## **Supplementary Materials**

## S1. Analyzing the relationship between ratio acuities measured by Weber fraction and math abilities.

We conducted supplementary analyses to explore whether results would change when we used weber fractions (*w*s) in place of accuracy as measures of nonsymbolic ratio acuity. Specifically, we re-calculated bivariate correlations, (with and without list-wise deletion Table S1 and S3; Figure S1) and re-conducted hierarchical regressions (Table S4) using weber fractions. For these analyses, the trimmed sample resulted in 74 participants for weber fractions for models predicting FKA, algebra, math fundamentals, and trigonometry. For models predicting symbolic fraction comparison, an additional 3 participants were excluded for below chance level performance, resulting in analytic samples of 71 participants.

Results with *ws* were consistent with our main text results and highlighted the relationship between line acuity and symbolic math abilities. This was true of bivariate correlations (FKA: r = -.29, p = .011, Math Fundamental: r = -.25, p = .027, Trig: r = -.23, p = .046). It was also true of regressions, with line ratio significantly predicting FKA ( $\beta = -.364$ , p = .007), algebra( $\beta = -.265$ , p = .048), math fundamentals ( $\beta = -.264$ , p = .046), and trigonometry ( $\beta = -.288$ , p = .035) before Raven's scores were added to the models. When Raven's was entered, line ratio no longer significant predicted any outcomes other than Math Fundamentals ( $\beta = -.289$ , p = .029).



	Circle Ratio	Dot Ratio	Line	Circle	Dot	FF	Inhibition	FKA	ALG	MF	Trig	Raven
Line Ratio	.42**	.29*	.07	.02	.15	04	.12	29*	20	26*	<b>-</b> .23 <sup>*</sup>	28**
Circle Ratio		.31**	.25*	.41**	.41**	10	.06	01	06	14	08	21
Dot Ratio			08	.09	.17	.21	.12	.09	.15	.16	.13	.08
Line				.23*	.20	.13	.05	.00	10	06	08	27**
Circle					.13	07	.02	.12	.02	.08	.00	.03
Dot						.17	.07	04	21	10	12	12
FF							02	.13	.10	.24*	.02	.06
Inhibition								07	.00	10	06	19
FKA									.50**	.43**	.41**	.37**
ALG										.80**	.71**	.43**
MF											.65**	.40**
Trig												.32**
Note, FF = fra	ction compari	son, FKA = frac	tional know	wledge, AL	G = algeb	ora, MF =	math fundan	nental, T	rig = Trig	onometry		

 Table S1. Bivariate correlation among ws from comparison tasks and tests (n=74, except for FF: n= 71).

Note, FF = fraction comparison, FKA = fractional knowledge, ALG = algeb  $p < .05, *^{*}p < .01$ 

	Ratio Line	Ratio Circle	Ratio Dot	Line	Circle	Dot	FF	Inhibition	FKA	ALG	MF	Trig	Raven
RPS composite	.78**	.53**	.89**	.46**	.31**	.40**	.20	07	.23*	.18+	.25*	.21*	.29**
Line Ratio		.39**	.40**	.26*	.04	.19+	.19	09	.35**	.32**	.37**	.31**	.33**
Circle Ratio			.51**	.20+	.01	.22	.02	10	.19+	.01	.09	.06	.12
Dot Ratio				.48**	.40**	.43**	.20	07	.13	.06	.13	.11	.22*
Line					.47**	.33**	.04	09	.02	.10	.07	.01	.16
Circle						.25*	.07	01	13	.02	09	02	10
Dot							04	.01	.03	.22*	.17	.14	.14
FF								07	.38**	.27*	.42**	.22*	.15
Inhibition									11	11	16	11	23
FKA										.55**	.57**	.51**	.39**
ALG											.84**	.75**	.45**
MF											-	72**	<i>Δ</i> Δ**
Trig												.12	.36**

**Table S2.** Bivariate correlation among accuracies from comparison tasks and tests without using a list-wise deletion.

Note, FF = fraction comparison, FKA = fractional knowledge, ALG = algebra, MF = math fundamental, Trig = Trigonometry \*p < .05, \*\*p < .01

	Ratio Circle	Ratio Dot	Line	Circle	Dot	FF	Inhibition	FKA	ALG	MF	Trig	Raven
Line Ratio	.39**	.31**	.13	.05	.20+	24*	.11	45**	34**	40**	34**	35**
Circle Ratio		.31**	.26*	.42**	.38**	10	.06	01	06	11	08	24*
Dot Ratio			05	.03	.17	.13	.16	01	.09	.08	.09	08
Line				.22*	.16	.03	.03	06	09	07	06	23*
Circle					.19+	05	03	.15	.04	.09	.02	.07
Dot						.11	<.01	03	21*	12	13	14
FF							07	.38**	.27*	.42**	.22*	.15
Inhibition								11	11	16	11	23 <sup>*</sup>
FKA									.55**	.57**	.51**	.39**
ALG										.84**	.75**	.45**
MF											.72**	.44**
Trig												.36**
Note, FF = fract	ion compari	son, FKA = fract	ional know	ledge, AL	G = alge	bra, MF =	= math funda	amental,	Trig = Tri	igonometi	ry	

**Table S3.** Bivariate correlation among *ws* from comparison tasks and tests without using a list-wise deletion.

owiedge, ALG = a ıg uy ig \*p <.05, \*\*p <.01

**Table S4 a-e**. Results from the hierarchical regression analyses predicting scores on Symbolic fraction comparison, FKA, Algebra, Math Fundamentals, and Trigonometry (*ws*, n= 74, except for symbolic fraction comparison).

			- <b>,</b>				/			
		Step 1 <i>R</i> <sup>2</sup> = .06			Step 2 ∆ <i>R</i> <sup>2</sup> =.10		Step 3 ∆ <i>R</i> ² =.001			
	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>	
Line	.132	.299	.016	.204	.106	.036	.213	.104	.037	
Circle	128	.309	.015	060	.650	.003	065	.629	.003	
Dot	.172	.166	.028	.220	.089	.040	.222	.090	.040	
Inhibition	043	.719	.002	061	.605	.004	055	.647	.003	
Line Ratio				036	.788	.001	026	.850	.000	
Circle Ratio				288	.072	.045	283	.082	.042	
Dot Ratio				.292	.024*	.071	.284	.033*	.064	
Raven							.038	.773	.001	

a. Symbolic Fraction Comparison (n=71)

p<.01\*\*, p<.05\*; Line = Line acuity, Circle = Circle acuity, Dot = Dot acuity, Line Ratio = Line ratio acuity, Circle Ratio = Circle ratio acuity, Dot Ratio = Dot ratio acuity.

	b. Fractional Knowledge												
		Step 1			Step 2		Step 3						
		$R^2 = .02$			$\Delta R^2 = .11$			$\Delta R^2 = .08$					
	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>				
Line	020	.873	.000	.014	.911	.000	.082	.497	.006				
Circle	.135	.274	.017	.088	.498	.006	.045	.723	.002				
Dot	048	.693	.002	057	.653	.003	051	.676	.002				
Inhibition	065	.588	.004	046	.695	.002	.007	.948	.000				
Line Ratio				364	.007*	.100	289	.029*	.060				
Circle Ratio				.076	.628	.003	.123	.416	.008				
Dot Ratio				.177	.163	.026	.118	.337	.011				
Raven							.316	.013*	.079				

p<.01\*\*, p<.05\*; Line = Line acuity, Circle = Circle acuity, Dot = Dot acuity, Line Ratio = Line ratio acuity, Circle Ratio = Circle ratio acuity, Dot Ratio = Dot ratio acuity.

	c. Algebra												
Step 1Step 2Step 3													
		$R^2 = .05$			$\Delta R^{2}=.08$			$\Delta R^2 = .13$					
	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>				
Line	078	.526	.006	040	.746	.001	.047	.689	.002				
Circle	.063	.601	.004	.013	.923	.000	042	.728	.001				
Dot	200	.100	.038	232	.072	.044	224	.062	.041				
Inhibition	.011	.927	.000	.012	.916	.000	.079	.472	.006				
Line Ratio				265	.048*	.053	170	.181	.021				
Circle Ratio				.073	.641	.003	.133	.365	.009				
Dot Ratio				.237	.063	.047	.163	.174	.021				
Raven							.400	.001**	.126				

p<.01\*\*, p<.05\*; Line = Line acuity, Circle = Circle acuity, Dot = Dot acuity, Line Ratio = Line ratio acuity, Circle Ratio = Circle ratio acuity, Dot Ratio = Dot ratio acuity.

	d. Math Fundamentals												
		Step 1 $R^2 = 03$			Step 2 $AB^2 = 13$		Step 3 $AP^2 = 08$						
	β	<u>р</u>	sr <sup>2</sup>	β	р	sr <sup>2</sup>	β	<u>р</u>	sr <sup>2</sup>				
Line	063	.611	.004	.006	.959	.000	.074	.533	.005				
Circle	.105	.393	.010	.121	.346	.012	.078	.530	.005				
Dot	097	.427	.009	066	.602	.003	059	.622	.003				
Inhibition	096	.420	.009	095	.408	.009	043	.704	.002				
Line Ratio				264	.046*	.052	189	.145	.026				
Circle Ratio				140	.366	.011	092	.536	.005				
Dot Ratio				.291	.022*	.071	.233	.058	.044				
Raven							.314	.012*	.078				

p<.01\*\*, p<.05\*; Line = Line acuity, Circle = Circle acuity, Dot = Dot acuity, Line Ratio = Line ratio acuity, Circle Ratio = Circle ratio acuity, Dot Ratio = Dot ratio acuity.

	e. Trigonometry												
		Step 1 <i>R</i> <sup>2</sup> = .02			Step 2 ∆ <i>R</i> <sup>2</sup> =.09		Step 3 ∆ <i>R</i> <sup>2</sup> =.05						
	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>	β	р	sr <sup>2</sup>				
Line	059	.635	.003	016	.896	.000	.038	.759	.001				
Circle	.033	.788	.001	003	.984	.000	037	.775	.001				
Dot	108	.379	.011	120	.352	.012	116	.362	.011				
Inhibition	050	.676	.002	044	.709	.002	002	.989	.000				
Line Ratio				288	.035*	.063	228	.094	.037				
Circle Ratio				.029	.852	.000	.068	.666	.002				
Dot Ratio				.230	.075	.044	.183	.152	.027				
Raven							.252	.053+	.050				

p<.01\*\*, p<.05\*; Line = Line acuity, Circle = Circle acuity, Dot = Dot acuity, Line Ratio = Line ratio acuity, Circle Ratio = Circle ratio acuity, Dot Ratio = Dot ratio acuity.

	Symbolic Fraction Comparison (with acc, n=84)												
		Step 1			Step 2								
		<i>R</i> <sup>2</sup> = .02			$\Delta R^{2}$ =.09								
	β	р	sr <sup>2</sup>	β	p	sr <sup>2</sup>							
Line	.028	.831	.001	066	.635	.003							
Circle	.124	.337	.012	.078	.568	.004							
Dot	118	.329	.012	188	.136	.027							
Inhibition	036	.750	.001	028	.799	.001							
Line Ratio				.168	.194	.020							
Circle Ratio				139	.297	.013							
Dot Ratio				.252	.125	.029							

**Table S5**. Results from the hierarchical regression analyses predicting scores on Symbolicfraction comparison without including Raven.