

Neural precursors of decisions that matter—an ERP study of deliberate and arbitrary choice

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Supplementary material

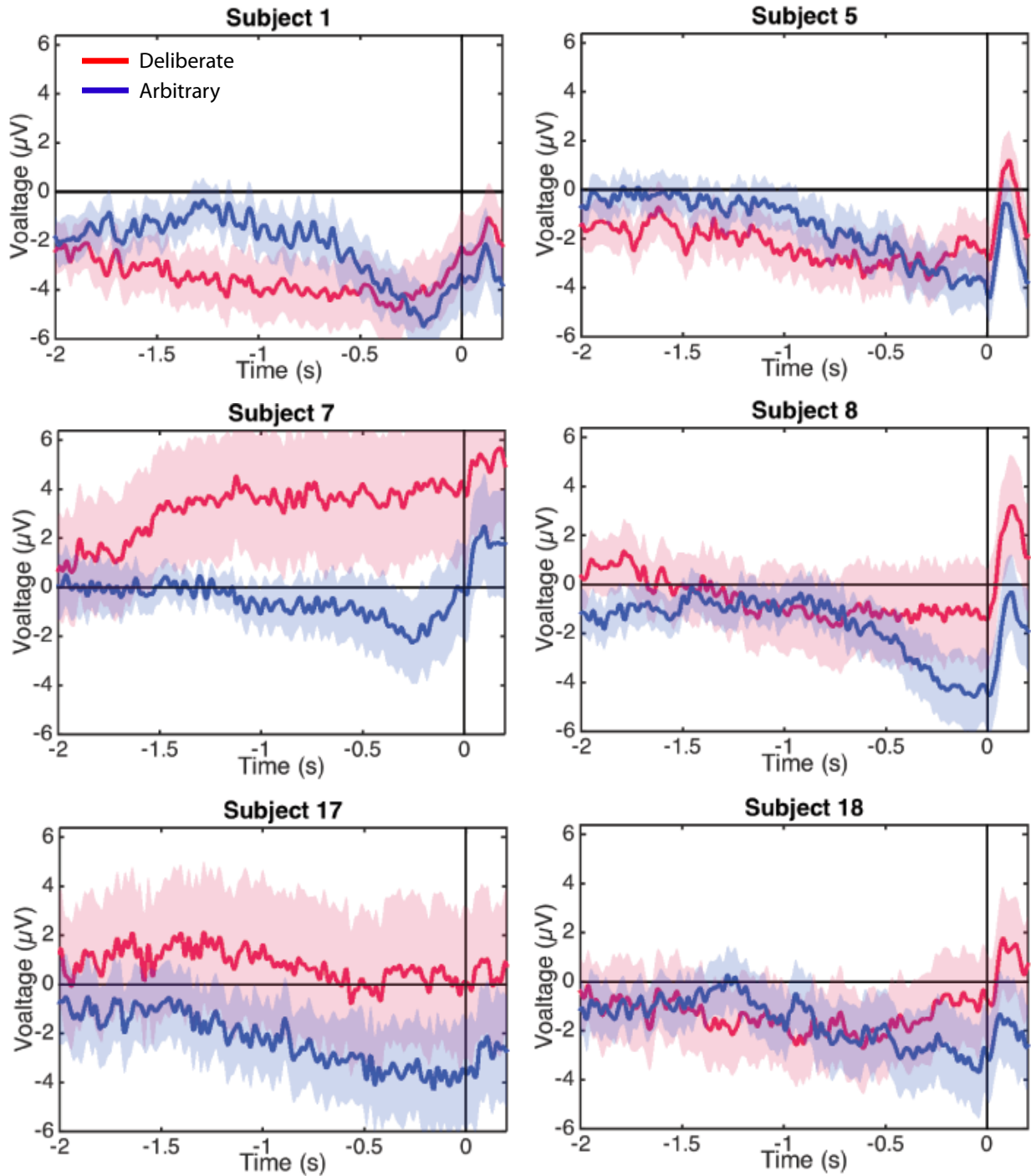


Figure S1: Six examples of for individual subjects' RPs (ERPs in the Cz electrode aligned to movement onset) for deliberate decisions (in red) and arbitrary ones (in blue).

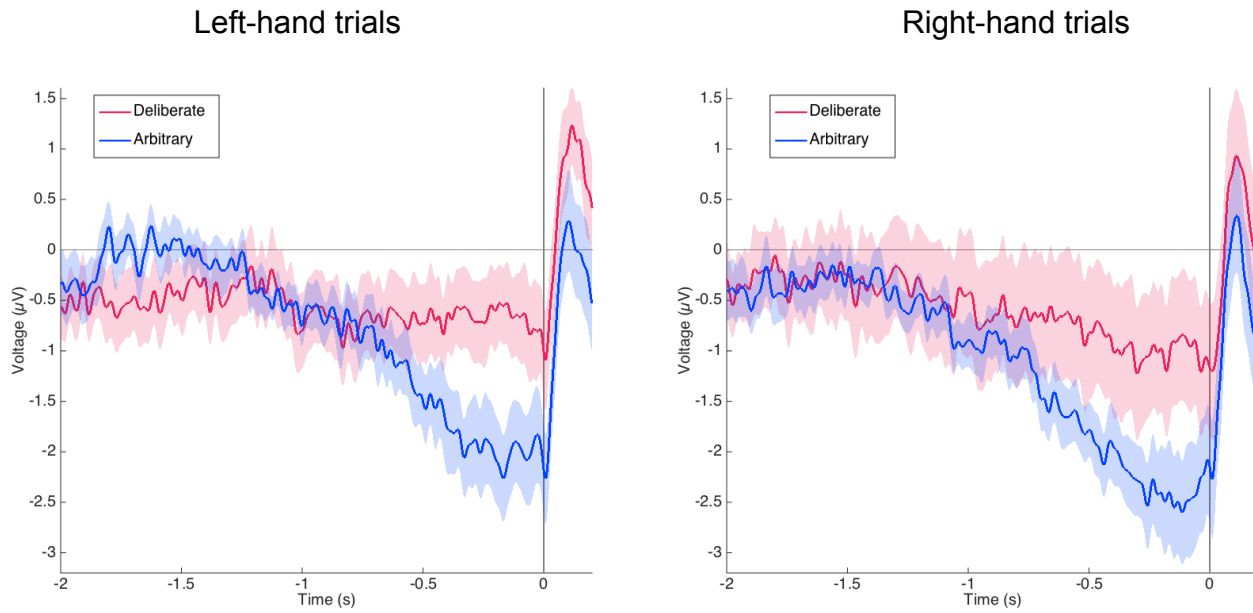


Figure S2: The RP for trials where subjects moved their left hand (left panel) and their right hand (right panel) separately. Dividing the trials into left-hand and right-hand ones results in only half the number of trials per subject, compared with Fig. 3. So, easy and hard decisions were pooled together to get back to approximately the same number of trials. Notably, the main pattern of results persists for each type of trials (right/left responses), where an RP is found for arbitrary decisions only.

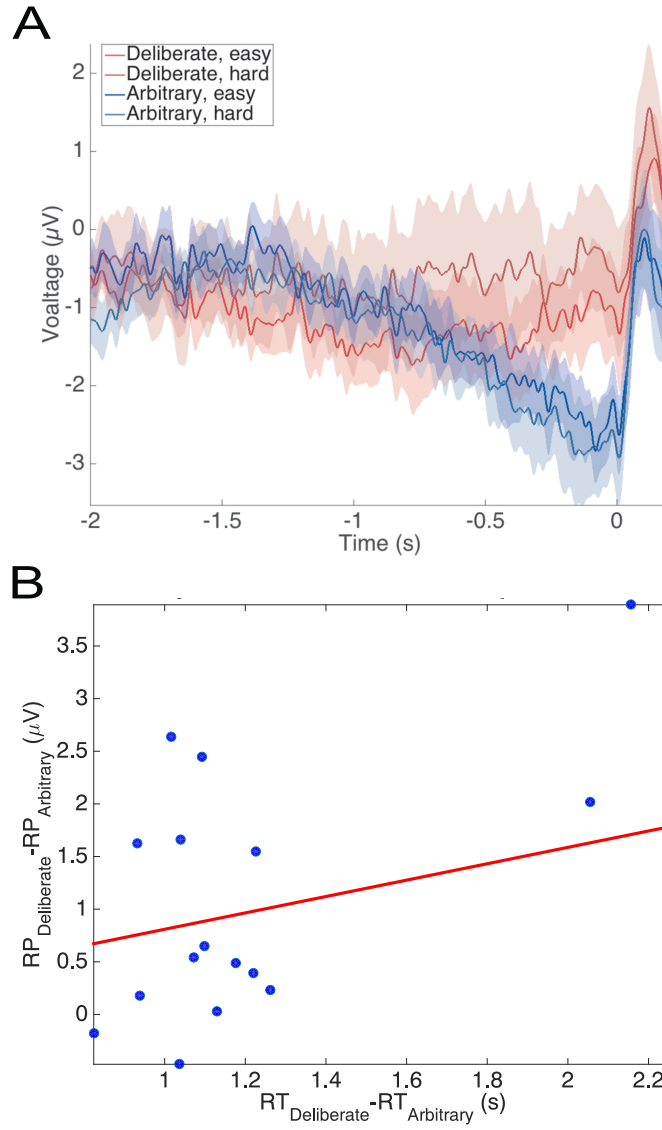


Figure S3: (A) The subjects with above-median RTs for arbitrary decisions (in blue) and below-median RTs for deliberate decisions (in red), show the same pattern that was found in the main analysis (Fig. 3). (B) A regression of the difference between the RPs versus the difference between the RTs for deliberate and arbitrary decisions for each subject. The equation of the regression line is  $y = 0.78 [CI -0.69, 2.25] x + 0.03 [CI -1.93, 2.00]$ . The  $R^2$  is low at 0.08 and, as the confidence intervals suggest, the slope is not significantly different from 0 ( $F(1,17)=1.48, p=0.28$ ). One subject, #7, had an RT difference between deliberate and arbitrary decisions that was more than 6 interquartile ranges (IQRs) away from the median difference across all subjects. That same subject's RT difference was also more than 5 IQRs higher than the 75<sup>th</sup> percentile across all subjects. That subject was therefore designated an outlier<sup>1</sup> and removed from the regression analysis.

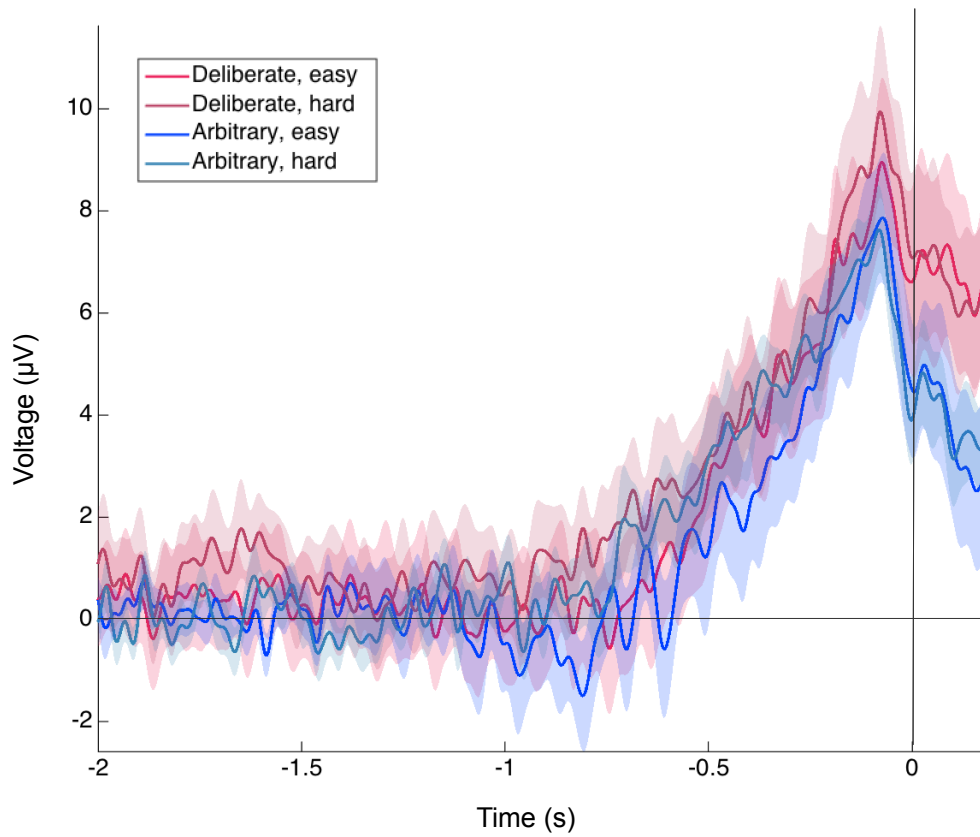


Figure S4: The lateralized readiness potential (LRP) for deliberate and arbitrary, easy and hard decisions. No difference was found between the conditions (all  $F_s < 1$ ).

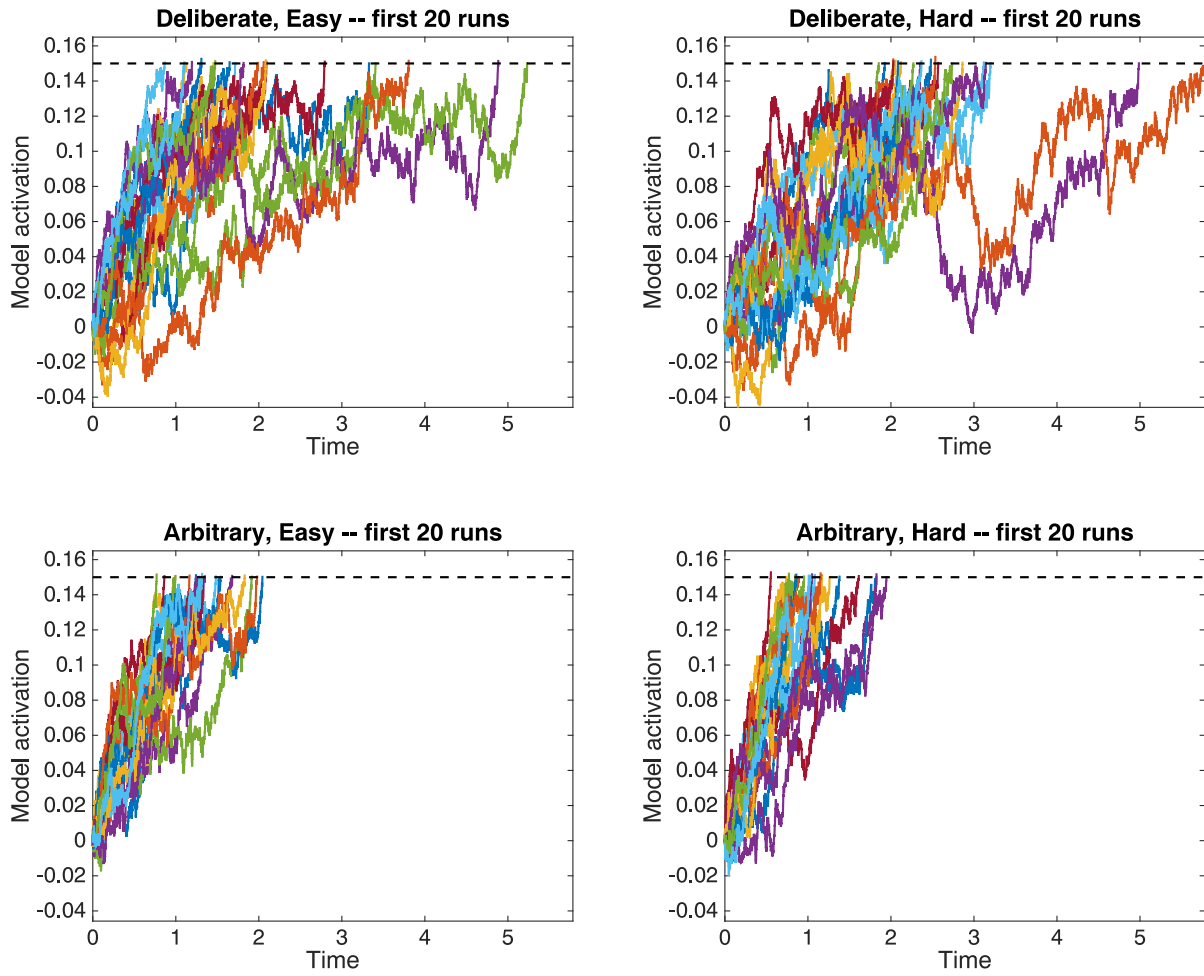


Figure S5: The first 20 model runs for all four decision conditions. The integration threshold, at 0.15, is designated by a dashed line in all decision conditions. Here  $t = 0$  s designates the beginning of the model's run.

**Table S1: NPO names and causes acronyms**

<b>NPO</b>	<b>Cause acronym</b>	<b>NPO website</b>
<b>Consensual NPOs</b>		
American Society on Aging	Pro Quality of Life for the Elderly	<a href="http://asaging.org/">http://asaging.org/</a>
Conservation Fund	Pro Environment protection'	<a href="http://www.conservationfund.org/">http://www.conservationfund.org/</a>
Bill & Melinda Gates Foundation	Pro Education	<a href="http://www.gatesfoundation.org/">http://www.gatesfoundation.org/</a>
Global Fund for Women	Pro Women's Rights	<a href="https://www.globalfundforwomen.org/">https://www.globalfundforwomen.org/</a>
The Hunger Project	Pro Hunger Relief	<a href="https://www.thp.org/">https://www.thp.org/</a>
Oxfam International	Pro Poverty & Disaster Relief	<a href="http://www.oxfam.org/">http://www.oxfam.org/</a>
World Wild Life Fund (WWF)	Pro Species Conservation	<a href="http://worldwildlife.org/">http://worldwildlife.org/</a>
Cancer Research Institute	Pro Cancer Research	<a href="http://www.cancerresearch.org/">http://www.cancerresearch.org/</a>
Habitat for Humanity	Pro Housing for All	<a href="http://www.habitat.org/">http://www.habitat.org/</a>
Reading is Fundamental	Pro Advancement of Literacy	<a href="http://www.rif.org/">http://www.rif.org/</a>
International Institute for Conservation of Historic and Artistic Works	Pro Culture & Arts Preservation	<a href="https://www.iiconservation.org/">https://www.iiconservation.org/</a>
Big Brothers and Big Sisters of America	Pro Youth Development	<a href="http://www.bbbs.org/site/c.9iILI3NGKKhK6F/b.5962335/k.BE16/Home.htm">http://www.bbbs.org/site/c.9iILI3NGKKhK6F/b.5962335/k.BE16/Home.htm</a>
United Nations Children's Fund (UNICEF)	Pro Child Protection	<a href="http://www.unicef.org/">http://www.unicef.org/</a>
Doctors without Borders (Medecins sans frontieres)	Pro Disaster Medical Care	<a href="http://www.msf.org/">http://www.msf.org/</a>
Soldiers' Angels	Pro Veterans & Military	<a href="http://www.soldiersangels.org/heroes/index.php">http://www.soldiersangels.org/heroes/index.php</a>
Disability Rights International	Pro Disabilities Rights	<a href="http://www.disabilityrightsintl.org/">http://www.disabilityrightsintl.org/</a>

National Crime Prevention Council (NCPC)	Pro Crime Prevention	<a href="http://www.ncpc.org/">http://www.ncpc.org/</a>
Amnesty International	Pro Human Rights	<a href="https://www.amnesty.org/">https://www.amnesty.org/</a>
Peace Corps	Pro Peace & Development	<a href="http://www.peacecorps.gov/">http://www.peacecorps.gov/</a>
World Health Organization	Pro World Health	<a href="http://www.who.int/en/">http://www.who.int/en/</a>
<b>Controversial NPOs</b>		
Planned Parenthood	Pro Abortion & Family Planning	<a href="http://www.plannedparenthood.org/">http://www.plannedparenthood.org/</a>
Pro-Life Alliance	Anti Abortion & Family Planning	<a href="http://www.prolifealliance.com/">http://www.prolifealliance.com/</a>
Human Rights Campaign	Pro LBGTQ Rights	<a href="http://www.hrc.org/">http://www.hrc.org/</a>
National Organization for Marriage	Anti LBGTQ Rights	<a href="https://www.nationformarriage.org/">https://www.nationformarriage.org/</a>
Stem for Life Foundation	Pro Stem Cell Research	<a href="http://www.stemforlife.org/">http://www.stemforlife.org/</a>
Christian Dental & Medical Association	Anti Stem Cell Research	<a href="http://www.cmda.org/">http://www.cmda.org/</a>
Greenpeace	Pro Action Against Climate Change	<a href="http://www.greenpeace.org/international/en/">http://www.greenpeace.org/international/en/</a>
Global Climate Scam	Anti Action Against Climate Change	<a href="http://www.globalclimatescam.com/">http://www.globalclimatescam.com/</a>
National Association for Gun Rights	Pro Gun Rights	<a href="http://www.nationalgunrights.org/">http://www.nationalgunrights.org/</a>
Coalition to Stop Gun Violence	Pro Gun Control	<a href="http://csgv.org/">http://csgv.org/</a>
American Gas Association	Pro Fracking for Natural Gas	<a href="http://www.aga.org/Pages/default.aspx">http://www.aga.org/Pages/default.aspx</a>
Americans Against Fracking	Anti Fracking for Natural Gas	<a href="http://www.americansagainstfracking.org/">http://www.americansagainstfracking.org/</a>
StandWithUs (Israel)	Pro Israel	<a href="http://www.standwithus.com/">http://www.standwithus.com/</a>
Palestinian Centre for Human Rights	Pro Palestine	<a href="http://www.pchrgaza.org/portal/en/">http://www.pchrgaza.org/portal/en/</a>
National Organization for	Pro Marijuana Legalization	<a href="http://norml.org/">http://norml.org/</a>

the Reform of Marijuana Laws		
Citizens Against Legalizing Marijuana	Anti Marijuana Legalization	<a href="http://www.calmca.org/">http://www.calmca.org/</a>
Understanding Animal Research	Pro Scientific Experiments on Animals	<a href="http://www.understandinganimalresearch.org.uk/">http://www.understandinganimalresearch.org.uk/</a>
International Association Against Painful Experiments on Animals	Anti Scientific Experiments on Animals	<a href="http://www.iaapea.com/">http://www.iaapea.com/</a>
Federation for American Immigration Reform	Pro Immigration Reform	<a href="http://www.fairus.org/">http://www.fairus.org/</a>
American Immigration Control	Anti Immigration Reform	<a href="http://www.immigrationcontrol.com/">http://www.immigrationcontrol.com/</a>
Human Cloning Foundation	Pro Human Cloning	<a href="http://www.humancloning.org/">http://www.humancloning.org/</a>
Americans to Ban Cloning	Anti Human Cloning	<a href="http://www.cloninginformation.org/">http://www.cloninginformation.org/</a>
Americans United for Separation of Church and State	Pro Separation of Church & State	<a href="https://www.au.org/">https://www.au.org/</a>
Christian Coalition of America	Anti Separation of Church & State	<a href="http://www.cc.org">http://www.cc.org</a>
Death with Dignity National Center	Pro Euthanasia (Assisted Suicide)	<a href="http://www.deathwithdignity.org/">http://www.deathwithdignity.org/</a>
Euthanasia Prevention Coalition	Anti Euthanasia (Assisted Suicide)	<a href="http://www.epcc.ca/">http://www.epcc.ca/</a>
The Alliance for Better Foods	Pro Genetically Modified Foods	<a href="http://www.betterfoods.org/">http://www.betterfoods.org/</a>
Non-GMO Project	Anti Genetically Modified Foods	<a href="http://www.nongmoproject.org/">http://www.nongmoproject.org/</a>
Answers in Genesis	Pro Creationism Teaching	<a href="https://answersingenesis.org">https://answersingenesis.org</a>
National Center for Science Education	Pro Evolution Teaching	<a href="http://ncse.com/">http://ncse.com/</a>



## References

- 1 Tukey, J. *Exploratory Data Analysis*. (Addison-Wesley, 1977).