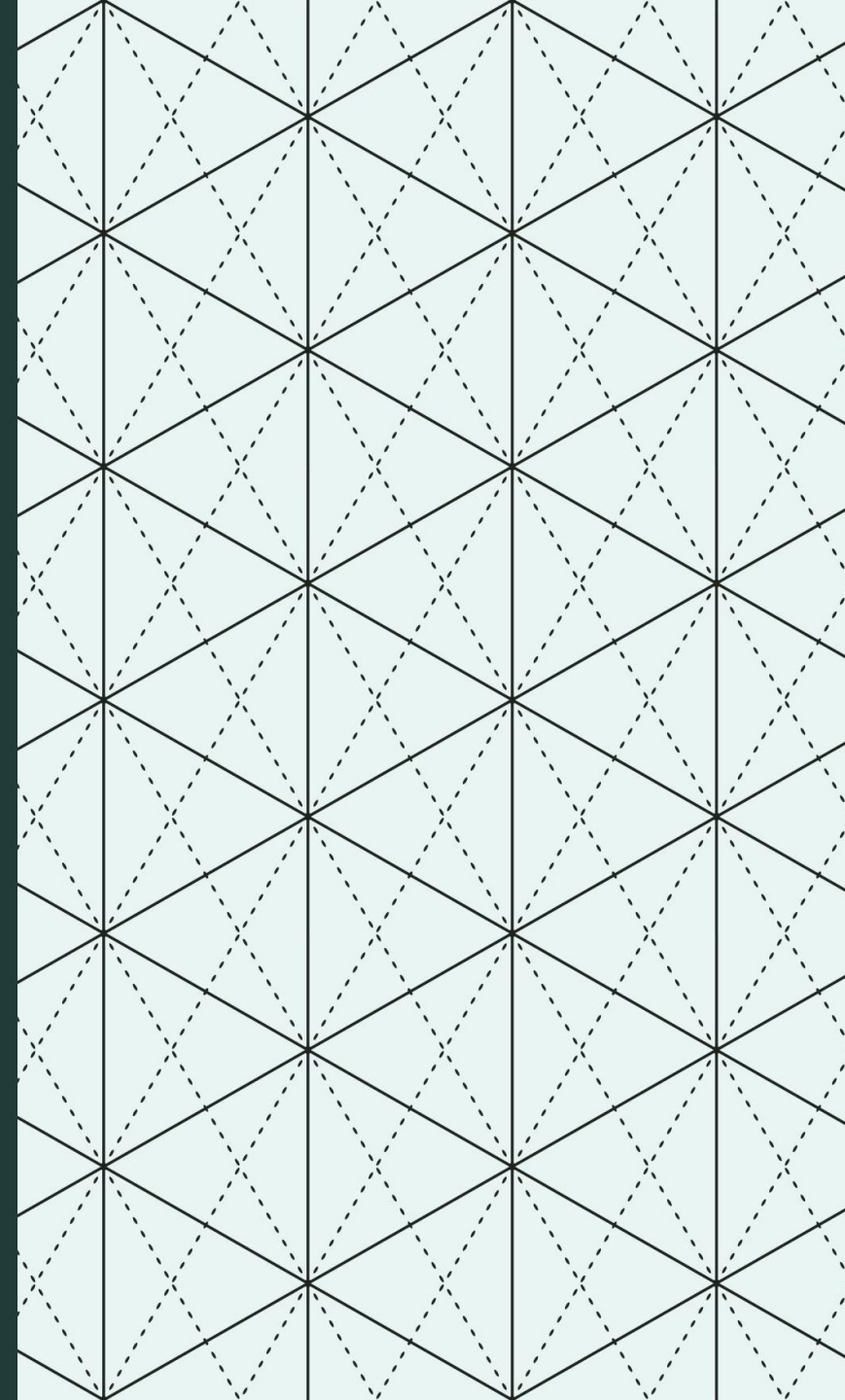


---

# WELCOME TO PSY 653 LAB!

MODULE 03:  
MEDIATION

\*Thanks to Gemma Wallace for her help with these slides





# OBJECTIVES

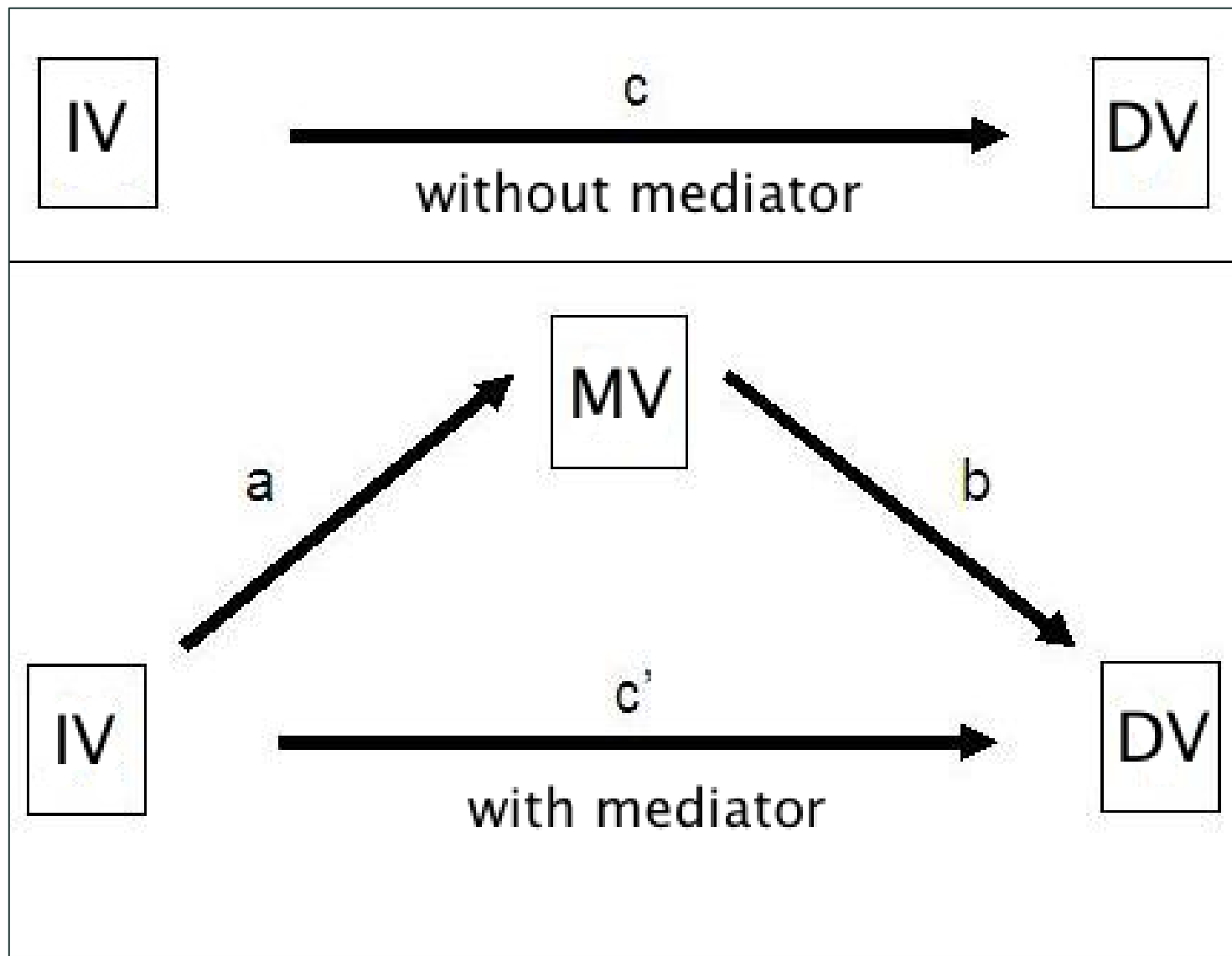
- Explain mediation
- Discuss the Baron & Kenny Criteria for testing mediation
- Coding tutorial



# MEDIATION

- A mediator variable is a variable that helps to explain the relationship between X & Y
- A mediated relationship occurs when a third variable plays an important role in governing the relationship between the two other variables
- We can have a full mediation (not likely in psychology) or a partial mediation model (more likely in psychology)

## THE "PATHS" IN MEDIATION



# BARON & KENNY CRITERIA FOR TESTING MEDIATION

1. Show **X** is related to **Y** (**c path**)
2. Show **X** is related to **M** (**a path**)
3. Show **Y** is related to **M** (**b path**)
4. Show that **M** explains the relationship between **X** and **Y** (**c' path**)
  - One way to do this is to show that controlling for **M** will cause  $r_{xy}$  to go toward zero

\*Must meet **all** criteria to run a mediation model



---

# CREATE A NEW R-PROJECT AND R-NOTEBOOK!

Download the “mediate2.csv” file  
from Canvas and save it into your  
R-project file

## LOAD LIBRARIES

```
6 # Load libraries
7 ```{r,message=FALSE}
8 install.packages("mediation")
9
10 library(tidyverse)
11 library(psych)
12 library(mediation)
13 library(ppcor)
14 ```
```

# STOP!



## ■ New R concept:

- We will be experiencing “Package conflicts” during this lab
- In short, both the ***psych*** package and the ***mediation*** package have a function called “mediate()”
- Therefore, we need to tell R which package to call the mediate() function from
  - To do this we use the package name followed by two colons and then the name of the function:  
“**package\_name::function()**”
    - Every time we use the mediate() function we will have to tell R which package it comes from.

Attaching package: `⚠mediation⚠`

The following object is masked from `⚠package:psych⚠`:

`mediate`

**Continue on...**



# READ IN DATA

```
13
14 # Read in data
15 ```{r}
16 med <- read_csv("mediate2.csv")
17
```

Parsed with column specification:

```
cols(
  x1 = col_double(),
  x2 = col_double(),
  x3 = col_double(),
  x4 = col_double(),
  x5 = col_double(),
  y1 = col_double()
)
```

18

This is a simulated dataset with four predictor variables (X1-X5) and one outcome variable (Y1)

Note: though not shown here, don't forget to do your data management "best practices" by examining descriptives and visualizing data before conducting analyses!



ANALYSIS 1: TEST THE HYPOTHESIS THAT **X4** MEDIATES THE  
RELATIONSHIP BETWEEN **X1** AND **Y1**

## STEP 1: DETERMINE IF MEDIATION IS PLAUSIBLE, BASED ON THE BARON & KENNY CRITERIA

### EXAMINE CORRELATIONS BETWEEN VARIABLES

```
--  
24 > cor({r})  
25 analysis1 <- select(med, X1, X4, Y1)  
26 cor(analysis1)  
27 >
```

	X1	X4	Y1
X1	1.00000000	0.04344269	0.3465506
X4	0.04344269	1.00000000	0.4104644
Y1	0.34655064	0.41046440	1.00000000

**rx<sub>y</sub> = .3466 (c path)**

**rx<sub>m</sub> = .0434 (a path)**

**r<sub>m</sub>y = .4105 (b path)**

## DO WE HAVE JUSTIFICATION TO TEST THE MEDIATION HYPOTHESIS? (BARON & KENNY CRITERIA)

```
--  
24 ~~~ {r}  
25 analysis1 <- select(med, X1, X4, Y1)  
26 cor(anaysis1)  
27 ~~~
```

	X1	X4	Y1
X1	1.00000000	0.04344269	0.3465506
X4	0.04344269	1.00000000	0.4104644
Y1	0.34655064	0.41046440	1.00000000

**rx<sub>y</sub> = .3466 (c path)**

**rx<sub>m</sub> = .0434 (a path)**

**r<sub>m</sub>y = .4105 (b path)**

# DO WE HAVE JUSTIFICATION TO TEST THE MEDIATION HYPOTHESIS? (BARON & KENNY CRITERIA)

```
24 ~~~{r}  
25 analysis1 <- select(med, X1, X4, Y1)  
26 cor(anaysis1)  
27 ~~~
```

	X1	X4	Y1
X1	1.00000000	0.04344289	0.3465506
X4	0.04344289	1.00000000	0.4104644
Y1	0.34655064	0.41046440	1.00000000

Negligible  
correlation

$r_{xy} = .3466$  (c path)

$r_{xm} = .0434$  (a path)

$r_{my} = .4105$  (b path)



ANALYSIS 2: TEST THE HYPOTHESIS THAT **X4** MEDIATES THE  
RELATIONSHIP BETWEEN **X3** AND **Y1**

## STEP 1: DETERMINE IF MEDIATION IS PLAUSIBLE, BASED ON THE BARON & KENNY CRITERIA

```
24 ~~~ {r}  
25 analysis2 <- select(med, x3, x4, y1)  
26 cor(analys2)  
27 ~
```

	X3	X4	Y1
X3	1.0000000	0.3424691	0.5053060
X4	0.3424691	1.0000000	0.4104644
Y1	0.5053060	0.4104644	1.0000000

**rx<sub>y</sub> = .5053 (c path)**

**rx<sub>m</sub> = .3425 (a path)**

**r<sub>m</sub>y = .4105 (b path)**

## DO WE HAVE JUSTIFICATION TO TEST THE MEDIATION HYPOTHESIS? (BARON & KENNY CRITERIA)

```
24 ~~~ {r}  
25 analysis2 <- select(med, x3, x4, y1)  
26 cor(analysis2)  
27 ~
```

	X3	X4	Y1
X3	1.00000000	0.3424691	0.5053060
X4	0.3424691	1.00000000	0.4104644
Y1	0.5053060	0.4104644	1.00000000

**rx<sub>y</sub> = .5053 (c path)**

**rx<sub>m</sub> = .3425 (a path)**

**r<sub>m</sub>y = .4105 (b path)**



## DO WE HAVE JUSTIFICATION TO TEST THE MEDIATION HYPOTHESIS? (BARON & KENNY CRITERIA)

```
24 ~~~ {r}
25 analysis2 <- select(med, x3, x4, y1)
26 cor(analysis2)
27 ~
```

**YES!**

	X3	X4	Y1
X3	1.000000	0.3424691	0.5053060
X4	0.3424691	1.0000000	0.4104644
Y1	0.5053060	0.4104644	1.0000000

All paths have moderate correlations

**rx<sub>y</sub> = .5053 (c path)**

**rx<sub>m</sub> = .3425 (a path)**

**r<sub>m</sub>y = .4105 (b path)**

# STEP 2: USE SEMI-PARTIAL CORRELATION TO EXAMINE CORRELATION BETWEEN X AND Y WHEN PARTIALLING OUT THE EFFECT OF THE MEDIATOR

```
40
41 {r}
42 spcor.test(x = med$x3, y = med$y1, z = med$x4)
43
```

estimate<dbl>	p.value<dbl>	statistic<dbl>	n<int>	gp<dbl>	Method<fctr>
0.3999824	2.030191e-24	10.66313	600	1	pearson
1 row					

(Baron & Kenny Criteria, continued)

## STEP 2.1: COMPARE SEMI-PARTIAL CORRELATION TO RXY (BARON & KENNY CRITERIA)

```
40  
41 {r}  
42 spcor.test(x = med$x3, y = med$y1, z = med$x4)  
43
```

estimate <dbl>	p.value <dbl>	statistic <dbl>	n <int>	gp <dbl>	Method <fctr>
0.3999824	2.030191e-24	10.66313	600	1	pearson
1 row					

Compare to  $r_{xy} = .5053$  (from previous slide)

$r_{y(x.m)} = 0.3999$ . This is 0.11 smaller than  $r_{xy}$  (0.5053), indicating that partial mediation is plausible. In other words, there is a portion of the relation between  $x$  and  $y$  that involves  $m$ .

## STEP 3: TEST MEDIATION MODEL VIA PSYCH::MEDIATE

```
59 - ### mediate in psych
60 - ```{r}
61
62   fitmed <- psych::mediate(Y1 ~ X3 + (X4), data = med)
63   summary(fitmed)
64
65   ...
```

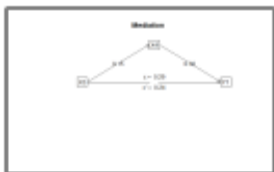
- × **psych::mediate**: mediate function (via psych package)
- × **Y1**: Outcome variable
- × **X3**: Predictor variable
- × **(X4)**: Mediator variable (keep it enclosed in parentheses)
- × **data = med**: dataset

```

59 ▾ ### mediate in psych
60 ▾ ```{r}
61
62 fitmed <- psych::mediate(Y1 ~ X3 + (X4), data = med)
63 summary(fitmed)
64
65 ...

```

1



2

```

Call: psych::mediate(y1 ~ X3 + (X4), data = med)
Direct effect estimates (Standardized regression)  (n=7)
a = 0.36, b = 0.32, c = 0.29, d = 0.00, e = 0.00, f = 0.00, g = 0.00, h = 0.00, i = 0.00, j = 0.00, k = 0.00, l = 0.00, m = 0.00, n = 0.00, o = 0.00, p = 0.00, q = 0.00, r = 0.00, s = 0.00, t = 0.00, u = 0.00, v = 0.00, w = 0.00, x = 0.00, y = 0.00, z = 0.00, aa = 0.00, ab = 0.00, ac = 0.00, ad = 0.00, ae = 0.00, af = 0.00, ag = 0.00, ah = 0.00, ai = 0.00, aj = 0.00, ak = 0.00, al = 0.00, am = 0.00, an = 0.00, ao = 0.00, ap = 0.00, aq = 0.00, ar = 0.00, as = 0.00, at = 0.00, au = 0.00, av = 0.00, aw = 0.00, ax = 0.00, ay = 0.00, az = 0.00, ba = 0.00, bb = 0.00, bc = 0.00, bd = 0.00, be = 0.00, bf = 0.00, bg = 0.00, bh = 0.00, bi = 0.00, bj = 0.00, bk = 0.00, bl = 0.00, bm = 0.00, bn = 0.00, bo = 0.00, bp = 0.00, bq = 0.00, br = 0.00, bs = 0.00, bt = 0.00, bu = 0.00, bv = 0.00, bw = 0.00, bx = 0.00, by = 0.00, bz = 0.00, ca = 0.00, cb = 0.00, cc = 0.00, cd = 0.00, ce = 0.00, cf = 0.00, cg = 0.00, ch = 0.00, ci = 0.00, cj = 0.00, ck = 0.00, cl = 0.00, cm = 0.00, cn = 0.00, co = 0.00, cp = 0.00, cq = 0.00, cr = 0.00, cs = 0.00, ct = 0.00, cu = 0.00, cv = 0.00, cw = 0.00, cx = 0.00, cy = 0.00, cz = 0.00, da = 0.00, db = 0.00, dc = 0.00, dd = 0.00, de = 0.00, df = 0.00, dg = 0.00, dh = 0.00, di = 0.00, dj = 0.00, dk = 0.00, dl = 0.00, dm = 0.00, dn = 0.00, do = 0.00, dp = 0.00, dq = 0.00, dr = 0.00, ds = 0.00, dt = 0.00, du = 0.00, dv = 0.00, dw = 0.00, dx = 0.00, dy = 0.00, dz = 0.00, ea = 0.00, eb = 0.00, ec = 0.00, ed = 0.00, ee = 0.00, ef = 0.00, eg = 0.00, eh = 0.00, ei = 0.00, ej = 0.00, ek = 0.00, el = 0.00, em = 0.00, en = 0.00, eo = 0.00, ep = 0.00, eq = 0.00, er = 0.00, es = 0.00, et = 0.00, eu = 0.00, ev = 0.00, ew = 0.00, ex = 0.00, ey = 0.00, ez = 0.00, fa = 0.00, fb = 0.00, fc = 0.00, fd = 0.00, fe = 0.00, ff = 0.00, fg = 0.00, fh = 0.00, fi = 0.00, fj = 0.00, fk = 0.00, fl = 0.00, fm = 0.00, fn = 0.00, fo = 0.00, fp = 0.00, fq = 0.00, fr = 0.00, fs = 0.00, ft = 0.00, fu = 0.00, fv = 0.00, fw = 0.00, fx = 0.00, fy = 0.00, fz = 0.00, ga = 0.00, gb = 0.00, gc = 0.00, gd = 0.00, ge = 0.00, gf = 0.00, gg = 0.00, gh = 0.00, gi = 0.00, gj = 0.00, gk = 0.00, gl = 0.00, gm = 0.00, gn = 0.00, go = 0.00, gp = 0.00, gq = 0.00, gr = 0.00, gs = 0.00, gt = 0.00, gu = 0.00, gv = 0.00, gw = 0.00, gx = 0.00, gy = 0.00, gz = 0.00, ha = 0.00, hb = 0.00, hc = 0.00, hd = 0.00, he = 0.00, hf = 0.00, hg = 0.00, hh = 0.00, hi = 0.00, hj = 0.00, hk = 0.00, hl = 0.00, hm = 0.00, hn = 0.00, ho = 0.00, hp = 0.00, hq = 0.00, hr = 0.00, hs = 0.00, ht = 0.00, hu = 0.00, hv = 0.00, hw = 0.00, hx = 0.00, hy = 0.00, hz = 0.00, ia = 0.00, ib = 0.00, ic = 0.00, id = 0.00, ie = 0.00, if = 0.00, ig = 0.00, ih = 0.00, ii = 0.00, ij = 0.00, ik = 0.00, il = 0.00, im = 0.00, in = 0.00, io = 0.00, ip = 0.00, iq = 0.00, ir = 0.00, is = 0.00, it = 0.00, iu = 0.00, iv = 0.00, iw = 0.00, ix = 0.00, iy = 0.00, iz = 0.00, ja = 0.00, jb = 0.00, jc = 0.00, jd = 0.00, je = 0.00, jf = 0.00, jg = 0.00, jh = 0.00, ji = 0.00, jj = 0.00, jk = 0.00, jl = 0.00, jm = 0.00, jn = 0.00, jo = 0.00, jp = 0.00, jq = 0.00, jr = 0.00, js = 0.00, jt = 0.00, ju = 0.00, jv = 0.00, jw = 0.00, jx = 0.00, jy = 0.00, jz = 0.00, ka = 0.00, kb = 0.00, kc = 0.00, kd = 0.00, ke = 0.00, kf = 0.00, kg = 0.00, kh = 0.00, ki = 0.00, kj = 0.00, kk = 0.00, kl = 0.00, km = 0.00, kn = 0.00, ko = 0.00, kp = 0.00, kq = 0.00, kr = 0.00, ks = 0.00, kt = 0.00, ku = 0.00, kv = 0.00, kw = 0.00, kx = 0.00, ky = 0.00, kz = 0.00, la = 0.00, lb = 0.00, lc = 0.00, ld = 0.00, le = 0.00, lf = 0.00, lg = 0.00, lh = 0.00, li = 0.00, lj = 0.00, lk = 0.00, ll = 0.00, lm = 0.00, ln = 0.00, lo = 0.00, lp = 0.00, lq = 0.00, lr = 0.00, ls = 0.00, lt = 0.00, lu = 0.00, lv = 0.00, lw = 0.00, lx = 0.00, ly = 0.00, lz = 0.00, ma = 0.00, mb = 0.00, mc = 0.00, md = 0.00, me = 0.00, mf = 0.00, mg = 0.00, mh = 0.00, mi = 0.00, mj = 0.00, mk = 0.00, ml = 0.00, mm = 0.00, mn = 0.00, mo = 0.00, mp = 0.00, mq = 0.00, mr = 0.00, ms = 0.00, mt = 0.00, mu = 0.00, mv = 0.00, mw = 0.00, mx = 0.00, my = 0.00, mz = 0.00, na = 0.00, nb = 0.00, nc = 0.00, nd = 0.00, ne = 0.00, nf = 0.00, ng = 0.00, nh = 0.00, ni = 0.00, nj = 0.00, nk = 0.00, nl = 0.00, nm = 0.00, nn = 0.00, no = 0.00, np = 0.00, nq = 0.00, nr = 0.00, ns = 0.00, nt = 0.00, nu = 0.00, nv = 0.00, nw = 0.00, nx = 0.00, ny = 0.00, nz = 0.00, oa = 0.00, ob = 0.00, oc = 0.00, od = 0.00, oe = 0.00, of = 0.00, og = 0.00, oh = 0.00, oi = 0.00, oj = 0.00, ok = 0.00, ol = 0.00, om = 0.00, on = 0.00, oo = 0.00, op = 0.00, oq = 0.00, or = 0.00, os = 0.00, ot = 0.00, ou = 0.00, ov = 0.00, ow = 0.00, ox = 0.00, oy = 0.00, oz = 0.00, pa = 0.00, pb = 0.00, pc = 0.00, pd = 0.00, pe = 0.00, pf = 0.00, pg = 0.00, ph = 0.00, pi = 0.00, pj = 0.00, pk = 0.00, pl = 0.00, pm = 0.00, pn = 0.00, po = 0.00, pp = 0.00, pq = 0.00, pr = 0.00, ps = 0.00, pt = 0.00, pu = 0.00, pv = 0.00, pw = 0.00, px = 0.00, py = 0.00, pz = 0.00, qa = 0.00, qb = 0.00, qc = 0.00, qd = 0.00, qe = 0.00, qf = 0.00, qg = 0.00, qh = 0.00, qi = 0.00, qj = 0.00, qk = 0.00, ql = 0.00, qm = 0.00, qn = 0.00, qo = 0.00, qp = 0.00, qq = 0.00, qr = 0.00, qs = 0.00, qt = 0.00, qu = 0.00, qv = 0.00, qw = 0.00, qx = 0.00, qy = 0.00, qz = 0.00, ra = 0.00, rb = 0.00, rc = 0.00, rd = 0.00, re = 0.00, rf = 0.00, rg = 0.00, rh = 0.00, ri = 0.00, rj = 0.00, rk = 0.00, rl = 0.00, rm = 0.00, rn = 0.00, ro = 0.00, rp = 0.00, rq = 0.00, rr = 0.00, rs = 0.00, rt = 0.00, ru = 0.00, rv = 0.00, rw = 0.00, rx = 0.00, ry = 0.00, rz = 0.00, sa = 0.00, sb = 0.00, sc = 0.00, sd = 0.00, se = 0.00, sf = 0.00, sg = 0.00, sh = 0.00, si = 0.00, sj = 0.00, sk = 0.00, sl = 0.00, sm = 0.00, sn = 0.00, so = 0.00, sp = 0.00, sq = 0.00, sr = 0.00, ss = 0.00, st = 0.00, su = 0.00, sv = 0.00, sw = 0.00, sx = 0.00, sy = 0.00, sz = 0.00, ta = 0.00, tb = 0.00, tc = 0.00, td = 0.00, te = 0.00, tf = 0.00, tg = 0.00, th = 0.00, ti = 0.00, tj = 0.00, tk = 0.00, tl = 0.00, tm = 0.00, tn = 0.00, to = 0.00, tp = 0.00, tq = 0.00, tr = 0.00, ts = 0.00, tt = 0.00, tu = 0.00, tv = 0.00, tw = 0.00, tx = 0.00, ty = 0.00, tz = 0.00, ua = 0.00, ub = 0.00, uc = 0.00, ud = 0.00, ue = 0.00, uf = 0.00, ug = 0.00, uh = 0.00, ui = 0.00, uj = 0.00, uk = 0.00, ul = 0.00, um = 0.00, un = 0.00, uo = 0.00, up = 0.00, uq = 0.00, ur = 0.00, us = 0.00, ut = 0.00, uu = 0.00, uv = 0.00, uw = 0.00, ux = 0.00, uy = 0.00, uz = 0.00, va = 0.00, vb = 0.00, vc = 0.00, vd = 0.00, ve = 0.00, vf = 0.00, vg = 0.00, vh = 0.00, vi = 0.00, vj = 0.00, vk = 0.00, vl = 0.00, vm = 0.00, vn = 0.00, vo = 0.00, vp = 0.00, vq = 0.00, vr = 0.00, vs = 0.00, vt = 0.00, vu = 0.00, vv = 0.00, vw = 0.00, vx = 0.00, vy = 0.00, vz = 0.00, wa = 0.00, wb = 0.00, wc = 0.00, wd = 0.00, we = 0.00, wf = 0.00, wg = 0.00, wh = 0.00, wi = 0.00, wj = 0.00, wk = 0.00, wl = 0.00, wm = 0.00, wn = 0.00, wo = 0.00, wp = 0.00, wq = 0.00, wr = 0.00, ws = 0.00, wt = 0.00, wu = 0.00, wv = 0.00, ww = 0.00, wx = 0.00, wy = 0.00, wz = 0.00, xa = 0.00, xb = 0.00, xc = 0.00, xd = 0.00, xe = 0.00, xf = 0.00, xg = 0.00, xh = 0.00, xi = 0.00, xj = 0.00, xk = 0.00, xl = 0.00, xm = 0.00, xn = 0.00, xo = 0.00, xp = 0.00, xq = 0.00, xr = 0.00, xs = 0.00, xt = 0.00, xu = 0.00, xv = 0.00, xw = 0.00, xx = 0.00, xy = 0.00, xz = 0.00, ya = 0.00, yb = 0.00, yc = 0.00, yd = 0.00, ye = 0.00, yf = 0.00, yg = 0.00, yh = 0.00, yi = 0.00, yj = 0.00, yk = 0.00, yl = 0.00, ym = 0.00, yn = 0.00, yo = 0.00, yp = 0.00, yq = 0.00, yr = 0.00, ys = 0.00, yt = 0.00, yu = 0.00, yv = 0.00, yw = 0.00, yx = 0.00, yy = 0.00, yz = 0.00, za = 0.00, zb = 0.00, zc = 0.00, zd = 0.00, ze = 0.00, zf = 0.00, zg = 0.00, zh = 0.00, zi = 0.00, zj = 0.00, zk = 0.00, zl = 0.00, zm = 0.00, zn = 0.00, zo = 0.00, zp = 0.00, zq = 0.00, zr = 0.00, zs = 0.00, zt = 0.00, zu = 0.00, zv = 0.00, zw = 0.00, zx = 0.00, zy = 0.00, zz = 0.00

```

3

```

data.frame
3 x 5

```

4

```

data.frame
1 x 5

```

5

```

data.frame
2 x 5

```

6

```

data.frame
1 x 5

```

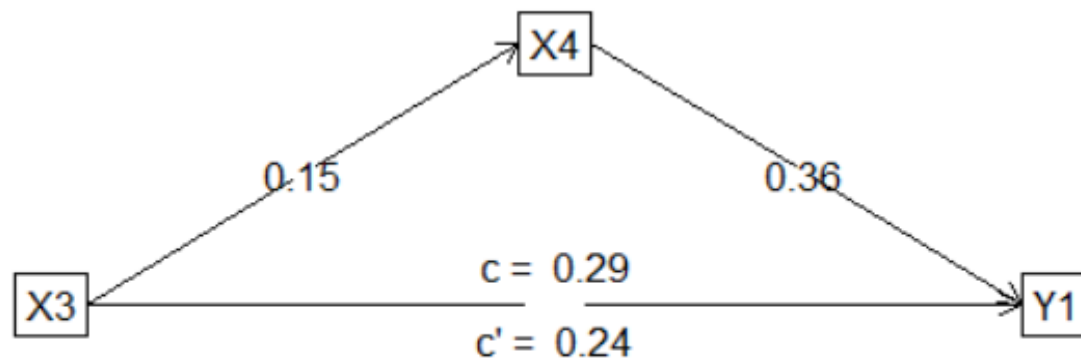
7

```

data.frame
1 x 5

```

## Mediation



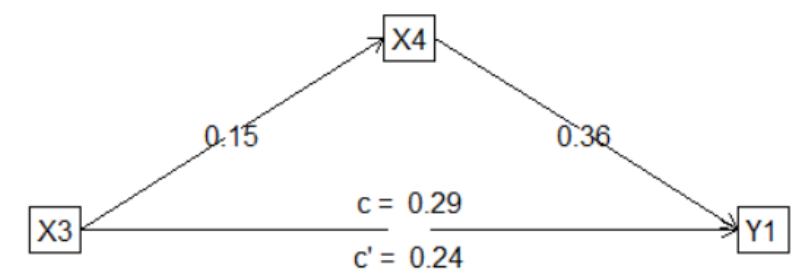
## WINDOWS

1. Model diagram with paths
2. Function call
3. c' path
4. c path
5. a path
6. b path
7. ab bootstrapped results (indirect effect)

# PSYCH::MEDIATE OUTPUT WINDOWS

## 1: Diagram

### Mediation



Call: psych::mediate(y = Y1 ~ X3 + (X4), data = med)

Direct effect estimates (traditional regression) (c')

R = 0.56 R2 = 0.32 F = 139.95 on 2 and 597 DF p-value: 1.44e-50

Total effect estimates (c)

'a' effect estimates

'b' effect estimates

'ab' effect estimates (through mediators)

## 2: Function

### Call

## 3: c' path

	Y1<dbl>
Intercept	1.52
X3	0.24
X4	0.36

3 rows

## 4: c path

	Y1<dbl>
X3	0.29

1 row

## 5: a path

	X4<dbl>
Intercept	2.15
X3	0.15

2 rows

## 6: b path

	Y1<dbl>
X4	0.36

1 row

## 7: a\*b path bootstrapped analysis (indirect effect)

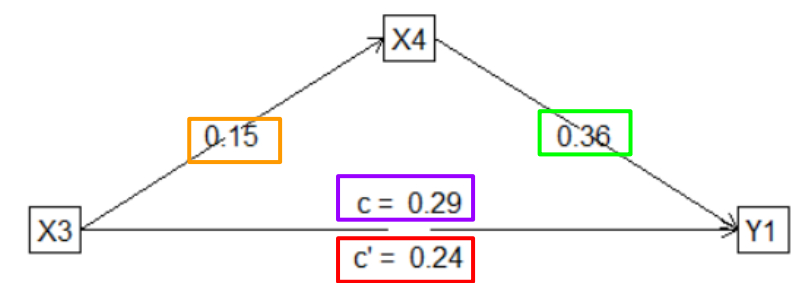
	Y1	boot	sd	lower	upper
			<dbl>	<dbl>	<dbl>
X3	0.05	0.05	0.01	0.04	0.07

1 row

# PSYCH::MEDIATE OUTPUT WINDOWS

## 1: Diagram

### Mediation



Call: psych::mediate(y = Y1 ~ X3 + (X4), data = med)

Direct effect estimates (traditional regression) (c')

R = 0.56 R2 = 0.32 F = 139.95 on 2 and 597 DF p-value: 1.44e-50

Total effect estimates (c)

'a' effect estimates

'b' effect estimates

'ab' effect estimates (through mediators)

## 2: Function Call

## 3: c' path

	Y1 <dbl>
Intercept	1.52
X3	0.24
X4	0.36

3 rows

## 4: c path

	Y1 <dbl>
X3	0.29

1 row

## 5: a path

	X4 <dbl>
Intercept	2.15
X3	0.15

2 rows

## 6: b path

	Y1 <dbl>
X4	0.36

1 row

## 7: a\*b path bootstrapped analysis (indirect effect)

	boot <dbl>	sd <dbl>	lower <dbl>	upper <dbl>
X3	0.05	0.01	0.04	0.07

1 row

Bootstrapped estimate

Evidence of partial mediation

# PSYCH::MEDIATE A\*B INTERPRETATION

To evaluate if the indirect effect is significant:

## Output Window 7: a\*b path bootstrapped analysis (indirect effect)

	Y1 <dbl>	boot <dbl>	sd <dbl>	lower <dbl>	upper <dbl>
X3	0.05	0.05	0.01	0.04	0.07
1 row					

**Does the bootstrapped confidence interval for the indirect effect (aka a path estimate \* b path estimate) contain zero?**

**In this case it does not, indicating that X4 partially mediates the relation between X3 and Y1.**

You can calculate the proportion of the relation of Y1 on X3 that is mediated by X4 by dividing the indirect effect by the total effect:

Proportion mediated =  $(a*b)/c$

Proportion mediated =  $0.054/0.29 = .1862$ . 18.6% of the effect is mediated.



## STEP 4: TEST MEDIATION VIA MEDIATION::MEDIATE

```
69 ## Mediate in mediation package
```

```
70 ```{r}
```

```
71 fitM <- lm(X4 ~ X3, data = med)
```

```
72 fitY <- lm(Y1 ~ X3 + X4, data = med)
```

```
73
```

```
74
```

```
75 fitmed <- mediation::mediate(fitM, fitY, treat = "X3", mediator = "X4")
```

```
76 summary(fitmed)
```

```
77
```

```
78 ```
```

Causal Mediation Analysis

Quasi-Bayesian Confidence Intervals

	Estimate	95% CI Lower	95% CI Upper	p-value
ACME	0.0535	0.0366	0.07	<2e-16 ***
ADE	0.2405	0.2002	0.28	<2e-16 ***
Total Effect	0.2940	0.2515	0.33	<2e-16 ***
Prop. Mediated	0.1806	0.1246	0.24	<2e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Sample Size Used: 600

Simulations: 1000

× Regress mediator variable (X4) on predictor variable (X3)

× Regress outcome variable (Y1) on predictor (X3) and mediator (X4)

× Use mediation::mediate to test models for mediation. Indicate predictor variable (treat = "X3") and mediator variable (mediator = "X4")

This is an alternative function for testing mediation. Both work!

## STEP 4: TEST MEDIATION VIA MEDIATION::MEDIATE

```
69 ## Mediate in mediation package
70 ```{r}
71 fitM <- lm(X4 ~ X3, data = med)
72 fitY <- lm(Y1 ~ X3 + X4, data = med)
73
74
75 fitmed <- mediation::mediate(fitM, fitY, treat = "X3", mediator = "X4")
76 summary(fitmed)
77
78 ```
```

### Causal Mediation Analysis

#### Quasi-Bayesian Confidence Intervals

	Estimate	95% CI Lower	95% CI Upper	p-value
ACME	0.0535	0.0366	0.07	<2e-16 ***
ADE	0.2405	0.2002	0.28	<2e-16 ***
Total Effect	0.2940	0.2515	0.33	<2e-16 ***
Prop. Mediated	0.1806	0.1246	0.24	<2e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Sample Size Used: 600

Simulations: 1000

**ACME:** "Average Causal Mediated Effect." This is the effect of the mediator alone (ab bootstrapped; equivalent to window 7 via `psych::mediate`)

**ADE:** "Average Direct Effect" (c' path; equivalent to window 3 via `psych::mediate`)

**Total Effect:** c path (equivalent to window 4 via `psych::mediate`)

**Prop. Mediated:** Proportion of variance explained by the mediator. (*a path \* b path*) / c path