Online Appendix

A. Algorithm to Classify Location Types

Following Zheng et al. (2009), we use the algorithm below to classify locations into home, office, or on the way.

Algorithm: Predicting Location Types

Input: Users' location logs and thresholds:$\varphi = \{LName, LTime, N_{thresh}, D_{thresh}, S_{thresh}\}$
Output: Location type: *Ltype*

For each $u_k \in U$ **do**
  Calculate all stay points for user u_k
  For each $l_i \in L_u$ **do**
    if l_i is not a stay point**:**
      Return *ON THE WAY*
    else:
      $NumNights_k$= number of days that customer u_k uses mobile apps at night
      $NumDays_k$= number of days that customer u_k uses mobile apps during the day
      if $NumNights_k \geq N_{thresh}$:
        Return *HOME*;
      else if $NumDays_k \geq D_{thresh}$:
        Return *OFFICE*;
      else:
        Return *ON THE WAY*

LName is the name of the location where individuals use mobile apps. *LTime* is the time when customers use mobile apps. N_{thresh}, D_{thresh}, and S_{thresh} are three thresholds. In our reseaerch, we set N_{thresh}, D_{thresh} , and S_{thresh} at 3, 3, and 60, respectively. U is the individual set. L_u is the location name set for user u. In the algorithm above, if the maximum duration time for a place where a user stays is not less than S_{thresh} (60 minites), we assume that this place is a stay point. Otherwise, we classify this place into the category of on the way. For each location in the stay point set, we calculate how many nights that each user plays mobile apps in that place as $NumNights_k$. We also quantify the number of days that a user plays mobile apps during the day as $NumDays_k$. If the number of nights is larger than or equal to N_{thresh} (3 days), then we predict that this place belongs to the home category. If the number of nights is less than three days and $NumDays_k$ is not less than D_{thresh}, we assume that this location belongs to the office category. Otherwise, we predict that this place is on the way.

B. Main Model Parameter Estimates of State-dependent App Choice

Table B1. Parameter Estimates of App Choice (Social Apps)

Parameter	Utilitarian		Social		Hedonic	
$\beta_{morning}$	-0.2093	(0.1307)	-0.1985	(0.3343)	0.2679	(0.3332)
β_{day}	-0.3197***	(0.1122)	-0.3656	(0.3036)	-0.0486	(0.2881)
$\beta_{evening}$	-0.4102***	(0.1085)	-0.3608	(0.2924)	-0.1174	(0.2937)
β_{home}	0.4516***	(0.0575)	-0.7258***	(0.2063)	0.2203	(0.2171)
β_{way}	-0.2655***	(0.0794)	0.0851	(0.2449)	0.0915	(0.2481)
β_{WiFi}	0.0077	(0.0542)	-0.1387	(0.1729)	0.0052	(0.1697)
$\beta_{tsocial}$	-0.0221	(0.0194)	0.0235	(0.1306)	0.0618	(0.0962)
β_{tinfo}	0.1222**	(0.0549)	0.0406	(0.0945)	0.2894	(0.1913)
β_{tent}	0.2128***	(0.0701)	0.1543***	(0.0478)	0.2678*	(0.1525)
β_{tshop}	0.2673**	(0.1127)	0.1904	(0.1871)	0.0399	(0.4488)
β_{ttool}	0.0828	(0.0549)	0.1390	(0.1500)	0.0053	(0.1727)
$\beta_{nsocial}$	-0.8234***	(0.0381)	-2.2162***	(0.2407)	-2.5399***	(0.3030)
β_{ninfo}	-0.2045**	(0.0940)	0.0439	(0.3296)	-0.3724	(0.4980)
β_{nent}	0.0916	(0.0794)	0.0753	(0.1459)	-1.4057***	(0.3032)
β_{nshop}	0.1213	(0.0911)	-0.3271	(0.3605)	-0.0848	(0.7824)
β_{ntool}	-0.2475***	(0.0752)	0.1139	(0.1811)	-0.5736	(0.3920)
β_{week1}	-0.0959	(0.0626)	0.0175	(0.2108)	-0.0549	(0.2073)
β_{week2}	-0.0196	(0.0660)	0.0245	(0.2083)	0.0917	(0.2049)
β_{mon}	-0.0530	(0.0970)	-0.0445	(0.3165)	0.0118	(0.3196)
β_{tues}	-0.0486	(0.0977)	0.0148	(0.3046)	-0.0001	(0.3101)
β_{wed}	0.0747	(0.0978)	-0.0812	(0.2939)	-0.0286	(0.3162)
β_{thur}	0.0106	(0.0973)	-0.0283	(0.3124)	0.0051	(0.3050)
β_{fri}	0.0966	(0.0969)	-0.0377	(0.2722)	-0.0292	(0.3116)
β_{sat}	0.0333	(0.0962)	-0.0861	(0.2806)	-0.0297	(0.3197)
$\beta_{Tinterval}$	-3.9997***	(0.1081)	-3.9997***	(0.2545)	-3.9996***	(0.4326)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table B2. Parameter Estimates of App Choice (Information Apps)

Parameter	Utilitarian		Social		Hedonic	
$\beta_{morning}$	-0.0462	(0.1365)	-0.0344	(0.1481)	-0.1244	(0.2966)
β_{day}	0.0006	(0.1114)	-0.0518	(0.2604)	0.0693	(0.2578)
$\beta_{evening}$	-0.1668	(0.1160)	-0.0432	(0.1980)	0.0577	(0.2472)
β_{home}	-0.4533***	(0.0319)	0.0458	(0.2715)	-0.0620	(0.1829)
β_{way}	-0.1268	(0.0808)	-0.1816	(0.2772)	-0.2117	(0.2141)
β_{WiFi}	-0.1854***	(0.0562)	-0.4345***	(0.1529)	-0.1579	(0.1448)
$\beta_{tsocial}$	0.1265*	(0.0679)	0.0224	(0.1188)	-0.1018	(0.0620)
β_{tinfo}	0.0686*	(0.0388)	0.1212	(0.1327)	-0.0943	(0.1867)
β_{tent}	0.2642**	(0.1067)	0.1907	(0.1447)	0.0776	(0.1448)
β_{tshop}	0.1817**	(0.0864)	0.0005	(0.1922)	0.4703	(0.4123)
β_{ttool}	0.1506**	(0.0689)	0.1716	(0.2289)	-0.0993	(0.1631)
$\beta_{nsocial}$	-0.2606**	(0.1064)	0.2915	(0.2290)	0.0196	(0.2854)
β_{ninfo}	-1.3336***	(0.0775)	-3.5882***	(0.3173)	-2.0811***	(0.4862)
β_{nent}	-0.0413	(0.1311)	-0.0230	(0.2011)	-0.3917	(03446)
β_{nshop}	-0.1388	(0.1377)	0.2302	(0.5172)	-0.4462	(0.5695)
β_{ntool}	-0.3079***	(0.1083)	-0.1549	(0.2095)	-0.0725	(0.3994)
β_{week1}	-0.1486*	(0.0824)	0.0397	(0.1475)	-0.0924	(0.1752)
β_{week2}	-0.0170	(0.0866)	0.0584	(0.0736)	-0.0168	(0.1592)
β_{mon}	-0.0987	(0.1273)	-0.0322	(0.2568)	0.0362	(0.2844)
β_{tues}	-0.1590	(0.1252)	0.0278	(0.2941)	-0.0671	(0.2476)
β_{wed}	0.0123	(0.1180)	-0.0570	(0.3207)	0.0325	(0.2673)
β_{thur}	0.0598	(0.1215)	-0.0705	(0.2664)	0.0445	(0.2709)
β_{fri}	0.0568	(0.1287)	-0.0621	(0.2535)	0.1818	(0.2799)
β_{sat}	0.0189	(0.1355)	-0.0673	(0.1703)	-0.0513	(0.2710)
$\beta_{Tinterval}$	-3.9525***	(0.1099)	-3.8665***	(0.2467)	-3.9559***	(0.4298)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table B3. Parameter Estimates of App Choice (Entertainment Apps)

Parameter	Utilitarian		Social		Hedonic	
$\beta_{morning}$	-0.1553	(0.1141)	-0.0671	(0.3486)	0.0779	(0.2911)
β_{day}	-0.1441	(0.0928)	0.1055	(0.3183)	-0.1970	(0.2302)
$\beta_{evening}$	-0.3056***	(0.0954)	-0.0057	(0.3076)	-0.2271	(0.2803)
β_{home}	-0.7969***	(0.0724)	0.3597	(0.2106)	-0.1355	(0.1541)
β_{way}	1.1496***	(0.1196)	-0.6494**	(0.2635)	0.0186	(0.1592)
β_{WiFi}	0.0635	(0.0527)	-0.0907	(0.1708)	0.1004	(0.1418)
$\beta_{tsocial}$	0.2446***	(0.0518)	0.1181	(0.1341)	-0.0432	(0.1387)
β_{tinfo}	0.2252***	(0.0487)	0.0550	(0.1322)	0.2021	(0.1827)
β_{tent}	-0.0828***	(0.0304)	-0.1624*	(0.0877)	0.4902***	(0.1052)
β_{tshop}	0.5555***	(0.1664)	0.0587	(0.1623)	0.0070	(0.1121)
β_{ttool}	0.1696***	(0.0506)	0.0187	(0.1261)	-0.0203	(0.1091)
$\beta_{nsocial}$	-0.1046	(0.0650)	0.3851	(0.2364)	-0.1818	(0.3409)
β_{ninfo}	-0.2699***	(0.0748)	0.1218	(0.3263)	-0.3113	(0.5166)
β_{nent}	-1.0723***	(0.0551)	-1.0052***	(0.1163)	-3.1190***	(0.2892)
β_{nshop}	-0.1995*	(0.1170)	0.3633	(0.3881)	-0.0539	(0.8320)
β_{ntool}	-0.0799	(0.0629)	0.4704*	(0.2769)	-0.5024	(0.4300)
β_{week1}	-0.2176***	(0.0636)	-0.0786	(0.2113)	-0.1125	(0.1854)
β_{week2}	-0.1757***	(0.0633)	0.0987	(0.2041)	0.0282	(0.1523)
β_{mon}	-0.0759	(0.0885)	-0.0272	(0.3104)	0.0612	(0.2804)
β_{tues}	-0.1022	(0.0916)	0.0803	(0.2997)	0.0459	(0.2594)
β_{wed}	0.0204	(0.0908)	0.0387	(0.3119)	0.0319	(0.2717)
β_{thur}	0.0559	(0.0885)	0.0698	(0.3064)	0.1331	(0.2349)
β_{fri}	0.2163**	(0.0918)	0.1537	(0.2780)	0.0691	(0.2902)
β_{sat}	0.0869	(0.0947)	-0.0712	(0.2943)	0.0292	(0.2483)
$\beta_{Tinterval}$	-3.9238***	(0.1077)	-3.9868***	(0.2565)	-3.8834***	(0.4383)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table B4. Parameter Estimates of App Choice (Shopping Apps)

Parameter	Utilitarian		Social		Hedonic	
$\beta_{morning}$	0.7905***	(0.2201)	0.0132	(0.3299)	1.0583***	(0.2419)
β_{day}	0.8400***	(0.1759)	0.2295	(0.3028)	0.6792***	(0.2614)
$\beta_{evening}$	0.5047***	(0.1663)	0.1301	(0.2858)	0.9570***	(0.2123)
β_{home}	-0.0808	(0.1490)	-0.0282	(0.1930)	0.1990	(0.1538)
β_{way}	0.0294	(0.1804)	-0.0023	(0.2313)	0.4007**	(0.1735)
β_{WiFi}	-0.3643***	(0.1303)	0.1095	(0.1588)	-0.3398***	(0.1151)
$\beta_{tsocial}$	0.1849	(0.1129)	0.0438	(0.1101)	-0.0738	(0.1393)
β_{tinfo}	0.2031*	(0.1131)	0.0178	(0.0943)	0.2404**	(0.1158)
β_{tent}	0.5061**	(0.2174)	0.0991***	(0.0338)	0.2672***	(0.0575)
β_{tshop}	-0.2250***	(0.0809)	1.0727***	(0.2157)	-0.7510**	(0.3556)
β_{ttool}	0.7232***	(0.1314)	0.0861	(0.0609)	-0.0884	(0.0616)
$\beta_{nsocial}$	-0.0509	(0.1517)	0.3636*	(0.1938)	-0.3487	(0.5633)
β_{ninfo}	-0.0593	(0.2388)	0.2656	(0.1867)	-0.4599	(0.4279)
β_{nent}	0.2430	(0.1889)	0.2057	(0.1516)	-1.0921***	(0.0407)
β_{nshop}	-1.7882***	(0.1021)	-3.6160***	(0.3679)	-3.6160***	(0.6772)
β_{ntool}	-0.1074	(0.2158)	0.1494	(0.2486)	-0.4909	(0.4197)
β_{week1}	0.0368	(0.1388)	0.2622	(0.2183)	0.0706	(0.1681)
β_{week2}	0.0701	(0.1407)	-0.0152	(0.1872)	0.2692**	(0.1137)
β_{mon}	-0.0726	(0.2075)	0.2105	(0.2972)	-0.0139	(0.1327)
β_{tues}	0.0223	(0.2094)	0.1949	(0.2791)	-0.0576	(0.1860)
β_{wed}	0.1072	(0.2251)	0.0312	(0.2782)	-0.1419**	(0.0657)
β_{thur}	0.1671	(0.2179)	0.0497	(0.3032)	-0.0709	(0.1184)
β_{fri}	0.5413**	(0.2312)	-0.0023	(0.2655)	-0.0694	(0.1562)
β_{sat}	-0.1449	(0.2053)	-0.0078	(0.2651)	-0.0856	(0.1828)
$\beta_{Tinterval}$	-3.9876***	(0.1343)	-3.7814***	(0.2553)	-3.9865***	(0.4241)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table B5. Parameter Estimates of App Choice (Tool Apps)

Parameter	Utilitarian		Social		Hedonic	
$\beta_{morning}$	0.0102	(0.1840)	-0.6016*	(0.3528)	0.0767	(0.3032)
β_{day}	0.0375	(0.1551)	-0.2816	(0.3235)	0.0677	(0.2458)
$\beta_{evening}$	0.0051	(0.1608)	-0.2279	(0.3121)	0.0530	(0.2449)
β_{home}	-0.3020***	(0.1108)	0.1969	(0.2238)	-0.3182*	(0.1751)
β_{way}	0.0487	(0.1325)	-0.0658	(0.2623)	-0.1125	(0.1857)
β_{WiFi}	0.0275	(0.0958)	0.0493*	(0.1733)	0.1180	(0.1737)
$\beta_{tsocial}$	0.1788	(0.1269)	-0.0371	(0.1381)	-0.0601*	(0.0346)
β_{tinfo}	0.2194***	(0.0837)	-0.0190	(0.1405)	0.3115**	(0.1574)
β_{tent}	0.2304**	(0.1024)	0.1640***	(0.0431)	0.2790**	(0.1152)
β_{tshop}	0.2583	(0.1861)	0.0872	(0.1940)	-0.2218	(0.3409)
β_{ttool}	0.0978	(0.0631)	-0.1791	(0.1388)	0.0231	(0.1759)
$\beta_{nsocial}$	-0.1974*	(0.1170)	0.4426*	(0.2399)	0.0004	(0.2781)
β_{ninfo}	-0.3696*	(0.1931)	0.2977	(0.3336)	-0.5410	(0.4909)
β_{nent}	-0.2489	(0.1635)	0.1565	(0.1425)	-1.0895***	(0.2451)
β_{nshop}	-0.0024	(0.2213)	0.1416	(0.3703)	0.0778	(0.7352)
β_{ntool}	-1.2108***	(0.0923)	-2.7952***	(0.2726)	-3.3086***	(0.4137)
β_{week1}	-0.2022**	(0.0979)	0.0579	(0.2283)	-0.1396	(0.1829)
β_{week2}	-0.1813*	(0.1016)	0.0231	(0.2175)	0.0359	(0.1859)
β_{mon}	-0.1394	(0.1700)	-0.1595	(0.3112)	0.0170	(0.2681)
β_{tues}	-0.2328	(0.1566)	0.0348	(0.3125)	-0.0362	(0.2683)
β_{wed}	-0.1002	(0.1562)	-0.0931	(0.3138)	0.0242	(0.2872)
β_{thur}	-0.0573	(0.1734)	-0.1182	(0.3144)	0.0472	(0.2346)
β_{fri}	-0.1231	(0.1583)	0.0681	(0.2893)	0.0188	(0.2895)
β_{sat}	-0.0002	(0.1646)	-0.0029	(0.2993)	0.0757	(0.2438)
$\beta_{Tinterval}$	-3.9303***	(0.1279)	-3.9982***	(0.2565)	-3.9869***	(0.4359)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table B6. Parameter Estimates of App Choice (Intrinsic and Heterogeneity Parameters)

α_{jv}: Intrinsic value of using app v in state j						
	Utilitarian		Social		Hedonic	
$v =$ social	-1.4603***	(0.1540)	0.4152	(0.3631)	0.6586	(0.4455)
$v =$ information	-1.7972***	(0.1744)	-1.5009***	(0.2189)	-0.6346	(0.3912)
$v =$ entertainment	-3.1149***	(0.1536)	0.5355	(0.3647)	0.4898	(0.3589)
$v =$ shopping	-2.9849***	(0.2868)	-0.5510	(0.3549)	-0.9884***	(0.3396)
$v =$ tool	-1.3428***	(0.2431)	-1.9594***	(0.3956)	-1.4096***	(0.3603)
Unobserved Heterogeneity						
η	0		0.8362***			
Prob(η)	0.4012		0.5988***			

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

C. Main Model Parameter Estimates of State-dependent App Usage Duration

Table C1. Parameter Estimates of App Usage Duration (Social Apps)

Parameter	Utilitarian		Social		Hedonic	
$\delta_{morning}$	-0.1006	(0.1285)	-0.1229	(0.1033)	-0.1425	(0.1339)
δ_{day}	0.0110	(0.1088)	-0.1887**	(0.0928)	-0.2133**	(0.1032)
$\delta_{evening}$	0.0255	(0.1100)	-0.1384	(0.0885)	-0.1919*	(0.1099)
δ_{home}	-3.4470***	(0.0880)	3.9998***	(0.0339)	-2.4458***	(0.0034)
δ_{way}	1.7253***	(0.0663)	-0.5012***	(0.0743)	-1.9378***	(0.0606)
δ_{WiFi}	0.0047	(0.0631)	-0.0136	(0.0477)	0.1458***	(0.0346)
$\delta_{tsocial}$	-0.1876***	(0.0311)	-0.1996***	(0.0302)	-0.5024***	(0.0345)
δ_{tinfo}	-0.0311	(0.0920)	-0.0378	(0.0615)	0.0491	(0.0691)
δ_{tent}	0.0034	(0.0559)	-0.0487	(0.1037)	0.0245	(0.0922)
δ_{tshop}	-0.0516	(0.1775)	-0.1192	(0.1311)	0.0216	(0.1805)
δ_{ttool}	-0.0821	(0.0607)	-0.0201	(0.0831)	-0.0822	(0.0698)
$\delta_{nsocial}$	0.4019***	(0.0296)	0.3660***	(0.0563)	0.5949***	(0.0400)
δ_{ninfo}	0.0517	(0.1276)	0.0385	(0.1396)	-0.0597	(0.1014)
δ_{nent}	0.0413	(0.0719)	0.0550	(0.1399)	-0.0135	(0.0745)
δ_{nshop}	-0.0084	(0.1643)	-0.0217	(0.0955)	-0.0323	(0.1237)
δ_{ntool}	0.1170	(0.0814)	0.0230	(0.1184)	0.1159*	(0.0679)
δ_{week1}	0.0179	(0.0581)	0.0041	(0.0587)	-0.0433	(0.0691)
δ_{week2}	0.0274	(0.0555)	0.0277	(0.0782)	0.0250	(0.0574)
δ_{mon}	0.0306	(0.1001)	-0.0486	(0.0950)	0.0144	(0.1098)
δ_{tues}	-0.0988	(0.0850)	-0.0395	(0.1055)	-0.1006	(0.1091)
δ_{wed}	-0.0180	(0.0873)	-0.0181	(0.1027)	-0.0670	(0.1185)
δ_{thur}	0.0322	(0.0880)	-0.0270	(0.0945)	-0.1243	(0.1048)
δ_{fri}	-0.0080	(0.0971)	-0.0506	(0.1086)	-0.1116	(0.1155)
δ_{sat}	0.0436	(0.0813)	-0.0231	(0.0914)	-0.0607	(0.1066)
$\delta_{Tinterval}$	0.0121	(0.0260)	-0.0187	(0.0293)	-0.0668**	(0.0329)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table C2. Parameter Estimates of App Usage Duration (Information Apps)

Parameter	Utilitarian		Social		Hedonic	
$\delta_{morning}$	-0.0103	(0.1260)	0.1472	(0.2246)	-0.1196	(0.2248)
δ_{day}	0.0963	(0.1060)	0.1832*	(0.1019)	-0.0409	(0.1399)
$\delta_{evening}$	0.0887	(0.1072)	0.2049	(0.2290)	0.0111	(0.1693)
δ_{home}	0.2132***	(0.0763)	0.2666***	(0.0728)	-0.0029	(0.1381)
δ_{way}	0.2651***	(0.0019)	0.0535	(0.1959)	0.1980	(0.1787)
δ_{WiFi}	0.0315	(0.0574)	-0.2799**	(0.1303)	0.1270	(0.1144)
$\delta_{tsocial}$	-0.0059	(0.0502)	0.0257	(0.0843)	-0.0615	(0.1174)
δ_{tinfo}	-0.3804***	(0.0318)	-0.1232**	(0.0490)	-0.1326**	(0.0598)
δ_{tent}	-0.0129	(0.0696)	0.0711	(0.1264)	0.0482	(0.1041)
δ_{tshop}	-0.4172***	(0.0386)	-0.1498	(0.1238)	-0.1200	(0.4447)
δ_{ttool}	0.0061	(0.0791)	-0.0165	(0.1875)	0.0023	(0.0969)
$\delta_{nsocial}$	0.1758	(0.1093)	0.0269	(0.1403)	0.3813***	(0.0913)
δ_{ninfo}	0.5723***	(0.0849)	0.2716**	(0.1292)	0.2148***	(0.0797)
δ_{nent}	-0.1591	(0.1559)	-0.1162	(0.1218)	-0.2046	(0.1702)
δ_{nshop}	0.6059***	(0.0990)	0.3336**	(0.1468)	0.3992	(0.3446)
δ_{ntool}	-0.1437	(0.1376)	-0.1448	(0.0956)	0.0185	(0.1635)
δ_{week1}	0.0369	(0.0704)	0.0267	(0.1687)	0.0751	(0.1433)
δ_{week2}	0.1606**	(0.0777)	0.0234	(0.1814)	0.0810	(0.1652)
δ_{mon}	0.0250	(0.1155)	0.1627	(0.2376)	0.0057	(0.1985)
δ_{tues}	0.1678	(0.1174)	0.1271	(0.2325)	-0.0666	(0.2039)
δ_{wed}	0.1154	(0.1038)	0.0397	(0.2246)	0.0255	(0.1927)
δ_{thur}	0.1171	(0.1169)	-0.0233	(0.1697)	0.0732	(0.1578)
δ_{fri}	0.0178	(0.1160)	-0.0922	(0.2099)	-0.1020	(0.1622)
δ_{sat}	0.1094	(0.1205)	0.0528	(0.2524)	-0.0125	(0.2043)
$\delta_{Tinterval}$	-0.0729**	(0.0331)	-0.0400	(0.0666)	-0.0002	(0.0543)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table C3. Parameter Estimates of App Usage Duration (Entertainment Apps)

Parameter	Utilitarian		Social		Hedonic	
$\delta_{morning}$	0.0241	(0.1166)	-0.1615	(0.1197)	0.1308	(0.1554)
δ_{day}	0.0558	(0.0989)	-0.1193	(0.1150)	-0.0796	(0.1596)
$\delta_{evening}$	0.0867	(0.0971)	-0.1215	(0.0867)	-0.0263	(0.1135)
δ_{home}	-0.5110***	(0.0426)	-0.4186***	(0.0929)	-0.0301	(0.0728)
δ_{way}	-2.7110***	(0.1332)	1.1167***	(0.1109)	-0.1179	(0.1179)
δ_{WiFi}	-0.2371***	(0.0472)	-0.1508**	(0.0619)	-0.0384	(0.0816)
$\delta_{tsocial}$	0.0158	(0.0454)	-0.0830**	(0.0392)	-0.0653	(0.0528)
δ_{tinfo}	-0.1604***	(0.0510)	-0.0890**	(0.0450)	-0.0831	(0.0546)
δ_{tent}	-0.2916***	(0.0314)	-0.1570***	(0.0381)	-0.1542**	(0.0735)
δ_{tshop}	-0.2409	(0.1623)	-0.0711	(0.1241)	-0.1073	(1.0121)
δ_{ttool}	-0.1019*	(0.0540)	-0.0346	(0.0982)	-0.0351	(0.2146)
$\delta_{nsocial}$	0.0031	(0.0699)	0.1350	(0.0875)	-0.0073	(0.3301)
δ_{ninfo}	0.2748***	(0.0307)	0.1153***	(0.0299)	0.2069	(0.2899)
δ_{nent}	0.6576***	(0.0566)	0.5247***	(0.0623)	0.2003	(0.3286)
δ_{nshop}	-0.2105*	(0.1123)	-0.2915***	(0.1060)	-0.0547	(0.2594)
δ_{ntool}	0.1297***	(0.0458)	-0.0094	(0.0915)	0.0398	(0.1346)
δ_{week1}	0.1771***	(0.0592)	0.0446	(0.0527)	0.0108	(0.0954)
δ_{week2}	0.0167	(0.0603)	-0.0406	(0.0530)	0.0139	(0.1076)
δ_{mon}	-0.0724	(0.0842)	-0.0068	(0.0377)	0.0219	(0.1404)
δ_{tues}	-0.0616	(0.1058)	0.0396	(0.0686)	0.0355	(0.0976)
δ_{wed}	-0.1808*	(0.0937)	-0.0269	(0.0308)	-0.0115	(0.1200)
δ_{thur}	-0.1531	(0.1068)	-0.0088	(0.0157)	-0.0094	(0.1244)
δ_{fri}	-0.2457**	(0.0984)	-0.1053	(0.0877)	0.0129	(0.1227)
δ_{sat}	-0.1010	(0.0994)	0.0269	(0.0900)	-0.0406	(0.1576)
$\delta_{Tinterval}$	0.0094	(0.0319)	0.0248	(0.0242)	-0.0030	(0.0816)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table C4. Parameter Estimates of App Usage Duration (Shopping Apps)

Parameter	Utilitarian		Social		Hedonic	
$\delta_{morning}$	-0.2473	(0.2089)	0.2034	(0.1714)	-1.4386***	(0.1282)
δ_{day}	-0.0816	(0.1623)	0.1719	(0.1595)	-1.4578***	(0.1684)
$\delta_{evening}$	0.1791	(0.1451)	0.2187	(0.1399)	-1.5711***	(0.0675)
δ_{home}	0.0699	(0.1402)	-0.1277	(0.1814)	0.0775	(0.2036)
δ_{way}	0.3592*	(0.1847)	0.1660	(0.1973)	-0.2291	(0.1509)
δ_{WiFi}	-0.3801***	(0.1260)	0.0515	(0.1158)	-0.1400	(0.2055)
$\delta_{tsocial}$	-0.0917	(0.1140)	0.0317	(0.0988)	-0.0114	(0.0948)
δ_{tinfo}	-0.1766	(0.2303)	0.0136	(0.0564)	0.4175***	(0.1090)
δ_{tent}	-0.1093	(0.3560)	-0.1011	(0.1121)	0.2312**	(0.1139)
δ_{tshop}	-0.5059***	(0.0679)	-0.6771**	(0.2888)	1.0096***	(0.0384)
δ_{ttool}	0.6330***	(0.1227)	-0.0809	(0.1622)	-0.4032***	(0.0615)
$\delta_{nsocial}$	0.4322**	(0.1893)	-0.0823	(0.1758)	0.0335	(0.2636)
δ_{ninfo}	0.4953***	(0.1658)	0.0348	(0.2949)	-0.1382	(0.2438)
δ_{nent}	0.0434	(0.4305)	0.0599	(0.2280)	-0.3354	(0.2192)
δ_{nshop}	1.7581***	(0.0461)	0.4408***	(0.1177)	-1.1253***	(0.1281)
δ_{ntool}	-0.4608***	(0.1222)	-0.0511	(0.1975)	-0.1635	(0.1072)
δ_{week1}	-0.0685	(0.1441)	-0.2928*	(0.1772)	-0.1070	(0.2103)
δ_{week2}	-0.2357*	(0.1241)	-0.2714*	(0.1625)	-0.4684**	(0.2223)
δ_{mon}	-0.3013	(0.2382)	-0.1224	(0.2650)	0.1176	(0.3178)
δ_{tues}	-0.7749***	(0.2289)	-0.2247	(0.2468)	0.3393	(0.3512)
δ_{wed}	-0.6275***	(0.2387)	-0.1636	(0.2601)	0.2648***	(0.0985)
δ_{thur}	-0.5437***	(0.2079)	-0.1223	(0.2836)	0.6471**	(0.2735)
δ_{fri}	-0.6161***	(0.2314)	-0.0917	(0.2670)	-0.0168	(0.2888)
δ_{sat}	-0.1701	(0.2002)	-0.0939	(0.2853)	0.5078	(0.3793)
$\delta_{Tinterval}$	-0.0398	(0.0682)	0.1280**	(0.0616)	0.0471	(0.1110)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table C5. Parameter Estimates of App Usage Duration (Tool Apps)

Parameter	Utilitarian		Social		Hedonic	
$\delta_{morning}$	-0.0286	(0.1539)	0.1002	(0.1097)	-0.1881	(0.1634)
δ_{day}	-0.0205	(0.1434)	0.4461***	(0.1073)	0.0513	(0.0981)
$\delta_{evening}$	-0.1204	(0.1427)	0.2512**	(0.1112)	0.0632	(0.1134)
δ_{home}	-0.5142***	(0.1071)	-0.3368***	(0.0736)	-0.1292	(0.1150)
δ_{way}	-0.4029***	(0.1078)	-0.0999	(0.0925)	-0.1578	(0.2148)
δ_{WiFi}	-0.0510	(0.0906)	0.0713	(0.0582)	-0.1659	(0.1150)
$\delta_{tsocial}$	-0.1193*	(0.0705)	-0.0205	(0.0474)	-0.0262	(0.0830)
δ_{tinfo}	0.0509	(0.1022)	-0.1262**	(0.0599)	0.0647	(0.0748)
δ_{tent}	-0.1217	(0.0875)	-0.0503	(0.0632)	-0.0111	(0.2565)
δ_{tshop}	-0.0226	(0.5565)	-0.1268**	(0.0563)	0.1063	(0.1633)
δ_{ttool}	-0.4707***	(0.0549)	-0.1201***	(0.0330)	-0.0824*	(0.0489)
$\delta_{nsocial}$	0.2460***	(0.0835)	0.3181***	(0.0528)	0.0451	(0.0597)
δ_{ninfo}	-0.0526	(0.2422)	0.2837***	(0.0899)	-0.1142	(0.0744)
δ_{nent}	0.4305***	(0.1017)	0.2090***	(0.0694)	0.0690	(0.1139)
δ_{nshop}	-0.4231**	(0.2040)	-0.1340***	(0.0176)	-0.1844	(0.3384)
δ_{ntool}	0.4198***	(0.0762)	0.0535	(0.0418)	0.1677	(0.1050)
δ_{week1}	-0.0379	(0.0972)	-0.0115	(0.0584)	-0.0423	(0.1213)
δ_{week2}	-0.0255	(0.0990)	0.0689	(0.0628)	-0.0491	(0.2176)
δ_{mon}	0.0542	(0.1508)	0.0684	(0.1051)	-0.0401	(0.0616)
δ_{tues}	-0.0055	(0.1255)	-0.0727	(0.0884)	0.0931	(0.1784)
δ_{wed}	0.1161	(0.1380)	0.0526	(0.0874)	0.1102	(0.2474)
δ_{thur}	0.1496	(0.1686)	0.0426	(0.0968)	0.0593	(0.1879)
δ_{fri}	-0.0983	(0.1483)	-0.0859	(0.0761)	0.0744	(0.1377)
δ_{sat}	0.1782	(0.1462)	0.0210	(0.1087)	0.0549	(0.0515)
$\delta_{Tinterval}$	0.0100	(0.0712)	0.0576*	(0.0296)	0.0032	(0.0964)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

Table C6. Parameter Estimates of App Usage Duration (Intrinsic and Heterogeneity Parameters)

Intrinsic value of using app *v* in state *j*						
	Utilitarian		Social		Hedonic	
$v = \text{social}$	-1.1711***	(0.1369)	-4.7679***	(0.1825)	0.4636***	(0.1184)
$v = \text{information}$	-2.0243***	(0.3177)	-0.4871**	(0.2116)	-0.6364***	(0.1188)
$v = \text{entertainment}$	-0.4362	(0.3322)	-0.4019***	(0.1497)	-1.3142***	(0.2773)
$v = \text{shopping}$	0.5451***	(0.1593)	0.6579***	(0.1493)	0.2736	(0.2247)
$v = \text{tool}$	-0.9603***	(0.1618)	-0.2561***	(0.0768)	-0.5561**	(0.2506)

Unobserved Heterogeneity		
τ	0	0.0136
$\text{Prob}(\tau)$	0.2251	0.7749***

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parentheses.

D. Main Model Parameter Estimates of Hidden State Transition

Table D1. Parameter Estimates of Hidden State Transition

Parameter	Utilitarian		Social		Hedonic	
$\gamma_{morning}$	-0.1484	(0.1250)	-0.1770*	(0.1073)	-0.4170***	(0.1257)
γ_{day}	-0.1857*	(0.1048)	-0.1996**	(0.0809)	-0.1637	(0.1218)
$\gamma_{evening}$	-0.3481***	(0.1027)	-0.1864**	(0.0772)	-0.1063	(0.1220)
γ_{home}	-0.5756***	(0.0770)	-0.3743***	(0.0516)	-0.3224***	(0.0902)
γ_{way}	-0.3435***	(0.0888)	-0.1246*	(0.0704)	-0.2023*	(0.1038)
γ_{WiFi}	-0.0969*	(0.0589)	-0.0044	(0.0553)	0.0258	(0.0819)
$\gamma_{tsocial}$	-0.0263	(0.0351)	-0.0125	(0.0302)	-0.0873	(0.0575)
γ_{tinfo}	-0.1071**	(0.0504)	0.0675	(0.0693)	0.0278	(0.0698)
γ_{tent}	0.0298	(0.0488)	0.0048	(0.0363)	-0.2122**	(0.1057)
γ_{tshop}	-0.1715	(0.1098)	0.4033***	(0.0812)	0.1951	(0.1759)
γ_{ttool}	0.0293	(0.0532)	-0.0419	(0.0432)	-0.1107	(0.0787)
$\gamma_{nsocial}$	0.0100**	(0.0494)	0.0071	(0.0503)	0.2410***	(0.0729)
γ_{ninfo}	0.0867	(0.0741)	-0.0687	(0.1158)	-0.3399***	(0.0140)
γ_{nent}	-0.1207	(0.0772)	0.1756***	(0.0569)	0.3700***	(0.1076)
γ_{nshop}	0.0783	(0.1534)	-0.5595***	(0.0428)	-0.6450**	(0.2580)
γ_{ntool}	-0.1847***	(0.0691)	-0.0365	(0.0560)	0.1632*	(0.0980)
γ_{week1}	0.0819	(0.0610)	-0.1270**	(0.0521)	-0.0084	(0.0899)
γ_{week2}	0.0153	(0.0648)	-0.0962*	(0.0571)	-0.0139	(0.0967)
γ_{mon}	-0.0491	(0.0987)	-0.0780	(0.0721)	-0.0142	(0.1436)
γ_{tues}	-0.0621	(0.0990)	-0.1193*	(0.0639)	-0.0596	(0.1453)
γ_{wed}	-0.0705	(0.1010)	-0.0842	(0.0664)	-0.0335	(0.1404)
γ_{thur}	-0.0423	(0.1009)	-0.0862	(0.0694)	-0.0339	(0.1532)
γ_{fri}	-0.0671	(0.01037)	-0.0253	(0.0701)	-0.0113	(0.1412)
γ_{sat}	-0.0287	(0.0985)	0.0048	(0.0693)	-0.0319	(0.1379)
$\gamma_{Tinterval}$	0.1610***	(0.0312)	0.0719**	(0.0335)	-0.1234***	(0.0478)
μ_{jk}: Intrinsic terms						
Utilitarian			-2.0152***	(0.1530)	-1.3863***	(0.1489)
Social	-0.4148***	(0.1225)			-0.6733***	(0.1272)
Hedonic	-0.3512*	(0.1838)	-1.9112***	(0.1761)		
Unobserved Heterogeneity						
ξ	0				0.9133**	
Prob(ξ)	0.4763				0.5237**	

E. Other Estimation Results for the Main Model

Marginal Effect of Previous App Usage Duration on Current App Usage Duration

We explore duration interdependence by examining the marginal effect of previous app usage duration (1 minute) on current app usage duration, using the intrinsic duration as the baseline. The results are shown below. Each sub-table corresponds to a specific internal state. In each table, numbers outside the parentheses are the marginal effects (i.e., differences of current usage duration after the previous usage duration to the intrinsic shares), while numbers inside are the current usage duration after the previous usage duration. For example, for the second cell in Table E1, 4.38 minutes is the usage duration of the information app (conditional on choosing it) after using social app, while the marginal effect, -0.54, is the difference of such usage duration to the intrinsic usage duration of information app (i.e., -0.54 = 4.38 – 4.92).

Table E1. Effects of Previous App Usage on Current Duration (Utilitarian State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.38***	-0.54	-0.04	-0.22	-0.34
	(2.35)	(4.38)	(3.13)	(0.82)	(3.79)
Information	-0.04	-0.61	-0.24	-0.21	0.01
	(2.69)	(4.31)	(2.93)	(0.83)	(4.14)
Entertainment	-0.09	0.63	-0.71	0.05	-0.79
	(2.64)	(5.55)	(2.46)	(1.09)	(3.34)
Shopping	0.11	-0.60	1.16	-0.60***	1.50
	(2.84)	(4.32)	(4.33)	(0.44)	(5.63)
Tool	-0.07	0.50	-0.06	-0.12	0.15
	(2.66)	(5.42)	(3.11)	(0.92)	(4.28)
Intrinsic Time	(2.73)	(4.92)	(3.17)	(1.04)	(4.13)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table E2. Effects of Previous App Usage on Current Duration (Social State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.41	-0.05	-0.06	0.02	-0.21
	(3.36)	(1.21)	(1.55)	(0.63)	(0.92)
Information	-0.01	-0.13	-0.03	-0.02	-0.12
	(3.76)	(1.13)	(1.58)	(0.59)	(1.01)
Entertainment	-0.02	0.04	-0.36***	0.02	-0.12
	(3.75)	(1.30)	(1.25)	(0.63)	(1.01)
Shopping	0.38	-0.15	0.46**	0.11	0.22
	(4.15)	(1.11)	(2.07)	(0.72)	(1.35)
Tool	-0.01	0.14	0.05	0.06	0.05
	(3.76)	(1.40)	(1.66)	(0.67)	(1.18)
Intrinsic Time	(3.77)	(1.26)	(1.61)	(0.61)	(1.13)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table E3. Effects of Previous App Usage on Current Duration (Hedonic State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.21	-0.33	0.21	-0.03	-0.03
	(3.15)	(1.34)	(4.30)	(2.45)	(2.03)
Information	0.03	-0.09	-0.33	-0.43	0.07
	(3.39)	(1.58)	(3.76)	(2.05)	(2.13)
Entertainment	-0.02	0.19	-0.13	0.19	-0.08
	(3.34)	(1.86)	(3.96)	(2.67)	(1.98)
Shopping	0.03	-0.29	0.49	0.21	0.11
	(3.39)	(1.38)	(4.58)	(2.69)	(2.17)
Tool	-0.07	-0.02	-0.01	1.20	-0.12
	(3.29)	(1.65)	(4.08)	(3.68)	(1.94)
Intrinsic Time	(3.36)	(1.67)	(4.09)	(2.48)	(2.06)

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Posterior Analysis

Figure E1. Posterior States Over Time (Bandwidth)

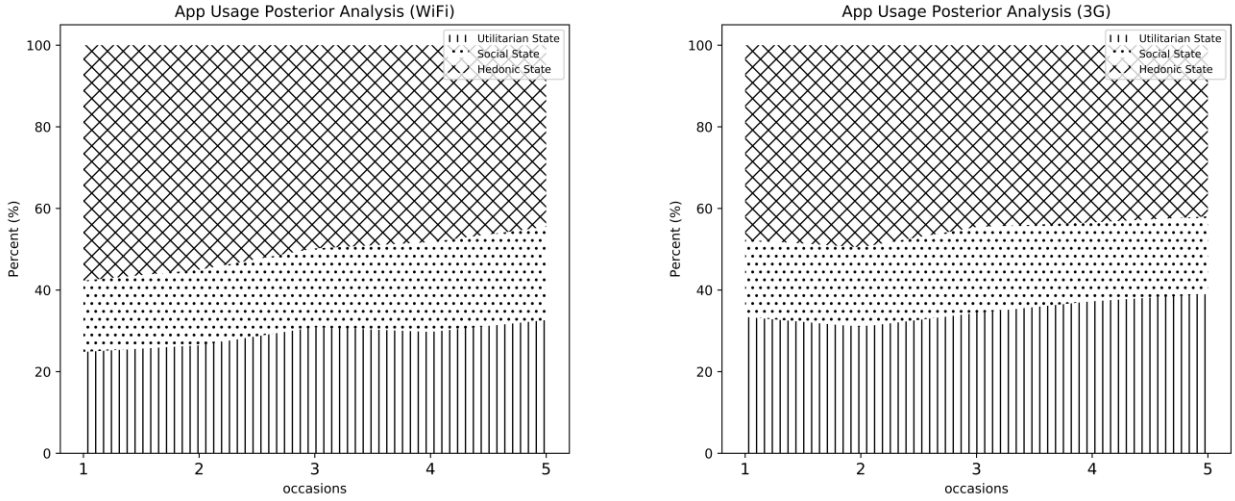


Figure E2. Posterior States Over Time (Time of Day)

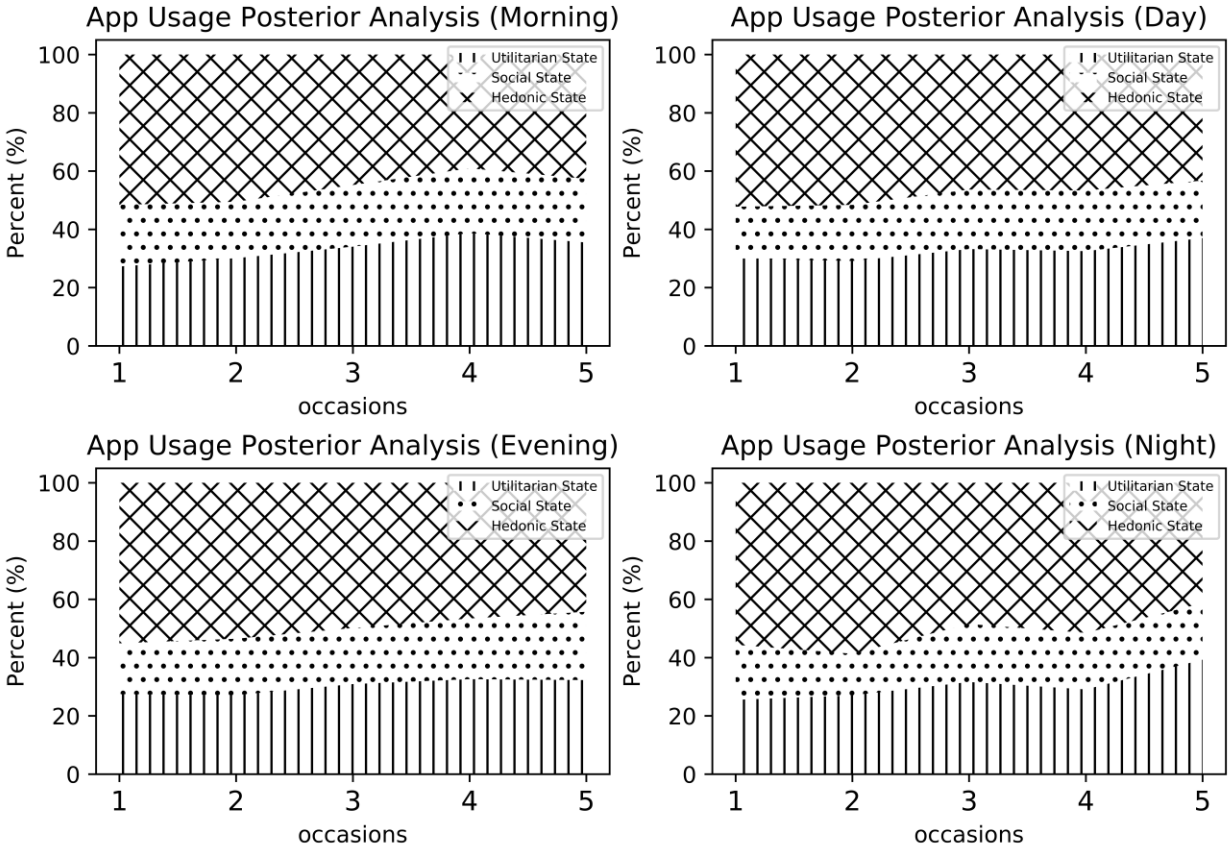
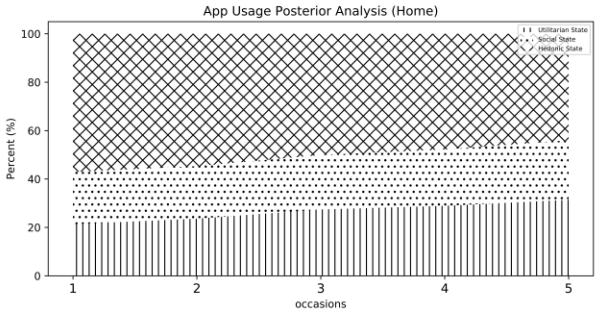
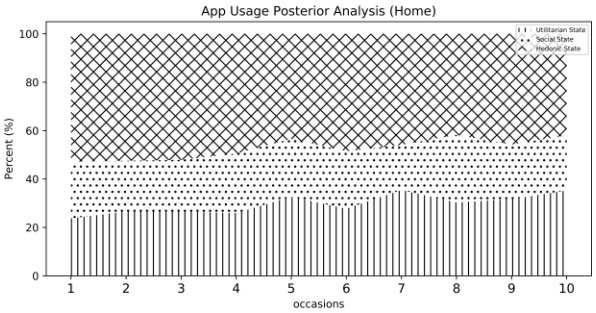
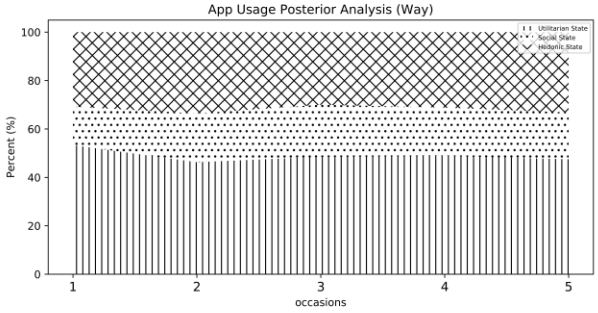
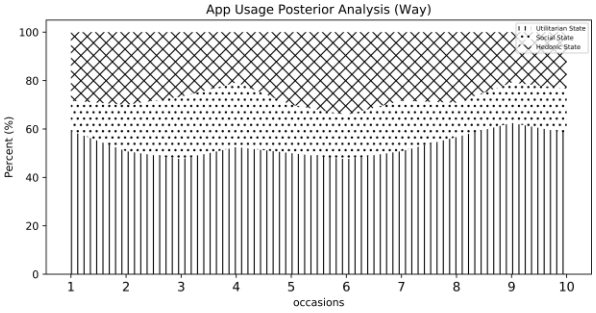


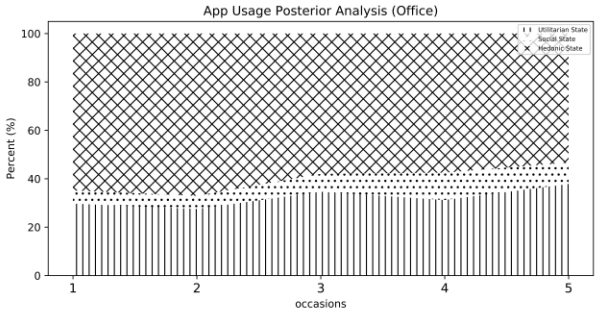
Figure E3. Posterior States Over Time (Location)


App Usage Posterior Analysis (Home)
Utilitarian State
Social State
Hedonic State
Percent (%)
occasions


App Usage Posterior Analysis (Home)
Utilitarian State
Social State
Hedonic State
Percent (%)
occasions


App Usage Posterior Analysis (Way)
Utilitarian State
Social State
Hedonic State
Percent (%)
occasions


App Usage Posterior Analysis (Way)
Utilitarian State
Social State
Hedonic State
Percent (%)
occasions


App Usage Posterior Analysis (Office)
Utilitarian State
Social State
Hedonic State
Percent (%)
occasions

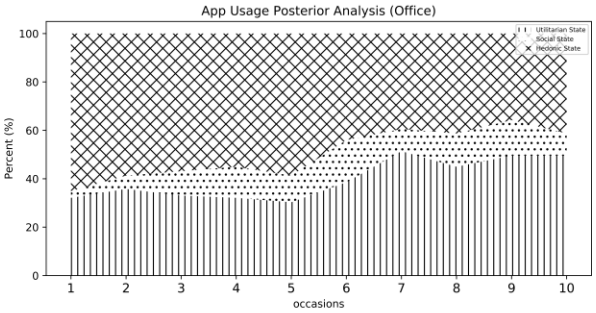

App Usage Posterior Analysis (Office)
Utilitarian State
Social State
Hedonic State
Percent (%)
occasions

Figure E4. Posterior States Over Time (First App)

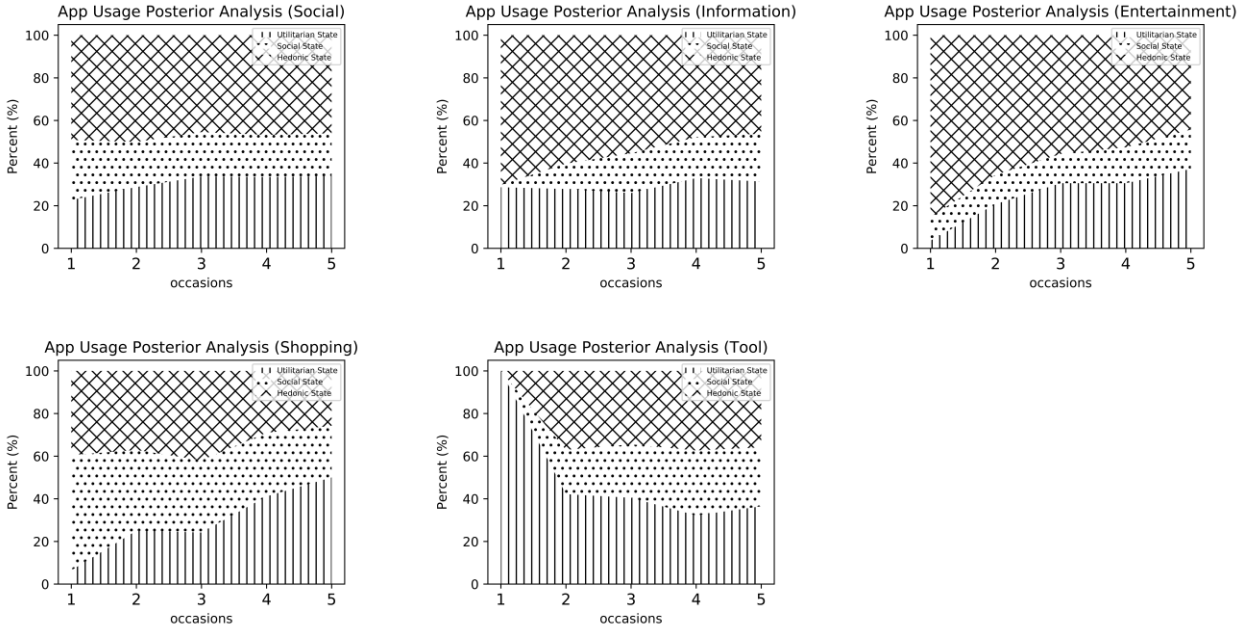


Figure E5. Posterior State Over Time (First and Second App Choices)

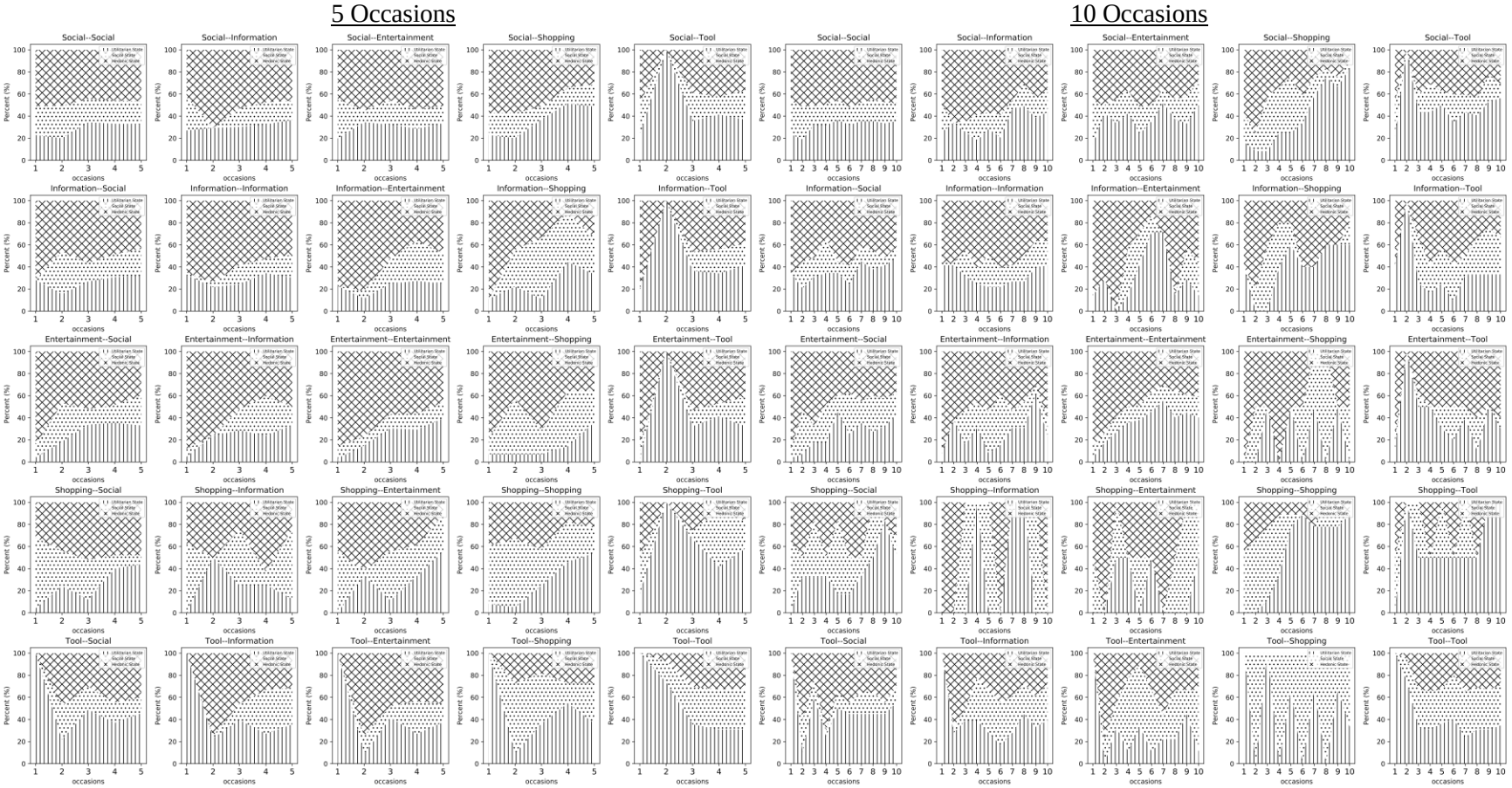
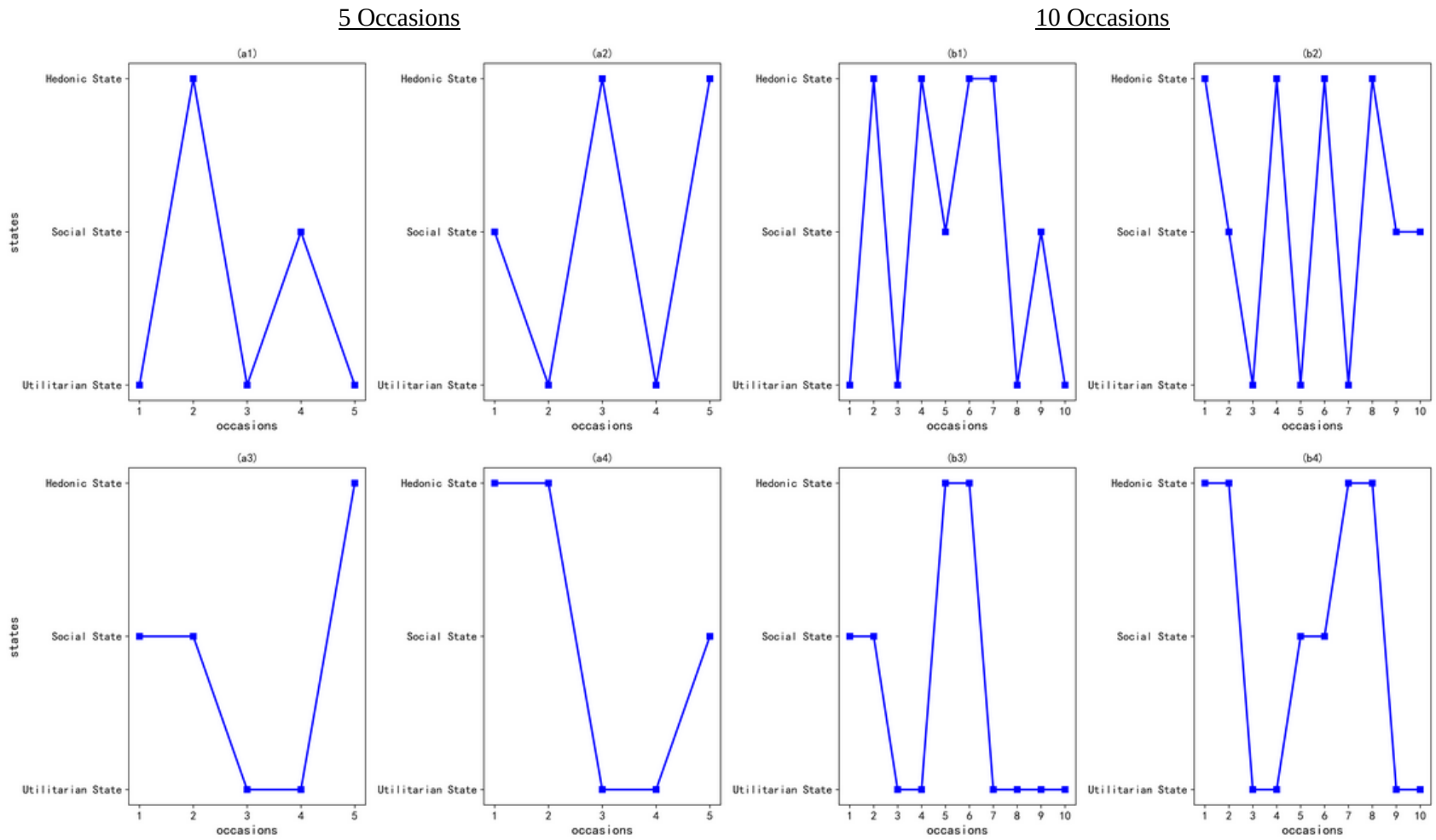


Figure E6. Posterior State Over Time (Session Examples)



F. Robustness Check – 15-Minute Threshold for Session Split

Table F1. Effects of Previous App Choice on Current Choice (Utilitarian State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	10.51 (35.09)	-1.55 (23.17)	-0.85 (7.49)	-1.06 (2.48)	-7.05 (31.77)	56.06
Information	-9.63 (14.95)	21.64 (46.36)	-3.73 (4.61)	-1.32 (2.22)	-6.96 (31.86)	51.34
Entertainment	-3.01 (21.57)	-1.20 (23.52)	7.91 (16.25)	-1.33 (2.21)	-2.37 (36.45)	59.60
Shopping	-8.10 (16.48)	1.94 (26.66)	-0.90 (7.44)	11.78 (15.32)	-4.72 (34.10)	61.16
Tool	-9.86 (14.72)	-8.07 (16.65)	-2.68 (5.66)	-2.13 (1.41)	22.74 (61.56)	50.98
Intrinsic Share	(24.58)	(24.72)	(8.34)	(3.54)	(38.82)	------

Table F2. Effects of Previous App Choice on Current Choice (Social State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	30.67 (86.82)	-3.95 (1.47)	-19.57 (8.45)	-5.40 (2.56)	-1.75 (0.70)	8.77
Information	-17.38 (38.77)	32.21 (37.63)	-9.09 (18.93)	-4.38 (3.58)	-1.36 (1.09)	16.39
Entertainment	-12.10 (44.05)	-1.85 (3.57)	16.83 (44.85)	-2.43 (5.53)	-0.45 (2.00)	18.67
Shopping	-5.80 (50.35)	-2.22 (3.20)	-12.66 (15.36)	21.92 (29.88)	-1.24 (1.21)	17.48
Tool	-9.83 (46.32)	0.33 (5.75)	-7.47 (20.55)	-0.34 (7.62)	17.31 (19.76)	21.45
Intrinsic Share	(56.15)	(5.42)	(28.02)	(7.96)	(2.45)	------

Table F3. Effects of Previous App Choice on Current Choice (Hedonic State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	36.02 (71.25)	-5.67 (5.03)	-26.41 (19.89)	-1.40 (1.77)	-2.54 (2.06)	12.00
Information	-9.39 (25.84)	20.63 (31.33)	-10.80 (35.50)	-0.41 (2.76)	-0.03 (4.57)	19.36
Entertainment	-13.35 (21.88)	-7.23 (3.47)	25.29 (71.59)	-2.01 (1.16)	-2.70 (1.90)	9.26
Shopping	-15.30 (19.93)	-3.59 (7.11)	-17.38 (28.92)	38.17 (41.34)	-1.90 (2.70)	17.59
Tool	-3.47 (31.76)	-3.73 (6.97)	-12.87 (33.43)	-0.60 (2.57)	20.67 (25.27)	16.23
Intrinsic Share	(35.23)	(10.70)	(46.30)	(3.17)	(4.60)	------

Table F4. Effects of Previous App Usage on Current Duration (Utilitarian State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.45 (2.33)	-0.39 (4.49)	-0.33 (2.58)	-0.20 (0.78)	-0.77 (2.86)
Information	-0.13 (2.65)	-1.31 (3.57)	0.35 (3.26)	-0.14 (0.84)	0.45 (4.08)
Entertainment	0.01 (2.79)	0.93 (5.81)	-0.50 (2.41)	-0.12 (0.86)	-0.96 (2.67)
Shopping	0.21 (2.99)	-0.38 (4.50)	0.96 (3.87)	-0.49 (0.49)	0.78 (4.41)
Tool	-0.33 (2.45)	0.87 (5.75)	-0.32 (2.59)	0.03 (1.01)	1.08 (4.71)
Intrinsic Time	(2.78)	(4.88)	(2.91)	(0.98)	(3.63)

Table F5. Effects of Previous App Usage on Current Duration (Social State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.69 (3.20)	0.05 (1.16)	-0.11 (1.43)	0.06 (0.66)	-0.15 (0.68)
Information	0.40 (4.29)	0.06 (1.17)	-0.12 (1.42)	-0.14 (0.46)	-0.07 (0.76)
Entertainment	0.00 (3.89)	-0.02 (1.09)	-0.06 (1.48)	-0.08 (0.52)	-0.16 (0.67)
Shopping	1.40 (5.29)	-0.08 (1.03)	0.89 (2.43)	0.10 (0.70)	0.41 (1.24)
Tool	0.41 (4.30)	0.40 (1.51)	-0.03 (1.51)	0.16 (0.76)	-0.03 (0.80)
Intrinsic Time	(3.89)	(1.11)	(1.54)	(0.60)	(0.83)

Table F6. Effects of Previous App Usage on Current Duration (Hedonic State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.08 (3.68)	-0.53 (1.45)	-0.34 (2.49)	0.35 (2.43)	0.22 (2.46)
Information	0.79 (4.55)	-0.05 (1.93)	-0.22 (2.61)	-0.11 (1.97)	-0.12 (2.12)
Entertainment	-0.13 (3.63)	0.04 (2.02)	-0.05 (2.78)	0.15 (2.23)	-0.05 (2.19)
Shopping	-0.08 (3.68)	-0.49 (1.49)	0.12 (2.95)	0.13 (2.21)	0.58 (2.82)
Tool	0.98 (4.74)	-0.12 (1.86)	0.29 (3.12)	1.26 (3.34)	-0.20 (2.04)
Intrinsic Time	(3.76)	(1.98)	(2.83)	(2.08)	(2.24)

Table F7. Intrinsic State Transition Matrix

$t \rightarrow t+1$	Utilitarian (%)	Social (%)	Hedonic (%)
Utilitarian	67.41	13.52	19.07
Social	33.52	39.36	27.12
Hedonic	37.84	8.56	53.60

Table F8. Change in State Transition Probability: *WiFi* (Baseline: *3G*)

$t \rightarrow t+1$	Utilitarian (%)	Social (%)	Hedonic (%)
Utilitarian	-1.72 (66.71)	0.71 (13.81)	1.01 (19.48)
Social	-0.41 (33.35)	0.73 (39.67)	-0.32 (26.98)
Hedonic	0.70 (38.13)	0.16 (8.63)	-0.86 (53.24)

Table F9. Change in State Transition Probability: Location (Baseline: *Office*)

$t \rightarrow t+1$	*Home* (%)			*On the Way* (%)		
	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic
Utilitarian	-11.42 (64.46)	4.74 (14.74)	6.68 (20.80)	-7.67 (68.21)	3.19 (13.19)	4.48 (18.60)
Social	5.95 (35.17)	-10.76 (36.39)	4.81 (28.44)	2.68 (31.90)	-4.85 (42.30)	2.17 (25.80)
Hedonic	4.46 (38.61)	1.01 (8.73)	-5.47 (52.66)	5.64 (39.79)	1.28 (9.00)	-6.92 (51.21)

Table F10. Change in State Transition Probability: Time of Day (Baseline: *Night*)

$t \rightarrow t+1$	*Morning* (%)			*Day* (%)			*Evening* (%)		
	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic
Utilitarian	-1.84 (70.27)	0.76 (12.33)	1.08 (17.40)	-3.93 (68.18)	1.63 (13.20)	2.30 (18.62)	-7.52 (64.59)	3.12 (14.69)	4.40 (20.72)
Social	2.91 (34.55)	-5.26 (37.49)	2.35 (27.96)	1.57 (33.21)	-2.82 (39.93)	1.25 (26.86)	2.45 (34.09)	-4.42 (38.33)	1.97 (27.58)
Hedonic	8.53 (43.24)	1.93 (9.78)	-10.46 (46.98)	1.98 (36.69)	0.45 (8.30)	-2.43 (55.01)	3.92 (38.63)	0.89 (8.74)	-4.81 (52.63)

G. Robustness Check – 25-Minute Threshold for Session Split

Table G1. Effects of Previous App Choice on Current Choice (Utilitarian State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	10.89 (34.88)	-3.91 (22.98)	-2.58 (6.99)	-0.90 (1.65)	-3.50 (33.50)	53.35
Information	-6.66 (17.33)	16.99 (43.88)	-2.70 (6.87)	-0.79 (1.76)	-6.84 (30.16)	51.69
Entertainment	-1.80 (22.19)	-6.25 (20.64)	10.54 (20.11)	-1.00 (1.55)	-1.49 (35.51)	60.12
Shopping	-2.32 (21.67)	0.37 (27.26)	-1.81 (7.76)	7.56 (10.11)	-3.80 (33.20)	61.33
Tool	-7.49 (16.50)	-6.35 (20.54)	-3.07 (6.50)	-1.53 (1.02)	18.44 (55.44)	50.01
Intrinsic Share	(23.99)	(26.89)	(9.57)	(2.55)	(37.00)	------

Table G2. Effects of Previous App Choice on Current Choice (Social State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	27.46 (89.60)	-2.85 (1.29)	-18.95 (7.19)	-4.17 (1.36)	-1.49 (0.56)	9.46
Information	-18.61 (43.53)	29.65 (33.79)	-8.09 (18.05)	-2.16 (3.37)	-0.79 (1.26)	17.11
Entertainment	-16.22 (45.92)	-1.70 (2.44)	20.99 (47.13)	-2.30 (3.23)	-0.77 (1.28)	17.38
Shopping	-3.89 (58.25)	-1.11 (3.03)	-10.40 (15.74)	16.03 (21.56)	-0.63 (1.42)	17.48
Tool	-7.37 (54.77)	0.01 (4.15)	-5.55 (20.59)	-0.73 (4.80)	13.64 (15.69)	21.23
Intrinsic Share	(62.14)	(4.14)	(26.14)	(5.53)	(2.05)	------

Table G3. Effects of Previous App Choice on Current Choice (Hedonic State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	35.02 (64.72)	-8.70 (6.05)	-21.21 (24.92)	-1.75 (1.69)	-3.36 (2.62)	12.88
Information	-8.98 (20.72)	26.24 (40.99)	-15.10 (31.03)	-0.92 (2.52)	-1.24 (4.74)	18.54
Entertainment	-13.59 (16.11)	-10.39 (4.36)	28.69 (74.82)	-1.87 (1.57)	-2.84 (3.14)	8.68
Shopping	-10.43 (19.27)	-5.58 (9.17)	-18.06 (28.07)	36.60 (40.04)	-2.53 (3.45)	17.43
Tool	-9.66 (20.04)	-6.96 (7.79)	-9.36 (36.77)	-0.83 (2.61)	26.81 (32.79)	15.45
Intrinsic Share	(29.70)	(14.75)	(46.13)	(3.44)	(5.98)	------

Table G4. Effects of Previous App Usage on Current Duration (Utilitarian State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.40 (2.40)	-1.02 (5.13)	0.11 (2.91)	-0.17 (0.92)	-0.60 (2.89)
Information	-0.03 (2.77)	-0.61 (5.54)	-0.47 (2.33)	-0.22 (0.87)	0.01 (3.50)
Entertainment	-0.26 (2.54)	1.02 (7.17)	-0.48 (2.32)	0.10 (1.19)	-0.93 (2.56)
Shopping	-0.09 (2.71)	-1.30 (4.85)	0.44 (3.24)	-0.66 (0.43)	1.73 (5.22)
Tool	-0.01 (2.79)	0.91 (7.06)	0.09 (2.89)	-0.16 (0.93)	0.40 (3.89)
Intrinsic Time	(2.80)	(6.15)	(2.80)	(1.09)	(3.49)

Table G5. Effects of Previous App Usage on Current Duration (Social State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.28 (4.03)	-0.05 (1.14)	-0.07 (1.66)	0.03 (0.61)	-0.26 (0.84)
Information	0.04 (4.35)	-0.17 (1.02)	-0.12 (1.61)	-0.02 (0.56)	-0.10 (1.00)
Entertainment	-0.10 (4.21)	0.24 (1.43)	-0.49 (1.24)	0.03 (0.61)	-0.14 (0.96)
Shopping	-0.18 (4.13)	-0.17 (1.02)	0.58 (2.31)	0.20 (0.78)	0.37 (1.47)
Tool	-0.22 (4.09)	0.35 (1.54)	0.03 (1.76)	-0.04 (0.54)	0.06 (1.16)
Intrinsic Time	(4.31)	(1.19)	(1.73)	(0.58)	(1.10)

Table G6. Effects of Previous App Usage on Current Duration (Hedonic State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.24 (2.91)	-0.15 (1.52)	0.10 (4.61)	0.04 (2.27)	0.14 (2.43)
Information	0.19 (3.34)	-0.28 (1.39)	-0.66 (3.85)	-0.50 (1.73)	0.20 (2.49)
Entertainment	-0.27 (2.88)	0.27 (1.94)	-0.07 (4.44)	0.09 (2.32)	-0.05 (2.24)
Shopping	0.23 (3.38)	-0.10 (1.57)	0.31 (4.82)	0.52 (2.75)	-0.10 (2.19)
Tool	-0.02 (3.13)	0.04 (1.71)	-0.50 (4.01)	0.69 (2.92)	-0.10 (2.19)
Intrinsic Time	(3.15)	(1.67)	(4.51)	(2.23)	(2.29)

Table G7. Intrinsic State Transition Matrix

$t \rightarrow t+1$	Utilitarian (%)	Social (%)	Hedonic (%)
Utilitarian	66.60	11.96	21.44
Social	31.02	42.33	26.65
Hedonic	34.70	8.32	56.98

Table G8. Change in State Transition Probability: *WiFi* (Baseline: *3G*)

$t \rightarrow t+1$	Utilitarian (%)	Social (%)	Hedonic (%)
Utilitarian	-2.46 (65.59)	0.88 (12.32)	1.58 (22.09)
Social	0.91 (31.40)	-1.69 (41.63)	0.78 (26.97)
Hedonic	-2.37 (33.72)	-0.57 (8.09)	2.94 (58.19)

Table G9. Change in State Transition Probability: Location (Baseline: *Office*)

$t \rightarrow t+1$	*Home* (%)			*On the Way* (%)		
	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic
Utilitarian	-10.05 (63.42)	3.60 (13.10)	6.45 (23.48)	-4.39 (69.08)	1.57 (11.07)	2.82 (19.85)
Social	5.21 (32.36)	-9.68 (39.85)	4.47 (27.79)	2.82 (29.97)	-5.23 (44.30)	2.41 (25.73)
Hedonic	6.49 (36.17)	1.56 (8.67)	-8.05 (55.16)	4.21 (33.89)	1.02 (8.13)	-5.23 (57.98)

Table G10. Change in State Transition Probability: Time of Day (Baseline: *Night*)

$t \rightarrow t+1$	*Morning* (%)			*Day* (%)			*Evening* (%)		
	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic
Utilitarian	-3.24 (68.07)	1.16 (11.44)	2.08 (20.49)	-3.03 (68.28)	1.08 (11.36)	1.95 (20.36)	-8.32 (62.99)	2.97 (13.25)	5.35 (23.76)
Social	2.17 (30.89)	-4.03 (42.58)	1.86 (26.53)	3.06 (31.78)	-5.68 (40.93)	2.62 (27.29)	1.97 (30.69)	-3.65 (42.96)	1.68 (26.35)
Hedonic	9.38 (42.22)	2.25 (10.13)	-11.63 (47.65)	0.88 (33.72)	0.21 (8.09)	-1.09 (58.19)	1.58 (34.42)	0.38 (8.26)	-1.96 (57.32)

H. Robustness Check – Reclassify App Category

We examine the robustness of app classification. Specifically, there are three well-known social-shopping apps in the China market during the sample period: MeiLiShuo, MoGuJie and BeiMeiShengQianKuaiBao. In the main model, we classify them as shopping apps. To check the robustness of the findings, we re-classify them as social apps. We then re-estimate the model and perform the same analyses. We report the results below. The main findings are robust.

Table H1. Effects of Previous App Choice on Current Choice (Utilitarian State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	10.89 (35.43)	-2.43 (25.18)	-2.12 (6.97)	-0.75 (2.30)	-5.59 (30.12)	58.25
Information	-6.82 (17.72)	18.52 (46.13)	-2.51 (6.58)	-1.14 (1.91)	-8.05 (27.66)	54.17
Entertainment	-5.21 (19.33)	-4.25 (23.36)	10.88 (19.97)	-1.26 (1.79)	-0.16 (35.55)	62.26
Shopping	-5.04 (19.50)	0.66 (28.27)	-1.43 (7.66)	9.80 (12.85)	-3.99 (31.72)	63.77
Tool	-5.87 (18.67)	-6.46 (21.15)	-3.12 (5.97)	-1.68 (1.37)	17.13 (52.84)	53.85
Intrinsic Share	(24.54)	(27.61)	(9.09)	(3.05)	(35.71)	------

Table H2. Effects of Previous App Choice on Current Choice (Social State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	27.10 (90.74)	-3.31 (1.19)	-17.43 (5.95)	-4.58 (1.50)	-1.78 (0.62)	8.67
Information	-19.38 (44.26)	31.40 (35.90)	-8.61 (14.77)	-2.45 (3.63)	-0.96 (1.44)	17.12
Entertainment	-15.18 (48.46)	-1.07 (3.43)	18.88 (42.26)	-1.85 (4.23)	-0.78 (1.62)	19.45
Shopping	-9.05 (54.59)	-1.48 (3.02)	-9.80 (13.58)	21.14 (27.22)	-0.81 (1.59)	18.05
Tool	-9.00 (54.64)	0.00 (4.50)	-6.81 (16.57)	-0.81 (5.27)	16.62 (19.02)	22.17
Intrinsic Share	(63.64)	(4.50)	(23.38)	(6.08)	(2.40)	------

Table H3. Effects of Previous App Choice on Current Choice (Hedonic State)

$t \rightarrow t+1$	Social (%)	Information (%)	Entertainment (%)	Shopping (%)	Tool (%)	Stop
Social	36.71 (74.97)	-7.88 (4.72)	-23.32 (16.50)	-1.90 (1.69)	-3.61 (2.12)	12.44
Information	-11.32 (26.94)	24.66 (37.26)	-11.25 (28.57)	-0.82 (2.77)	-1.27 (4.46)	20.75
Entertainment	-14.72 (23.54)	-8.26 (4.34)	27.74 (67.56)	-1.81 (1.78)	-2.95 (2.78)	10.07
Shopping	-14.92 (23.34)	-5.34 (7.26)	-15.50 (24.32)	37.75 (41.34)	-1.99 (3.74)	18.98
Tool	-8.42 (29.84)	-5.08 (7.52)	-9.48 (30.34)	-0.75 (2.84)	23.73 (29.46)	17.40
Intrinsic Share	(38.26)	(12.60)	(39.82)	(3.59)	(5.73)	------

Table H4. Effects of Previous App Usage on Current Duration (Utilitarian State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.39 (2.13)	-0.62 (3.93)	-0.11 (2.81)	-0.22 (0.75)	-0.42 (3.42)
Information	-0.10 (2.42)	-0.68 (3.87)	-0.32 (2.60)	-0.21 (0.76)	-0.10 (3.74)
Entertainment	-0.15 (2.37)	0.45 (5.00)	-0.72 (2.20)	0.01 (0.98)	-0.83 (3.01)
Shopping	0.05 (2.57)	-0.64 (3.91)	0.96 (3.88)	-0.57 (0.40)	1.26 (5.10)
Tool	-0.11 (2.41)	0.34 (4.89)	-0.11 (2.81)	-0.14 (0.83)	0.02 (3.86)
Intrinsic Time	(2.52)	(4.55)	(2.92)	(0.97)	(3.84)

Table H5. Effects of Previous App Usage on Current Duration (Social State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.47 (2.99)	-0.07 (1.09)	-0.10 (1.39)	0.00 (0.56)	-0.21 (0.82)
Information	-0.06 (3.40)	-0.13 (1.03)	-0.07 (1.42)	-0.03 (0.53)	-0.13 (0.90)
Entertainment	-0.14 (3.32)	-0.00 (1.16)	-0.37 (1.12)	0.00 (0.56)	-0.13 (0.90)
Shopping	0.27 (3.73)	-0.17 (0.99)	0.38 (1.87)	0.08 (0.64)	0.18 (1.21)
Tool	-0.09 (3.37)	0.11 (1.27)	0.02 (1.51)	0.04 (0.60)	0.02 (1.05)
Intrinsic Time	(3.46)	(1.16)	(1.49)	(0.56)	(1.03)

Table H6. Effects of Previous App Usage on Current Duration (Hedonic State)

$t \rightarrow t+1$	Social	Information	Entertainment	Shopping	Tool
Social	-0.27 (2.86)	-0.35 (1.22)	0.08 (3.87)	-0.09 (2.21)	-0.07 (1.84)
Information	-0.09 (3.04)	-0.13 (1.44)	-0.40 (3.39)	-0.46 (1.84)	0.01 (1.92)
Entertainment	-0.12 (3.01)	0.14 (1.71)	-0.21 (3.58)	0.14 (2.44)	-0.14 (1.77)
Shopping	-0.07 (3.06)	-0.32 (1.25)	0.33 (4.12)	0.10 (2.40)	0.04 (1.95)
Tool	-0.18 (2.95)	-0.06 (1.51)	-0.11 (3.68)	1.02 (3.32)	-0.14 (1.77)
Intrinsic Time	(3.13)	(1.57)	(3.79)	(2.30)	(1.91)

Table H7. Intrinsic State Transition Matrix

$t \rightarrow t+1$	Utilitarian (%)	Social (%)	Hedonic (%)
Utilitarian	67.24	11.56	21.20
Social	30.60	45.79	23.61
Hedonic	35.58	7.51	56.91

Table H8. Change in State Transition Probability: *WiFi* (Baseline: *3G*)

$t \rightarrow t+1$	Utilitarian (%)	Social (%)	Hedonic (%)
Utilitarian	-1.53 (66.62)	0.53 (11.58)	1.00 (21.80)
Social	-0.15 (30.54)	0.27 (45.90)	-0.12 (23.56)
Hedonic	-0.86 (35.22)	-0.18 (7.44)	1.04 (57.34)

Table H9. Change in State Transition Probability: Location (Baseline: *Office*)

$t \rightarrow t+1$	*Home* (%)			*On the Way* (%)		
	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic
Utilitarian	-11.02 (64.25)	3.82 (12.40)	7.20 (23.35)	-6.39 (68.88)	2.21 (10.79)	4.18 (20.33)
Social	4.61 (32.04)	-8.17 (43.24)	3.56 (24.72)	1.28 (28.71)	-2.27 (49.14)	0.99 (22.15)
Hedonic	5.56 (36.88)	1.17 (7.79)	-6.73 (55.33)	3.58 (34.90)	0.75 (7.37)	-4.33 (57.73)

Table H10. Change in State Transition Probability: Time of Day (Baseline: *Night*)

$t \rightarrow t+1$	*Morning* (%)			*Day* (%)			*Evening* (%)		
	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic	Utilitarian	Social	Hedonic
Utilitarian	-2.43 (69.06)	0.84 (10.73)	1.59 (20.21)	-3.49 (68.00)	1.21 (11.10)	2.28 (20.90)	-6.71 (64.78)	2.32 (12.21)	4.39 (23.01)
Social	2.14 (30.72)	-3.79 (45.58)	1.65 (23.70)	2.31 (30.89)	-4.11 (45.26)	1.80 (23.85)	2.12 (30.70)	-3.77 (45.60)	1.65 (23.70)
Hedonic	7.46 (40.38)	1.58 (8.53)	-9.04 (51.09)	2.87 (35.79)	0.61 (7.56)	-3.48 (56.65)	1.81 (34.73)	0.38 (7.33)	-2.19 (57.94)