

## Supplementary materials

**Table S1** Sample characteristics

Characteristics	Pakistan	China
<b>Age (years)</b>		
M	29.83	28.30
SD	04.77	4.80
<b>Gender (%)</b>		
Female	39.6	49.1
Male	60.4	50.9
<b>Education (%)</b>		
High school/college	4.8	4.7
Graduation	47.2	25.7
Postgraduate	42.4	51.4
Other	5.6	18.2
<b>Occupation (%)</b>		
Student	37.4	75.5
Employee/part-time work	36.5	19.4
Self-employed/own business	16.9	4.1
Other	9.3	1.1
<b>Monthly income (%)</b>		
Under 5,000 PKR	14.3	—
5,000–9,999 PKR	26.1	—
10,000–19,999 PKR	21.1	—
20,000–39,999 PKR	13.8	—
Over 40,000 PKR	24.7	—
Under 1,000 CNY	—	6.5
1,000–2,000 CNY	—	25.5
2,001–3,000 CNY	—	34.7
3,001–5,000 CNY	—	17.3
5,001–8,000 CNY	—	9.2
8,001–10,000 CNY	—	4.5
Over 10,000 CNY	—	2.3

Note: Sample size for Pakistan, N=356; China, N=444.

**Table S2** Scales reliability

	Constructs	Items	Pakistan	Chinese
1.	Aesthetic design	03	0.835	0.960
2.	Functional design	03	0.880	0.979
3.	Symbolic design	03	0.936	0.959
4.	Self-determined need satisfaction	12	0.873	0.804
5.	Self-determined need frustration	12	0.786	0.777
6.	Willingness-to-pay a premium price	03	0.806	0.881
7.	Negative word-of-mouth	03	0.894	0.886

**Table S3** Factor loadings of exploratory factor analysis for 11-factor model (data from Pakistan)

Items	<b>SDRF</b>	<b>SDCF</b>	<b>SDAF</b>	<b>SDAS</b>	<b>SDRS</b>	<b>SDCS</b>	<b>SD</b>	<b>NWOM</b>	<b>FD</b>	<b>AD</b>	<b>WTPP</b>
RF3	0.967										
RF4	0.958										
RF2	0.953										
RF1	0.920										
CF3		0.943									
CF2		0.937									
CF4		0.933									
CF1		0.858									
AF3			0.948								
AF2			0.932								
AF4			0.895								
AF1			0.894								
AS2				0.823							
AS3				0.822							
AS4				0.811							
AS1				0.789							
RS4					0.794						
RS1					0.765						
RS2					0.763						
RS3					0.762						
CS3						0.827					
CS4						0.804					
CS2						0.765					
CS1						0.761					
SD3							0.923				
SD2							0.921				
SD1							0.858				
NWOM3								0.901			
NWOM1								0.882			
NWOM2								0.800			
FD1									0.900		
FD3									0.870		
FD2									0.846		
AD1										0.816	
AD3										0.800	
AD2										0.765	
WTPP3											0.828
WTPP1											0.810
WTPP2											0.809
Reliability coefficients	0.967	0.942	0.940	0.915	0.852	0.844	0.936	0.894	0.880	0.835	0.806
Eigenvalue	8.14	3.95	3.51	3.31	2.41	2.20	1.99	1.80	1.63	1.58	0.94
% of variance	9.39	8.89	8.77	8.015	7.37	7.18	6.87	6.36	6.28	5.72	5.65
Cumulative % of variance	9.39	18.28	27.04	35.19	42.56	49.34	56.61	62.97	69.24	74.97	80.62

Notes: K-M-O measure of sampling adequacy=0.816; Bartlett's test of sphericity=11,171.819; p&lt;0.000.

Abbreviations: AD, aesthetic design; FD, functional design; SD, symbolic design; SDAS, self-determined autonomy satisfaction; SDAF, self-determined autonomy frustration; SDCS, self-determined competence satisfaction; SDCF, self-determined competence frustration; SDRS, self-determined relatedness satisfaction; SDRF, self-determined relatedness frustration; WTPP, willingness-to-pay premium; NWOM, negative word-of-mouth.

**Table S4** Item-wise communalities for 11-factor model (data from Pakistan)

Items	Initial	Extraction
AD1	1.000	0.801
AD2	1.000	0.724
AD3	1.000	0.750
FD1	1.000	0.843
FD2	1.000	0.818
FD3	1.000	0.794
SD1	1.000	0.818
SD2	1.000	0.926
SD3	1.000	0.930
AS1	1.000	0.788
AS2	1.000	0.809
AS3	1.000	0.808
AS4	1.000	0.799
AF1	1.000	0.812
AF2	1.000	0.878
AF3	1.000	0.904
AF4	1.000	0.812
RS1	1.000	0.676
RS2	1.000	0.690
RS3	1.000	0.715
RS4	1.000	0.728
RF1	1.000	0.863
RF2	1.000	0.917
RF3	1.000	0.941
RF4	1.000	0.928
CS1	1.000	0.685
CS2	1.000	0.699
CS3	1.000	0.723
CS4	1.000	0.716
CF1	1.000	0.763
CF2	1.000	0.891
CF3	1.000	0.906
CF4	1.000	0.889
VTPP1	1.000	0.717
VTPP2	1.000	0.710
VTPP3	1.000	0.760
NWOM1	1.000	0.861
NWOM2	1.000	0.750
NWOM3	1.000	0.900

Abbreviations: AD, aesthetic design; FD, functional design; SD, symbolic design; AS, autonomy satisfaction; AF, autonomy frustration; CS, competence satisfaction; CF, competence frustration; RS, relatedness satisfaction; RF, relatedness frustration; VTPP, willingness-to-pay premium; NWOM, negative word-of-mouth.

**Table S5** Factor loadings of exploratory factor analysis for 11-factor model (data from China)

Items	SDRF	SDAF	SDRS	SDCS	SDAS	FD	SDCF	SD	AD	NWOM	WTTP
RF3	0.929										
RF2	0.910										
RF4	0.869										
RF1	0.853										
AF3		0.932									
AF2		0.904									
AF1		0.890									
AF4		0.870									
RS3			0.891								
RS2			0.888								
RS1			0.878								
RS4			0.791								
CS3				0.903							
CS4				0.896							
CS2				0.868							
CS1				0.835							
AS2					0.861						
AS3					0.861						
AS4					0.859						
AS1					0.848						
FD2						0.973					
FD1						0.970					
FD3						0.970					
CF2							0.878				
CF3							0.854				
CF1							0.787				
CF4							0.772				
SD2								0.945			
SD3								0.942			
SD1								0.938			
AD2									0.934		
AD3									0.928		
AD1									0.914		
NWOM1										0.898	
NWOM3										0.876	
NWOM2										0.870	
WTPP1											0.891
WTPP2											0.858
WTPP3											0.854
Reliability coefficients	0.924	0.923	0.906	0.906	0.898	0.979	0.851	0.959	0.960	0.886	0.881
Eigenvalue	5.70	4.30	3.70	3.12	2.82	2.72	2.46	2.14	1.79	1.72	1.61
% of variance	8.47	8.41	8.14	8.12	7.99	7.40	7.20	7.07	6.99	6.24	6.21
Cumulative % of variance	8.47	16.88	25.02	33.14	41.14	48.53	55.73	62.80	69.79	76.03	82.23

Notes: K-M-O measure of sampling adequacy=0.810; Bartlett's test of sphericity=14,286.641;  $p<0.000$ .

Abbreviations: AD, aesthetic design; FD, functional design; SD, symbolic design; SDAS, self-determined autonomy satisfaction; SDAF, self-determined autonomy frustration; SDCS, self-determined competence satisfaction; SDCF, self-determined competence frustration; SDRS, self-determined relatedness satisfaction; SDRF, self-determined relatedness frustration; WTPP, willingness-to-pay premium; NWOM, negative word-of-mouth.

**Table S6** Item-wise communalities for 11-factor model (data from China)

Items	Initial	Extraction
AD1	1.000	0.909
AD2	1.000	0.948
AD3	1.000	0.927
FD1	1.000	0.959
FD2	1.000	0.968
FD3	1.000	0.957
SD1	1.000	0.916
SD2	1.000	0.930
SD3	1.000	0.931
AS1	1.000	0.749
AS2	1.000	0.779
AS3	1.000	0.785
AS4	1.000	0.771
AF1	1.000	0.802
AF2	1.000	0.826
AF3	1.000	0.874
AF4	1.000	0.766
RS1	1.000	0.810
RS2	1.000	0.837
RS3	1.000	0.836
RS4	1.000	0.667
RF1	1.000	0.759
RF2	1.000	0.848
RF3	1.000	0.878
RF4	1.000	0.789
CS1	1.000	0.714
CS2	1.000	0.770
CS3	1.000	0.839
CS4	1.000	0.833
CF1	1.000	0.639
CF2	1.000	0.794
CF3	1.000	0.747
CF4	1.000	0.615
WTPP1	1.000	0.859
WTPP2	1.000	0.788
WTPP3	1.000	0.794
NWOM1	1.000	0.843
NWOM2	1.000	0.789
NWOM3	1.000	0.828

**Abbreviations:** AD, aesthetic design; FD, functional design; SD, symbolic design; AS, autonomy satisfaction; AF, autonomy frustration; CS, competence satisfaction; CF, competence frustration; RS, relatedness satisfaction; RF, relatedness frustration; WTPP, willingness-to-pay premium; NWOM, negative word-of-mouth.

**Table S7** Structural equation model results (Pakistan)

H	Paths	Unstandardized $\beta$	Standardized $\beta$	SE	p-value	Decision
H1	AD→SDNS	0.260	0.512	0.020	0.000	Supported
H2	AD→SDNF	-0.036	-0.039	0.048	0.454	Not supported
H3	FD→SDNS	0.137	0.318	0.017	0.000	Supported
H4	FD→SDNF	0.008	0.010	0.041	0.852	Not supported
H5	SD→SDNS	0.143	0.327	0.017	0.000	Supported
H6	SD→SDNF	-0.125	-0.158	0.042	0.003	Supported
H7	SDNS→WTPP	0.700	0.343	0.101	0.000	Supported
H8	SDNS→NWOM	-0.742	-0.391	0.091	0.000	Supported
H9	SDNF→WTPP	-0.144	-0.128	0.055	0.010	Supported
H10	SDNF→NWOM	0.168	0.160	0.050	0.000	Supported

Abbreviations: H, hypothesis; AD, aesthetic design; FD, functional design; SD, symbolic design; SDNS, self-determined needs satisfaction; SDNF, self-determined needs frustration; WTPP, willingness-to-pay premium; NWOM, negative word-of-mouth; SE, standard error.

**Table S8** Structural equation model results (China)

H	Paths	Unstandardized $\beta$	Standardized $\beta$	SE	p-value	Decision
H1	AD→SDNS	0.203	0.328	0.027	0.000	Supported
H2	AD→SDNF	-0.134	-0.204	0.030	0.000	Supported
H3	FD→SDNS	0.110	0.192	0.025	0.000	Supported
H4	FD→SDNF	0.034	0.056	0.028	0.222	Not supported
H5	SD→SDNS	0.081	0.138	0.026	0.002	Supported
H6	SD→SDNF	0.071	0.114	0.029	0.014	Supported
H7	SDNS→WTPP	0.423	0.265	0.071	0.000	Supported
H8	SDNS→NWOM	-0.329	-0.214	0.070	0.000	Supported
H9	SDNF→WTPP	-0.356	-0.238	0.066	0.000	Supported
H10	SDNF→NWOM	0.231	0.160	0.066	0.000	Supported

Abbreviations: H, hypothesis; AD, aesthetic design; FD, functional design; SD, symbolic design; SDNS, self-determined needs satisfaction; SDNF, self-determined needs frustration; WTPP, willingness-to-pay premium; NWOM, negative word-of-mouth; SE, standard error.

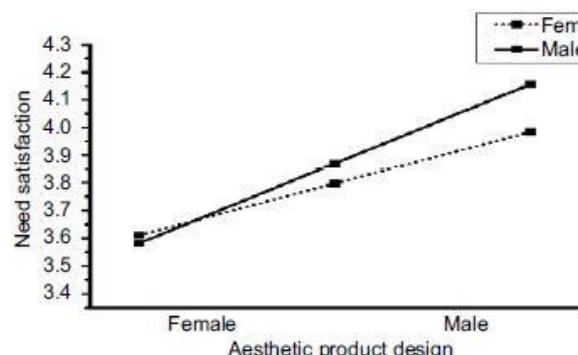


Figure S1 The moderating effect of gender on the effect of aesthetic design on self-determined need (Pakistani sample).

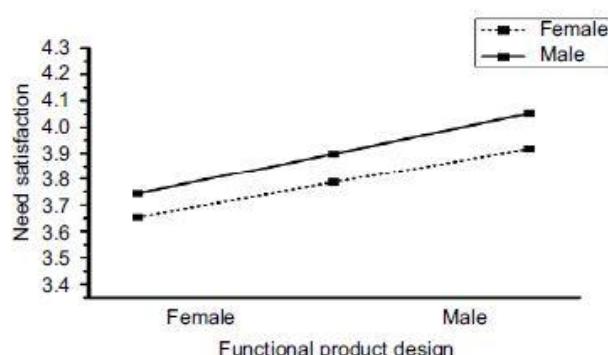
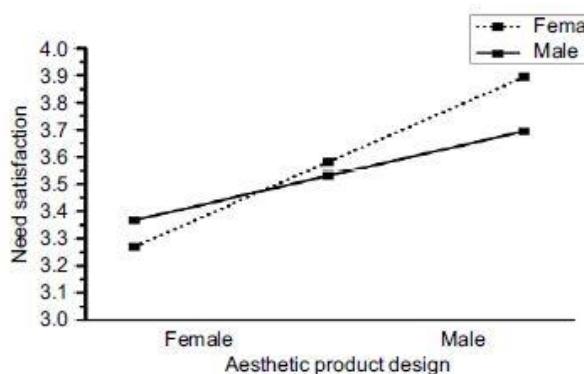
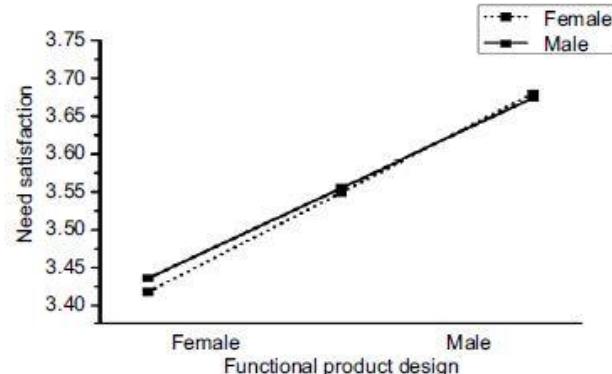


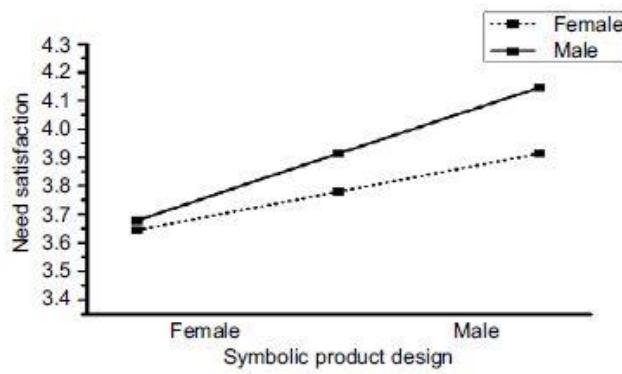
Figure S3 The moderating effect of gender on the effect of functional design on self-determined need (Pakistani sample).



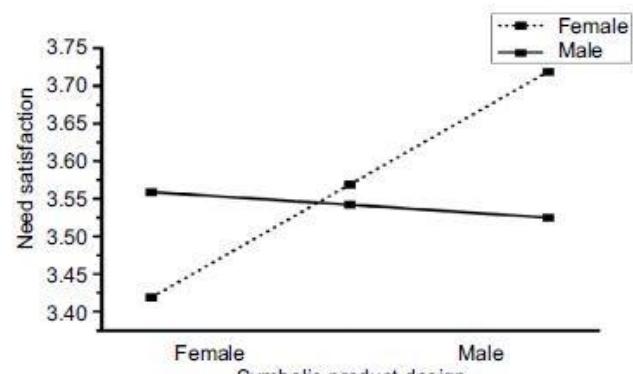
**Figure S2** The moderating effect of gender on the effect of aesthetic design on self-determined need (Chinese sample).



**Figure S4** The moderating effect of gender on the effect of functional design on self-determined need (Chinese sample).



**Figure S5** The moderating effect of gender on the effect of symbolic design on self-determined need (Pakistani sample).



**Figure S6** The moderating effect of gender on the effect of symbolic design on self-determined need (Chinese sample).