"

E: (English explanation)

E: "The shape doesn't change?"

S: "No, the shape doesn't change."

E: (English explanation)

Ball.

E: "How is it?"

S: "Similar to the box before ... where the shape and color doesn't [sic] change, but the patterns inside start looking like eyes."

E: "A face?"

S: "Yea, like a face."

E: "Like a cartoon?"

S: "What is it? ... Every direction I look at ... I start seeing eyes over here, but if I look over here, I see eyes over here."

S: "Every direction I look, there's always ..."

E: "Always in the middle, right?"

E: (English explanation)

Face.

S: "It no longer looks like your face."

E: "Everything changed?"

S: "The shape of your face doesn't change, but your eyes ..."

E: "This area?"

S: "Yea, that area I can no longer tell who it is."

E: (English explanation)

Another experimenter: "Was it like a picture or a line drawing?"

S: "I guess like a drawing. It's no longer a human face, almost like a cartoon character."

Kanji character.

E: "How is it?"

S: "I see a weird face."

E: "Around here?"

S: "You see this here? These kind of look like eyes."
 E: (English explanation)
 S: "I couldn't see a real face shape."

Ball.
 S: "No change."
 E: (English explanation)

Electrodes: Sham stimulation.

Box.
 E: "How is it?"
 S: "No change."
 E: (English explanation)

Face.
 S: "No change."
 E: (English explanation)

Kanji character.
 S: "No change at all."
 E: (English explanation)

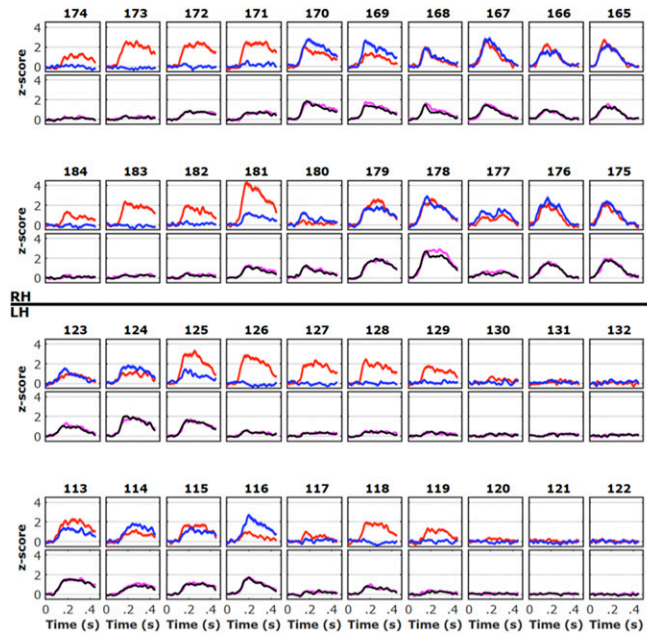


Fig. S1. Time course of ECoG broadband gamma responses for each fusiform electrode for faces (red traces), objects (blue traces), colored stimuli (purple traces), and black/white stimuli (black traces). Response magnitude is the average across trials of the z-score calculated separately for each trial with respect to the prestimulus baseline from all trials. Solid lines give response mean; colored shading gives its SE across trials. LH, left hemisphere; RH, right hemisphere.

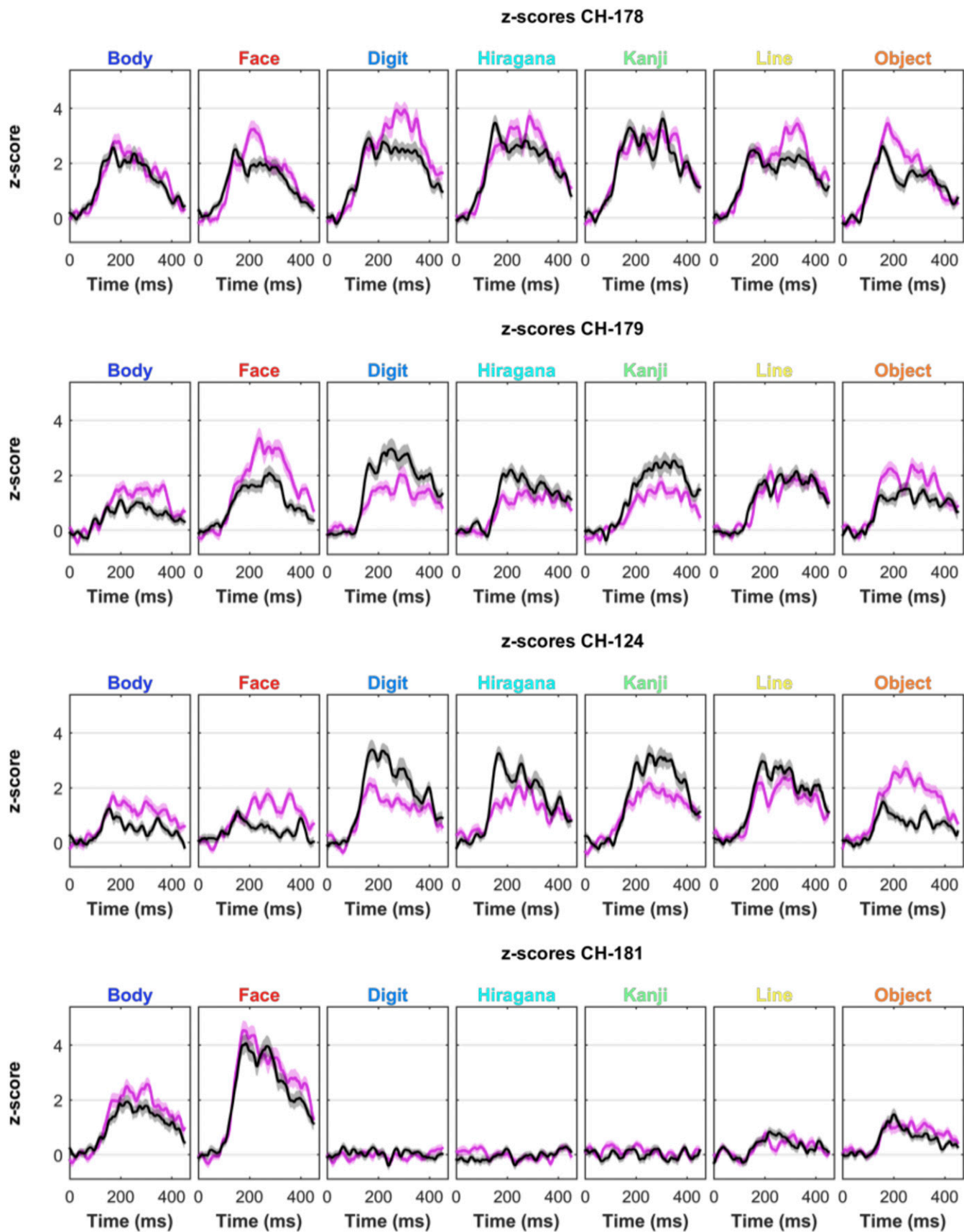


Fig. S3. Time course of broadband gamma power for color (purple) and grayscale (black) conditions for each of the stimulus categories for the two electrodes that showed a significant interaction of color \times category (electrodes 124 and 179) and (for comparison) for a face-selective electrode (181) and a color-prefering electrode (178) that did not show a significant interaction of color \times category. Interestingly, the interaction in electrodes 124 and 179 reflects a color preference only for the photograph stimuli (body, face, object), not for the symbol/line drawing stimuli, for which the response is higher for the black and white than color versions. Also note that stimulation of electrode 179 produced weak color percepts.

