科技部補助專題研究計畫成果報告
期末報告

過去情境影響當下決策判斷的機制

計 畫 類 別 ： 個別型計畫
計 畫 編 號 ： MOST 104-2410-H-004-049-
執 行 期 間 ： 104年08月01日至105年07月31日
執 行 單 位 ： 國立政治大學心智、大腦與學習研究中心

計 畫 主 持 人： 徐慎謀

計畫參與人員： 學士級-專任助理人員：吳昭蓉

報 告 附 件 ： 出席國際學術會議心得報告

中 華 民 國 105 年 10 月 28 日

中 文 摘 要 ： 過往的研究已發現對事務的判斷取決於當下所處的情境。此情境效應已在各學門如心理物理學、社會科學、管理經濟學等領域獲得廣泛的研究。但情境效應通常會造成兩種相左的現象：其一為同化現象，也就是當下的判斷會依附之前的判斷；其二為對比現象，也就是當下的判斷會遠離之前的判斷。本計劃藉由一連串的行為實驗研究之前情境是如何影響當下的決策判斷，期能了解是何種機制造成同化或對比現象。研究結果顯示情境效應的產生端賴之前刺激物的知覺特性以及受試者對之前刺激物的反應判斷。細究發現之前刺激物的知覺特性會造成對比現象。反之，受試者對之前刺激物的反應判斷會造成同化現象。進一步的研究發現，此種機制不僅在受試者對知覺刺激物的判斷上可觀察到，在高層次的語意判斷也可發現。因此，根據本計畫的研究結果，我們認為之前刺激物的知覺或語意特性以及受試者對之前刺激物的判斷會影響現象對比或同化現象的發生。

中 文 關 鍵 詞 ： 同化、對比、連續性效應、分類

英 文 摘 要 ： Judgments pertaining to the same target may be profoundly influenced by the context in which they are made. Two types of such decision bias, assimilation effects and contrast effects, have been frequently reported in the literature and have been a central topic in main fields, such as psychophysics, social judgment and marketing. However, how these two opposing consequences are determined remains obscure. In this project, we conducted a series of behavioral experiments to explicate the mechanisms underlying the assimilative and contrastive consequences of preceding effects. During categorization of a sequence of randomly presented stimuli, categorization performance regarding current stimuli was influenced by the local sequential context provided by previous trials. Such sequential effects depend on both the perceptual and decisional component of preceding trials. When the perceptual attributes of preceding stimuli were controlled, the context provided by preceding responses slanted current categorization judgment toward assimilative consequences (assimilation effects). In contrast, when preceding responses were held fixed, the context provided by preceding stimuli slanted current categorization judgment toward contrastive consequences (contrast effects). Furthermore, this pattern of findings is not limited to perceptual stimuli, but can be generalized at a higher semantic level. In sum, this project suggests that the perceptual/semantic and decisional components of preceding trials play an important role in mediating the consequences of preceding effects.

英 文 關 鍵 詞 ： Assimilation; Contrast; Sequential effect; Categorization

科技部補助專題研究計畫成果報告

（□期中進度報告/□期末報告）

（計畫名稱）

計畫類別：■個別型計畫　□整合型計畫

計畫編號：MOST104－2410－H－004－049－

執行期間：2015 年 08 月 01 日至 2016 年 07 月 31 日

執行機構及系所：國立政治大學心智、大腦與學習研究中心

計畫主持人：徐慎謀

共同主持人：

計畫參與人員：吳昭蓉

本計畫除繳交成果報告外，另含下列出國報告，共 _1_ 份：

□執行國際合作與移地研究心得報告

■出席國際學術會議心得報告

□出國參訪及考察心得報告

中　華　民　國　105 年　10 月 28 日

摘要

過往的研究已發現對事務的判斷取決於當下所處的情境。此情境效應已在各學門如心理物理學、社會科學、管理經濟學等領域獲得廣泛的研究。但情境效應通常會造成兩種相左的現象：其一為同化現象，也就是當下的判斷會依附之前的判斷；其二為對比現象，也就是當下的判斷會遠離之前的判斷。本計劃藉由一連串的行為實驗研究之前情境是如何影響當下的決策判斷，期能了解是何種機制造成同化或對比現象。研究結果顯示情境效應的產生端賴之前刺激物的知覺特性以及受試者對之前刺激物的反應判斷。細究發現之前刺激物的知覺特性會造成對比現象。反之，受試者對之前刺激物的反應判斷會造成同化現象。進一步的研究發現，此種機制不僅在受試者對知覺刺激物的判斷上可觀察到，在高層次的語意判斷也可發現。因此，根據本計畫的研究結果，我們認為之前刺激物的知覺或語意特性以及受試者對之前刺激物的判斷會影響現象對比或同化現象的發生。

關鍵詞: 同化、對比、連續性效應、分類

Abstract

Judgments pertaining to the same target may be profoundly influenced by the context in which they are made. Two types of such decision bias, assimilation effects and contrast effects, have been frequently reported in the literature and have been a central topic in main fields, such as psychophysics, social judgment and marketing. However, how these two opposing consequences are determined remains obscure. In this project, we conducted a series of behavioral experiments to explicate the mechanisms underlying the assimilative and contrastive consequences of preceding effects. During categorization of a sequence of randomly presented stimuli, categorization performance regarding current stimuli was influenced by the local sequential context provided by previous trials. Such sequential effects depend on both the perceptual and decisional components of preceding trials. When the perceptual attributes of preceding stimuli were controlled, the context provided by preceding responses slanted current categorization judgment toward assimilative consequences (assimilation effects). In contrast, when preceding responses were held fixed, the context provided by preceding stimuli slanted current categorization judgment toward contrastive consequences (contrast effects). Furthermore, this pattern of findings is not limited to perceptual stimuli, but can be generalized at a higher semantic level. In sum, this project suggests that the perceptual/semantic and decisional components of preceding trials play an important role in mediating the consequences of preceding effects.

Keywords: Assimilation; Contrast; Sequential effect; Categorization

Introduction

Classical perceptual decision-making theories often assume that there is a direct mapping between stimulus magnitude and corresponding perceptual judgments. From this perspective, the information conveyed by stimuli may serve as a sole basis for the judgments. However, decisions are not made in isolation. Instead, they are often situated within a rich context shaped by preceding material and thereby are biased. It has long been established that preceding contexts play a crucial role in biasing current decision-making (Helson, 1964; Laming, 1997; Lockhead, 2004). However, less clarity surrounds the direction of the effect of preceding context. On one hand, preceding context produce contrast effects in target judgment. For example, the same target person is judged to be less hostile when preceded by a hostile person (e.g., Adolf Hitler) than when preceded by a peaceful person (e.g., the pope; Herr, 1986). On the other hand, preceding context yields assimilation effects in target judgment. The length of the Mississippi river, for example, is judged to be longer if compared with a high rather than a low numeric standard (Jacowitz & Kahneman, 1995). In sum, two types of such decision bias have been frequently reported in the literature: (a) Assimilation effects - current stimuli are judged as closer to immediately preceding stimuli than they actually are, and (b) Contrast effects – current stimuli are judged as away from immediately preceding stimuli than they actually are. One essential issue is thus raised regarding how these two opposing consequences (or directions) are determined. To date, empirical evidence is still lacking as to explicating the mechanisms that mediate these two types of bias.

Category learning research has suggested that the consequences of the effects of preceding context may be attributed to the perceptual/decisional components of preceding trials (Jones, Love, & Maddox, 2006). Indeed, the effect of preceding context seems to depend on the quality of preceding stimuli (i.e., the effect of the perceptual component). Previous research has demonstrated that during judgment on line length (Ward & Lockhead, 1971), stronger preceding effects could be found when the perceptual attributes of stimuli, such as the luminance and line length, were reduced. In support, during the magnitude estimation of a sequence of tones of varying loudness (Jesteadt, Luce, & Green, 1977), once the response to the previous stimuli was controlled, participants tended to label the same tone in a different manner when it was preceded by tones varying in loudness. In contrast, preceding effects also seem to reflect the repetition of the responses (i.e., the effect of the decisional component) that have been recently reinforced. In the studies of probabilistic learning, participants consistently exhibited a bias toward whichever response was correct on previous trials. For example, during a two-choice task with equal rates of reinforcement for responses A and B, participants' overall rate of choosing A was 50%, but this value was 60% on trials following the reinforcement of A and 40% on trials following reinforcement of B (Engler, 1958).

In the present project, a series of experiments were carried out to investigate the mechanisms underlying the assimilative and contrastive consequences of preceding effects. In our recent study, the two opposing consequences can be concurrently observed in sequential effects during categorization tasks (Hsu & Lee, 2016; Hsu & Yang, 2013), indicating that sequential dependencies may provide a window to tap into those phenomena. Here, sequential effects indicate that when a sequence of stimuli is presented, the decisions regarding the stimuli in current trials vary according to the local sequential context shaped by the stimuli presented in immediately preceding trials (Garner, 1953). Taken together, this project aimed to examine how perceptual and decisional components of preceding trials may shape current categorization decisions, leading to different consequences of sequential effects.

Experiment 1

We firstly reanalyzed the data collected from our previous study (Hsu & Yang, 2013) to probe the roles of perceptual and decisional influences of preceding trials on current decisions.

Method

Participants. Fifteen right-handed participants without past neurological or psychiatric history participated in this experiment. All had normal or corrected-to-normal vision and provided their written informed consent.

Stimuli. Ten continua of morphed facial expressions from fear to disgust were created using FantaMorph (Abrosoft). In each continuum, a disgusted prototype was morphed 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% and 90% of the physical distance to an identity-matched fearful prototype, resulting in 11 face images (i.e., fearful and disgusted prototypes, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 70:30, 80:20 and 10:90 fear-disgust morphed faces). The prototypical expressions of fear and disgust were selected from FEEST (Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002). A total of 110 face stimuli were used (10 continua of different identities × 11 stimuli per continuum). The face images subtended a horizontal visual angle of 6.8° and a vertical angle of 8.6° around the center of the screen. The viewing distance was 60 cm.

Procedure. Each trial began with a 600-ms fixation cross located in the center of the screen, followed by a 400-ms presentation of a facial expression. A blank screen was presented at the offset of the face stimulus and participants were instructed to categorize whether the face was fearful or disgusted via a key press with no time limitation. Performance feedback was not provided during the experiment. The key press initiated a new trial after a 500-ms inter-trial interval. Trials were blocked by continua. In other words,

participants had to complete 10 blocks, with a break between blocks. Within each block, the order of face stimuli from the same continuum was randomized. Each face was repeated 9 times, resulting in a total of 99 trials in each block (9 repetitions x 11 expressions per continuum). To acquaint the participants with the procedure, the experiment began with 1-2 blocks of practice trials, with different sets of face continua not being used in the experiment.

Results

Categorization data of expression continua. For each expression continuum, categorization data were calculated as the percentage of choices corresponding to the "fear" or "disgust" emotion category for each morphed face (Fig. 1). Responses to stimuli at the same morph steps were averaged, irrespective of their sequential context. Although the exact data patterns varied across continua and participants, a highly consistent picture emerged. In accord with previous evidence (Hsu & Yang, 2013), the categorization data of each continuum fell into two clear regions with an abrupt category shift, and each region belonged to the emotion category that corresponded to the prototype at that end. In general, a morphed face blended with more elements of fear or disgust from the prototypes, i.e., a smaller distance between the prototype and the morphed face, was more likely to be categorized as "fear" or "disgust", respectively.

To control for the variability in the locations of the fear-disgust borderline across continua and participants so as to properly examine the effect of sequential context, we chose to analyze three types of face images from each emotion category: the prototypes (P-face), the morphs close to the category boundary (B-face), and the morphs lying at the mid-points of the P-and B-faces (M-face). These faces were all highly recognizable and were judged as belonging to a distinct emotion category with categorization rates above 77.78% for each continuum and each individual (P-face: mean ± SEM = 95.59 ± 0.88%, after collapsing across continua, emotion categories, and participants; M-face: 94.56 ± 0.66%; B-face: 87.95 ± 0.73%). The gray bars in Fig. 1 illustrate an example of how these target faces were selected.

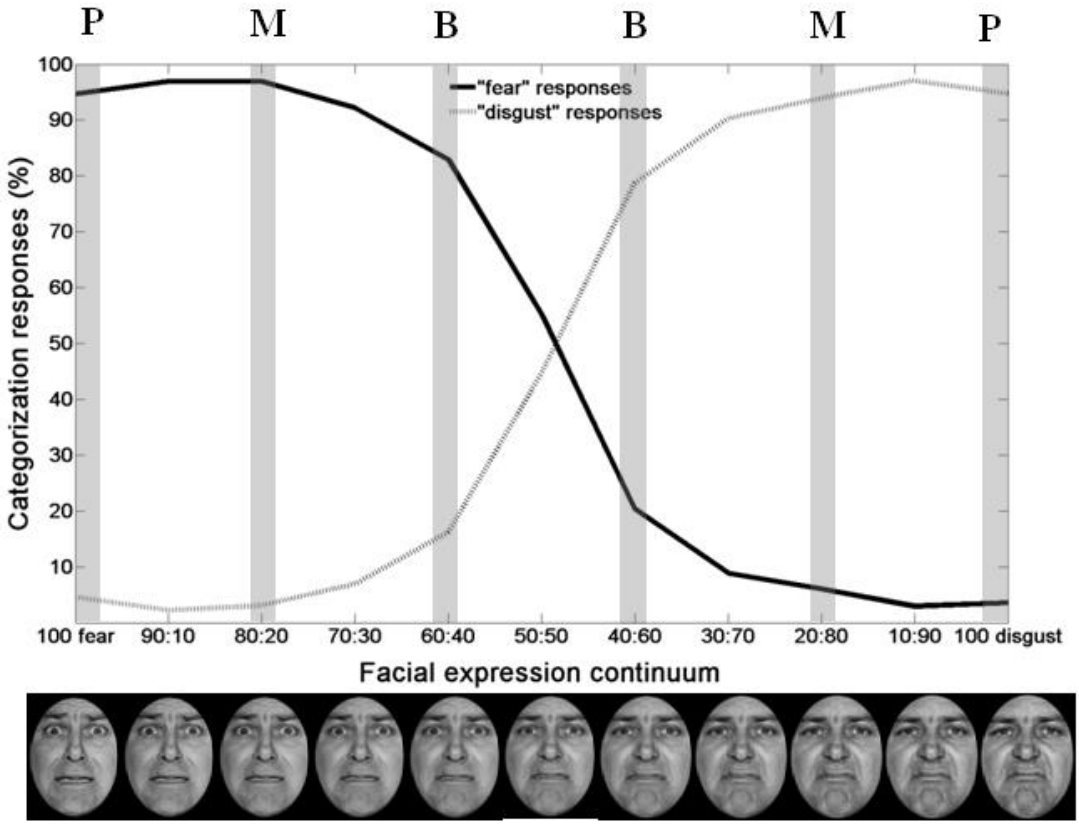

Figure 1. An example of the categorization data. The data were taken from one of fear-disgust continua from a single participant. The expression continuum ranges from the prototypical expression of fear to the prototypical expression of disgust in 10 morphing steps. It should be noted that depending on the continua and individuals, the exact location of a category boundary was between 70:30 and 30:70 fear-disgust morphs. The gray bars indicate the expression stimuli selected for analyzing sequential effects. The notations P, M and B represent the P-, M- and B-faces, respectively.

The role of the perceptual component of preceding trials. Because evidence has shown that sequential contexts exert the strongest influence on the categorization of ambiguous stimuli (Hampton, Estes, & Simmons, 2005; Stewart, Brown, & Chater, 2002; Zotov, Jones, & Mewhort, 2011), all of our analyses focused exclusively on ambiguous expressions at the boundaries between two emotion categories, where the percentages of "fear" and "disgust" responses were approximately 50%. The proportion of "fear" responses to the ambiguous faces were first analyzed as a function of the preceding stimuli (Fig. 2). Next, the obtained results were collapsed across continua. The preceding stimuli were the previously selected P-faces, M-faces, and B-faces, depending on whether preceding stimuli were from the "fear" emotion category (white zone) or from the "disgust" category (gray zone).

To examine whether the perceptual component of preceding trials shaped categorization

responses to the faces in current trials, only preceding stimuli whose categorization responses were modal responses were considered. Here, modal responses were defined as the dominant or the majority category choices that participants assigned to a given face stimulus. As a result, the effect of previous responses could be controlled because all the preceding stimuli were associated with the same response ("disgust" in the gray zone or "fear" in the white zone) but differed in their perceptual distance to the current faces. In turn, the effect of the perceptual component could be isolated and studied. When the preceding faces originated from the "fear" emotion category (the white zone in Fig. 2), the proportion of the "fear" categorization judgments of the current ambiguous faces were increased, with decreasing relative distance between the preceding and current faces (linear trend analysis, $F(1,14) = 30.57$, $p < 0.001$). Conversely, when the preceding stimuli originated from the "disgust" category (gray zone in Fig. 2), the proportion of the "fear" responses to the current ambiguous faces were increased ($F(1, 14) = 20.85$, $p < 0.001$), with increasing relative distance between the preceding and current faces.

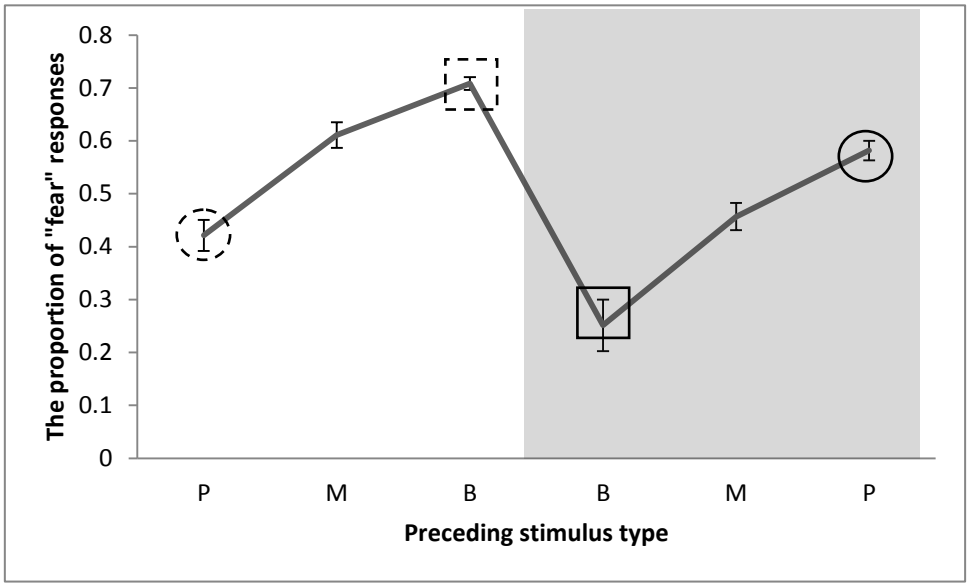

Figure 2. The effect of the perceptual component of preceding stimuli on the "fear" responses to current ambiguous faces. Only preceding stimuli with modal responses were considered to control the effect of preceding responses. The white zone indicates that the preceding stimuli are from the "fear" emotion category, whereas the gray zone indicates that the preceding stimuli are from the "disgust" category. The solid or dashed circles, respectively, represent the distant preceding expressions from the "disgust" or "fear" categories, whereas the solid or dashed squares, respectively, represent the nearby preceding expressions from the two categories. Error bars represent ±SEM.

The above data showed that there was decreased accuracy to the current ambiguous faces after more distant expressions from the same category or increased accuracy to the current ambiguous faces after more distant expressions from the opposite category. This pattern

provides evidence for contrast effects when the relative distance between the preceding and current expressions was increasingly large, given that the current stimulus was more likely to be judged as away from the category of the distant preceding stimulus. However, a complementary indication of the present results is that responses to the current ambiguous faces were more accurate after more nearby preceding expressions from the same category, or more errors were induced after more nearby preceding expressions from the opposite category. In this view, when the relative distance was increasingly small, the current stimulus was judged as close to the category of the nearby preceding stimulus. This suggests that the findings of this experiment could be alternatively explained in terms of assimilation effects.

To clarity whether the findings were due to assimilation effects, contrast effects or both, we examined responses to the current expressions that were preceded by a member of one category relative to after preceded by a member of the other category. Because contrast effects could be observed when the relative distance between successive expressions was large, we expected that participants would classify current stimuli as *further from* the category of the *distant* preceding stimuli. Indeed, the present results showed more "fear" responses to the current ambiguous faces after the distant P-faces from the "disgust" category (solid circle in Fig. 2) than after the distant P-faces from the "fear" category (dashed circle; paired t-test; paired t-test, $t(14) = 2.62$, $p = 0.02$). Given that our previous findings also revealed a possible involvement of assimilation effects when the relative distance was small, we expected that participants would classify current stimuli as *close to* the category of the *nearby* preceding stimuli. As expected, more "fear" responses to the current ambiguous faces were observed after the nearby B-faces from the "disgust" category (dashed square in Fig. 2) than by the nearby B-faces from the opposite category (solid square; $t(14) = 6.32$, $p < 0.001$).

The role of the decisional component of preceding trials. To examine whether the decisional component of preceding trials affected categorization judgment of current stimuli, we analyzed how the "fear" responses to the ambiguous faces varied when preceded by ambiguous faces associated with "fear" and "disgust" responses, respectively. Because the perceptual attributes of preceding stimuli (i.e., ambiguous faces) remained constant but the associated responses differed, we reasoned that the effect of the perceptual component could be controlled and in turn, the effect of the decisional component could be isolated. For this analysis, ambiguous faces in preceding trials were chosen because they provide a sufficient number of both the "fear" and "disgust" responses for analysis. The results showed that participants were more likely to repeat previous responses (Fig. 3; paired t-test, $t(14) = 9.86$, $p < 0.001$). In other words, they were biased to assimilate current responses towards the category membership assigned to the preceding ambiguous expressions.

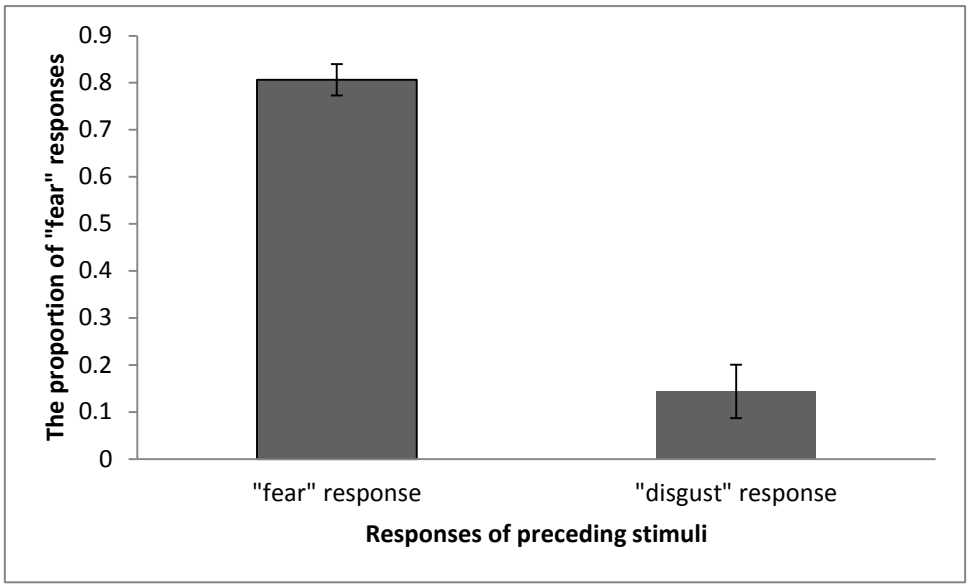

Figure 3. The effect of the decisional component of preceding stimuli on the "fear" responses to current ambiguous faces. The responses were sorted according to whether the preceding stimuli were categorized as "fear" or "disgust". Only ambiguous faces were considered as the preceding stimuli to control the effect of the perceptual component of preceding trials. Error bars represent ±SEM.

Discussion

During categorization of a sequence of randomly presented expressions, categorization performance regarding current expressions was influenced by the local sequential context provided by previous trials. Such sequential effects depend on both the perceptual and decisional components of preceding trials. When the perceptual attributes of preceding stimuli are controlled, the context provided by preceding responses may slant current categorization judgment toward assimilative consequences (assimilation effects). When preceding responses are controlled, relative distance between two successive stimuli may determine how current expressions were categorized. Intriguingly, two types of categorization biases were likely to be equally involved in this context. On one hand, when the relative distance between two successive expressions was relatively large, participants were biased to categorize the current expressions as away from the category of the immediately preceding expressions (contrast effects). On the other hand, when the relative distance was relatively small, participants were biased to assimilate responses towards the category of the preceding expressions (assimilation effects).

Experiment 2

Experiment 2 aimed to further examine the respective roles of perceptual and decisional components of preceding trials in current decisions. Given that the perceptual component of preceding trials may result in both assimilation and contrast effects, in this experiment, we

manipulated perceptual attributes of stimuli by reducing the presentation time to explore to what extent the consequence of sequential effects may depend on the perceptual component of preceding trials.

Method

Participants. Fifteen right-handed participants without past neurological or psychiatric history participated in the experiment. All had normal or corrected-to-normal vision and provided their written informed consent.

Stimuli and procedure. The stimuli and procedure were as in Experiment 1, with the exception that the faces were presented for only 33 ms.

Results

Categorization data of expression continua. As before, for each continuum, categorization data were calculated as the percentage of choices corresponding to the "fear" or "disgust" emotion category for the individual morphed faces. The categorization data for each continuum also fell into two clear regions, each of which belonged to the emotion category corresponding to the prototype at that end. Moreover, three types of face images from each emotion category were selected as preceding stimuli.

The role of the perceptual component of preceding trials. Similarly, we only considered preceding stimuli whose categorization responses were modal responses to control the effects of preceding responses. A somewhat different pattern of results was found as compared with those obtained in Experiment 1 (Fig. 4). A linear relationship between relative distances and categorization performance was found only when the ambiguous expression was preceded by the faces originated from the "disgust" category (the gray zone; linear trend analysis, $F(1,14) = 5.95$, $p = 0.029$), but not by the faces originated from the "fear" category (the white zone; linear trend analysis, $F(1,14) = 1.45$, $p = 0.24$). This finding indicates that the proportion of the "fear" categorization judgment on the current ambiguous faces was linearly increased with increasing relative distances between the current and preceding stimuli.

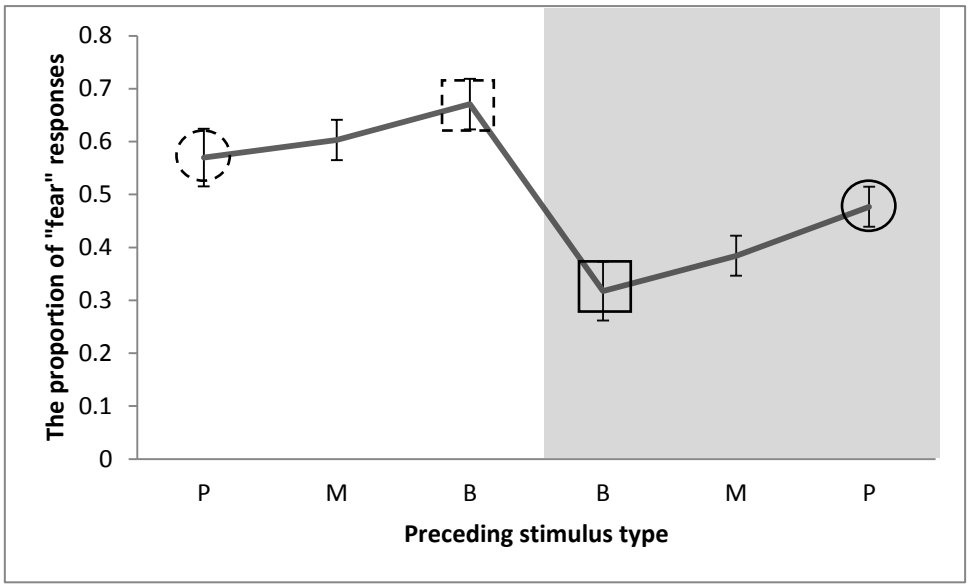

Figure 4. The effect of the perceptual component of preceding stimuli on the "fear" responses to current briefly-presented ambiguous face. Only preceding stimuli with modal responses were considered to control the effect of preceding responses. The white zone indicates that the preceding stimuli are from the "fear" emotion category, whereas the gray zone indicates that the preceding stimuli are from the "disgust" category. The solid or dashed circles, respectively, represent the distant preceding expressions from the "disgust" or "fear" categories, whereas the solid or dashed squares, respectively, represent the nearby preceding expressions from the two categories. Error bars represent ±SEM.

Further analyses revealed that the proportion of the "fear" responses to the current ambiguous faces were enhanced after the nearby B-faces from the "fear" category (dashed square in Fig. 4) than after the *nearby* B-faces from the "disgust" category (solid square; paired t-test, $t(14) = 3.37$, $p = 0.005$). This finding indicates that participants were biased to categorize the current expressions as close *to* the category of the *near* preceding expressions (assimilation effect). In contrast to the results obtained in Experiment 1, no contrast effect was observed, as there was no significant difference in the proportions of the "fear" responses when the current expressions followed the distant P-faces from the "disgust" category (solid circle) or the distant P-faces from the "fear" category (dashed circle; $t(14) = 1.47$, $p = 0.16$).

The role of the decisional component of preceding trials. As in Experiment 1, the proportion of the "fear" responses to the current ambiguous expressions were higher following preceding "fear" responses compared with following preceding "disgust" responses (Fig. 5; solid square; paired t-test, $t(14) = 7.42$, $p < 0.001$). Accordingly, when the expressions were briefly presented, participants also tended to assimilate current responses towards the category of the preceding ambiguous expressions.

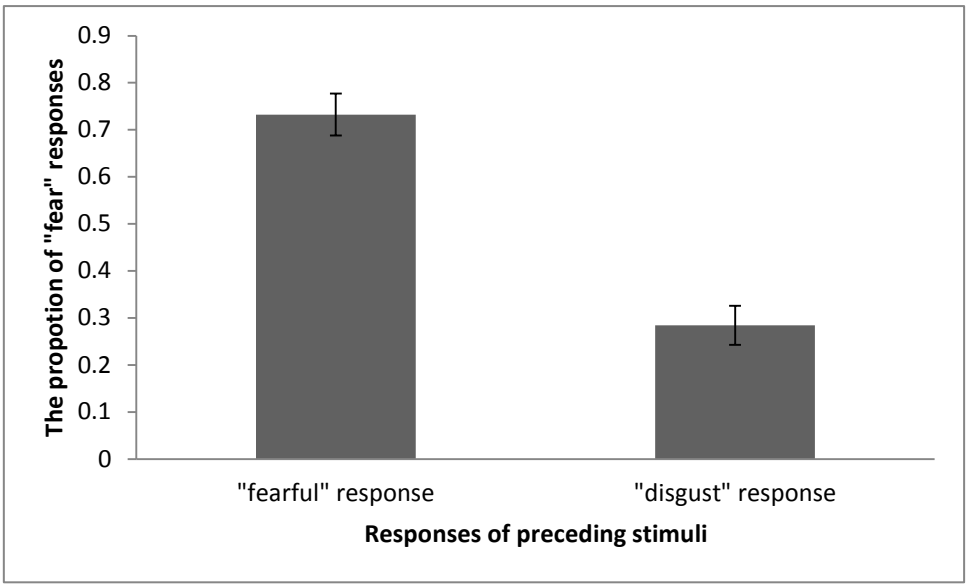

Figure 5. The effect of the decisional component of preceding stimuli on the "fear" responses to current briefly-presented ambiguous faces. The responses were sorted according to whether the preceding stimuli were categorized as "fear" or "disgust". Only ambiguous faces were considered as the preceding stimuli to control the effect of the perceptual component of preceding trials. Error bars represent ±SEM.

Discussion

As compared with the results reported in Exp. 1, this experiment revealed that a brief presentation of a stimulus may diminish contrast effects while assimilation effects remain intact. These findings suggest that contrast effects are tightly linked to the perceptual quality of stimuli. In contrast, assimilation effects are more associated with preceding responses, because the manipulation of the perceptual component of preceding trials has little impact on the effects.

Experiment 3

Experiment 3 was set out to examine whether the obtained findings are limited to perceptual stimuli, or can be generalized at a higher semantic level. Accordingly, in this experiment, continua of perceptual stimuli were replaced with continua of numerical stimuli, whereas the rest of the design would closely mimic those in previous experiments.

Method

Participants. Fifteen right-handed participants without past neurological or psychiatric history participated in this experiment. All had normal or corrected-to-normal vision and provided their written informed consent.

Stimuli. We modified the design of a previous research (Mussweiler & Strack, 1999). As shown in Table 1, participants were presented with 5 questions. For each question, there were 9 potential answers forming an answer continuum. To ensure that participants did not familiarize and then habituated to those answers, the values of the answers were not fixed but randomly generated within a small range.

Question	Actual answer	Continua of answers 1-9
Antarctic: mean temperature in winter (℃)	-68	**1**: (-178 to -152), **2**: (-151 to -125), **3**: (-124 to -98), **4**: (-97 to -71), **5**: (-70 to -44), **6**: (-43 to -17), **7**: (-16 to 10), **8**: (11 to 37), **9**: (36 to 64)
Gandhi: age	78	**1**: (1 to 15), **2**: (16 to 31), **3**: (32 to 47), **4**: (48 to 63), **5**: (64 to 79), **6**: (80 to 95), **7**: (96 to 111), **8**: (112 to 127), **9**: (128 to 143)
Whale: length (m)	33	**1**: (0.1 to 0.4), **2**: (0.5 to 0.9), **3**: (1 to 7), **4**: (8 to 13), **5**: (14 to 20), **6**: (21 to 49), **7**: (50 to 78), **8**: (79 to 107), **9**: (108 to 136)
Einstein: year of first visit to United States	1921	**1**: (1730 to 1764), **2**: (1765 to 1799), **3**: (1800 to 1834), **4**: (1835 to 1869), **5**: (1870 to 1904), **6**: (1905 to 1939), **7**: (1940 to 1965), **8**: (1966 to 1997), **9**: (1992 to 2016)
Aristotle: year of birth	-322	**1**: (-1574 to -1304), **2**: (-1303 to -1033), **3**: (-1032 to -762), **4**: (-761 to -491), **5**: (-490 to -220), **6**: (-119 to 151), **7**: (152 to 422), **8**: (423 to 693), **9**: (694 to 964)

Table 1. The stimuli used in Experiment 3.

Procedure. Participants had to complete 5 blocks, one block for each question and they were informed the question before the start of each block. Within each block, the order of 9 numerical stimuli (i.e., potential answers) from the same continuum was randomized. Each answer was repeated 9 times, resulting in a total of 81 trials in each block (9 repetitions x 9 answers per continuum).

Each trial began with a 600-ms fixation cross located in the center of the screen, followed by a 400-ms presentation of a potential answer. A blank screen was presented at the offset of the face stimulus and participants were instructed to categorize whether the provided answer was high or low to describe the question of the block via a key press within 2 seconds. Performance feedback was not provided during the experiment. The key press initiated a new trial after a 1000 ms inter-trial interval.

Results

Categorization data of answer continua. For each question, categorization data of the corresponding answer continuum were calculated as the percentage of choices corresponding to the "high" or "low" response category for each potential answer (Fig. 6). Responses to each answer were averaged, irrespective of their sequential context. Similarly, although the exact data patterns varied across continua and participants, a consistent pattern also emerged, in which the categorization data of each continuum fell into two clear regions with an abrupt category shift, and each region belonged to the "high" or "low" category.

As before, to control for the variability in the locations of the borderline across continua and participants so as to properly examine the effect of sequential context, we chose to analyze three types of answers from each category: the answers at both ends of a continuum (P-answer), the answers close to the category boundary (B-answer), and the answers closer to the B-answers (M-answer). These stimuli were all highly recognizable and were judged as belonging to a distinct category for each continuum and each individual. The gray bars in Fig. 6 illustrate an example of how these stimuli were selected.

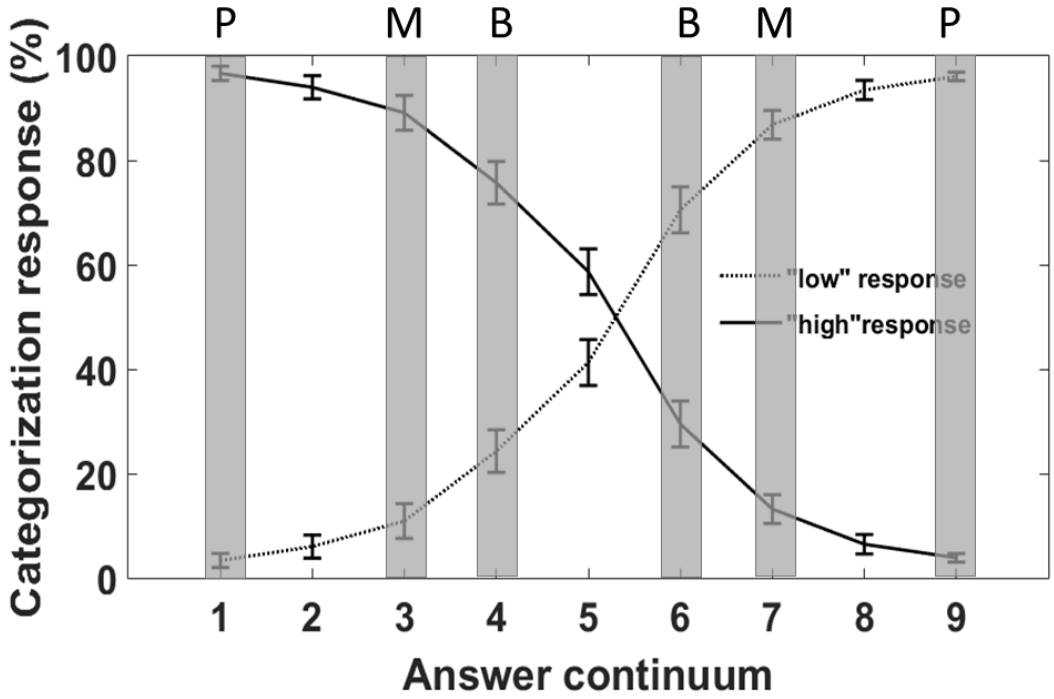

Figure 6. Categorization data for the answer continuum. Data were obtained after being collapsed across the participants. The continuum expresses 9 potential answers as indicated in Table 1. It should be noted that depending on the continua and participants, the exact location of a category boundary varies. The gray bars indicate the answer stimuli selected to analyze sequential effects. The notations P, M and B represent the P-, M- and B-answers, respectively.

The role of the perceptual component of preceding trials. In accord with previous experiments, we analyzed to what extent current judgment on ambiguous answers would be influenced, respectively, by the perceptual and decisional components of preceding trials. To this end, the "high" responses to the ambiguous answers were analyzed as a function of the preceding stimuli (Fig. 7). Next, the obtained results were collapsed across continua. The preceding stimuli were the previously selected P-answers, M-answers, and B-answers, depending on whether preceding stimuli were from the "high" response category (white zone) or from the "low" category (gray zone).

To isolate the role of the perceptual component of preceding trials in categorization responses to the answers provided in current trials, we only considered preceding stimuli whose categorization responses were modal responses as in previous experiments. Distinct from previous results in Exp. 1 and 2, the proportion of the "high" categorization judgments of the current ambiguous answers did not significantly differ as a function of preceding stimulus type, no matter when the preceding faces originated from the "high" response category (the white zone in Fig. 7; $F(1,14) = 1.18$, $p = 0.32$) or from the "low" response category (gray zone in Fig. 7; $F(1, 14) = 1.48$, $p = 0.24$).

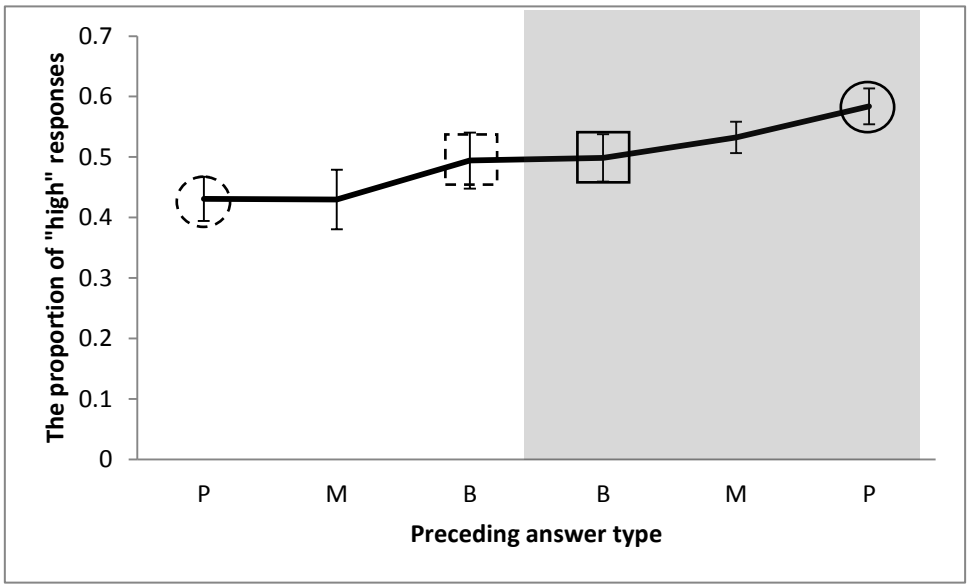

Figure 7. The effect of the perceptual component of preceding stimuli on the "high" responses to current ambiguous answers. Only preceding stimuli with modal responses were considered to control the effect of preceding responses. The white zone indicates that the preceding stimuli are from the "high" response category, whereas the gray zone indicates that the preceding stimuli are from the "low" category. The solid or dashed circles, respectively, represent the distant preceding answers from the "low" or "high" categories, whereas the solid or dashed squares, respectively, represent the nearby preceding answers from the two categories. Error bars represent ±SEM.

In contrast to the results reported in Exp. 2, contrast effects were observed in this experiment, as there was an increased proportion of "high" responses to the current ambiguous answers after the distant P-answers from the "low" category (solid circle in Fig. 2) relative to when preceded by the distant P-answers from the "high" category (dashed circle; paired t-test, $t(14) = 3.54$, $p = 0.003$). However, no assimilation effect was found. The proportion of "high" responses to the ambiguous answers were comparable after the nearby B-answers from the "low" category (dashed square in Fig. 2) and after the nearby B-answers from the opposite category (solid square; $t(14) = 0.21$, $p = 0.84$).

The role of the decisional component of preceding trials. To examine whether the decisional component of preceding trials affected categorization judgment of current stimuli, we analyzed how the "high" responses to the ambiguous answers varied when preceded by ambiguous answers associated with "high" and "low" responses, respectively (Fig. 8). In line with the results in Exp. 1 and 2, participants were more likely to repeat previous responses (paired t-test, $t(14) = 2.78$, $p < 0.02$). In other words, they were biased to assimilate current responses towards the category membership assigned to the preceding ambiguous expressions.

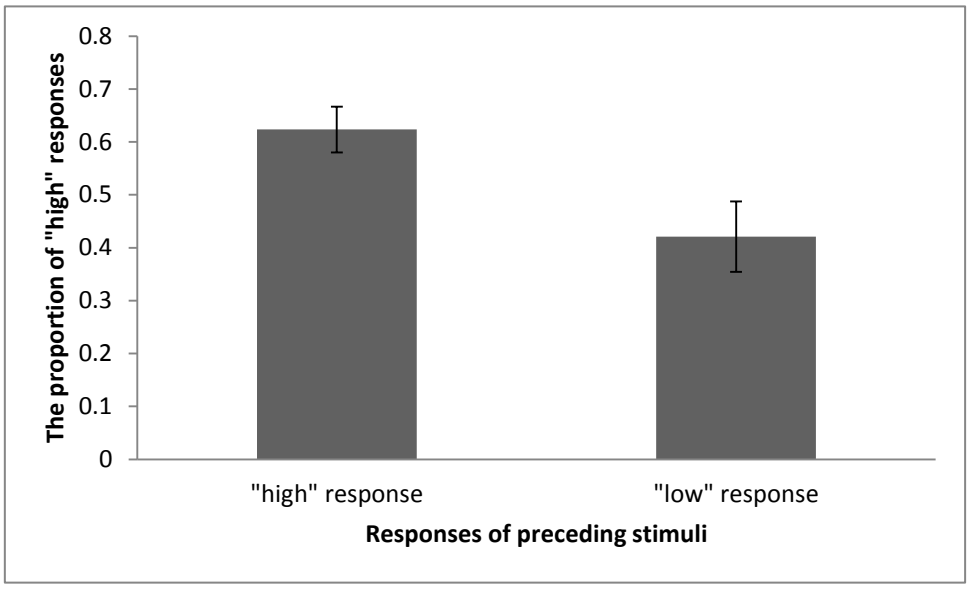

Figure 8. The effect of the decisional component of preceding stimuli on the "high" responses to current ambiguous answers. The responses were sorted according to whether the preceding stimuli were categorized as "high" or "low". Only ambiguous answers were considered as the preceding stimuli to control the effect of the perceptual component of preceding trials. Error bars represent ±SEM.

Discussion

During categorization of a sequence of randomly presented semantic stimuli, categorization

performance regarding current stimuli was influenced by the local sequential context provided by previous trials. Such semantic sequential effects also depend on both the perceptual and decisional components of preceding trials. When the semantic attributes of the stimuli are controlled, the context provided by preceding responses may slant current categorization judgment toward assimilative consequences. When preceding responses are held fixed, the context provided by preceding stimuli may slant current categorization judgment toward contrastive consequences.

Conclusion

One difficulty with studying the role of perceptual and decisional components in the directions of sequential effects is that repeated instances of the same stimulus always lie in the same category. This phenomenon produces a confounding between previous stimuli and responses that makes the decisional and perceptual effects difficult or impossible to separately identify. To break the relationship between stimulus and response, we assess the effect of the previous category while the previous stimulus is held constant, giving a measure of the decisional sequential effect. Reciprocally, we evaluate the effect of the previous stimulus while controlling for the previous response provides a measurement of the perceptual sequential effect.

The overall results point towards a consistent pattern, in which assimilation effects may result from preceding responses. Specifically, participants exhibit a tendency to repeat their categorization judgment. In contrast, contrast effects are related to the nature of preceding stimuli. When perceptual quality of the stimuli is rendered poor, contrast effects diminish. Intriguingly, this pattern of findings is not limited to perceptual stimuli. Rather, we suggest that our findings are a general phenomenon and can be extend to at a semantic level of categorization judgment as demonstrated in Exp. 3.

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附件五

科技部補助專題研究計畫出席國際學術會議心得報告

日期:105 年 7 月 20 日

計畫編號	MOST　104－2410－H－004－049		
計畫名稱	過去情境影響當下決策判斷的機制		
出國人員 姓名	徐慎謀	服務機構 及職稱	政治大學心智大腦與學習中心 助理研究員
會議時間	105 年 5 月 5 日至 105 年 5 月 8 日	會議地點	西班牙格瑞那達
會議名稱	(中文)心理環境國際會議 (英文) 2016 International Meeting of the Psychonomic Society		
發表題目	(中文)之前情境對人臉意識知覺的影響 (英文)Effects of preceding context on conscious face perception		

一、參加會議經過

The presented results were obtained based on the collective budget from this and previous grants. Attending this conference serves two purposes: (1) to receive feedback on the presented data and (2) to get inspired for the next project. I had an oral presentation on May 7th in the “Social cognition” symposium. Although the attendees were fewer than expected because conference dinner was approaching, I still received some great comments which immediately trigger my idea for the next MEG experiment. Moreover, this conference also offered an opportunity to get acquainted with other researchers, such as the symposium host Fiona Newell.

二、與會心得

In general, I undoubtedly benefit a lot, particularly the discussion from the symposia “The effect of prior brain states on information processing” and “Judgement”, as they are relevant to my current research theme. Moreover, some familiar faces in the field of cognitive psychology also attended this conference. It is exciting to hear their keynote speeches. It is worth mentioning that this conference is surprisingly organized. Formal lunch and afternoon refreshment are served everyday while registration fee charges little and most of the attendees are approachable. In the future, I will probably put the meeting held by the

Psychonomic Society on the top of my list.

三、發表論文全文或摘要

As below

四、建議

N/A

五、攜回資料名稱及內容

The PDF version of the program and abstract book

六、其他

N/A

International Meeting of the Psychonomic Society

Granada - Spain | May 5 - 8, 2016

Collaborating Societies:

SEPEX
Sociedad Española de Psicología Experimental

ABSTRACT BOOK

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that varied in length. On each trial, participants were asked to remember the number and then were shown a target line. After a delay, they reproduced the length of the target line using an adjustable line. Once they were satisfied with the length of their reproduction, they then reported their memorization number. In two experiments, we demonstrate that participants under a high cognitive load exhibit a stronger central tendency bias than when under a low cognitive load. Although not anticipated at the outset, we also find that judgments exhibit an anchoring bias.
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Knowing-It-All But Still Learning: Perceptions of One's Own Knowledge and Belief Revision.
SARA HAGÁ, *University of Lisbon*, KRISTINA R. OLSON, *University of Washington*.
Our lay theories suggest that people who are overconfident in their knowledge, are less likely to revise that knowledge when someone else offers an alternative belief. Similarly, we might assume that people who are willing to revise their beliefs, might not be very confident in their knowledge to begin with. We conducted 2 studies that call these lay theories into question. In Study 1 (N = 80), we asked children aged 4 to 11 years and college students about familiar (e.g., green) and unfamiliar (e.g., chartreuse) color names. In Study 2, we asked participants of the same age groups (N = 80) about familiar (e.g., brush), unfamiliar (e.g., rug beater), and apparently familiar (e.g., hammer-shaped chocolate) objects. In both studies, participants had the opportunity to keep or revise their original answers, after seeing how a peer answered the same questions. Young children were simultaneously more overconfident in their knowledge (e.g., that they knew what chartreuse meant) *and* more likely to revise their initial beliefs (e.g., to choose another color after seeing a peer choose a different color), than older children and adults. We discuss the potential causes and functions of this dissociation between the confidence with which beliefs are held and the revision of those beliefs across development.
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The Relative Influence of Perception and Memory in Producing the Central Tendency Bias.
SEAN DUFFY, JOHN SMITH, and SARAH ALLRED, *Rutgers University, Camden.*
Two experiments test the effect of memory and perception on estimates of categorized stimuli. When recalling stimuli, people combine inexact memories of stimuli with information about the distribution in which they are embedded, resulting in a central tendency bias. Experiment 1 explores the role of memory in producing this bias. Participants (N=44) completed a line estimation task where they viewed target lines on a computer and reproduced their length by adjusting a second line to equal the target. *Memory condition* participants saw the target line, which disappeared and had to reproduce its length from memory. *Perception condition* participants adjusted the second line while the target line was still present. Using dummy variable regression we examined *bias* (over or underestimating the reproduction length) by *actual stimulus size*, we found that participants in the memory condition had stronger negative slopes (β = -0.20) and larger intercepts (β = 30.1) than in the perception condition (perception condition as reference category). The omnibus analysis was significant [$F(3, 34) = 206.12$, $p < .001$] as were coefficients for both intercept and slope ($p < .001$). In Experiment 2 we tested the effect of target presentation time on estimates. Participants (N=74) viewed target lines for either 32, 64, or 128 milliseconds under a white noise mask, then reproduced their length. We found presentation time did not affect the slope or intercepts of the bias by actual size in these three conditions. We discuss the relative role of memory and perception in producing the central tendency bias.
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ANDALUCIA I & II ROOM, SATURDAY 7TH MAY, 17:20-19:00
TS29 Social Cognition

N-Equality: More People, Less (Concern for) Equality?
STEPHEN M. GARCIA, *University of Michigan*, AVISHALOM TOR, *University of Notre Dame*.
Do inequality concerns and, therefore, inequality aversion diminish with group size? Concerns over economic inequality in particular play a central role in debates over law and public policy in areas ranging from taxation and regulation to the scope and nature of the modern welfare state. The present studies contribute to inequality research by examining whether people's willingness to tolerate inequality depends in part on the number of recipients of the resources to be distributed. Building on our earlier *N-Effect* findings that show how social comparison and competitive motivation decrease as the number of competitors increases (Garcia & Tor, 2009; Tor & Garcia, 2010; Garcia, Tor, & Schiff, 2013), we find that as the number of recipients increases social comparison-based concerns about relative outcomes diminish, thereby increasing tolerance for inequality. Study 1 analyzed faculty salary data from 5,327 faculty members of the entire University of Texas system, finding that the variance of salaries within an academic department positively correlates with department size. Study 2 employed a between-subjects design, asking participants to choose between allocations among groups of recipients while varying the number recipients across the two conditions, finding participants preferred the equal payoff significantly more in the small-N condition than in the larger-N one. Study 3 related the effect of N on inequality concerns to social comparison, shedding further light on the mechanism underlying the effect. Together, these findings bear important implications for policy, practice and research on inequality.
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Effects of Preceding Context on Conscious Face Perception.
SHEN-MOU HSU, JHAO-RONG WU, *National Chengchi University.*
How an external piece of information gains access to conscious processing has been one of the central issues in the literature. However, the role of preceding context on conscious perception is still poorly understood. In this study, participants were instructed to view a briefly presented masked face from trial to trial, such that they were able to recognize the identity of target faces (conscious face identification) in some trials, but were only able to detect the presence of the targets (conscious face detection without

identification) in some other trials, and not able to detect the presence of the targets in the rest of trials. The behavioral results showed that the performances of both conscious face identification and detection were biased by the preceding context shaped by preceding responses. Specifically, participants were more likely to respond not consciously perceiving targets when they made the same responses (not seeing the targets) in preceding trials. MEG data provided further evidence and revealed that preceding contexts, as shaped by preceding responses, differentially modulated phase clustering before the presentation of the target faces. Intriguingly, those contextual effects were independent of preceding stimulus types. The overall findings thus suggest that conscious perception is affected by preceding context. Furthermore, the context provided by preceding responses instead of preceding stimuli may slant current conscious judgement toward assimilative consequences.
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Cooperation and Punishment: Effects of Facial Appearance and Facial Expression.
RAOUL BELL, LAURA MIETH, AXEL BUCHNER, *Heinrich Heine University Düsseldorf*. Facial cues are used to form first impressions of strangers. People make trustworthiness judgments based on facial appearance alone. According to Brown and Moore (2002), the punishment of misleading signals of prosociality serves to increase signal reliability. In the present study, we directly examined how cooperation and punishment are influenced by facial impressions. Participants played a prisoner's dilemma game with interactants who either had a likable or unlikable facial appearance (Experiment 1), or either had a smiling or neutral facial expression (Experiment 2). A multinomial model was used to distinguish between four types of punishment: moralistic punishment, antisocial punishment, hypocritical punishment and irrational punishment. Facial likability and smiling increased the global amount of punishment imposed on uncooperative interactants. This effect was indirect rather than direct: it was solely due to an increased willingness to cooperate with likable-looking and smiling individuals, which in turn provided more opportunity for moralistic punishment (the most common form of punishment observed in our experiments). Smiling even decreased the average strength of punishment imposed on the interactants, suggesting that it may serve as a form of appeasement. The results have implications for theories about how facial emotions are used in social exchange.
Email: Raoul Bell, raoul.bell@hhu.de

Here's Looking at You: The Effect of Facial Motion and Gaze Shifts on Judgements of Attractiveness.
FIONA N. NEWELL, PIK KI HO, ZORA KNAUF, *University of Dublin, Trinity College Dublin*, ANDREW T. WOODS, *Xperiment. mobi, Surrey*, HANNI KIISKI *University of Dublin, Trinity College Dublin*.
Eye gaze direction facilitates social attention and the perception of facial expressions, but it is also an important determinant for the aesthetic evaluation of faces. Typically, studies on facial attractiveness report that images of faces with direct eye gaze on the observer are preferred over images of the same faces with averted gaze. However, in the natural world, the eyes are constantly in motion and these dynamic changes can often occur with rigid (viewpoint) or non-rigid (expression) changes of the face. In a series of experiments, we investigated how eye gaze direction affects the attractiveness ratings of an unfamiliar face when an expression change occurred (Experiment 1) or across full or ¾ views of the face (Experiment 2). First, we found that faces in which there was an eye gaze shift towards rather than away from the observer were rated as more attractive, particularly when an expression changed from neutral to smiling. The lowest ratings were provided when the eye gaze shifted towards the observer but when the expression changed from smiling to neutral. Second, for neutral faces only, we found that head orientation affected the benefit of eye gaze: faces were rated as more attractive when turned slightly away from the observer, irrespective of eye gaze shifts, although gaze shifts towards the observer were less attractive in a full-face view. Our results suggest that perception of eye gaze for expression or social attention may not be independent from the information eye gaze provides for the aesthetic judgements of faces.
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Investigating the Neural Correlates of Affiliation Based on Shared Aesthetic Preferences.
HARRY FARMER, ANTONIA HAMILTON, *University College London.*
Discovering that other people share similar preferences to ourselves has been demonstrated to lead to increased judgments of both similarity and affiliation. At present however there has been little investigation of the neural basis of learning about shared preferences or the pathways by which such shared preferences influence judgments of affiliation. We investigated this question in a functional MRI study of 25 adults between the ages of 18 and 40. During the study participants made judgments about which of two pieces of artwork they preferred and then saw the decisions of two confederates. Unknown to the participants the decisions of the confederates were manipulated such that one of them agreed with the participants choice in 75% of trials while the other agreed in only 25% of trials. Participants completed 80 trials overall and rated the confederates on their similarity and likeability after every 20 trials. Behavioural results showed that participants rated the similar choice confederate as more similar to them and likeable than the different confederate. Analysis of the fMRI data showed that observing the different compared to similar confederate led to greater activation in a number of areas heavily linked to social learning and the representation of value including bilateral orbitofrontal and bilateral medial prefrontal cortices. These findings shed light on how we form judgements of others based on our knowledge of their personal taste.

Certificate of Participation

Shen-Mou Hsu, Jhao-Rong Wu

have presented the paper entitled

EFFECTS OF PRECEDING CONTEXT ON CONSCIOUS FACE PERCEPTION.

at the International Meeting of the Psychonomic Society
PS 2016
held in Granada, Spain, from May 5th to May 8th, 2016.

M. Teresa Bajo
Scientific Committee Chair

科技部補助計畫衍生研發成果推廣資料表

日期:2016/07/22

科技部補助計畫	計畫名稱: 過去情境影響當下決策判斷的機制
	計畫主持人: 徐慎謀
	計畫編號: 104-2410-H-004-049- 學門領域: 實驗及認知心理學

無研發成果推廣資料

104年度專題研究計畫成果彙整表

計畫主持人：徐慎謀	**計畫編號：**104-2410-H-004-049-
計畫名稱：過去情境影響當下決策判斷的機制	

成果項目					量化	單位	質化 （說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等）
國內	學術性論文	期刊論文			0	篇	
		研討會論文			0		
		專書			0	本	
		專書論文			0	章	
		技術報告			0	篇	
		其他			0	篇	
	智慧財產權及成果	專利權	發明專利	申請中	0	件	
				已獲得	0		
			新型/設計專利		0		
		商標權			0		
		營業秘密			0		
		積體電路電路布局權			0		
		著作權			0		
		品種權			0		
		其他			0		
	技術移轉	件數			0	件	
		收入			0	千元	
國外	學術性論文	期刊論文			0	篇	
		研討會論文			1		Hsu, S.-M. & Wu, J.-R.(2015). Effects of preceding context on conscious face perception. International Meeting of the Psychonomic Society 2016.
		專書			0	本	
		專書論文			0	章	
		技術報告			0	篇	
		其他			0	篇	
	智慧財產權及成果	專利權	發明專利	申請中	0	件	
				已獲得	0		
			新型/設計專利		0		
		商標權			0		
		營業秘密			0		
		積體電路電路布局權			0		

		著作權	0		
		品種權	0		
		其他	0		
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		收入	0	千元	
參與計畫人力	本國籍	大專生	0	人次	
		碩士生	0		
		博士生	0		
		博士後研究員	0		
		專任助理	0		
	非本國籍	大專生	0		
		碩士生	0		
		博士生	0		
		博士後研究員	0		
		專任助理	0		
其他成果 （無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）					

科技部補助專題研究計畫成果自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現（簡要敘述成果是否具有政策應用參考價值及具影響公共利益之重大發現）或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估
   ■達成目標
   □未達成目標（請說明，以100字為限）
   　□實驗失敗
   　□因故實驗中斷
   　□其他原因
   說明：

2. 研究成果在學術期刊發表或申請專利等情形（請於其他欄註明專利及技轉之證號、合約、申請及洽談等詳細資訊）
   論文：□已發表　□未發表之文稿　■撰寫中　□無
   專利：□已獲得　□申請中　■無
   技轉：□已技轉　□洽談中　■無
   其他：（以200字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性，以500字為限）
   Humans constantly have to adapt their strategies in response to changing opportunities and threats in nature. Such an adaptation to a dynamic environment may thus result in privileged access to recent information. The results obtained in this project are significant, because they provide a solid psychological basis for a better understanding of the effects of recent information on decision-making.

4. 主要發現
   本研究具有政策應用參考價值：■否　□是，建議提供機關
   （勾選「是」者，請列舉建議可提供施政參考之業務主管機關）
   本研究具影響公共利益之重大發現：■否　□是
   說明：（以150字為限）
   Assimilation and contrast effects in current decision are separately associated with preceding stimuli and responses.