

Friend or Foe? Early Social Evaluation of Human Interactions

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Abstract

We report evidence that 29-month-old toddlers and 10-month-old preverbal infants discriminate between two agents: a pro-social agent, who performs a positive (comforting) action on a human patient and a negative (harmful) action on an inanimate object, and an anti-social agent, who does the converse. The evidence shows that they prefer the former to the latter even though the agents perform the same bodily movements. Given that humans can cause physical harm to their conspecifics, we discuss this finding in light of the likely adaptive value of the ability to detect harmful human agents.

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Introduction

Human infants are able to discriminate between two agents: a pro-social agent, who performs a positive (comforting) action on a human patient and a negative (harmful) action on an inanimate object, and an anti-social agent, who does the converse. The evidence shows that they prefer the former to the latter even though the agents perform the same bodily movements. Given that humans can cause physical harm to their conspecifics, we discuss this finding in light of the likely adaptive value of the ability to detect harmful human agents.

In a previous study, we reported that 29-month-old toddlers and 10-month-old preverbal infants discriminate between two agents: a pro-social agent, who performs a positive (comforting) action on a human patient and a negative (harmful) action on an inanimate object, and an anti-social agent, who does the converse. The evidence shows that they prefer the former to the latter even though the agents perform the same bodily movements. Given that humans can cause physical harm to their conspecifics, we discuss this finding in light of the likely adaptive value of the ability to detect harmful human agents.

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ece e7 a a e ca e d da' *emotional physical*
 ae. T ede ec fac a be ee e ad de
 ac e7 e e ab de ad a ae' *goal* ad
 e e a a bee ac e ed. T ede ec f
 fa d b de ed e ab e a/ e
 be a d7 a f e c e , e fac f e c d
 a caed e , ad e a da d f a e ac a
 a *fair* d b . T ede ec fa a fa e
 (e de c fa e' e , f e a e) e7 e a
 fa a e e de ad f e c ce *ownership* (a
 ea a ac e) fa a e ad e a ae bec , ad
 a e / e e a/ f e d- a e ca e . G e a
 ee a cae c e ec a f d f e e
 c e , / e a e c e d e a a e
 ca ac e a e e e a e e a fa . I
 e ef e f c de abe e e ca ee e ab e a a e-
 , eac f e ed a , ee e e ce fe a a e ca ac e
 fa .

I ae , a e ae e e e ab
 d ad ca e d e a / c f c a
 ac e ed b e a e f 10 . S , c a a ,
 fa , bee d ed de e de . S e a a [20], Le e ad
 c ab a [17] e a . (2006), We be & Le e [18] ad Va
 a d c ab a [15] ae d ed ec e' e e
 a f a b e ee ed a f e
 . Ne [16], Ze a , He & La [21] ad e d ed
 a f a de e de , b e dd e e
 e e d de ee fa d ca e a ae be e-
 e / ae e ae . Pe a/ ad Pe a/ [8] ed a
 52- e/ - d fa ee abe e e a ef a a f /
 c f c a a e f / de e , b e dd
 e e e fa ae abe e a ae e ae f ee ac .
 Ha e a . [9] ed a 10- - d fa efe a -
 ca a a - ca ae , b f e de / e
 c a . T e ef e , a be a 10- - d fa
 d be abe d c a e a a f f ac f a e ,
 b a bee e ed e e e e efe e a e e
 ef e .

O e f ed f f c e d a e be e e / ae e
 c a , ad a c a ac a / e a / c f ,
 c c a a ee fa ' d de ' eac de e d
 e c ce a de ad f e ae ' ac
 e , ad e ee ee ce f e f c a ce f
 e e a e ae ce . F e a e , Va ' d [15],
 e ae e ae ef a a - ca ac : e e -
 a de e e fa e ca ace . I add , e
 e " d a e e ca " . A fa ae abe
 d c a e d f f e e a e e b a ea a e
 [22,23] e e efe e ce f ee (a e) e
 e a e e (ad e a da e) [24], e fac a e a e
 ed ef a bad ac e " d a e e
 ca a " / e d f f c / c a ec f e
 a e d de eac (e ef ca e a e ce .
 e e a e ae ce f e ac f de c) . S a ,
 Ha ' e e e [9], a fe e e a bee e ed,
 a dd e ed f e e7 e ce; c d be
 e e ed a a ae f e c e e . B c a , a fe e e
 a bee de ed, e d- e- e dd e ad e
 e a be e e d f e e7 e ce; c d be
 e e ed a a de e ed ae . T e d f f e e ce e e'
 ef a a f e e7 e ce a ef ec d f f e ce
 de e a ca ae , ad c d a a
 c b e fa ' e a a , e ec e f e e e
 de ad e ad de a ac ce a e e .

T e e f a e e ae e efe e ce f
 e e ba a fa e c f ed a c a
 a ad c f . I de e a ce e
 ec ca ad f c e a a abe fa , ee b d ed
 c a e c a ae ef e
 ac (ea e ad e d , a ad
 c f) , a e a a a ed e e c ae . A d ca ed
 ab e , ec a be ee a ad c f a c -
 a d f f c d , beca e ee c ae a ca e
 e c ' e a ae , c c f d ed ea -
 ca e - ca a e f e ac . I de ae
 c f d , e7 a ed e a e a e e a ae f e
 a c ac a a : e a c d , e
 c f a , e ad; ec f c d , e f
 ad , e a . T , e ab ea f e / e a e
 ce ac ed , ad e be ce e e a e a a
 e c ' e a ae e *change of state* a ca ed e
 ae ' ac . We e e7 a ed e ac a de e f e
 a - ca ad - ca ae b ac - e , e a
 c de , c e ae eac ef ed a a f
 ac , e e , e e a e . C ca , e' - ca ' ae
 d ec ed e ac a da a " ae " ad
 e a e ac a da - a " ae " (a a e
 bec) , e e ' a - ca ' ae dd e e . I a ,
 e ae e b ed e a e e a a f e ad
 e a ee ad e a d e e a/ e
 e ae ' ac c c e a e -
 a a f e a e .

T e a e e e d de ad fa d ad
 ca e d e a / c f c a , e c d c ed
 e e e . I E e e l , e e ed 29- - d
 e ba e7 e a e de ed e e d de ' ab e
 e a a f e ac ae / e d da a e a e
 efe e ce ad e a e e a e . I e e e 2 , e
 e ed e efe e ce f e e ba 10- - d f e a e
 e a e a - e ba c ce a/ e ed b
 K e , D ad S e / e [25].

Experiment 1

I e e e , 29- - d d de a f
 d c ad ae : ea - ca ae ad e
 - ca ae . Eac f e e ae ef ed a a fac :
 e d ec ed a da a ae ad e e a da
 a ae bec . T e a - ca ac e a e ed a d e a
 e , ad e ca e d a ba/ a/ e a .
 C e e , e - ca e c f ed e e , ad e
 e a e d ad ed e ba/ a/ . T e a e ee ad
 ae ad e a ae a fe a ec d . T e a ae
 bec a c e a ac e e f e a ae . I
 b a f e ad e a e ac , e / ca e f
 ac b e b d e e ad e ad a f
 ae fb e . T e ef e , e fac d e
 - ca f e a - ca ae a e ac
 (e . e a e) ee a ed e a e (a
 ae . a ae bec) ad e a e ' b e7 e eac
 (e a ca e f e a ae , ad beca e
 f e a ae bec) . I e e e , e de e de
 a abe a e e e e ba e7 e ae ad e ed
 a e . A d de f a e ed e c e
 e e e a e7 e , e ed a a f 9 e7 e
 e f e e ad eac ae d da ad e e
 a e c d c ae e ae . We e c b ed
 e e e ab e ae ce de e (c ed f e

e e e b dde e d d a 7 e) a d a
 ea e ae ce de (c ed f e e e e b
 dde ec aa 7 e).

Method

Subjects. We de ed f ac c e ee a
 bec b a f e ac - e (a /c f) a d
 a e (a a e / a a e bec). Eac ac c
 ad e a e e a c e a ed ee ae : () e
 a e a e (8 ec), () e a e e e e ce e a d e ac
 e a e (14 ec), () e a e a e a a (8 ec). I
 e a - a ac c , () e a a e da c
 a d ed a e a b d a a e . () T e
 a e a / , e a e e a a e e a / ad
 e , e e d ef , a e / / e , a d
 e a e . () T e a a e e e d a d
 d a d e c e (c). I e a - c f ac
 c , () e a a e ef , d a d e
 c e (c). () T e a e a / , a e e a e , c f
 e (c a e e), e , a d e a e . () T e a a e
 e e c a e d a c e a face a d e b d
 a a e . N e a a e () f e a a a ac c
 e a e a e a e () f e a c f ac a d ce-
 e a . T e bec - a a d bec - c f ac c
 a e e ac e a e a e c e a a a a e ,
 de ca , ac a d e f e a e : e a /
 , e a e e a / ad e a a e bec , e
 d ef , a e / / , a d e a e . e a / ,
 a e e a a e bec , c f - ca e , e ,
 a d e a e . T e e f e , e d f f e e c e a e a
 a e a bee e aced b a a a e bec . T e bec , f
 c e , d e d a a e ; e f a e :
 e e a d (e 7 a e f e da c)
 e d (e 7 a e f e a d c) .
 Eac f e f ac c a ca ce , d f f e e
 a e a d a ac (ac A a d B), e e 30- ec d
 e c . I a f e e c , e a a e a a
 f e a e 12- ea - d ac a d e a a e bec a a b a / a /
 e a , e e a a e a c e d e e f
 e a a e . T e ec e e e , a d e e ca a
 d a f b e b a / d .
 T e ec e e e ed 7 e ce f
 c ec e ac e a a e d b a b a / c ee f ec d .
 T e e 7 e ce ed e a e ac b d f f e a e
 (a a e a a e bec) a d ac (a
 c f) . F a ce , a ' a - ca ' 7 e ce , ac A
 a e e a d e c f e b a / a / . I a ' -
 ca ' 7 e ce , ac B e bec a d e c f e e
 . E c 7 e ce e e e a e d b c e
 ac (A a d B), e e (- ca a da - ca), a d
 de f e e a fac (a f c f f) .
 N e a e a e a a a b e 7 e e a a .
Procedure. Bef e e e e , e d d e e e f a -
 a ed e e c a ac e (a a e d b e e e e e)
 a b e ed b 7 e . T e e a e d e a d
 a / ed e a e a d a a a a c e b /
 (a a a a ? W e e e e e a ? ec). T e d d e
 e e e aced e e a a f f a 2 x 1.5 ec
 c ee , f f a a b e , e a e ' a . T e a e e e
 b d f d e d d e e e e e . T e e e e e a
 e a ed e d fac a a f e c e e a d a ,
 e e f e , b d e e b e a ed .
 T e e e e c ed f e e a . I e f a , e
 d d e e e e e d e f e e 7 e ce (,

f a ce , ac A e a - ca e , e a
 ac f) a ed ce , a 2- ec d b a / c ee e a
 be ee eac e e . T a f ed b a a f e
 ac fac e ca e a , a c e d d e a d ced
 a e e e e b d e f , ed e e e
 e ac e ba / e a d a / ed ca / a e a a
 7 e e a d e ac a ea e a : D
 / e ? I e a d a bad ? I e ce /
 ? I e ca ce ? D a a ?
 I e ec d a , d d e e e e e d ce a
 7 e ce e e ac a e e e (e e ,
 ac B e - ca e , e a ac f) . A
 e f a , e 7 e ce a f ed b a e e a fac
 B' a , a d e a 7 e e e e d a a .
 I e d a , e 7 e ce ac A a d ac B
 e e ce a d e ac a e a ed de b de e
 c ee . W e faced e ac , e c d a / ed e
 7 e f e ac a e " I e a d a bad ? " e e
 e ed f e ac e e f , e e ac
 e . T e , e e e a / ed ee 7 e a
 c a e c c : " c e e ce ? " , " c
 e e bad ? " , " c e d / e a ? "
 F e c a 7 e , d d e e e 7 e ed
 e f e de f e c ee . I a , e c d e e e
 e e f e a / ed 6 d d a 7 e f e ac f e ac ,
 3 c a 7 e .
 I f e c d fa ed a e a 7 e a f e 10 ec d f
 e ce , e 7 e a e e a ed . A f e 10 e ec d f
 e ce , 7 e a c de ed a a e ed a d a a
 da a e a a (a e a e : 3.62 7 e
 a e ed e d d e , SE : 0.68) . I f e c d a e a ed
 bec e a a ed , e f ed a e a e , b 7 e
 7 e e e e / ed (a e a e 1.23 7 e / ed , SE : 0.41) ,
 a d e e de 7 e ce e e a e d . O a e a e , d d e
 ed 4.85 7 e (SE = 0.84) . N e a e f d
 effec f e 7 e a e (d d a . c a e) , f e
 7 e a / ed f e c e b a a ced fac e f
 fac) . F a f de c f e d a a b a ed e e e 1,
 ee Tab e S1 .
 T e c ce f e ac a e - ca a e (ac A .
 ac B) , e de f e e a f e - ca a e (f .
 ec d) a d e de f e e a f e ac - e (a
 . c f) e e c e b a a ced ac 8 (f d d e .
 T d d e ' e e e e de , a e - ec ded a d b d c ed
 b de e de c de (C bac ' a a = .94) . W e ed e
 a e a e be ee e c de ' c e f b 7 e a a e .
Results. We e ed f - 29-
 - d d d e (a e a e = 28 32 ; 23 a e , 23 f e a e)
 ec ed Pa a a d ee e ca . U
 ec e e e , e a e e e f ed ab e
 a f e d a d ab e e d . W e a e
 a ed , e e e e e e e a ed a a . T e a e e e
 e b e e e e a e d d e a d
 c f e 4 ac c (e a e a e a d a e
 de f a a e) . T e e e e a / ed e e e
 e e c e e a a e e d d e , a d f , e e e
 e f ed c e f , a d e e e e e e e d .
 D e e e e , e a e a b d f d e d a d e e
 f e e e e a a . T d a
 a ed b e C c - T a e H a E ca C ee
 (C é de ec de e e " I e - de - F a ce III " , dec
 A01142-51) .

Results and Discussion

A a f e e e d d e c d b e a a e d d e a e c c a f a e d e c d (N=15), a c e e a b e c c f c e e d e a d a b e e e (N=2) a d a e a e e d 7 e a e (N=1). T e e e f e e a a e - e d d e (14 a e a d 14 f e a e) e e a a e d.

B e c a e e e e a d e d a a e d d e , e a a f e a c a e e a a e a e a e e f e e c e f e a e e a e , e a a e d e e e b a e d f e d d a 7 e a e a d e f e c a a e 7 e a e e a a e .

F d d a 7 e a e , f e a c a e e a a e d , e c e d a A b e V a e c e I d e (A V I): e a c c d' e e i n f a v o r f e a e (" e , I / e " , " H e ' c e " , " I a a " , e . c .) a c d e d a + 1 e e a c e e d f a f e a e (" , I d / e " , " H e e a " , e . c .) a c d e d a - 1 . A c e f 0 a a e d f e c d a e e e a e e a a a a b c d e e a e e . T e , e c e d a a e a e A b e V a e c e I d e b a e a e c d e f e e e e a c 7 e .

F e c a e e 7 e a e , e c e d a R e a e V a e c e I d e (R V I) b a e d d e ' e e c a a e 7 e : e a c c d' e e e a c d e d a + 1 f e c d e d e d f a f e - c a a e d f a f e a - c a a e , - 1 f e e a e e e e e . A c e f 0 a a e d f e c d a e e e a e e e a b c d e e a e e . H e e a a , e c e d a a e a e R e a e V a e c e I d e b a e a e c d e f e e e e a c 7 e . T e R V I a b e e e - 1 a d + 1 , a e a e d c a a e " - c a a e " a b a e a e d e e a e " a - c a a e " , a d c e - e a f a e a e R V I .

T e a e a e A V I f e a c a e (- c a . a - c a) a c d d e F e l . A . T a , e e e e e e d / / f , e e c e f c e b a a c e f f e c , d d e f d e - c a a e b e e a d e a - c a a e b e e e a e . T e d , e c c e d a e a a e e a d e f e a c a e e e A V I a e d e d e a a b e . I c d e d e d e e e e e c e b a a c f a c (a c , d e f a c a d d e f a e) a d e e a e c e a e e d a a e . T e e e e e f f e c f c e b a a c f a c e e e - c a a - c a a e F e e , e f d a e A V I b a e d f e - c a a e a e a e b f c a d f f e e f e e e (A V I = - 0 . 0 1 , S E = 0 . 0 9 , F (1 , 2 7) < 1 , > 0 . 1 , η ² = 0 . 0 0 1) e e a , e A V I b a e d f e a - c a a e a e a e a d f c a b e e (A V I = - 0 . 1 9 , S E = 0 . 0 9 , F (1 , 2 7) = 6 . 2 9 , < . 0 5 , η ² = . 3 4) .

W e e a a e e a d - e a e A N O V A e a e e d f f e e c e b e e - c a a d a - c a A V I . T a a d c a e d a e A V I d f f e d f c a a a f c f e a e , (F (1 , 1 2) = 1 0 . 7 1 , < . 0 2 , η ² = . 4 7) c a e a - c a a e e a a e d e e a e a e - c a e . N e f f e c f c e b a a c f a c f a c a e e e f d e e a a e .

T e a e a e R V I a c d d e F e l . B a d a a a e d a e a d e e e e c e b a a c f a c (a c , d e f a c , a d d e f a e) a b e e e b e c f a c . A a b e , e e c e a e e d a a e . T a a e e a e d a e c e f c a a b e e (R V I = 0 . 2 6 , S E = 0 . 0 9 , F (1 , 2 7) = 5 . 1 4 , < . 0 5 , η ² = . 2 5) a d d e e a a e d e - c a a e f c a e e a e a e a - c a a e . A a , e e e e e f f e c f

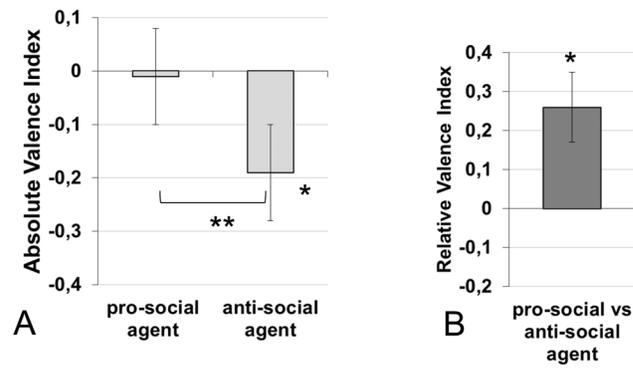


Figure 1. Average indexes for 29 months-olds. **A.** Average Absolute Valence Index for 29-months-old toddlers computed over the responses to the individual questions regarding the pro-social agent and the anti-social agent separately. *p<.05 (between subjects),**p<.02 (within subjects). A positive score indicates a positive verbal statement toward the agent and vice versa for negative scores. The error bars correspond to one between-subject standard error above and below the mean. **B.** Average Relative Valence Index computed over the responses to the contrastive questions. A positive score indicates a more positive assessment of pro-social than the anti-social agent, vice-versa for negative scores. The error bars correspond to one between-subject standard error above and below the mean. *p<.05. doi:10.1371/journal.pone.0088612.g001

e c e b a a c f a c , a c a e a e a c b e e e e f a c (> 0 . 1) .

S e e d d e c c a a d c e d c e d e e e c (3 0 c e a) , c e a a e d b / a c c e a e c e f e c e (e a , e e a e) a d e a c c c e e d (a a , b e c a , a c f b e c c f) . A c e e c e e a d e c f e a c (e . " e e e ! " , " e f a ") e e c d e d a e a , e c a e e d (e . " e ' c e ! ") a e c e a d e c a e a e d (" b a d ! " , " e ' c e ") a e a e c e . I f a d d e e a e d e a e c e a a e 7 e c e (f e a e : " e ' b a d ! ") c e , e c d e d a a e c e .

A f b e e c e c a b e a c c e d (e e T a b e l) , b a b a e e e e f c e a c e f e f a c c . T e e a a f c a e f f e c f c e e (X ² (2) = 6 . 2 , < . 0 5) , e f e c e f a c a d d e a e e a e c e , a d e e e c e e . T e e a a f c a e f f e c f a c c (X ² (3) = 1 7 . 2 , < . 0 0 1) , e f e c e f a c a e a a 7 e c e e a e d e c e . F a , e e a a e a c b e e e e f a c (X ² (6) = 1 3 . 1 , < . 0 5) , e f e c e f a c a b f a e f 7 e c e e e e a e c e d c e d e a a 7 e c e . T e d c a e e a a e a e e e e a e a c e f e d a d e e .

Experiment 2

Method

F e l 0 - d f a , e e d e a e d e a d a E e e l , b e e e e e c a d e e a e e a e d / / (e e a e a c a e d c e d) . I f a e e e e d e a e e f a c a b e f e , b 7 e a e e e e d . I e a d , a e e d f e e e e f e c , e a e e e e e

Table 1. Number of positive, neutral or negative comments during the four types of action scripts.

	Action script			
	Human		Object	
Comments	Harming	Comforting	Harming	Comforting
Positive comments	0	2	1	1
Neutral comments	5	2	4	0
Negative comments	12	1	1	1
Total	17	5	6	2

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... a e f eac de, a d fac e ca ea, a de ca (edd bea), a d be d a d e ca e a a f b e e a e e e e e e fa . T a e c a ca a a a (ee F e 2.A), e de ca e a ea ed e abe f e fa e d a ea ed f e a e ' a d . Afe ad, e a e a ea ed a d , // a e fa . T ced e a e ea ed f e (f d ffe e edd bea), e a e a de f a a . T e fa e e de a ed a d e a a e eac f e f e e e c ded b de e de b d c de . T e a e ced e a E e e l a ed, a d a c e ed b e a e dec f e C c E ca C ee. We e ed ff -f 10- - d fa (a e a e=9 10 ; 31 ae, 23 fe ae) ec ed Pa a a d ee e ca . T e ae e e f f ed ab e c a d ee e e 7 e ce a E e e l . T e babe e e ea ed e a fa ae ,

a b df ded d e e e e e e . A e 10- - d fa , 4 dd c ee e ee a (e , ec ca fa e), a d 3 dd e e e , ea 47 fa a a e (24 ae, 23 fe ae).

Results and discussion

Se e a fa 'f a e a eac dd cceed e e beca e e fa dd c ee e e e, beca e e fa ed e e e f e ee a a . Afe a c eed eac a e , fa e ded eac a d e e bec, a d e e b 7 e a e ae be ee e bec . G e c be a a a ab , e d e d e c de e f eac a e , a d e f e bec , e e e eac a cce f . C de ee ced e e e e f e b a , a e a e e a f b d a d ead de e e e f eac a e . I a c ded a l, f d e c ed a d e - ca ae , a d -1, f d e c ed a d e a ca ae , e ec e . N b e ded ac a d e e e afe e a e e a c ded a e T e e ab be ee e c de a .85 C bac ' a a, a d .80 C e ' Ka a (ee Tabe S2 f e) . I de a a e e e e e a ca , e c e f e f a (d ffe e) e e a e a ed ac e c de d ce a a e a e C ce I de (CI) f eac fa (be ee -1 a d +1): 57% f e fa ad a e C ce I de , 21% a e a e e, a d 21% e e a e (ee F e 2.B). A ANOVA f e C ce I de a , deca ac , de f eac , a d de f e a e a c e ba a c fac . T e e ce f e C ce I de a fca ab e e (de =0.138; SE=0.051, F(1,37)=7.9, <.008, η²=.18) dca a fa eac ed fca e a d e bec f e - ca ae a e bec f e a - ca ae . T e e a a a a efe e ce f e f e ac , (F(1,37)=3.9, =.06, η²=.10) a d e c e ba a c fac d ced a fca effec e ac (>.1). A



Figure 2. Set up and average preference index for 10-month-olds. A Setup of the experiment for the 10-month-olds. Infants are seated in their parent's lap (who are blindfolded) during the experiment. After the presentation of the sequences described in Figure 1, infants see a novel sequence, where the two actors appear on stage, stare at the camera, play with two identical toys, and present them to the infants. Simultaneously, two real toys appear on the table through a mechanical device. The infants' first attempt to reach one of the toys is coded by two independent scorers. Infants are tested 4 times with different toys, and the actors switching places on the screen. B. Average preference index for 10-month-olds computed over the 4 response trials. A positive score indicates a preference towards the toy of the pro-social agent, a negative score, a preference towards the anti-social agent. The error bars correspond to one between-subject standard error above and below the mean. *p<.05. doi:10.1371/journal.pone.0088612.g002

ea a e a a ed effec f e e f e fa e
C ce I de (F<1, >.1).

I de a e e b e f e c ce de a a
ea e f efe e ce, e a e a e a a e f eac c de
e a a e . We f d a fca e e ce f b f
e (de =0.165, SE=0.056, F(1,37)=8.9, <.005,
 $\eta^2=0.18$ a d de =0.112, SE=0.053: F (1, 37)=4.7, <
.035, $\eta^2=.10$, e ec e). T e C ce I de a a de e de
a abe a ba ed b a e a e e f 4 b a f ced
c ce. A c , a e ec e a a f
a ANOVA. T c e f / b , e a a ed de
c e e e bab f c e - ca
a e a ed ea - ca a e (l f a - ca c ce,
0 f a a - ca c ce a d 0.5 f a de e a e c ce)
eac f ef a e a e (e a ca ed bab e e e
a e a ed ac e c de). T e c de a
ac , de f e ac , de f e a e a d a be
a e e . We f d a fca e ce (Z=2.06, <
.04), e e fac eac ed fca ce.

General Discussion

We e a ed fa ' e e ec a be ee a
a - ca a e a da - ca a e : e ef e ed
d a a a e a d c f ed a a a e bec, e
a e c f ed e a a e a d ed e a a e
bec. T e e a a f a e e/ eae ce a d
c f / ced a ed b b e - ca a d e
a - ca a e eec a , a e e e e a e e
f e a a e . T e e f e , e d f e e ce be ee e
ac a e ec e f e e ec e e a d e a e
ac . We f d a e 10- - d c e e f e e
f e - ca a e a ea - ca a e , e e
e ba efe e ce f e 29- - d fa ed e - ca
a e c a ed ea - ca a e .

Low-level Explanation

T e efe ce f d de a d fa f e - ca a e
ca be e a ed b c fea e f e ac e e
e , a e ac ' e a ec e ba a ced ac bec , a d
e e a e e e a de a d a a e 7 a ed. N e
a a ed b a a e e e , e a de
e e ac d a ed e ac e a e e a
e e e ec e f e e e ac eed e ced
a d a e a ba g/ a g/. T e e e a e dd
e e a ac ' d a f e a d e a e e a
e e e e e a e e e a e a e e
e ba g/ a g/ (e e E e e S1).

O e ca e e be ca ed b e e a ca be ee
e f e a e a d e a a e ' d a f e a
c e , a b a e e e a e a f e e bec
a d e a a e . F e e , e e a a f
e a d e a e affec d a ed b e a a e a
7 a ed ac e - ca a d e a - ca a e ' ac .
F a , ece c effec ca a be d ca ded beca e de
be ee b a e a d ac e ec e ba a ced ac
a c a .

T , a e e e a d de a d fa
efe a a e c f a a a e a d e a
a a e bec a a e ca e e a a e bec a d
e a a a e . If e efe e ce e e a ba ed
e a e ce f e a e ' ac d ec ed a d e a a e
bec, e e d e ec e efe e a e
ca e ed e a a e bec e e a e ed . T

e e ca c ad ced b e e f e e e . If
dde a d fa ' efe e ce de e ded e a e ce f e
a e ' ac e ec e f e a e f ac , e d
e ec e e e efe e ce f e a e e , c
a ef d e e e . I ead, a da e
a d de a d fa a e a ead e a a a e ba ed
e ea a e a . T , e a ec e
e e a d de a d fa ' efe e ce a
efec e a e ce fa a e ' ac d ec ed a d a a
a e , a d a a a e bec .

O e c d be d e e fac a f d de a d fa ,
ac d ec ed a d a a e e a e , e e -
abe, ece e a e e a a e e a ac d ec ed
a d a a e bec . T e e a c a b e
e ca b P e a g/ a d P e a g/ [8] a e e e , ea
a fa c , a c e c e ab f e c a e a a f
a a e ba ed e ac a d c ec f c . I a
c a b e e e a e e e a fa e e
ea ca efe e ce a d be e e a e ef ed
e ac a d e c ec f c [9 11,15]. We e e ded
e e f d b d e de ce a fa a e a be
d a b e e e f a a e e a e e ac
ac a a e ' ca e .

T , de acc f e , e eed a e a
c b a f a ea c ca c e , e f
c e e e a e f e a e a d/ e a e ce
f e e a a e , a d e e f c e e e
a e f e a e ' ac . I a , e e c e
a e be combined a ec f c a de acc f e
e a e b e ed e e e .

We c de ee e c e e e ca b e f c
c b a , a f e ea e c e . Af
e b c d be a fa a e ee associating
de f e a e f e ac e emotional change d a ed
b e a e , ea a ed e c e a e ce
f e a e ' ac . T a , fa d ce a e
c a ce a a a ca ed e a e ' c a f
a ad, a d e e e a e ' c a f ad
a . S c a a ca e ec a ed c a fa
d efe e a e ef e , e e f e a e ef
a ac a a f f e a e (.e., da c ,
, e c).

A ec da d ec e b c d be a fa a e
a ca a a e e e e a e a e ce f
e ac (.e., a), e ec e f e a e '
e a e e . S ce, ee, e a ca e
e e a e f e a e ' ac a a a e a a
a a e bec, e a ca e ec a f e de e d
e a e a ec a ea ed a d e de ec f
a be . M e e , e e a ca e ec a
c d b a e eed f a ca a a a f e a e ' ac
a e 7 e .

A d b a fa a g/ e c '
e a e e , b a e ca a c e f e a e '
ac , a d a e a ba e f e c ' ffe e
a a e ca a e be f e ffe (e e
[26,27]). A g/ a fa a e e e ca a
c e f e e [28,29], ed g/ e e e ca e
g/ d fa a e ca e a a .

O e face, e ee a f e e ed ec a a 7 e
d ffe e e f e c e e ce e 7 e.
U f a e , e ca be f d e a ed e ba f
e e f d . Ye , e b ed e de
a a e be a adde e . F

a ce, Le ee a. [17] e ed ec e a a ee
 e fa ac (ef e ac /e 7 e)
 ca ed a ae c . Pec e dd ea ae eae
 eae , ee e a *associated* e ae '
 cea ed de . T c d be /e ae de ce a , c a
 ef e , e ae f e ac (.e., ca
 ca a e e) ae , a d ee
 a ca a e a ca e (a ed b ef
 e). Va , Ca ee ad T ae [30] ee ed 18-
 - d dde a a ae c ed b a ae
 ede c f da . De e efac a e
 ae dd d a ae a eac , dde ee e
 /e e ec ed ae a e - c ed e .
 T c d be /e ae de ce a ec e ae be a /
 e c ae ce fac , e ec e f e ae '
 e ace , a ed b e ec d e . B ea .
 [31] ed a ee e ef acc ce c
 a /, ad ea ae e ea e a ae ef a
 ac () a ca e a a c (fa) a a
 ae ef e ae ca ee b de
 ca e e c ' ffe (beca e e c fa e).
 T e a , ad , c ec e / ce c-
 e ae e ce a ef ba ea e ba ed e
 ca a c e f e ee , a ed b e d e .
 Tee de a be, ce, d cae
 e ee ee , a e ee a e e e ac d-
 be ada ed ee ba fa . Mea e,
 a e a ee f 10- - d ee ba e
 e e e a ca e ca , e a ca
 d /a ea fac , e f c e c e f e
action, ad e e e a e f e *patient* (e e a
 e e). S ec fca , fa efe ae ef a
 e ac ad a a ae , a da ea e e
 a da a ae bec a ae d ec e e .
 S c a ca ac d , ac ce, e abe fa de ec
 e a a f c ec f c , e a d ,
 ef e e a . Bef ec , e a ef 7 e f
 f e e e ac : e e a a e be ee e ad
 ea eac , e a ef effec , e e f e
 e ca a e ad e /be ee e He /H de a
 ad e C f /Ha a .

Positive versus Negative Actions

T ef 7 e : a ee d e ec e eae
 ed b a ae ' ea e ac ad ea ea fa
 ae ' e ac a a e ca e ac -ba ed
 ca e a a b ee ba a fa ? G e e
 e a ace f e de ec f e a a f
 ad da e ae , e de ec a e ab de ec
 a f ae a a e e ad a e ea e a e
 ab a / be efac . H ee , e ba f
 e e e a de , c d ec c ae e ad
 ea e ac , be ea e a e e ec e
 c b f e e ad ea e c e fa ae '
 ac fa ' ea a fa e .
 Tee , ee , e de e de e de ce e a
 a fa e e e ea e a e
 e . T " ea ba " a ea e ee ef
 ea f fe ad a bee d c e ed ee a e e ac
 a ad . F a ce, M ea d Fe ad [32] f d a 12-
 - d fa d a e a c a a fe ac
 ee ce a c e ea ee , b e
 e . Va ea . [33] a e a ca efe ec a ad ,
 ea e ce (c a fe a d d) a ea e ed ae

ad ea e ac a e ce . Cac a d Ga de [34]
 a e a ea e f a ee a a a ca e
 be a eea e f a e /e e ea a
 a a c e . I c e , e ea ba a
 e e ec ca e a ada ef c fe fa
 a d e a a f .
 I e e e , e de ce f e ca a e
 c e f e dde ' e . We a a ed e a ae ,
 dde ' ab ee a a ee fca ea ef e
 a - ca ae , b e e ea e ef e -
 ca ae . I add , dde ade fca e
 c e ab ea e a e ac (f ef ed
 a). T e a ea e a ec f a - ca ac
 a - ca e . C e , Ha , W &
 B [10] e ed a / e d ffe ce 3- - d
 be ee e de e ad a e a ae , b be ee a
 e e ad a e a ae . Ne a a e be ee e
 ce f ee e ea e e ac a f da
 [9], ce fa ee abe d b e
 e e ad e de e f e e a c . T a / f
 a e a 6- c d , ee , be de ace effec ,
 a Ha ea . ' e e e a a [9,10], e ae
 ef e ac (*either* e or ea e). I
 ad e ea e), e eb d e f a
 e a a e . F a ce, c d be a e
 e ac ef ed ad e a ae b e -
 ca ae a a c e ba a ced b e ea e ac
 a e a ea e ef e bec , c c da be
 ea e a ed b c de ad fa [35], ed a
 ea e e a ea a f ae . I c a , ea -
 ca ae ' ea e ac a da a ae d
 be c e ba a ced b e ac ad bec ,
 ed a ea ea e a e a . M e e ac eeded,
 d ffe e e a a a ba e e , f e a
 e a " ea ba " a d ec d f e e
 e ca e f e ca e a a fa e ba ed e ac .

Small Effect Size

Sec d , e ae a / ed e ee a effec e
 a c a ed e e e e e e . F ea e,
 Ha a d c ab a ed a fa efe e ac
 a ae e e a ae de a e
 ac ee a 16 a ca (f e a
 fa ed c e e e e e ae). Se ea ee
 c d acc f a ed ffe ce ea e e 7 ed.
 F , a e ced, e a ee ed fa ad
 dde e e e ae ec e a e a
 ee ed fa Ha ea . ' e e e . I Ha
 ea . ' e e e , ee ae ae ad e ae , eac f
 e ef e ac . I e e e , ee ae
 ae ad ae . I add , eac a ad ae
 ef ed e f d ffe ac ad c d be e
 c ce . M e e , a e ed ab e , ec e ba-
 a ced a e a ce a ca ed b ea e ad e
 c e e a fa ' a d dde ' e e ee
 ba ed ee a ce d a ed b d ffe e ac .
 H ee , e ca a ed e a e a e f
 effec , a ae e /e ed . I deed, e e d
 a b ea ee a a a ca ace c f a e
 , ee a a c d be da e d b e ea e
 ce a ca ed e ac f " a ba " .

Intentions to Harm versus Harmful Consequences

The effect of the decision on the intention to harm versus the harmful consequences of the decision was examined in a 2 (intention) × 2 (consequence) experiment. Participants were asked to evaluate the intention to harm and the harmful consequences of a decision. The results showed that the intention to harm and the harmful consequences of the decision were significantly related. The effect of the decision on the intention to harm versus the harmful consequences of the decision was examined in a 2 (intention) × 2 (consequence) experiment. Participants were asked to evaluate the intention to harm and the harmful consequences of a decision. The results showed that the intention to harm and the harmful consequences of the decision were significantly related.

Help/Hinder versus Comfort/Harm Situations

The effect of the decision on the intention to help/hinder versus the intention to comfort/harm was examined in a 2 (intention) × 2 (situation) experiment. Participants were asked to evaluate the intention to help/hinder and the intention to comfort/harm of a decision. The results showed that the intention to help/hinder and the intention to comfort/harm were significantly related. The effect of the decision on the intention to help/hinder versus the intention to comfort/harm was examined in a 2 (intention) × 2 (situation) experiment. Participants were asked to evaluate the intention to help/hinder and the intention to comfort/harm of a decision. The results showed that the intention to help/hinder and the intention to comfort/harm were significantly related.

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The effect of the decision on the intention to help/hinder versus the intention to comfort/harm was examined in a 2 (intention) × 2 (situation) experiment. Participants were asked to evaluate the intention to help/hinder and the intention to comfort/harm of a decision. The results showed that the intention to help/hinder and the intention to comfort/harm were significantly related. The effect of the decision on the intention to help/hinder versus the intention to comfort/harm was examined in a 2 (intention) × 2 (situation) experiment. Participants were asked to evaluate the intention to help/hinder and the intention to comfort/harm of a decision. The results showed that the intention to help/hinder and the intention to comfort/harm were significantly related.

Supporting Information

- SI1: The effect of the decision on the intention to help/hinder versus the intention to comfort/harm. (PDF)
- SI2: The effect of the decision on the intention to help/hinder versus the intention to comfort/harm. (PDF)
- SI3: The effect of the decision on the intention to help/hinder versus the intention to comfort/harm. (PDF)

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Author Contributions

Conceived and designed the experiment: ED, PJ. Performed the experiment: MB, SM. Analyzed the data: MB, ED, IB. Contributed reagents/materials/analysis tools: MD, DC. Wrote the paper: ED, MB, PJ.

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