

Supplemental Materials

7/31/2021 5:53:00 PM

Protocol: Systematic literature search for temporal discounting

The procedure of the search was performed based on our preregistration (<https://osf.io/e4anc>) and the papers retrieved were collected in a Zotero group and then uploaded onto covidence.

1. A computerized literature search was performed using PsycINFO and PubMed with a combination of keywords related to time preferences, including the names of specific questionnaires or tasks used to measure temporal discounting mentioned in general literature reviews of temporal discounting.

Looking for measurements:

The 3 reviews listed in the preregistration under “literature search” (point 1) were screened. The following is information extracted from the individual reviews:

Cross, Copping, & Campbell, 2011: Experiential discounting task

Pauli-Pott & Becker, 2015: Choice delay task, delay/temporal discounting task, Mandsley index of delay aversion, Delay Frustration Task

Sharma, Markon, & Clark, 2014: Delay of Gratification Task

Kirby & Maraković, 1996: The Kirby questionnaire (monetary choice questionnaire)

The following input was entered in Pubmed using the following filters: title, abstract and selected Meshterms (temporal discounting, aging, aged). The benefit of searching for Meshterms is that the search will retrieve references on a topic in Pubmed regardless of the wording of the author.

02.01.19 → 167 hits

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("delay of gratification"[Title/Abstract] OR "delay discounting"[Title/Abstract] OR "temporal discounting"[Title/Abstract] OR "intertemporal choice"[Title/Abstract] OR "inter-temporal choice"[Title/Abstract] OR "delay aversion"[Title/Abstract] OR "discounting task"[Title/Abstract] OR "delay task"[Title/Abstract] OR "experiential discounting task"[Title/Abstract] OR "choice delay task"[Title/Abstract] OR "temporal discounting task"[Title/Abstract] OR "maudsley index of delay aversion"[Title/Abstract] OR "delay frustration task"[Title/Abstract] OR "delay of gratification task"[Title/Abstract] OR "kirby questionnaire"[Title/Abstract] OR "monetary choice questionnaire"[Title/Abstract] OR "delay discounting"[Mesh:NoExp]) AND ("aging"[Title/Abstract] OR "older adults"[Title/Abstract] OR "elderly"[Title/Abstract] OR "age differences"[Title/Abstract] OR "aging"[Mesh:NoExp] OR "aged"[Mesh:NoExp])
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The following input was entered in OVID, which is provided by Unibas as a tool to search in the PsycInfo database. The search was performed in the advanced search using the following filters: ti=title and ab=abstract and sh=subject headings (Delay of gratification, Delay discounting, Aging, Age differences). The benefit of searching for subject headings is that the search will retrieve references on a topic in PsychInfo regardless of the wording of the author.

02.01.19→152 hits

(("delay of gratification" or "delay discounting" or "temporal discounting" or "intertemporal choice" or "inter-temporal choice" or "delay aversion" or "discounting task" or "delay task" or "experiential discounting task" or "choice delay task" or "temporal discounting task" or "maudsley index of delay aversion" or "delay frustration task" or "delay of gratification task" or "kirby questionnaire" or "monetary choice questionnaire").ti,ab. or ("delay of gratification" or "delay discounting").sh.) and ((aging or "older adults" or elderly or "age differences").ti,ab. or (aging or "age differences").sh.)

2. Additionally, to the keyword search in *Pubmed* and *PsycInfo*, the following keyword search was performed in the *web of science core collection* database using the advanced search. The filter “TS= Topic” was used for the search. TS searches the following fields within a record: Title, Abstract, Author Keywords and Keywords Plus. The web of science core collection does not have index terms, which would be equivalent to Meshterms (pubmed) or subject headings (psychInfo). This step is not listed in the preregistration.

02.01.19 →714 hits:

TS=("delay of gratification" or "delay discounting" or "temporal discounting" or "intertemporal choice" or "inter-temporal choice" or "delay aversion" or "discounting task" or "delay task" or "experiential discounting task" or "choice delay task" or "temporal discounting task" or "maudsley index of delay aversion" or "delay frustration task" or "delay of gratification task" or "kirby questionnaire" or "monetary choice questionnaire") and TS=(aging or "older adults" or elderly or "age differences")

3. Articles citing the original papers listed under “literature search” (point 2) in the preregistration were searched for in *Pubmed*, *PsycInfo* and *Web of science core database* (WOS is not listed in preregistration) and included.

Pubmed: (26.11.18)

Kirby & Maraković, 1996: 105 hits

Kirby, Petry, & Bickel, 1999: 400 hits

Coller & Williams, 1999: not in the database

Mischel, Shoda, & Rodriguez, 1989: 296

PsycInfo (26.11.18):

Kirby & Maraković, 1996: 71 hits

Kirby, Petry, & Bickel, 1999: 259 hits

Coller & Williams, 1999: not in the database

Mischel, Shoda, & Rodriguez, 1989: 268

Web of science core database (22.01.19)

Kirby & Maraković, 1996: 356 hits

Kirby, Petry, & Bickel, 1999: 972 hits

Coller & Williams, 1999: not in the database

Mischel, Shoda, & Rodriguez, 1989: 1275 hits

4. All papers cited in the reviews listed under “literature search” (point 3), were individually searched in either *Pubmed* or cross referenced and included.

After collecting the papers from the search all the papers were uploaded to the software covidence.

Supplementary Table 1

References excluded at the full-text screening

Exclusion label	Description	Rationale	Article and year	N	
No access	If the article was not freely available or if the reference was incorrect, the article was excluded as “no access”.	Only full text papers can provide data to include in the meta-analysis.	Antonides & Wunderink (2001) Bochner & Kenneth (1968) Drobetz, Maercker & Forstmeier (2010) Drobetz, Maercker & Forstmeier (2011) Kirby (1997)	Loeckenhoff, O'Donoghue & Dunning (2010) Ownby, Marconi, Waldrop-Valverde (2015) Takahashi, Oono, Ohmura, Kitamura & Radford (2009)	8
Wrong format	If the article was given in another format than an experimental study (e.g. book chapter, dissertation) then the article was excluded as “wrong format”.	We focused on empirical reports for which full texts could be accessed.	Aadland & Sherrill (2015) Adams (2009) Ainslie (1975) Albert (2012) Attanasio & Jappelli (2001) Bari, Kellermann, & Studer (2016) Becker & Mulligan (1994) Becker (1997) Bradford & Burgess (2010) Chao et al. (2009) Chapman (2005) Dodd (2008) Dai (2012) Enzler, Diekmann, & Meyer (2013) Rambaud, Oller & Martínez (2018) Forstmeier & Maercker (2011) Frye, Galizio, Friedel, DeHart & Odum (2016) Gold, Waltz, Prentice, Morris & Heerey (2008) Grabowski, Pollak & Czerw (2017) Green, Myerson & Ostaszewski (1999) Hampton (2019) Hassenzahl & Laschke (2014) Halevy (2004) Hausman (1979) Kastenbaum (1966) Keller & Strazzera (2012) Killeen (2009)	Komlos (2004) Lawrance (1991) Lattimore & Hutter (2014) Loewenstein (1987) Loewenstein & Prelec (1992) Mazur (1987) Moore & Symons (2005) Moreno (2016) Myerson & Green (1995) Myerson, Green & Warusawitharana (2001) Ortendahl & Sjöberg (1979) Pehlivanovo (2018) Prelec & Lowenstein (1991) Rachlin (1995) Rachlin, Safin, Arfer & Yen (2015) Ray & Bossaerts (2011) Samanez-Larkin, Carstensen & McClure (2010) Samanez-Larkin, Hagen & Weiner (2014) Schlosnagle (2013) Smith & Boettiger (2014) Takahashi (2005) Tate (2016) Vanderveldt (2017) Wittmann & Paulus (2009) Wittmann & Paulus (2016)	52
Wrong study design	If the study design was other than an experimental study we excluded the article as “Wrong study design”.	The purpose of this exclusion criteria, was to limit potential in-between variance and to ensure a satisfying qualitative comparability between the results.	Agarwal, Driscoll, Gabaix, & Laibson (2009) Baker, Johnson, & Bickel (2003) Cadena & Keys (2015) Clare, Helps, Sonuga-Barke & Edmund (2010) Dai, Pleskac & Pachur (2018) de Wit, Enggasser & Richards (2002) Deaton (2018) Dickman (1990) Hershfield et al. (2011)	Kaplan et al. (2016) Luo, Ainslie & Monterosso (2014) Michaelson, de la Vega, Chatham & Munakata (2013) Prevost et al. (2010) Reynolds, Richards, Dassinger & de Wit (2004) Walther (2010) Wang & Dvorak (2010) Worbe, Savulich, Voon, Fernandez-Egea & Robbins (2014)	18
Subsample	If the sample was a subsample of another included study then the study was excluded under the label “subsample”.	We aimed to avoid including the same data (or subsets of data) multiple times in our analyses.	Anderson, Harrison, Lau, & Rutström (2014) Anderson, Harrison, Lau, & Rutström (2008)	James, Boyle, Yu, Han & Bennett (2015) Johnson et al. (2010)	4

Wrong Subjects	If the sample only consisted of patients with cognitive impairment (e.g. Alzheimers) or other disorders (e.g. drug addiction, pathological gambling, depression) known to impair cognition, the study was excluded under the label “wrong subjects”.	<p>Individuals with cognitive impairment or other disorders, may have significantly different monetary time preferences, compared to individuals without such an impairment (e.g. Maccallum, Fiona; Bonanno 2016). Excluding these studies limits potential confounds introduced by impairment differences.</p> <p>Maccallum, F., & Bonanno, G. A. (2016). The Economics of Losing a Loved One: Delayed Reward Discounting in Prolonged Grief. <i>CLINICAL PSYCHOLOGICAL SCIENCE</i>, 4(4), 683–690. https://doi.org/10.1177/2167702615605827</p>	<p>Amlung & MacKillop (2014) Andrade, Alessi, & Petry (2013) Andrade & Petry (2014) Andrade & Petry (2012) Athamneh, Stein, Quisenberry & Pope (2017) Banca et al. (2016) Callan, Shead & Olson (2011) Celma-Merola, Abella-Pons, Mata, Pedra-Pages & Verdejo-Garcia (2017) Chamorro et al. (2012) Cherek & Lane (1999) Cherek, Moeller, Dougherty & Rhoades (1997)</p>	<p>Duva, Silverstein, Steven & Spiga (2011) Epstein et al. (2003) Gray & MacKillop (2014) Halfmann et al. (2013) Hanoch, Rolison & Gummerum (2013) Hofmeyr et al. (2017) Maccallum et al. (2016) Meade, Lowen, MacLean, Key & Lukas (2011) Smith, Steel, Parrish, Kelm & Boettiger (2015) Szuhany, MacKenzie & Otto (2018) Tompkins et al. (2016) Vuchinich & Simpson (1998)</p>	23
No age comparison	If no age comparison was given studies were excluded under the label “no age comparison”.	The analysis tests for age differences, so if a study did not provide either the raw data, or an age comparison, it was not included in the analysis.	<p>Acheson, Vincent, Sorocco, & Lovallo (2011) Acuff, MacKillop, & Murphy (2018) Ahn, Ramesh, Moeller, & Vassileva (2016) Ahn et al. (2011) Albein-Urios, Martinez-González, Lozano, & Verdejo-Garcia (2014) Albein-Urios, Martinez-González, Lozano, Clark, & Verdejo-Garcia (2012) Anderson, Harrison, Lau, & Rutström (2013) Appelhans (2011) Arantes, Berg, Lawlor, & Grace (2013) Arechar, Kraft-Todd, & Rand (2017) Arfer & Luhmann (2017) Arfer & Luhmann (2015) Ashare & Kable (2015) Ashare & McKee (2012) Athamneh, Stein, & Bickel (2017) Augenblick, Niederle, Sprenger (2015) Ayecinena & Rentschler (2018) Aranovich (2016) Baker, Johnson, & Bickel (2003) Ballard et al. (2015) Ballard & Knutson (2009) Benjamin, Choi, & Fisher (2016) Benoit, Gilbert & Burgess (2011) Benzion, Rapoport & Yagil (1989) Berenson et al. (2016) Bialek & Sawicki (2014) Bickel et al. (2012) Bickel, Pitcock, Yi, & Angtuaco (2009) Bickel, Odum, & Madden (1999) Bjork (2009) Bjork, Hommer, Grant, & Danube (2004) Blondel, Loheac, & Rinaudo (2007) Boettiger et al. (2007) Businelle, McVay, Kendzor & Copeland (2010)</p>	<p>Ku, Tucker, Laugesen, McKinlay & Grace (2017) Kuang, Milhorn, Stuppy-Sullivan, Jung & Yi (2018) Kurti & Dallery (2014) Lane, Cherek, Rhoades, Pietras & Tcheremissine (2003) Launay et al. (2015) Lawyer et al. (2011) Lerner, Li & Weber (2013) Li, Jin & Guo (2016) Li et al. (2013) Liberman, Sagristano & Trope (2002) Lim & Bruce (2015) Lin & Epstein (2014) Lindbergh, Puente, Gray, MacKillop & Miller (2014) Lopez-Guzman, Konova, Louie & Glimcher (2018) Loewenstein & Thaler (1989) Luo, Ainslie, Giragosian & Monterosso (2011) Luo, Ainslie, Giragosian & Monterosso (2009) Luo, Ainslie, Pollini, Giragosian & Monterosso (2012) MacKillop, Anderson, Castelda, Mattson & Donovan (2006) MacKillop et al. (2015) Madden, Petry, Badger & Bickel (1997) Magen, Dweck & Gross (2008) Manwaring, Green, Myserson, Strube & Wilfley (2011) Marco-Pallares, Mohammadi, Samii & Munte (2010) Martin et al. (2015) Martin et al. (2017) Martin et al. (2008)</p>	262

			<p>Camchong et al. (2011) Carpentieri, Baldassarre & Matarazzo (2014) Cavagnaro, Aranovich, McClure, Pitt, Myung (2016) Chabris, Laibson, Morris, Schuldt & Taubinsky (2009) Chabris, Laibson, Morris, Schuldt & Taubinsky (2008) Chapman et al. (2001) Chapman, Nelson & Hier (1999) Chapman (1999) Charlton & Fantino (2008) Cheng, Shein & Chiou (2012) Chiong et al. (2016) Ciccarelli, Malinconico, Griffiths, Nigro & Consenza (2016) Claus, Kiel & Hutchison (2011) Clewett et al. (2014) Coelho et al. (2017) Coffey, Schumacher, Baschnagel, Hawk & Holloman (2011) Coffey, Gudleski, Saladin & Brady (2003) Cona et al. (2019) Crockett, Clark, Liebermann, Tabibnia & Robbins (2010) Curry, Price & Price (2007) Dai & Fishbach (2013) Dai, Harrow, Song, Rucklidge & Grace (2016) Dallery & Raiff (2007) Daniel, Stanton & Epstein (2013) Davis et al. (2010) Dassen, Houben, Allom & Jansen (2018) Dassen, Houben & Jansen (2015) De Rezende Costa et al. (2016) Decker, Figner & Steinglass (2016) Delaney & Lades (2017) Diekhof et al (2012) Dombrovski et al. (2012) Drobetz et al. (2014) Du, Green & Myerson (2002) Ebert (2010) Elton, Smith, Parrish & Boettiger (2017) Engelmann, Maciuba, Vaughan, Paulus & Dunlop (2013) Epstein et al. (2014) Epstein, Jankowiak, Lin, Paluch, Koffarnus & Bickel (2014) Ericson, White, Laibson & Cohen (2015) Ersner-Hershfields, Garton, Ballard, Samanez-Larkin & Knutson (2009) Espin, Exadaktylos, Herrmann & Brañas-Garza (2015) Evens et al. (2015) Farris, Aston, Abrantes & Zvolensky (2017) Fellows & Farah (2005) Fettermann & Robinson (2013) Figner et al. (2010) Fitzsimmons & Davidsson (2008) Frederick, S. (2005) Foxall, Doyle, Yani-de-Soriano & Wells (2011)</p>	<p>Martucci, Borg, MacNiven, Knutson & Mackey (2018) Marx et al. (2010) Matusiewicz et al. (2013) McClure, Laibson, Loewenstein & Cohen (2004) McClure et al. (2007) McCuddy & Peery (1996) McHugh & Wood (2008) Meade et al. (2016) Meade et al. (2017) Meier & Sprenger (2012) Meda (2009) Mellis, Woodford, Stein & Bickel (2017) Miao & Zhong (2015) Michalczuk, Bowden-Jones, Verdejo- Garcia & Clark (2011) Miedl, Pieters & Buechel (2012) Milenkova at al. (2011) Mishra & Lalumiere (2017) Mishra & Novakowski (2016) Mitchell (1999) Mitchel & Wilson (2010) Mitchell & Wilson (2012) Moody, Franck & Bickel (2016) Mostert et al. (2015) Mueller, Schiebener, Stockigt & Brand (2017) Muench & Juliano (2017) Muenta et al. (2018) Myerson, Baumann & Green (2014) Myerson et al. (2003) O'Connor, Rossiter, Yucel, Lubman & Hester (2012) Odum, Baumann & Rimington (2006) Olivola & Wang (2016) Ostaszewski (2007) Otto, Markman & Love (2012) Palombo, Keane & Verfaellie (2016) Palombo, Keane & Verfaellie (2015) Peisker et al. (2018) Pepper & Nettle (2013) Peters & Büchel (2010) Peters & Büchel (2009) Peters & D'Esposito (2016) Petry (2001) Pine et al. (2010) Pinto, Steinglass, Greene, Weber & Simpson (2014) Poosch, Bernhardt, Guevara, Huys & Smolka (2018) Price, Higgs, Maw & Lee (2016) Radu, Yi, Bickel, Gross & McClure (2011) Raineri & Rachlin (1993) Read (2001) Read, Frederick & Scholten (2013) Read et al. (2005) Richards et al. (1999) Robles & Vargas (2007) Rodriguez, Turner, Van Zandt & McClure (2015) Reynolds & Schiffbauer (2004) Rzezak et al. (2016) Sawicki & Bialek (2016)</p>	
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			<p>Fujita, Trope, Liberman & Levin-Sagi (2006) Garza, Harris & Bolding (2013) Godoy, Kirby & Wilkie (2001) Griskevicius et al. (2011) Hardisty, Appelt & Welke (2013) Hariri et al. (2006) Harris, Kuss & Griffiths (2018) Harris (2012) Harrison & McKay (2012) Hampton et al. (2017) Heckman et al. (2017) Heerey, Matveena & Gold (2011) Heerey, Robinson, McMahon & Gold (2007) Hendrickson & Rasmussen (2013) Hinvest, Elliott, McKie & Anderson (2011) Hoffman et al. (2006) Hoffman et al. (2008) Horan, Johnson & Green (2017) Housden, O'Sullivan, Joyce, Lees & Roiser (2010) Hsu & Vlaev (2014) Huckans et al. (2011) Hulka et al. (2014) Hulka et al. (2015) Ifcher & Zarghamee (2011) Irvine et al. (2013) Jarmolowicz, Bickel & Gatchalian (2013) Jarmolowicz et al. (2014) Johnson & Bickel (2002) Johnson (2012) Jonason, Koenig & Torst (2010) Jones, Fearnley, Panagiotopoulos & Kemp (2015) Jones et al. (2018) Joutsa et al. (2015) Kaighobadi & Stevens (2013) Kassam, Gilbert, Boston & Wilson (2008) Kayser, Allen, Navarro-Cebrian, Mitchell & Fields (2012) Kelley & Schmeichel (2015) Kirby, Petry & Bickel (1999) Kirby & Marakovic (1995) Kirby (1997) Kirby & Guastello (2001) Kirby & Maracovic (1996) Klapproth (2012) Knezevic-Budisin, Pedden, White, Miller & Hoaken (2015) Koehler, Langstaff & Liu (2015)Koenig (2009) Koritzky, Rice, Dieterle & Bechara (2015) Kowal & Faulkner (2016) Kraeplin, Scherbaum, Buehringer & Goshke (2019)</p>	<p>Scherbaum, Haber, Morley, Underhill & Moustafa (2018) Scheres & Sanfey (2006) Scheffer et al. (2014) Schmaal et al. (2012) Schmidt, Holroyd, Debener & Hewig (2017) Schutten, Stokes & Arnell (2017) Schweighofer et al. (2008) Seinstra, Sellitto, Kalenscher & Stephens (2018) Senecal, Wang, Thompson & Kable (2012) Shamosh et al (2008) Sheffer et al (2013) Slater, Oliver, Appel, Tschernev & Silver (2018) Swann et al (2002) Sweitzer et al (2008) Szamosi, Nagy & Keri (2013) Szanto, Galfalvy, Vanyukov, Keilp & Dombrovski (2018) Sze, Slaven, Bickel & Epstein (2017) Sze, Stein, Bickel, Paluch & Epstein (2017) Takahashi et al. (2008) Takahashi et al. (2010) Thorell, Sjowall, Mies & Scheres (2017) Thornton, McCarty & Stokes (2017) Tsukayama & Duckworth (2010) Van der Oord, Braet, Cortese & Claes (2018) Van der Broek, Acker, Palmer, de Wit & MacKillop (2016) Van der Broek-Stice, Stojek, Beach, van Dellen & MacKillop (2017) Vanyukov et al. (2016) Vickers, Preston, Gonzalez & Angott (2016) Weaver, Vandello & Bosson (2013) Weatherly & Derenne (2013) Weatherly, Terell & Derenne (2010) Weber et al. (2016) Weber & Chapman (2005) Weber & Hüttel (2008) Weidberg, Landes, Garcia-Rodriguez, Yoon & Secades-Villa (2015) Weller, Cook, Avsar & Cox (2008) Wiehler, Bromberg & Peters (2015) Wing, Moss, Rabin & George (2012) Wood & McHugh (2013) Xu et al (2009) Yi, Carter & Landes (2012) Yi, King, Carter, Landes & Bickel (2010) Yoon & Chapman (2016) Yu et al. (2017) Yu (2012) Zhong & DeVoe (2010)</p>	
Wrong age groups	All studies with a participants age range lower than 25 years, or with a mean age differences not falling in	Our meta-analysis focused on adult age differences, consequently it was important to exclude children and adolescent samples, or samples that only contained a small age range that would	<p>Ahn & Vassileva (2016) Al-Khaled, Heldmann, Bolstorff, Hagenah, & Münte (2015) Allen, Moeller, Rhoades, & Cherek (1998) Andreoni & Sprenger (2012) Attema, Bleichrodt, L'Haridon, Peretti-Watel, & Seror (2018) Augustine & Larsen (2011)</p>	<p>Madden, Petry & Johnson (2009) Madden et al. (2004) Mahalingam (2014) Malesza & Ostaszewski (2016) Manning et al. (2014) Massar et al. (2015) Mason, O'Sullivan, Blackburn, Bentall & El-Derededy (2012)</p>	302

the two categories: 18-35 and 65-85, were excluded. Furthermore, for studies only reporting the standard deviation and the mean age were excluded as “wrong age groups”, unless the standard deviation was 12.5 or higher.

lead to poor estimates of age effects. Also, for this reason, we only considered studies that explicitly stated the age of the participants, making it possible to definitely assess whether the studies fitted into our (age) criteria.

Ayduk, Zayas, Downey, Cole, Shoda, & Mischel (2008)
 Bailey, Gerst, & Finn (2018)
 Bauer 2012
 Bartels & Oleg (2011)
 Benhabib, Bisin, & Schotter (2010)
 Benjamin, Choi, & Strickland (2010)
 Berry (2014)
 Bertoux, Crut de Souza, Zamith, Dubois, & Borgeois-Gironde (2015)
 Bialaszek & Ostaszewski (2012)
 Bidewell, Griffin, & Hesketh (2006)
 Biro (2013)
 Bixter & Luhmann (2015)
 Bixter, Trimmer & Luhmann (2017)
 Blackburn & El-Dereby (2013)
 Bobova, Finn, Rickert, & Lucas (2009)
 Boecker-Schlier et al. (2016)
 Botvinick (2009)
 Boyle, Yu, Gamble, & Bennett (2012)
 Brocas, Carrillo, & Tarraso (2018)
 Bulley & Pepper (2017)
 Byrne, Patrick & Worthy (2016)
 Byrne & Worthy (2015)
 Caceda et al. (2014)
 Calluso, Tosoni, Pezzulo, Spadone & Comitteri (2015)
 Carter, McCullough, Kim-Spoon, Corrales & Blake (2012)
 Carter, Pedersen & McCullough (2015)
 Caswell, Celio, Morgan & Duka (2016)
 Caswell, Morgan & Duka (2013)
 Chapman (2001)
 Chapman (1996)
 Chapman (1995)
 Chapman & Winquist (1998)
 Chapman & Weber (2006)
 Charlton, Gossett & Charlton (2011)
 Charlton et al. (2013)
 Chavez, Villalobos, Baroja & Bouzas (2017)
 Chen & He (2016)
 Chen, Guo & Feng (2017)
 Cheng & Gonzalez-Vallejo (2016)
 Cherniawsky & Holroyd (2013)
 Coller & Williams (1999)
 Cho et al. (2010)
 Cho et al. (2012)
 Christakou, Brammer & Rubia (2011)
 Contreras-Rodriguez (2015)
 Copping, Campbell & Muncer (2014)
 Cornwall, Byrne & Worthy (2018)
 Crockett et al. (2013)
 Curtis, Williams & Anderson (2018)
 Da Silva, De Faveri, Correa & Matsushita (2017)
 Dai & Busemeyer (2014)
 Daly, Harmon & Delaney (2009)
 Daniel, Stanton & Epstein (2013)
 de Ridder, Kroese, Adriaanse & Evers (2014)
 de Wit, Flory, Acheson, McCloskey & Manuck (2007)
 De Wilde et al. (2013)

Mazas, Finn & Steinmetz (2000)
 McDonald, Richards & de Wit (2003)
 McLeish & Oxoby (2009)
 McLeish & Oxoby (2007)
 Meyer, Newman & Jordan (2015)
 Mezzio, Nguyen, Kiselica & O'Day (2018)
 Michaelson (2018)
 Miedl et al. (2015)
 Milfont & Schwarzenthal (2014)
 Miller, Lynam & Jones (2008)
 Miller & Shapira (2004)
 Mischel & Metzner (1962)
 Mischel, Zeiss & Ebbesen (1972)
 Mishra & Lalumiere (2011)
 Mishra & Sritharan (2012)
 Mitchell, Schirmer, Ames & Gilbert (2011)
 Mitchell, Fields, D'Esposito & Boettiger (2005)
 Mobini, Grant, Kass & Yeomans (2007)
 Moeller et al. (2002)
 Mohammadi (2016)
 Mole et al. (2015)
 Monterosso et al. (2007)
 Moody, Tegge & Bickel (2017)
 Morgan et al. (2016) Murphy et al. (2017)
 Murphy & Flessner (2017)
 Myerson, Baumann & Green (2017)
 Naude, Kaplan, Reed, Henley & Reed (2018)
 Negash, Sheppard, Lambert, Nathaniel & Fincham (2016)
 Nejati, Salehinejad & Nitsche (2018)
 Nombela, Rittman, Robbins & Rowe (2014)
 O'Connell, Christakou, Haffey & Chakrabarti (2013)
 Odum & Rainaud (2003)
 Ohmura, Takahashi, Kitamura (2005)
 Onnink et al. (2015)
 Oritz et al. (2015)
 Ostaszewski (1996)
 Ostaszewski, Green & Myerson (1998)
 Ostaszewski & Karzel (2002)
 Ostaszewski (1997)
 Oswald & Sailer (2013)
 Paglieri, Borghi, Colzato, Hommel & Scrolli (2013)
 Parthasarathi, McConnell, Luery & Kable (2017)
 Pender (1996)
 Perales, Verdejo-Garcia, Moya, Lozano & Perez-Garcia (2009)
 Petry (2001)
 Petry (2003)
 Petry (2002)
 Petry & Casarella (1999)
 Petry, Kirby & Kranzler (2002)
 Pronpattananangkul & Nusslock (2016)
 Privitera, McGrath, Windus & Doraiswamy (2015)
 Pulcu et al. (2014)
 Pyone & Isen (2011)
 Pyone & Isen (2010)
 Rachlin, Raineri & Cross (1991)

			<p>Dehart, Friedel, Lown & Odum (2016) Delaney, Stein & Gruber (2017) Del Missier et al (2012) Delprat, Leroux & Michaud (2016) Denant-Boemont, Diecidue & L'Haridon (2017) Dennhardt & Murphy (2011) DeSteno, Li, Dickens & Lerner (2014) DeVoe, House & Zhong (2013) Dickens & DeSteno (2016) Dixon et al. (2003) Dixon et al. (2005) Doi, Nishitani & Shinohara (2015) Dom, D'Haene, Hulstijn & Sabbe (2006) Dombrowski et al. (2011) Duckworth, Tsukayama & May (2010) Eisenberg, Campbell, MacKillop, Lum & Wilson (2007) Eisenberg et al. (2007) Epstein et al (2008) Estle et al. (2006) Faralla, Novarese & Ardizzone (2017) Field, Santarcangelo, Goudie & Cole (2006) Fields, Smallman, Hicks, Lange & Thamocharan (2017) Finn, Gunn & Gerst (2015) Fishbach, Friedman & Kruglanski (2003) Franco-Watkins, Rickard & Pashler (2010) Friedel et al. (2014) Garcia-Rodriguez, Secades-Villa, Weidberg & Yoon (2013) Giner-Sorolla (2001) Goncalves & Silva (2015) Gonzalez et al. (2012) Gray, Amlung, Acker, Sweet & MacKillop (2014) Green, Myerson & Macaux (2005) Green, Myerson & McFadden (1997) Green Fristoe, Myerson (1994) Green, Myerson & Ostaszewski (1999) Greenhow, Hunt, Macaskill & Harper (2015) Guan, Cheng, Fan & Li (2015) Harrison, Hofmeyr, Ross & Swarthout (2018) Hayden, Parikh, Deaner & Platt (2007) He et al. (2016) Hendrickson & Rasmussen (2017) Helper, Albarracin, McCulloch & Noguchi (2012) Herman, Critchley & Duka (2018) Hesketh, Watson-Brown & Whiteley (1998) Hinson, Jameson & Whitney (2003) Hinvest & Anderson (2010) Hirsh, Morisano & Peterson (2008) Hirsch, Guindon, Morisano & Peterson (2010) Ho, Tong & Jia (2016) Hsee, Zhang, Wang & Zhang (2013) Hu et al. (2017) Huang, Hu & Li (2017) Ikink, Engelmann, van den Bos, Roelofs & Figner (2019) Israel, Rosenboim & Shavit (2014)</p>	<p>Rachlin & Jones (2008) Rass, Ahn & O'Donnell (2016) Read, Olivola & Hardisty (2017) Read & Roelofsma (2003) Reed, Levin & Evans (2012) Reyes-Huerta & dos Santos (2016) Reynolds & Richards (2006) Reynolds, Richards, Horn & Karraker (2004) Reynolds, Leraas, Collins & Melanko (2009) Ripke et al. (2012) Ritschel et al. (2015) Robles, Huang, Simpson & McMillan (2011) Robles & Vargas (2008) Rodriguez, Hendrickson & Rasmussen (2018) Rollins, Dearing & Epstein (2010) Rounds, Beck & Grant (2007) Rudzinska-Wojciechowska (2017) Sasse, Peters & Brassens (2017) Scherbaum, Frisch, Holfert, O'Hora & Dshemuchadse (2018) Scherbaum et al. (2016) Schweighofer et al. (2006) Schwenke, Dshemuchadse, Vesper, Bleichner & Scherbaum (2017) Sellitto, Ciaramelli & di Pellegrino (2010) Sharma & Khan (2018) Shenhav, Rand & Greene (2017) Simioni, Dagher & Fellows (2012) Simmen-Janevska, Forstmeier, Krammer & Maerker (2015) Simpson & Vuchinich (2000) Smith & Hantula (2008) Soutschek et al. (2017) Sripada, Gonzalez, Luan Phan & Liberzon (2011) Stein et al. (2018) Steinberg et al. (2010) Steinberg et al (2008) Steinglass e al. (2012) Steward et al. (2017) Stillwell & Tunney (2012) Stoy et al. (2012) Sun & Li (2010) Sweeney & Freitas (2016) Sweitzer, Allen & Kaut (2008) Sweitzer et al. (2013) Takahashi, Ikeda, Fukushima & Hasegawa (2007) Takahashi, Ikeda, Hasegawa (2007) Takahashi, Ohmura, Oono & Radford (2009) Takahashi, Oono, Radford (2008) Takahashi, Sakaguchi, Oki & Hasegawa (2008) Tanaka, Camerer & Nguyen (2006) Tate (2015) Tate et al. (2017) Taylor et al. (2016) Thaler (1981) Thomas, Seiden, Koffarnus, Bickel & Wing (2015) Thorell et al. (2017) Todokoro et al. (2018)</p>	
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			<p>Jarmolowicz (2012) Jauregi, Kessler & Hassel (2018) Jimura et al. (2009) Jimura, Chushak & Braver (2013) Jimura, Chushak, Westbrook & Braver (2018) Joireman, Sprott & Spangenberg (2005) Joireman, Balliet, Sprott, Spangenberg & Schultz (2008) Jones et al. (2018) Kable et al. (2017) Kable & Glimcher (2010) Kable & Glimcher (2007) Kaplan, Reed & Jarmolowicz (2017) Khwaja, Silverman & Sloan (2007) Kim, Sung & McClure (2012) Kim & Zaubermann (2009) Kirby & Herrnstein (1995) Klein-Fluegge (2015) Knutson, Westdorp, Kaiser & Hommer (2000) Kong & Zhang (2016) Komlos (2004) Lane, Cherek, Pietras & Tcheremissine (2003) Lange & Eggert (2015) Lee, DeBruine & Jones (2018) Leitao, Guedes, Yamamoto & Araujo (2013) Lempert, Glimcher & Phelps (2015) Lempert, Porcelli, Delgado & Tricomi (2012) Li et al. (2016) Li et al. (2013) Lindbergh, Puente, Gray, MacKillop & Miller (2014) Liu, Wang & Jiang (2013) Locey, Jones & Rachlin (2011) Lu & Zhuang (2014) Luhmann (2013) Luhmann et al. (2008) MacKillop et al. (2016) Macrae et al. (2017) Madden, Begotka, Raiff & Kastern (2003)</p>	<p>Torres et al. (2013) Van den Bos, Rodriguez, Schweitzer & McClure (2014) Van der Laan, Barendse, Viergever & Smeets (2016) Van der Wal, Schade, Krabbendam & Van Vugt (2013) Verdejo-Garcia et al. (2010) Voon et al. (2010) Wainwright & Romanowich (2016) Wang et al. (2014) Wang, Reed, Baugh & Fercho (2018) Wang & Huangfu (2017) Wang et al. (2017) Wang et al. (2017) Weatherly, Derenne & Terrell (2011) Weatherly, Plumm & Derenne (2011) Weller et al. (2014) Wiehler, Petzschner, Stephan & Peters (2017) Wilson & Daly (2004) Willner et al (2010) Wittmann, Leland & Paulus (2007) Woolley & Fishbach (2018) Yeomans, Leitch & Mobini (2008) Yi, Johnson & Bickel (2005) Yi, Stuppy-Sullivan, Pickover & Landes (2017) Yoon et al. (2007) Young & McCoy (2015) Young, Vangsness & McCoy (2018) Zacny & de Wit (2009) Zauberman, Kim, Malkoc & Bettman (2009) Zauberman & Lynch (2005) Zhang et al. (2016) Zhao, Cheng, Harris & Vigo (2015) Zhao, Kirwen, Johnson & Vigo (2017)</p>	
Wrong indication	If the studies did not report a temporal discounting outcome, or did not provide enough information to enable the calculation of the effect sizes, we excluded the study as “wrong indication”.	It had to be possible to calculate an age effect size concerning temporal discounting from the results of the study to have it included in the meta-analysis. Therefore, we excluded all studies for which this was not possible.	<p>Albert (2012) Anderson et al. (2009) Axon (2009) Behan, Stone, & Garavan (2015) Berman et al. (2013) Bialaszek, Marcowski, Ostaszewski (2017) Blain, Hollard, & Pessiglione (2016) Bradford (2010) Bremner (2011) Borghans & Bart (2006) Bowen, Grady, & Spaniol (2018) Boyle et al. (2012) Brown, Ivkovic, Weisbenner (2015) Burks et al. (2012) Cairns (1997) Cavaliere, De Marchi & Banterle (2014) Conell-Price & Jamison (2015) Cornelius & Caspi (1987) Cubitt, McDonald & Read (2018)</p>	<p>Herrmann, Johnson & Johnson (2015) Hess, Ozowski & Leclerc (2005) Huston, Finke (2003) Jobe (2014) Jones et al. (2009) Johnson (1997) Jones & Sullivan (2016) Kirby & Petry (2004) Kirby (2004) Kovalchik, Camerer, Grether, Plott & Allman (2005) Liu & Aaker (2007) Liu, Wang & Liao (2016) Loeckenhoff, Reed & Maresca (2012) Loeckenhoff, Rutt, Samanez-Larkin, O'Donoghue & Reyna (2017) Loeckenhoff et al. (2016) Lockenhoff et al. (2019) MacKeigan, Larson, Draugalis, Bootman & Burns (1993)</p>	80

			<p>Deakin, Aitken, Robbins & Sahakian (2004) Deaton & Paxson (1994) Denburg et al. (2007) Dror, Katona & Mungur (1998) Finucane 2010 Finucane, Mertz, Slovic & Schmidt (2005) Forstmeier, Drobetz & Maercker (2011) Freund & Blanchard-Fields (2014) Fung & Carstensen (2003) Gerhart et al. (2016) Ghazal, Cokely, Garvia-Retamero (2014) Godoy et al. (2004) Green et al. (1996) Halfmann (2016) Han et al. (2018) Han et al. (2016) Han, Boyle, James, Yu & Bennett (2015) Han et al. (2013) Han et al. (2014) Harrison, Lau & Williams (2012) Harrison et al. (2005) Herman et al (2018)</p>	<p>MacPherson, Phillips & Della Salla (2002) Mehrabian (2000) Meier et al (2013) Meier et al. (2015) Meier & Sprenger (2010) Mikels & Reed (2009) Melenhorst (2002) Rademacher, Salama, Gründern & Spreckelmeyer (2014) Read & Read (2004) Rieger & Mata (2015) Richter & Mata (2018) Rung, Johnson & Madden (2018) Schreiber & Weber (2016) Seaman et al. (2016) Seinstra et al. (2015) Shivapour et al (2012) Spaniol, Bowen, Wegier & Grady (2015) Stromback, Lind, Skagerlund, Vastfjall & Tinghog (2017) Tentori, Osherson, Hasher & May (2001) Westbrook, Kester & Braver (2013) Zhang & Rashad (2008)</p>	
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Bayesian Meta-Analysis

We used the brms package (Bürkner, 2017, 2018) to conduct a Bayesian meta-analysis. We set our prior for the pooled effect size μ as a normal distribution with a mean of 0 and standard deviation of 1 and the prior for the study heterogeneity τ as a Half-Cauchy distribution with a peak of 0 and scaling parameter of 0.5. The model converged and produced reliable estimates with 6000 iterations. This model produced an estimate of the pooled effect size, $\mu = -0.05$, 95% CI [-0.13, 0.03], and an estimate of study heterogeneity, $\tau = 0.27$, 95% CI [0.22, 0.34]. These are consistent with our frequentist meta-analytic results as the estimates of the effect size are similar and the confidence/credible intervals contain zero.

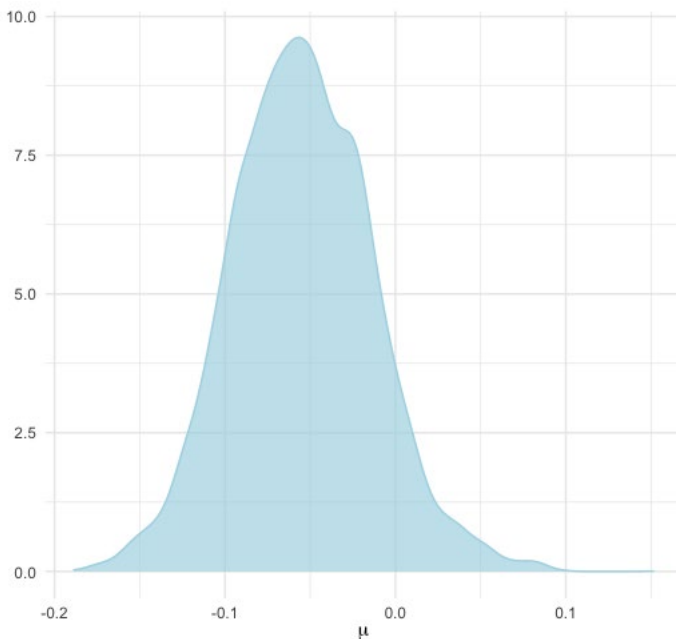


Figure S1: Posterior distribution of pooled effect of age on temporal discounting.

Using the posterior distribution (Figure S1), we next tested three hypotheses: 1) that the effect of age on discounting was greater than zero ($z > 0$), (2) that the effect of age on discounting was less than zero ($z < 0$), and (3) that the magnitude of the negative effect of age on discounting was greater than a small effect ($z = 0.1$). For the first hypothesis, we found little support for the effect of age on discounting to be greater than zero (9% probability of effect being greater than 0, Evidence Ratio (half Bayes Factor) = 0.095). For the second hypothesis, we found strong support (91% probability of pooled effect being less than 0, Evidence Ratio = 10.483) for the effect of age on discounting to be less than zero. However, we found little support for the hypothesis that the magnitude of this effect was greater than a small effect (13.1% probability of pooled effect being less than -0.1, Evidence Ratio = 0.15). Collectively, these results suggest that age has a *very* small, negative effect of discounting with age such that older adults discount less than younger adults.