Troubleshooting tau2

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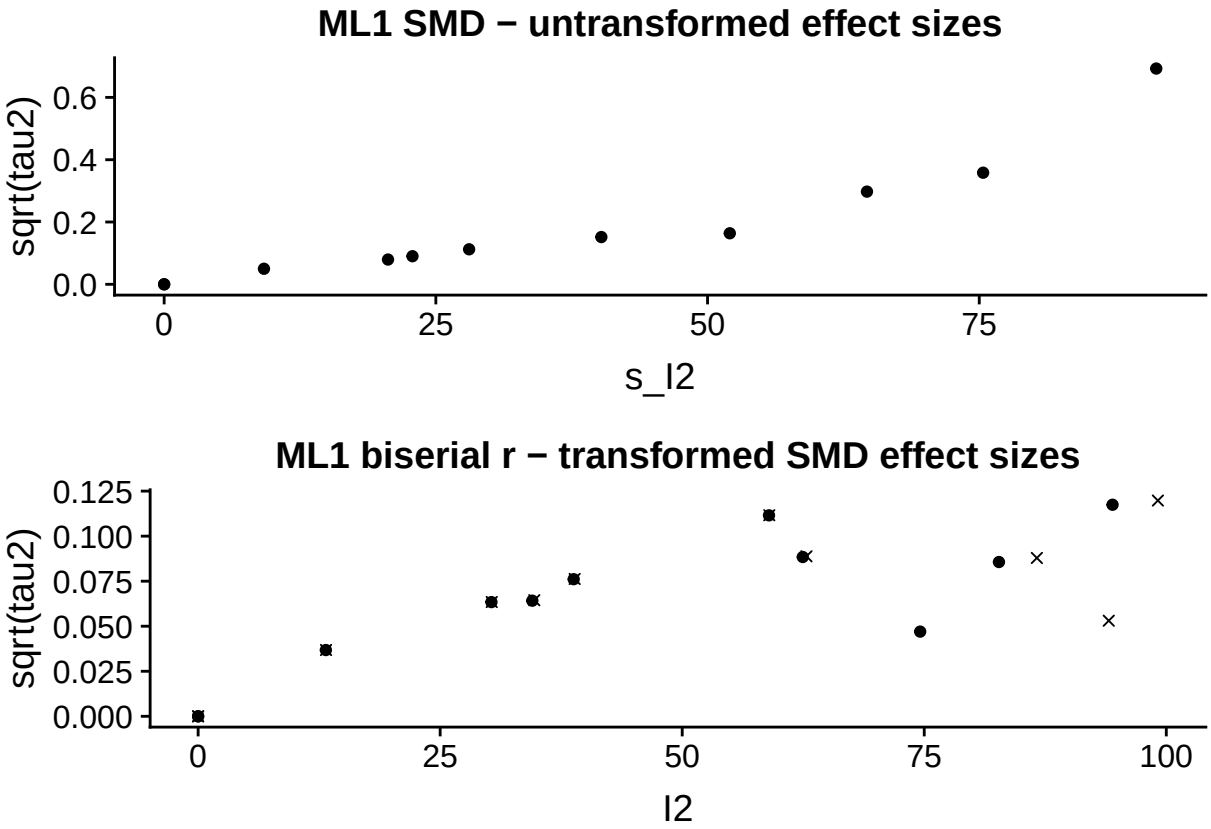


Figure 1.

The four effects at the end are Anchoring 1,2,3,4. X corresponds to untruncated and circles are truncated

We see that the non-monotonicity after transformation is not explained by truncation. Rather (especially in view of the 4th to last effect which wasn't truncated) there seems like there might be a relation with effect size.

Effect size?

- The transformation is not monotonic for large values and this is not explained by the truncation (see next section) which almost only affects the I2
- Let's take a closer look at two effects with very different effect sizes (mean SMD 0.3 vs. 1.25): Quote attribution [fifth effect from the right Figure 1] vs. Anchoring 1. [4th effect from the right Figure 1].

Facts so far:

a) After transformation we see an unexpected pattern in heterogeneity estimates amongst the four largest effect sizes; tau2 seems too low compared to I2

b) The transformation affects sampling variance estimates differently depending on effect size; the relative decrease in sampling variance is larger the larger the effect size. In other words, after transformation

the larger effect sizes have relatively more weight than before the transformation (see table below).

c) This is true both across effects and within effects. E.g., for the Anchoring effect size d = 1.94 the ratio of the pre-transformation variance to post-transformation variance is 4.92 whereas for the effect size d = .78 it is 1.98. This correlation is almost perfect ($r = 0.9793788$)

d) For anchoring 1, 15/36 effect sizes are above the mean

Anch_d	Quote_d	Quote_ratio	Anch_ratio	ratio_SE_d	ratio_SE_biserial	diff
1.9358953	0.1428146	1.599823	4.920552	1.312842	0.4268453	0.8859970
1.9190913	0.2848341	1.638608	4.894985	1.559450	0.5220297	1.0374206
1.9091921	0.1904345	1.618207	4.775832	1.432800	0.4854793	0.9473207
1.7985065	0.4043938	1.696513	4.338456	1.236039	0.4833415	0.7526974
1.7595741	0.4243020	1.698968	4.192815	1.268851	0.5141503	0.7547004
1.5425613	-0.0281924	1.587498	3.444869	1.569181	0.7231252	0.8460562
1.5380018	0.2650376	1.631445	3.419766	1.223754	0.5838082	0.6399458
1.4475343	0.7850061	1.985841	3.155849	1.147058	0.7217942	0.4252634
1.3998277	-0.0097800	1.585750	3.028752	1.436391	0.7520448	0.6843465
1.3961374	0.4960837	1.744134	3.023292	1.158077	0.6680931	0.4899837
1.3585772	0.3777543	1.680104	2.928235	1.206522	0.6922542	0.5142682
1.2992184	0.4074653	1.692584	2.803664	1.176750	0.7104087	0.4663410
1.2837530	0.0919068	1.592879	2.771543	1.195955	0.6873467	0.5086078
1.2783209	0.3444035	1.665636	2.756673	1.160429	0.7011538	0.4592748
1.2513118	0.3050008	1.647970	2.699848	1.186654	0.7243257	0.4623279
1.2424463	0.5131952	1.751863	2.686805	1.119211	0.7297532	0.3894580
1.2048796	0.1896070	1.637301	2.604831	1.348918	0.8478804	0.5010380
1.1722829	0.6483402	1.854137	2.545781	1.175468	0.8561134	0.3193541
1.1676719	0.2258736	1.618136	2.539634	1.132992	0.7218895	0.4111028
1.1579618	0.2220126	1.624488	2.515637	1.129371	0.7292980	0.4000726
1.1484093	0.5376382	1.780049	2.505327	1.165818	0.8283206	0.3374977
1.1474958	0.3801458	1.683444	2.498426	1.171885	0.7896185	0.3822669
1.1331580	-0.2623734	1.633673	2.475843	1.292004	0.8525225	0.4394817
1.1121591	-0.0886205	1.594119	2.441522	1.403935	0.9166578	0.4872776
1.0973322	0.2164204	1.621569	2.414807	1.180561	0.7927594	0.3878016
1.0722916	0.4434275	1.715549	2.369948	1.097248	0.7942716	0.3029760
1.0344022	0.2662388	1.638122	2.310257	1.114901	0.7905371	0.3243641
1.0148381	0.6836683	1.888167	2.277854	1.167972	0.9681596	0.1998120
0.9978796	0.9372292	2.170713	2.256643	1.066842	1.0262187	0.0406238
0.9948256	0.5510003	1.781740	2.250801	1.158482	0.9170573	0.2414243
0.9818146	0.1722639	1.607329	2.232852	1.102376	0.7935503	0.3088254
0.9394935	0.2854108	1.637805	2.173762	1.171984	0.8830227	0.2889609
0.9202060	0.4064767	1.692499	2.148213	1.113957	0.8776464	0.2363111
0.9142239	-0.3545910	1.664268	2.141064	1.116715	0.8680325	0.2486825
0.8186843	0.3109583	1.653178	2.024230	1.273362	1.0399482	0.2334138
0.7809322	0.1571675	1.601415	1.980853	1.062405	0.8588981	0.2035066

Note: Anch_d = SMD Anchoring, Quote_d = SMD Quote attribution, Quote_ratio = pre-transformation SE / post-transformation SE for Quote attribution, Anch_ratio = pre-transformation SE / post-transformation SE for Anchoring 1, ratio_SE_d = Ratio SMD SEs: Anchoring / Quote attribution, ratio_SE_biserial = Ratio biserial SEs: Anchoring / Quote attribution, diff = Ratio SMD - Ratio biserial.

```
## # A tibble: 4 x 2
##   effect                above_average
```

```
##   <chr>                          <int>
## 1 Anchoring 1 - NYC                 15
## 2 Anchoring 2 - Chicago             17
## 3 Anchoring 3 - Everest             20
## 4 Anchoring 4 - Babies              15
```

Truncation problems?

Compare the actual values

effect	trunc_ES	trunc_tau	trunc_I2	nontrunc_ES	nontrunc_tau	nontrunc_I2
Anchoring 1 - NYC	0.6755430	0.0884084	62.45300	0.6757149	0.0887992	62.83626
Anchoring 2 - Chicago	0.8983524	0.0856280	82.71637	0.8995111	0.0878808	86.63295
Anchoring 3 - Everest	0.9597406	0.1174212	94.44943	0.9611498	0.1197472	99.13042
Anchoring 4 - Babies	0.9931885	0.0470057	74.57810	0.9969872	0.0530517	94.05795
Flag Priming	0.0117417	0.0000000	0.00000	0.0117426	0.0000000	0.00000
Gambler's Fallacy	0.3810843	0.0641740	34.51711	0.3811101	0.0644334	34.72507
Gender math attitude	0.3451290	0.0760947	38.79143	0.3451553	0.0762331	38.89472
Imagined Contact	0.0726507	0.0633849	30.29463	0.0726458	0.0634324	30.32839
Money Priming	-0.0103580	0.0000000	0.00000	-0.0103563	0.0000000	0.00000
Quote Attribution	0.1969836	0.1115349	58.96618	0.1970003	0.1115854	58.99622
Sunk Costs	0.1890881	0.0367789	13.19310	0.1891098	0.0368051	13.21200

It is strange that there are (very slightly) different outcomes for non-truncated effects, this is probably due to metafor (which I use for truncation) uses the exact variance formula whereas I use the approximate. Compare truncated vs. non-truncated manual formulas to check:

effect	trunc_ES	trunc_tau	trunc_I2	nontrunc_ES	nontrunc_tau	nontrunc_I2
Anchoring 1 - NYC	0.6757149	0.0887992	62.83626	0.6757149	0.0887992	62.83626
Anchoring 2 - Chicago	0.8985896	0.0859735	83.53608	0.8995111	0.0878808	86.63295
Anchoring 3 - Everest	0.9599007	0.1175366	94.83766	0.9611498	0.1197472	99.13042
Anchoring 4 - Babies	0.9934218	0.0476427	76.40955	0.9969872	0.0530517	94.05795
Flag Priming	0.0117426	0.0000000	0.00000	0.0117426	0.0000000	0.00000
Gambler's Fallacy	0.3811101	0.0644334	34.72507	0.3811101	0.0644334	34.72507
Gender math attitude	0.3451553	0.0762331	38.89472	0.3451553	0.0762331	38.89472
Imagined Contact	0.0726458	0.0634324	30.32839	0.0726458	0.0634324	30.32839
Money Priming	-0.0103563	0.0000000	0.00000	-0.0103563	0.0000000	0.00000
Quote Attribution	0.1970003	0.1115854	58.99622	0.1970003	0.1115854	58.99622
Sunk Costs	0.1891098	0.0368051	13.21200	0.1891098	0.0368051	13.21200

Exactly the same result for non-truncated effects, so that seems to be the case

Let's take a closer look at the truncated vs. untruncated variance estimates for Anchoring 4 which has the largest change in I2.

r	trunc_vi	nontrunc_vi	n
1.1167645	0.0005761	0.0000004	113
1.0929915	0.0007781	0.0000426	84
1.0768533	0.0008288	0.0001431	91
1.0676675	0.0007473	0.0001522	88
1.0646775	0.0007464	0.0001669	87
1.0600336	0.0009031	0.0002457	75
1.0489555	0.0007191	0.0002638	91
1.0461864	0.0009898	0.0003896	66
1.0420274	0.0006931	0.0003087	97
1.0338802	0.0005161	0.0002868	143
1.0177833	0.0007714	0.0005693	85
1.0170141	0.0008362	0.0006325	84
1.0156292	0.0009690	0.0007571	77
1.0029448	0.0005671	0.0005426	130
0.9931593	0.0014041	0.0014041	66
0.9893006	0.0012507	0.0012507	74
0.9860595	0.0010022	0.0010022	84
0.9775499	0.0005740	0.0005740	163
0.9718189	0.0010373	0.0010373	93
0.9709787	0.0013048	0.0013048	81
0.9707347	0.0004679	0.0004679	209
0.9700342	0.0010014	0.0010014	99
0.9676861	0.0004084	0.0004084	247
0.9633971	0.0013405	0.0013405	83
0.9520865	0.0001298	0.0001298	929
0.9497412	0.0011221	0.0011221	111
0.9491725	0.0009079	0.0009079	138
0.9483338	0.0014090	0.0014090	91
0.9476352	0.0008051	0.0008051	158
0.9296920	0.0015966	0.0015966	104
0.9270524	0.0001342	0.0001342	1178
0.9238010	0.0022826	0.0022826	73
0.9061668	0.0022524	0.0022524	84
0.8951671	0.0031355	0.0031355	75
0.8950033	0.0026308	0.0026308	80
0.8920045	0.0027227	0.0027227	78

Note that the (biserial) r itself is not truncated and so the same between the two. It is clear truncation leads to a larger estimate of the variance for an effect.

To summarize: Truncation leads to an increase in estimated study variance, but a (small) decrease in meta-analytic effect size estimate. In other words, truncation (as seen in the first figure) leads to a lower I2 but does not affect the τ particularly

Old stuff

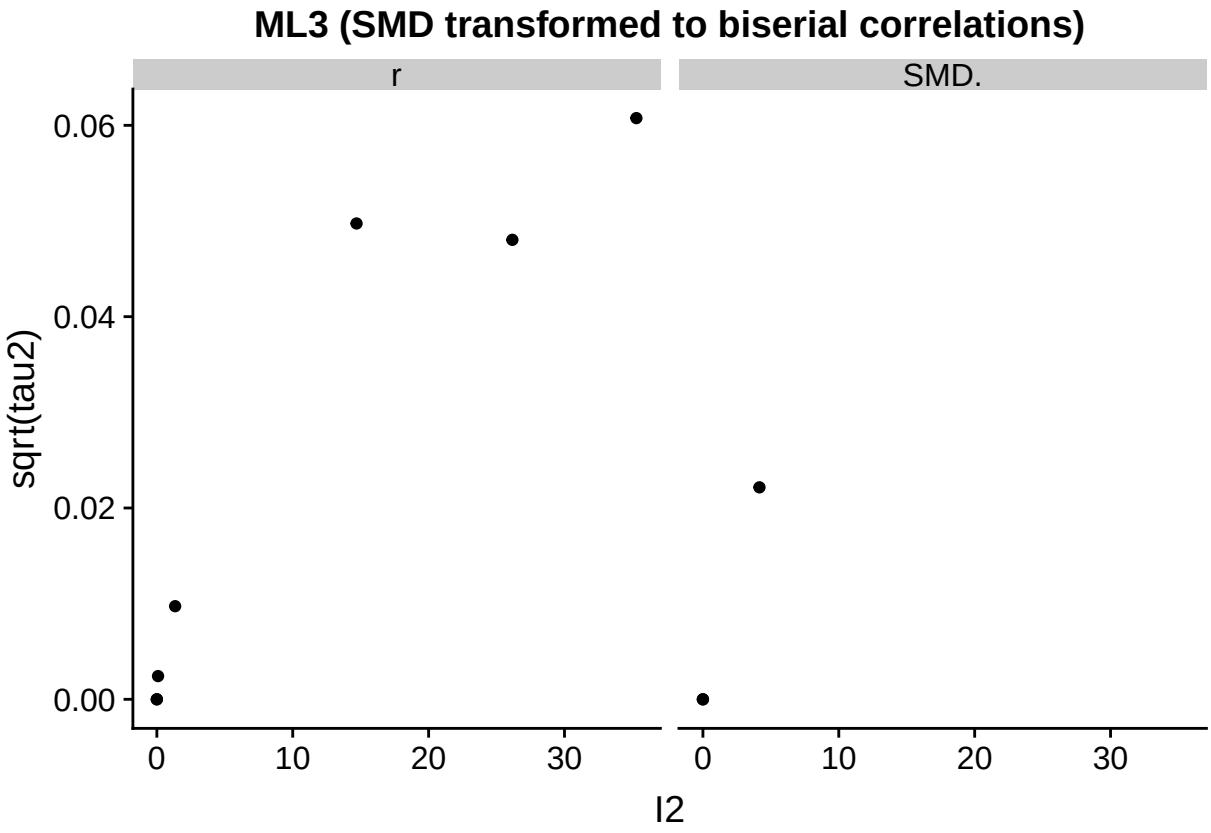
Check which effects get truncated:

```
dat %>%
  split(.$effect) %>%
  map_dfr(transform_MA, .id = "effect") %>%
```

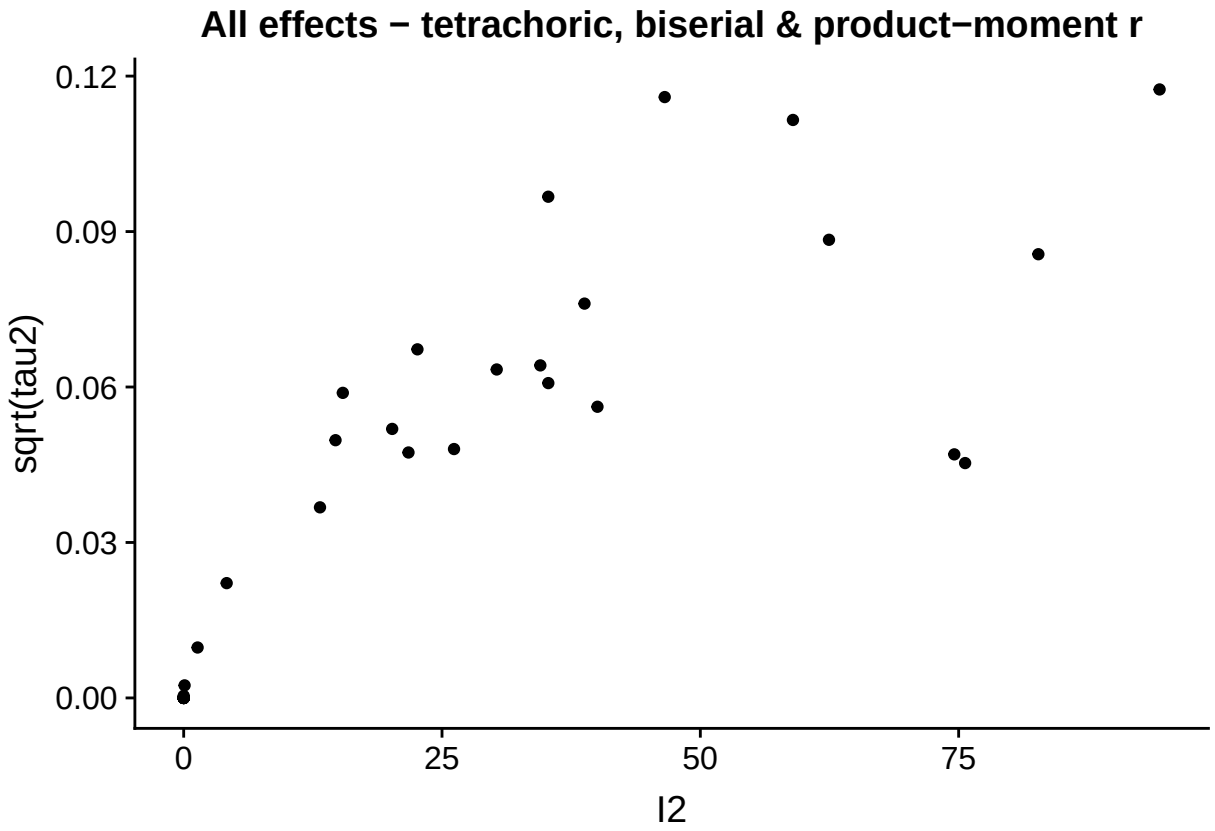
```
  filter(r > 1)
```

```
##                   effect        r           vi  n
## 1  Anchoring 2 - Chicago 1.037239 0.0009615220 NA
## 2  Anchoring 2 - Chicago 1.023831 0.0009003590 NA
## 3  Anchoring 2 - Chicago 1.034815 0.0009406875 NA
## 4  Anchoring 2 - Chicago 1.070713 0.0013542127 NA
## 5  Anchoring 3 - Everest 1.003413 0.0011468637 NA
## 6  Anchoring 3 - Everest 1.100490 0.0008669169 NA
## 7  Anchoring 3 - Everest 1.045074 0.0008877424 NA
## 8  Anchoring 3 - Everest 1.012695 0.0002738024 NA
## 9  Anchoring 3 - Everest 1.168396 0.0018200691 NA
## 10 Anchoring 3 - Everest 1.098721 0.0008235548 NA
## 11 Anchoring 3 - Everest 1.070460 0.0007698048 NA
## 12 Anchoring 3 - Everest 1.011212 0.0009320243 NA
## 13 Anchoring 3 - Everest 1.030118 0.0004800473 NA
## 14 Anchoring 3 - Everest 1.065253 0.0009301704 NA
## 15 Anchoring 3 - Everest 1.003478 0.0006001020 NA
## 16 Anchoring 3 - Everest 1.114616 0.0007160133 NA
## 17 Anchoring 3 - Everest 1.015831 0.0007893139 NA
## 18 Anchoring 3 - Everest 1.027750 0.0007539286 NA
## 19  Anchoring 4 - Babies 1.017014 0.0009290498 NA
## 20  Anchoring 4 - Babies 1.017783 0.0008520000 NA
## 21  Anchoring 4 - Babies 1.064677 0.0008235548 NA
## 22  Anchoring 4 - Babies 1.002945 0.0006317964 NA
## 23  Anchoring 4 - Babies 1.092992 0.0008590549 NA
## 24  Anchoring 4 - Babies 1.048956 0.0007941040 NA
## 25  Anchoring 4 - Babies 1.033880 0.0005749757 NA
## 26  Anchoring 4 - Babies 1.046186 0.0010923186 NA
## 27  Anchoring 4 - Babies 1.015629 0.0010798194 NA
## 28  Anchoring 4 - Babies 1.116764 0.0006360040 NA
## 29  Anchoring 4 - Babies 1.060034 0.0010004780 NA
## 30  Anchoring 4 - Babies 1.042027 0.0007675570 NA
## 31  Anchoring 4 - Babies 1.067667 0.0008256784 NA
## 32  Anchoring 4 - Babies 1.076853 0.0009239412 NA
```

Basically the anchoring effects.



The one non-increasing effect in the left plot above is 'Credentials interaction'. However, note that all the ML3 'correlations' are either transformed partial eta-squared of 2x2 tables in the first table (we can't fix this, would have to get into the raw data which seems liek too much work, I mentioned this in the revised draft)



The effect that is close to one of the anchoring effects (I2 ~75, tau ~.05) is Allowed vs. forbidden which also has r = .90.