ð)3.þ “E , 2018, Vol. 26, No. 11, 1935–1951
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McGurk ~ Ê,º § 3V D/”5 0.v *

¬ K [1] : [1] † ó c [1,2,3,4]

([1] D Ù T “ ð)3 ;@Ñ- .þ “ “K• , D Ù 100871)
([2] D Ù T “ g • L- ; §6* †5ßF Fú%æ ËO¹ Ñ , D Ù 100871)
([3] D Ù T “ IDG SÓ 5 ´6>.þ “-A/£ m, D Ù 100871)
([4] "†!Œ 580 T “ ð)3 ;6>.þ “-A/£K• , Fþ { 321004)

5000 N(Alsius, Paré, & Munhall, 2018; MacDonald, 2018)! ¬ ¯ ‘ , , z ú&c4g | •L• 2(4 +± McGurk u Á4)E ! Marques0v ç(2016)+±4)E h >® " McGurk u Á+±-A/£ &)3? >ó Y ¡ 5Dô/8 +± \.g , Q £ \ ¯ ,*U>ó Y ¡ 5+±)3@ç N ¸’? F÷McGurk u Á, ÷ McGurk u Á U'¦ · ç4Ñ?- A L- -A/£ Z+± Á*U ! sA 4)E Kó Z »>ó Y ¡ 5 K MÅ, & McGurk u Á YCØ " :Bà !¸ ¯UŸÎ 6 " McGurk u Á+±"xFü ¹*y Ç ; & McGurk u Á +± ž ú 2M@Õ@çD°´>Z "¶ ÷ ³ C*y'–)3 g $í+± ž ú); !Î 6 " McGurk u Á Z 6* ... U+± >ó Y : -7! ß/®K MÅ0v ! Alsius 0v ç(2018)+±4)E h>® " McGurk u Á ‰ g>ó Y?-A L- Dô/8+± -A/£ ¤ 6 È mK} T ÷L->®" <+±K MÅ , Q £ \ ž ú McGurk u Á þ*L(´+± 2M ÷ McGurk g$í ;>ó Y -7! g$í+± / ! sA 4)E +± h>®, +± U » ú J € z-A/£ ¬*U McGurk 80 <+± 5)3 T, !Î 6"¶ ÷.‹3ü '-mK MÅ ; A £ & McGurk u Á+± ž ú 2M+±K=E 2(4 T :Bà !MacDonald (2018) +±4)E M« ³ 40 ¡ z McGurk u Á+± þ(ÝDô/8 ÷ ‰52+± ðC ³/8, \ & ³ ¸ #+± M« , !Î 6 " McGurk u Á+± - Ý-A/£E , !

Y ´ JA & McGurk u ÁE =y •L• 2(4 +± 4)E !NÃ u Ï@ÕMcGurk u Á+±"xFü ;*y ÇK MÅ ! º û W € ² / ¹ W €K! /+±>ÿ Ó ' þ , K=E ž ú McGurk u Á+±,% 2M !E - ’ û,i Õ N < Õ ..‹3ü Í Dô/8 ,% 6> g 6 W æL• , K= E McGurk u Á+±@Ñ- .‹3ü '-m ! - ; ý ' W ’ -A/£ , H ÷L->®" <+±K MÅ !

2 McGurk ~ Ê,º#•H D+, Ð

6-A/£ -7YFô*U“McGurk u Á þ*L(´” ‰ g@ñ $McGurk u Á g ^(G >)+± 4 4—— ¬*U McGurk g$í Ë ê G N"xFü ; @Î0Ä £ Z þ*L McGurk u Á+± N •! ¸(U"xFü+±Dô/8 ZL->® Í ’>ó Y -7! g$í C>ó Y : -7! s : GA þ McGurk u Á+± g$í ‰ g ˜ rA N) !-A/£ Z - e*U+± McGurk g$í \>ó>ö“ga” Í Y>ö “ba”+±>ó Y3ñ 5¸ þ*L McGurk u Á # 6* L-]“da” (Beauchamp, Nath, & Pasalar, 2010; Fernández et al., 2017; Nath & Beauchamp, 2012)K‘ ‘ x C, >ó>ö“ka” Í Y>ö“pa” 6* L-]“ta” (Gurler, Doyle, Walker, Magnotti, & Beauchamp, 2015) - æL• , Œ 6-A/£ U pM 7 Fô*U“i”0v £ ZFz, ¸ ¯>ó>ö“gi” Í Y>ö “bi” 6* L-] “di” (Colin, Radeau, Soquet, Demolin, Colin, & Deltenre, 2002) ! Œ 6-A/£ UD²M x z#(Í pM , ¸ ¯>ó>ö“aga” Í Y>ö“aba” 6* L-] “ada” (Bertelson, Vroomen, & de Gelder, 2003; Buchan & Munhall, 2012)E 6-A/£ GFú : Q NM 7¯, ¸ ¯>ó>ö “gaga” Í Y>ö“baba” 6* L-] “dada” (Mallick, Magnotti, & Beauchamp, 2015; McGurk & MacDonald, 1976);ª&c McGurk g$í 6 µ G.ú , s \ £ e ðF* \'¦ Ç>ó>öD²M ¹ Y>öD²M +±3ñ 5 , ¬ W € L-]+± Y>ö g$í þ*L f !

g í u 6'¦ Ç+±>ó Y œ3ñ 5 z G Ô*L McGurk u Á, 59 £ 3ñ 5 F : GU¤ 3 oM±"x4C-. N ¸(hierarchical predictivecoding model, Olasagasti, Bouton, & Giraud, 2015) ' ³? F÷ !A N ¸50;~]>ó>ö ¹ Y>ö œ+± Õ . Ñ ¿Dô/8, '/ø ³>ó >ö œ(4 • , lip aperture)¹ Y>ö œ (0Y ¹ ž \ , second formant)U'–)34! Ó 7+± Õ . C ¹4!/§ K!, Ï/£ : 9 L>öEGE€ &DÀ ’+± L- œE =y M±"x ¹ Q Ú+± Õ . CDô/8 ! U ¥ ¸+± McGurk u Á Z, >ó>ö“ga”¹ Y>ö“ba”+±>ó Y : -7!DÀ ’ ;>ó>ö“da” ¹ Y>ö“da”+±>ó Y -7!DÀ ’ U 7E ¹ 4!/§K! Z+± } 4L‹ e ÒDþ, m E .ú ò â 8+±>ó Y : -7! £ : GEM = µ g+±C EGE€ ß/®¸ 59 6* G ! ÒDþ“da”+±=• ® ! s ¯ É úDô ’, & »>ó>ö “ba” ¹ Y>ö“ga”+± : -7!DÀ ’ , £ } 4 ; £ >ó Y -7!M 7¯+± } 4F* : ÒDþ, ‘, E .ú>ó Y : -7! œDÀ ’ GEM =D° gC EGE€ ß/®', <º 5 ! m , <º 5+± þ*L 6* \ g>ó Y : -7! g $í+±>ó YEGE€=• ® U ¹4! Õ .4C-./§K! ZL‹ e Ò Dþ ý W>ó Y -7! g$í+±=• ®¸ T6> ^ ! æ @M± L € z g$í \>ó Y -7!+± , E 59=• ® ' U ¹4!/§K! Z } 4 ÒDþ+±¸ó Y -7! L- TPðpÜ @ ‡Á‰S) Y>ö GucGurk

+± \7 *^ Ó !P +±*y Ç —— >®=ØA Ò w : 9 »
ËKr Y>ö g$í+± L- , F*0Ä \ þ*L ³ McGurk u
Á(Gurler et al., 2015; Mallick et al., 2015; Wilson,

u Á+±-A/£ µ > !E 6* \ g McGurk u Á Y CØ ^ \“ & Y>ö œ+± L-]>ó>ö œ+± ž ú 59 þ*L C ”, ¯ É f Y>ö g$í , ^Kë g 3 Y >ö L- þ*L+± C/£0 \ ’7 >ó>ö œ+± ž ú, E \ ’7 Y>ö œ YCØ f +± ž ú ! :Dô , ú 6 -A/£52 û Y>ö g$í+±>ÿ Ó .g ³ McGurk u Á+± /` Ç T—— M A0 M P 0v 2M & McGurk u Á+± ž ú : T ! ! D° ³ • eA! 'M 7¯ ¹ ^ 'M 7¯ (*U tA0 KzA0 Q.ú ^") & McGurk u Á+± ž ú , 4 É=• ; U “ ^ ' ” ¹ “A! ’” Q.ú Ž # 8+± McGurk u Á þ*L(´!Î 6 k9„ /(Quinto, Thompson, Russo, & Trehub, 2010)!

E 6-A/£52lµ & Y>ö œ+± u(Ý ’ , McGurk u Á+±-A/£80 < ! U>ó>ö g$í : +± ò â 8 , f Y>ö g$í+± u(Ý Ž # ! >ó>ö g$í h \“ba”, 59 Y>ö g$í 6* \ “ba”(;>ó>ö œ -7!), Œ 6* \ -.ú YB¤ ’ ü“a” +±M M¾(“ba”+±D²M œ ü ^) ! ¯ ‘ - ’ , ;52+± g$í3ñ 5 Œ GA þ=ØA Ò w Y] ³“ba” (s ËKr+± Y>ö g$í \“a”), >ó >ö?-A œ & Y>ö L- • = ³“ =’ r ” !E ;3ü ¥ McGurk u Á1¨ i (Irwin, Avery, Brancazio, Turcios, Ryherd, & Landi, 2018)A 80 < • g McGurk 80 <+± -.ú < ——3ü ¥ McGurk u Á " +± \ Y>ö œ : , f >ó>ö œ 6* f W €+± Y >ö L- ; 59A < " +± \>ó>ö œ : , f Y>ö œ ;, >ó>ö œ G & Y>ö L- E =y=’ ŗ Œ €(Ý ³>ó>ö œ ž ú Y>ö L- ! W ’-A/£ JA 3A 80 < ; M4 +± McGurk 80 <E =y! D°, O¹@î ¹52 \ S 61¨ i+± g c (¸ ¯ Q.ú80 <+± u Á þ*L(´ \ S,% iU¤ \ S$í"h ³,% i+±>ó Y ¡ 5 ,% 6> gU¤), 50;~ 3A < ‰ g - W>ó Y ¡ 5+± 4 4 !

- ;, >ó>ö ¹ Y>ö g$í u(Ý+± 9 ’ T Œ 6* EM =McGurk u Á+± W € ² / ! U>ó Y ¡ 5-A /£ Z , >ó>ö ¹ Y>ö g$í : - Ç>®1ë-›] 9 ’ u(Ý z G BB¤>ó Y ¡ 5, U - Ç #K!/Ä ²+±>ó Y g$í / ’ &>ó Y ¡ 5 ž ú : T(Munhall, Gribble, Sacco, & Ward, 1996; Stevenson, Zemtsov, & Wallace, 2012)! McGurk u Á Œ : ¸ C !-A/£ þ(Ý , >® Y>ö g$í(,%! »>ó>ö g$í) u(Ý+± #E U–360~ 360 ms+± #K!/Ä ² , F* G Ô*L McGurk u Á ! € &c, 9 ’ T+±Kz { 9 # Œ G)7! McGurk u Á ü >(Munhall et al., 1996)‘ C, ¬=ØA 6* L L-] >ó Y œ u(Ý+± : 9 ’, Œ ú&c 6* Ô*L McGurk u Á(Soto-Faraco & Alsius, 2009)Ę Œ €(Ý ³ McGurk u Á+±/` Ç T !

h €59?- , McGurk u Á - æL• æ @]'–)3 g$í 2M ž ú59 þ*L W € ² / , s - æL• õ ¤ 6D° g+±/` Ç T(: æ @ ¹ •"µ ^) !(Ý 6-A/£ T F* " 7 859 7+±'–)3 g$í 2M ¯ , ž ú McGurk u Á(Q £ " >ó>ö œ+± ž ú), Œ Ä ' ³D° g -7!+±4 @ç; &c59 ¡ *>ó ³ Y>ö œ+± ‰*U ! - W i Ä Ï/£+±K MÅ \UŸ € Y>ö œ+± L• T 8Kz #(—! Kz {), McGurk u Á ¯ , CU¤E \ Ë Kr*L"h Z µ e>î+±>ó Y?-A L- ò œ(¸ ¯ U 5 o+±(Ü ° Z ; X ç5w V) !Iµ &E -K MÅ, > M± LUŸ*^ » Y>ö œ L• TKz { , W € &>ó>ö œ +± pFú Ë Í, >ó>ö œ & Y>ö L- +± ž ú Ë Í, E 6* B þ ! G McGurk u Á !

3.1.2 AÚ. 3V

¯ 7 ´ mE , '–)3 g$í+± f & McGurk u Á+± ž úD° T ! s ¬L• &,% 9+±'–)3 g$í , W €+±@Ñ- 'ã . : 9 , Œ 6*EM = McGurk u Á þ *L(´ f !59 A , ,%! »'–)3 g$íE 1¨7 859 7 +±A07¯ 2M7 759 8+±@Ñ- 2M C U ËKr*L "h Z ! e>î(¸ ¯ > L• &+± e e \'–)3 g$í,% 9+±L• • , s7 CØ+±@Ñ- 'ã . æ @ þ*L f) !&c 59E 1¨-A/£ £ : G ! 6-A/£ h>® !4 " < 3Fz E =y Ï@Õ—— € W € 3Fz4 McGurk (Î+±" < ü > #, McGurk u Á ^ G ü > !-A/£Fô*U ù (Î 80 <, >®!o=ØA UE =y>ó Y Q Ú (Î(McGurk (Î)+± 9 #E =y -M¦ +±>ó>ö C Y>ö (Î(E Kz { ³=ØA 3Fz U McGurk (Î 7+±" <) !4 É=• ; , McGurk u Á þ*L(´ U ù (Î Ž # 8! , (Î Ž # {(Alsius, Navarra, Campbell, & Soto-Faraco, 2005)!E - ’-A/£E þ(Ý, ¯ É=ØA 9 #E =y -M¦? >ö (Î(: 9 »>ó>ö Y>öEGE€+±0Y 6 W L>ö EGE€),F McGurk u Á þ*L(´ Œ GKz {(Alsius, Navarra, & Soto-Faraco, 2007)Ę ý.g" < 3Fz & McGurk u Á+± ž ú £ : ò ò mK} »>ó>ö C Y>ö EGE€59 \ ] -7Y T+±" < 3Fz+± ž ú ! - M¦Fô*U ù (Î80 <+±-A/£@Ö=ØA 9 #E =y -M¦ ‰@Ý ó (,Î Œ þ(Ý ³ -7!+±4 Ę(Buchan & Munhall, 2012)! E 6-A

=ØA **' 3 ð g$í è" <L•F +± ò â), McGurk u Á+± þ*L(´ ! { (Tiippana, Andersen, & Sams, 2004) !

K‘ ³" < 3Fz , E 6-A/£ Ï@Õ ³M± L & McGurk u Á+± ž ú—— ¯ É ;-› w@ö=ØA Ò 8 ' u(Ý>ó Y -7! g$í(s ËKr 7 ú G 2 X>ó Y : -7!+± McGurk g$í), ,%! » w- =ØA >ó Y g$í 6* : -7!+± ò â, McGurk u Á+± þ*L(´ !P (Gau & Noppeney, 2016) W €M± L>ó Y -7! G ðE McGurk u Á+± þ*L !

4) 7 mE , U McGurk u Á+± W € ² /-A /£ Z , -A/£52 ! G " 7 859 7+±'–)3 g$í 2M & McGurk u Á+± ž ú , s &7 759 8+±@Ñ- ,% 2M " D° > !;ª&c 6-A/£ Ï@Õ" < 3Fz ¹ M± L ¯ , ž ú McGurk u Á , sE - æ > ú 6D° T+± þ ,/§K! ! W ' 50;~ Ï/£ £ °7 759 8 +±@Ñ- 2M ¸ ¯ W €+± ò4 'ã . & McGurk u Á+± ž ú—— U : 9+± ò4 'ã . 8, W €+±>ó Y ¡ 5 C@å G þ*L C, E Œ !BaDþ e>ó Y?-A L- ò œ !

- W*L"h Z e>î s ¡-A/£D° >+±K MÅ \UŸ L• • YCØ+±.k G ‹ T ¯ , ž ú>ó Y?-A L- ! > (, McGurk u Á+± ž ú , > ÷ 6Dµ — f ó i Ð A ` 4 , ¦

1940 ð

McGurk u Á þ*L(´!Î 6 / , !Î 6=•(Ý ' 7 E 8 A úA 52+± þ ,B¸ ì({' 7à , ²-÷-÷ , 9• t, 2008)! ;4 -A/£ þ(Ý, !vA úA l0 U>ó Y : - 7! >ó Y -7! ,(Y>ö Ž # 8 , Q Ú M g$í +± •-›(´!Î 6 / ; s \!vA úA T “*L U>ó Y : -7! Ž # 8 •-›(´ { » ,(Y>ö ¹>ó Y -7! Ž #, = ç ! æ @ >ó>ö œ ž ú({' 7à, ²-÷ -÷, 9• t, 2009) !E õ ;8 A úA 52+±-A/£4 É - 7! !E È-A/£ €(Ý ' ³A ?- ´ C / ;>ó Y ¡ 5 6* È þ ,+± Ñ ¿ ! 8 ´ 3 &A ?- ´ C /+± ž ú E =yA 3óK=E !

3.2.3 B#@6 ½ L $ 8

McGurk u Á \ -.ú?-A L- (ÝAŽ, ¤ 6 : 9 ´ C5ù œ(¬*U : 9 úA) +± ç U McGurk u Á 7 6* … U /, A ?- ´ C / Œ \E M = McGurk u Á W €K! /+± 2M x - ¦A/£ þ(Ý A úA 52+± McGurk u Á þ*L(´! 8 A úA 52 { (Hisanaga, Sekiyama, Igasaki, & Murayama, 2016; Sekiyama & Tohkura, 1993) E 6* *^ » A ú A 52,%! »8 A úA 52 ! >]L•F >ó>ö œ+± ž ú ! U Y ´ C Z , " >ó X çL•F \ :.iA¹+±, m Y ç UL• &L• Ñ"n Z ! k > » ¬*U Y>ö œ, 59 : \>ó>ö œ ! ;4 -A/£E þ(Ý!vA úA 52+±McGurk u Á þ*L(´ Œ! 8 A úA 52 { (Sekiyama, 1997)

:Dô, Œ 6-A/£52!Î 6 þ(Ý!vA 8 A úA 52 xK!+± McGurk u Á / (Magnotti, Mallick, Feng, Zhou, Zhou, & Beauchamp, 2015)@Ñ g McGurk u Á YCØ ^ 6D° T+± W € /, 3ñK!! D°+± d Y : É W >, » \Fô*UD° T d Y(307 ç) D° G McGurk g$í(9 W)E =y"xFü !4 É=• ; McGurk u Á þ*L(´ U!vA 8 A úA 52 ç4Ñ ²F 6D° T+± W € / , s U Q1¨ ç4Ñ xK! ¡ €59?- !Î 6 k9„ / !

K‘ ³ McGurk u Á þ*L(´+± / , : 9A ?- ´ C5ù œE 6* ž ú W € U þ*L McGurk u Á # L-]+±M 7¯1¨ ¸ !-A/£ þ(Ý, & »3ü ¥+± McGurk g$í(>ó>ðga” Y>ö“ba”), 8 A úA 52 ! G Ò w L-] “tha”, 59 A úA 52 ! G Ò w L-] “da” !E 6* ; úA / 6 —— A Z £!Î 6 “th” +± þM, 598 A e*L"h Z“tha” +± þM G »“da”+± þM (Burnham & Dodd, 2018) !

h €59?-, A ?- ´ C / ž ú McGurk u Á þ*L(´+±-A/£4 É : -7! ! £ Z8ä ÄK` T4 É+± -A/£ d YFüD° ≤ 59 T d Y-A/£!Î 6 þ(Ý k9„ / !50;~] McGurk u Á þ*L(´ YCØ ¤ 6D° T+± W € /, m A ?- ´ C 2M/£0 \ : \ McGurk u Á W € /+± ’#½ , ú …*¾ !-.ú? F÷ \UŸA ?- ´ C /-› Ë G &>ó Y?-A L- Ô*L ž ú(¸ ¯ 7 ´ ý]+±M 7¯ L- 1¨ ¸ /), \ & McGurk u Á þ*L(´+± ž ú : L ; k !E 6* \ g : 9A ?- ´ C5ù œ52 & McGurk g$í+± Í B¸ » ý W,% i+±“ K5K}”——6-A/£=• ;, ¬ McGurk u Á!Î 6 þ*L , >ó>ö œ Œ 3ü & Y>ö L- Ô*L ³ ž ú (Brancazio & Miller, 2005)¦ m McGurk u Á+± þ*L 6* \E 4 +±Dô/8 , >ó>ö œ+± ž úL->®Dë] - Ç/8 Ó z G Ô*L u Á … U ý W“K5K}) ! U C*y ´ C Ñ<º+± € ÷.k G , 1 * T “*L=ØA U>ó Y?-A L- Z &>ó>övq§Qp 6 ‡^Í - Ô!z+± ^ÁH€=@

u Á þ*L(´ ! { , £ A=ØA &>ó>ö g$í+±L•F g " >ó ! > , & aF g +±" >ó Œ ! > (Buchan & Munhall, 2012)!

s \ , Œ 6 : -7!+±4 É ——-A/£ þ(Ý, =Ø A \ S,8 aF g ; McGurk u Á+± C £!Î 6 2((Hisanaga et al., 2016; Paré, Richler, ten Hove, & Munhall, 2003; Wilson et al., 2016)Ë ý.g & a F g +± Z [>óFû Í & McGurk u Á+± þ*L £ : \ òM¨+±, C •>óFû ^6*8ä Bà LA þ McGurk u Á+± aF >ó>ö?-A œ !¸ ¯UŸ Paré0v ç(2003) E =y+± -2(D ËO¹ þ(Ý, McGurk u Á+± L- ; W €" >ó%æ \ S U aF g !Î 6,% ! E ,! Ò Ô c ³ W €+±" >ó%æ z4›,4 É=• ;, >® W € +±" >ó%æE UL•F g ², @ç \" >ó aF ,i ,^ E \MÊ a , F* : ž ú McGurk u Á þ*L(´ ! 6 € W €" >ó%æ.è - aF g 10°~20°# , McGurk u Á z G k9„ ü >(s ú&c … Ù), 6.è - aF g 60° 7, McGurk u Á z G ¹ •"µ ^ !

50;~] 7E : -7!+±-A/£4 É, aF g " >ó #K! ; McGurk u Á þ*L(´+± 2(E L->®E - ' Ï/£ ! 6-A/£4 É : -7! 6* 6 Q W Ì UŸ (1) : 9-A/£ xK! ¬*U+±-A/£80 < C 3 ½ æ" : 9 ! ¸ ¯UŸ Buchan ¹ Munhall (2012) D°+± \ ù (Î ¹ , (Î Ž # 8+± ç4Ñ ² / ; Gurler 0v ç (2015)! D°+± \7 *^" >ó'ã . 8+± ç4ÑK! /; Paré0v ç(2003)+±-A/£ : \7 *^" >ó (JA Ô c=ØA +±" >ó z4›), £ A@Ý ,,i Õ+± æ" ; £ -A/£ : 9(¬*U1ÅKq ç,i>ÿ6É+± L Á3ì 5, 59L‹ £ -A/£ e*U+±3Ï C , v - \ ) ! 7 ËO¹@ë@Î C ú ‰ 7+± /F* 6*)7!-A/£ xK!4 É : 9 ! (2) : 9-A/£ xK!+± ¡BÐ g ? 3 æ" … U / ! ¸ ¯ Gurler 0v ç(2015) ÷ Buchan ¹ Munhall (2012) Fô*U+± \ æ • ¡BÐ g, 59 Wilson 0v ç(2016) FFô *U 3 • ¡BÐ g, E Œ 6* ž ú" >ó #K!+±4 É !

K‘ ³ aF g , L•F £ ° g 9 d6* ý ÈBà A þ McGurk u Á+±>ó>ö?-A œ !-A/£ þ(Ý , ¬ : u(Ý aF g (3>óM¾!ì &>ÿ3ì 4 3, u (Ý!Î 6 aF +±EÐ -F 3 ; C 3>óM¾!ì!a ZD¡ 4 3, u(Ý 7 wF 3), McGurk u Á Œ : G ¹ •"µ ^ (Jordan & Thomas, 2011)U ¬*U £ °80 <+±>ó Y ¡ 5-A/£ Z Œ þ(Ý ³1¨ i+± u Á—— ¬"µK‘ aF Dý Õ œ(*† 8L•F £ ° g +±Dý Õ œ), >ó Y ¡ 5 ú&c G þ*L (Thomas & Jordan, 2004)Ë, ë+± \ , E È-A/£ t!Î 6Fô*U,i Õ - \ !59 U £ °Fô*U,i Õ - \+± McGurk u Á-A/£ Z , -A/£52 F* " ³ aF ÷,i,^ g , **’ ³L•F £ ° g ! m W ’-A/£K‘ ³ " aF g , E ÁA ! D°L•F £ ° g +±,i Õ / (¸ ¯Th } 6eM·0v aF •Dæ g ! U @î ¡BÐ g T < ' Y -7!+± z ý 8 , jFü@Ö m 6 ¡BÐ g>³, ¡ WL•F g) ! E 6* g > E - ')3? McGurk u Á ý È@î › ! ¸ ¯UŸ > -Dþ+± -M¦-A/£=• ; , ; ƒB|5•4 +± L• •(,%! » W ; ƒB|5•4 +±L• •)þ*L ! G McGurk u Á, A=ØA & £ aF •Dæ g (Th } 6eM)+±" >ó #K! !J¬ " >ó%æ W • ! G ; s & a F g +±" >ó #K! ¡ ú59 !- " >ó%æ W • ! > ! A 4 É Œ \ . ³ 7 ´ ý]+± Õ@ç(L•F £ ° g Œ6* ý È 6 u+±>ó>ö?-A œ 59 & aF g +± " >ó : \ þ*L McGurk u Á+± ò>® Ž #) !

4.2 McGurk ~ Ê,º Ö Ll!ë

T6> Ò c ³>ó Y œ+±DÀ ’ x ;, - ø & £ E =y ¡ 5 Í ! ‘ #"¶ ÷+±K MÅ \UŸ T6> U Ò c g$í ;+± : 9Kc âFù ¯ , Í >ó Y g$í , E 59 Ô *L McGurk u ÁU¤-A/£52 JA *U ¤ 6D°P #K! 3DÕ(´+±6>*b - \(electroencephalogram, EEG) \6>-î + - \(magnetoencephalography, MEG) 0•A K MÅ !, z+±-A/£4 É ý.gUŸ &>ó Y œ+± ¡ 5 þ*L U Í LKc â; 59 U Í ‡ LKc â , T6> G JA ? à McGurk g$í+±>ó Y : -7! ß/® !

þ*L McGurk u Á # , >ó Y ¡ 5Dô/8 U Í L ^ 3ü þ*L ¬A/£ þ(Ý , & » McGurk g$í59 ?-, € þ*L McGurk u Á #, N1 " r,%! »>ó Y -7! g$í ! < ; 59 A,%! »!Î 6 þ*L McGurk u Á+± McGurk g$í Œ ! <(Romero, Senkowski, & Keil, 2015)! N1 h>®*^ Y>ö g$íEM = !,%! » , (Y>ö g$í , >ó Y g$í B þ+± N1 " r ! < , E 6* ú M ³>ó Y ¡ 5Dô/8 Z>ó>ö œ V*U(´+± Ë Í (Besle, Fort, Delpuech, & Giard, 2004)m , þ*L McGurk u Á #+± N1 " rKz { 6* ý.g ³ ‘ #>ó >ö œ & Y>ö œ+± ž ú ! ; k !59 A N1 \ ¸ #,% *b z(event related potential, ERP)±0Y - W BL" , E Œ ý.gE .ú ž ú þ*L U Í LKc â ! .‹3ü \8Ž4 É Œ=• ;, € McGurk u Á þ*L #, Beta M¾ â+± ¾ c,%! »>ó Y -7!+± g$í U Í L (0~500 ms)! g (Romero et al., 2015)!E ; 7 E N1 4 É1¨ i , ý.g ³ McGurk u Á+± þ*L(,%

! »>ó Y -7!+± ò â) L->® ! g+±>ó Y ¡ 5, 59 A E .ú ¡ 5 U Í L ^ 3ü þ*L !

Fô*Uoddball80 <E =y+±-A/£ Œ \ . McGurk u Á Z+±>ó Y ¡ 5Dô/8 þ*L U Í L+±>ï%æ ! E 1¨-A/£ 3>ó Y -7! g$í ‰ g 4 ó g$í , McGurk g$í ‰ g | g$í , ! D° McGurk g$í ¹>ó Y -7! g$í+± ERP!4 É=• ; , U L Í Kc â (Y>ö g$í u(Ý ; 200~300 ms), McGurkg$í GA þ ^ f F z B L " (mismatch negativity, MMN) (Saint-Amour, De Sanctis, Molholma, Ritter, & Foxe, 2007) ! MMN ú M ³ & '(ÝM¾(´D° {+± Ý / Y>ö g$í+± Ï- ; ú M ³ T6> 3 € z Y>ö g$í ; x z +± -2(D Y>ö g$íE =y! D°+± Í Dô/8 ! € Y>ö L- f # , ^ G Ô*L MMN ! ‘ , MMN ‰ g Y>öDÕ X6* È+±*b*L)3 4 4 !MMN e*^ Y >ö g$í+±'–)3 ‹ T f 59A þ !:Dô , & McGurk g$í59?-, Y>ö g$í+±'–)3 ‹ T!Î 6 þ*L C , s h>ï L- C Œ BB¤ ³MMN, E =Ø/ g McGurk-MMN !McGurk-MMN U µ G-A/£ Z Ä] ³Fú :(Colin et al., 2002; Colin, Radeau, Soquet, & Deltenre, 2004; Eskelund, MacDonald, & Andersen, 2015)!E ý.g U Í McGurk g$í+± LKc â , W € ^ 3ü L-] ³ Ý /+± Y>ö g$í(;ª&c Y>ö g$í+±'–)3 ‹ T ËKr 7 £!Î 6 f), >ó Y ¡ 5 3ü þ*L ³(DÈ B, (o)a , {Fþ –, = €L , 2017) Fô*U1¨ i oddball80 <+±MEG -A/£ Œ=• ; , þ*L McGurk u Á # , U L Í Kc â(Y>ö g$í u(Ý ; 160 ms ÷ 270 ms), : 96> g+± Gamma \8Ž"h Õ G Ë g(Kaiser, Hertrich, Ackermann, Mathiak, & Lutzenberger, 2005)59 Gamma‹3ü \8Ž ; œ ¡ 5 Í 6 (IÞ"– Ó, SñEe ", P #… 9: , 2018)!E ; 7E McGurk-MMN +±4 É1¨ i, ‘ #>ó Y ¡ 5 3ü - ø þ*L , T6> Ï"x] ³ Y >ö $+±“ f ” (ËKr 7 \ h>ï L f , '–)3 g$í £!Î 6 C) !

U 7E McGurk-MMN +±,% -A/£ Z(Fô*U oddball 80 <), -A/£52 h>®! D° ³ McGurk g$í (| g$í) ;>ó Y -7! g$í (4 ó g$í)+± / , s \E 1¨-A/£ **’ ³ 8K MÅUŸ ‘ # Ô*L+± MMN /£0 *^ » Y>ö L- þ*L f , E *^ »>ó>ö œ ; Y>ö œ : -7!U¤ m , U W ’+±,% -A/£ Z ÁA 50;~ Í ’ -3ñ &&” Ž #—— 3>ó Y -7! g $í ‰ g 4 ó g$í >ó Y : -7! A : GA þ McGurk u Á+± g$í ‰ g | g$í ! Ê › Y>ö L- þ*L f z G þ*L MMN +± t@ę E .ú ò â 8+±>ó Y : -7! g$í,%! »>ó Y -7! g$í ÁA : G Ô*L MMN !E - Õ@ç i ÄE - ’ Ï/£ !

U Í +±,% & ‡ LKc â(7E >ó Y ¡ 5Dô/8 3ü - ø x ;), T6> G JA ? à>ó Y : -7! ß/® (McGurk g$í+±>ó Y œ ËKr 7 \ : -7!+±, m 6* þ*L ß/®)!A£=• ; , U g$í u(Ý ; 500~800 ms, McGurkg$í,%! »>ó Y -7! g$í 6 ! g +± BetaM¾ â ¾ c ! Ê › 6-A/£ , >ó Y : -7! g $í+± Beta M¾ â ¾ c! >ó Y -7! g$í g(Lange, Christian, & Schnitzler, 2013)E 6* ú M ³>ó Y : -7!+± ß/® u Á ÷7 759 8+± ß/®? àDô /8 ! T6> 6* U Í +±,% & ‡ LKc â z Ï"x] >ó Y : -7! ß/® , £ A JA ? à ! - æL• , Fô*U oddball 80 <+± MEG -A/£ Œ=• ; , þ*L McGurk u Á #, Í ‡ L+± GammaM¾ â"h Õ G Ë g E Œ ý.g ³ ; Y>ö œ : -7!+±>ó>ö œ & Y>ö L - +± ž ú (Kaiser et al., 2005) 6BÐ+± \ , ¬=Ø A Ò w L-]>ó Y : -7! , McGurk u Á ú G þ*L (Soto-Faraco & Alsius, 2009)E ý.g , ¬>ó Y : -7! ß/®!Î 6? à, >ó Y ¡ 5 Œ G þ*L, ¹52 \,% &(/ø+±Dô/8 !

4.3 McGurk ~ Ê,º-. ©7G p

K‘ ³ #K!E /8K MÅ, U T6> Í McGurk g $í+±Dô/8 Z, - WFú>®K MÅ \UŸ È6> g ï ; ³ Í ÷E È6> gB¤ , ‰*UU¤-A/£52 JA *U ¤ 6D°P /§K! 3DÕ(´+± Ì6* T-î ž \ = ü - \ (functional magnetic resonance imaging, fMRI) ¾ M²-î g$í - \ (transcranial magnetic stimulation, TMS) ¹ MEG 0• ‘K MÅ ¦ z+±-A/£4 É ý.gUŸ MË 7+Û (superior temporal cortex) >ó Y ¡ 5Dô /8,% ; MÊ 8+Û (inferior frontal cortex);>ó Y : -7! ß/®,% !

U þ*L McGurk u Á+±Dô/8 Z, MË 7+Û o ; >ó Y ¡ 5 ó 4,% (Beauchamp et al., 2010; Miller

Dô/8 Z 6* 6 : 9+±$í"h N < ! ¤ €59?-UŸ T6> Ï"x] ß/® £ G - ø JA ? à # , MÊ 8+Û o$í"h Ë g; 59$í"hB· g, ^B· 6 V » ß/®? à , E 59 6 V » McGurk u Á+± þ*L ! ‘ #! D° McGurk u Á þ*L ¹!Î þ*L #+±MÊ 8+Û o$í"h/8 Ó , ^ 6* Ä] Fernández0v ç(2017)+±4 É ! s €Dô ³ T 6> JA ? à ß/®+± #K! â, ¯ É þ*L ³ McGurk u Á, F 6* ß/® 3ü ' Y? à ! m *^ » ß/® ^, MÊ 8+Û o+±$í"h Œ ^K¼ x ü < ¦% &+±¯ É!Î 6 þ*L McGurk u Á, F ß/®E !Î 6? à , £ $í"h 6* ú&cD° g ! ‘ #! D° McGurk u Á þ*L ¹!Î þ*L #+±MÊ 8+Û o$í"h/8 Ó, ^ 6* Ä] Gau ¹ Noppeney (2016)±4 É ! (3)MÊ 8+Û o+± : 9 g 6* U : 9+± #K!E /8 7B¤] : 9+± ‰ *U ! Fernández0v ç(2017) Ç z+± \ IFG, 59 Gau ¹ Noppeney (2016)Ç z+± \ IFS, z4›/: 6 g X ! ¹52 6* U 7E Í #K!E /8 ZB¤] ¬ Ò+± ‰*U ——K¼,m ß/®? à/8 Ó+± f , MÊ 8 +±$í"h N < ŒK¼ x f !E WK MÅ i ÄE - ’Fô*U #K! /§K! 3DÕ(´F*D°P +±MEG - \# ’ Ï/£ !

4) 7 mE , & McGurk u Á+±,% 6> g 3 ½ ú 6D° T Ï2O/§K! !K‘ ³ 7E MÊ 8+Û o$í"h N < x C, W ’-A/£E 50;~E =y Ì6*E Ò 3 ½ ! ¸¯ & g$í+± Í \¯, UMË 7+Û o ;MÊ 8+Û o ¹52 xK! ME?+±U¤E 6 Ö » >)3? McGurk u Á Z+±>ó Y ¡ 5Dô/8 ¹>ó Y : -7! ß/®Dô/8 !E 50;~E =y G €2M N < 3 ½(multivoxel pattern analysis, MVPA), Ï/£ McGurk g$í,%! »>ó Y -7! g$í C \ :6*A þ McGurk u Á+±>ó Y : -7! g$í+± T6>$í"h N < 6 , / !E 6 Ö » > E - ’)3? T6> & McGurk g$í+± Í ,%! » £ >ó Y g$í 6 , YBU X !

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McGurk u Á ú M ³>ó>ö œ & Y>ö L- +± ž ú !A u Á ý '7 ÷ 40 G ¡ , ú \>ó Y?-A L- -A/£ Z+±& %æK MÅ ! Y ´ JA & McGurk u Á+±-A/£>®%æE =y2(4 T à)3¯ 8UŸ(1) McGurk u Á+±"xFü ;*y ÇUŸA þ McGurk u ÁL- >®'¦ ÇD²M +±>óM¾ ¹'¦ ÇD²M +±M M¾3ñ 5 !, z D° e*U>ó>öD²M “g” Y>öD²M “b”+±3ñ 5 !,% -A/£ Z - ›Ez+± Fü 4 4 g McGurk u Á þ*L (´ , & McGurk g$í Ë ê G N"xFü ;@Î0Ä £ Z þ*L McGurk u Á+± N •! ¸ ! G •-A/£ 3 McGurk u Á*y Ç gUŸ >® L-] : 9 » ËKr Y>ö g$í+±M 7¯ ^0Ä \ þ*L ³ McGurk u Á ! (2) McGurk u Á+± ž ú 2MUŸ 2 '–)3 g$í (¸¯UŸ >ó>ö "p Þ g$æ 2 vrNÐ(

¯ McGurk u Á þ*L(´) C \>ó Y g$í+±'–)3 ï • ,
E ; £ ° Ï@Õ McGurk u Á6> g c+±-A/£(¸ ¯
EEG fMRI 4 É) 5•D° < !E„ ë+± \, µ > 6
McGurk u Á+±-A/£ 3.‹3ü*L)3 - \ ;@Î0Ä N ¸
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*UEEG fMRI 4 É0v.‹3ü.þ “ 4 4E =y ï • 5 ,
¾ C \.‹3ü.þ “-A/£ 50;~ V*U@Î0Ä N ¸ («
,% Á ï •+± & Á6> g , g N ¸+± ï • «].‹3ü '
-m ¦¸ ¯UŸ3.‹3ü*L)34 É ; NED N ¸,%4 5 , J
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+±,% 6> g !E 6 Ö » > Ç z È6> gBLBP4C
-. g$í / È6> gBLBP=• ®>ó Y œ+±#2 •
Ó ÷ È6> gBLBP &>ó>ö œ+± V*U0v ! º
¯UŸ -Dþ ý '+± G L>öA ?- L- +± É Õ Ú N ¸
(model of causal inference in multisensory speech
perception, Magnotti & Beauchamp, 2017) Ñ g ç
UL• & GEGE€ œ # £ : \,! ÒE =y ¡ 5 , 59
\ u Q ÚE È : 9EGE€+± œ \ S 9#½+± 6* T
(É Õ Ú), £ › ‘4 “ ¡ 5 ” C“ : ¡ 5” 3Fz p
Fú—— UL• &>ó Y : -7!+± McGurk g$í # ,
T6> G u Q Ú>ó Y œ \ ’7 9 - W ç+± 6* T
(÷ : \ ’7 9 - W ç+± 6* T), £ › ‘4 “ ¡
5 ” C“ : ¡ 5” ª 3Fz pFú £ t=• ® ! U ¹
= É Õ Ú x ; , ¯ É ”=y“ ¡ 5” ª , F G Ô
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þ*L ³ McGurk u Á(Alsius et al., 2018; Tiippana, 2014) !(3) U ËO¹ Z Í ’ ˜ rA N !'@ÛK‘ ³>ó Y -7! g$í x C , Ë Í ,(Y>ö+± Ž # ‰ g ˜ rA N, ›>@Ñ U McGurk u Á Z›> Ë \>ó>ö œ & Y >ö L- EM = ³ ž ú , 59 : \=ØA Y>ö L- YCØ+± K MÅ(Alsius et al., 2018) (4) ÁA Ò w ¹ ¡+± üE T4 @Î4 É, E \ 3 ’E =y p 3 ½+± ò>® • › ! - ; , -A/£52E L->®" < McGurk u Á+± Õ ¬ TK MÅ—— 3 McGurk u Á+±-A/£4 @ç Õ ¬] >ó Y -7!+±?-A L- ò œ Z # , L->®AU {(Alsius et al., 2018) g McGurk u Á+± Í Dô/8 @ç U(ÝAŽ 7E \.‹3ü 7F* ;>ó Y -7! #+± Í Dô/8 : ¹ • - d ! h>® €(Ý U 8-A/£ ZUŸ (1) W € & >ó Y -7! g$í+± Í :"¶ ÷>ó Y ß/®, s & McGurk g$í+± Í 6*"¶ ÷>ó Y : -7! ß/®+± Ï"x ¹? à(Fernández et al., 2017) !59 A McGurk u Á+± þ*L(´ ; Ï"x>ó Y : -7!+±6* È(3DÕ,L Ë+±>ó Y -7! g$í ¹ McGurk g$í) 6 k9„BL,% (Strand et al., 2014) (2),%! » McGurk g$í , MË 7+Û o &>ó Y -7! g$í ! | ª , &>ó Y -7! g $í+±$í"h ! g(Lüttke, Ekman, van Gerven, & de Lange, 2015) (3) W €+±McGurk u Á þ*L(´ ; W € U — Z V*U>ó>ö œD² Ö Y>ö)3? }+±6* È!Î 6 k9„% !59 ;52+± g$í h>® \>ó Y -7! g$í !E ý.g > McGurk u Á : - Ç6*,! Ò , &>ó Y -7! g$í+±-A/£(Van Engen et al., 2017) !

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M'"• ~ , é ú > . (2005). 6{ ê 7B+,´ W7A j f.D0¦ . *ó*60 –, 28*(1), 10–12.

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The influential factors and neural mechanisms of McGurk effect

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Abstract: The McGurk effect is a typical audiovisual integration phenomenon, influenced by characteristics of physical stimuli, attentional allocation, the extent that individuals rely on visual or auditory information in processing, the ability of audiovisual integration, and language/culture differences. Key visual information that leads to the McGurk effect is mainly extracted from the mouth area of the talker. The McGurk effect implicates both audiovisual integration (which occurs in the early processing stage and is related to the activation of superior temporal cortex) and the conflict of the incongruent audiovisual stimuli (which occurs in the late processing stage and is related to the activation of inferior frontal cortex). Future studies should further investigate the influence of social factors on the McGurk effect, pay attention to the relationship between unimodal information processing and audiovisual integration in the McGurk effect, and