

# A Consumer Adoption Model for Smart Phone – A survey on Japanese younger generation.

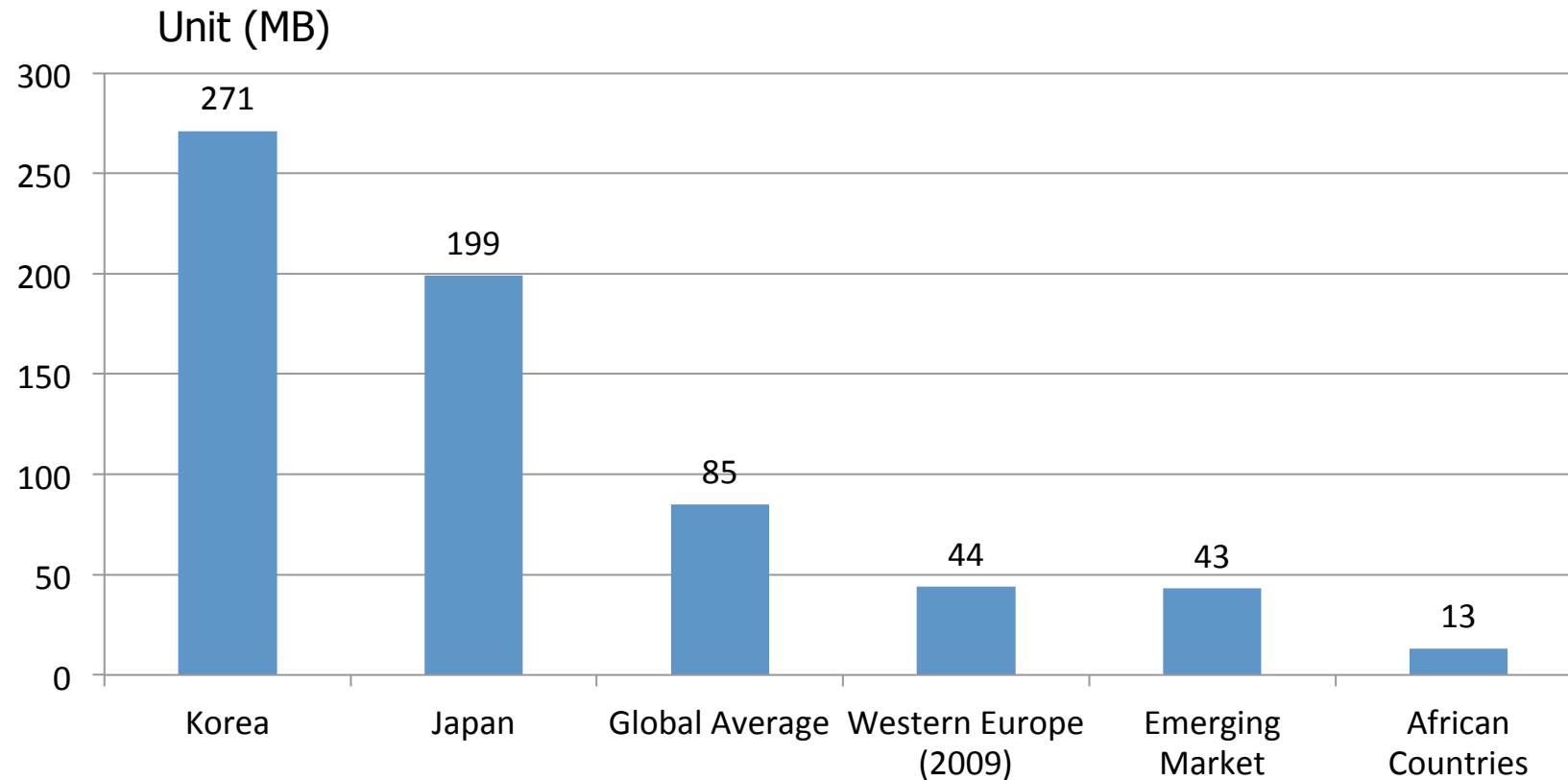
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# **BACKGROUND**

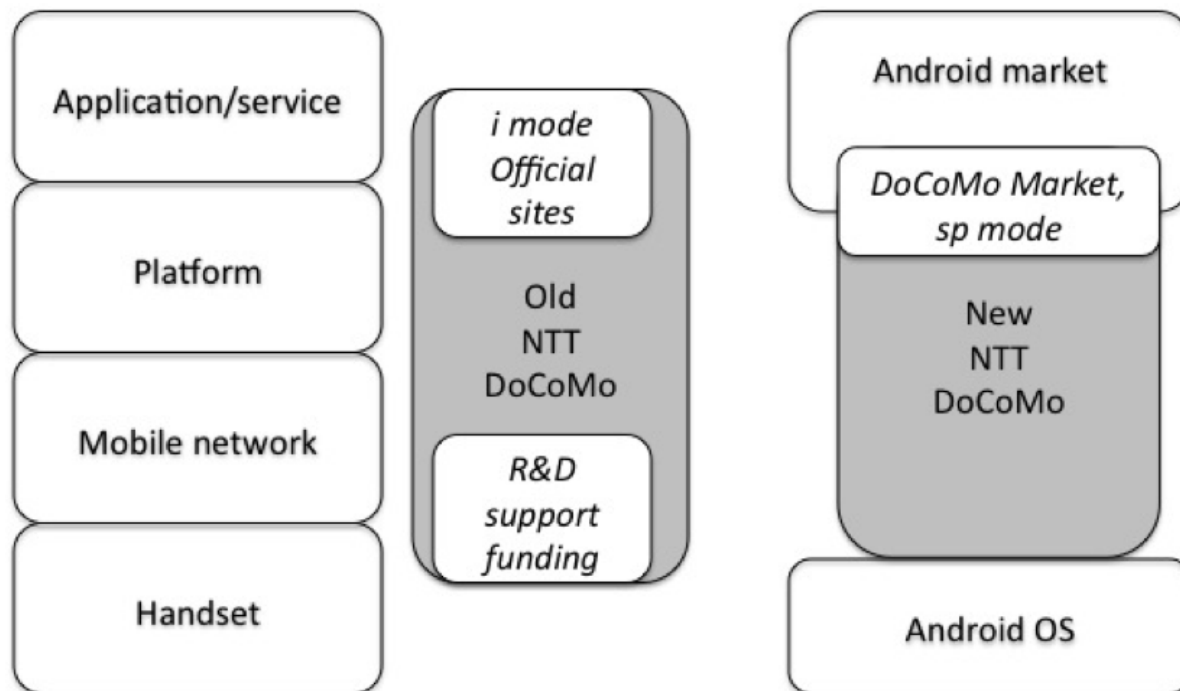
# Average Traffic per Smart Phone User in Select Countries (2010).



Source: Informa Telecoms and Media (2010)

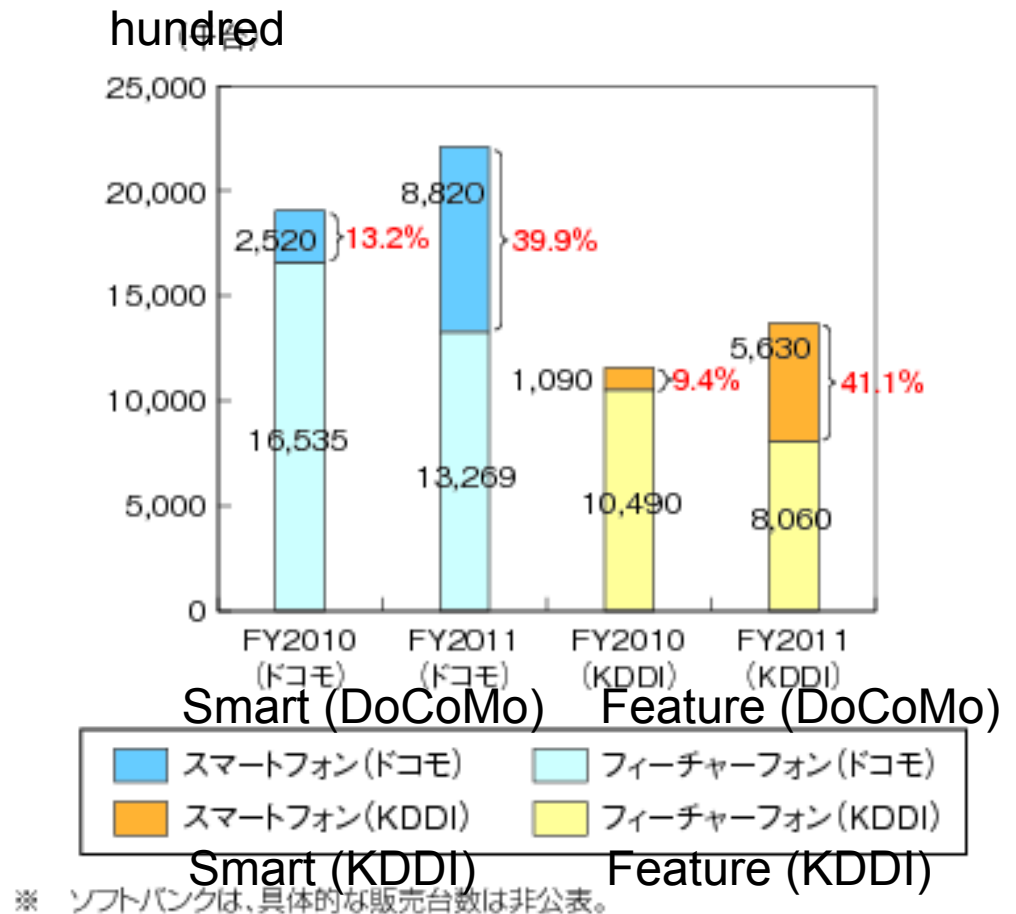
# Market Positions of Mobile Phone Operator.

- Market structure of smart phone for vendors and operators.



# Slow switch of handsets in Japan.

- In FY 2011 about **half** of handset shipment of major two carriers is **feature phone**.
- Its migration speed is very slow in Japan.

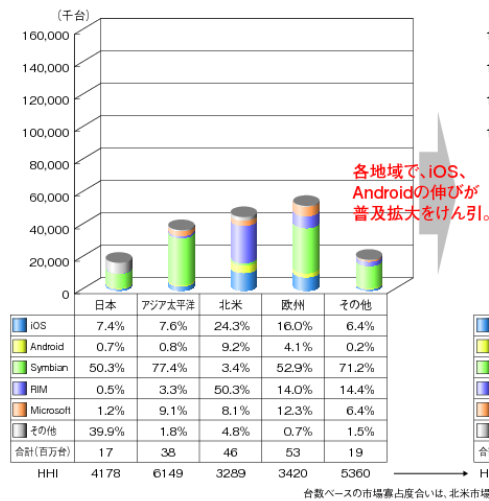


Source: MIC Communication White Paper

# Diffusion of Smart Phone.

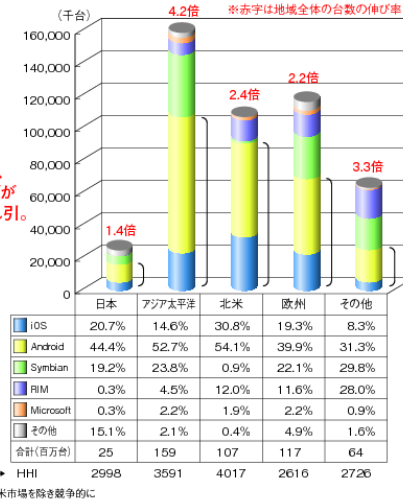
【OS別】

スマートフォンのエンドユーザ向け販売台数(2009年)



FY 2010

スマートフォンのエンドユーザ向け販売台数(2011年)

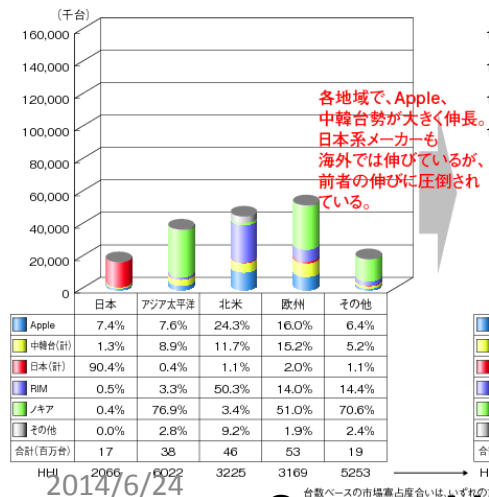


FY 2011

- Diffusion speed is very slow in Japan.
  - Japan: 1.4
  - Asia Pacific: 4.2
  - North America: 2.4
  - Euro: 2.2
  - Others: 3.3

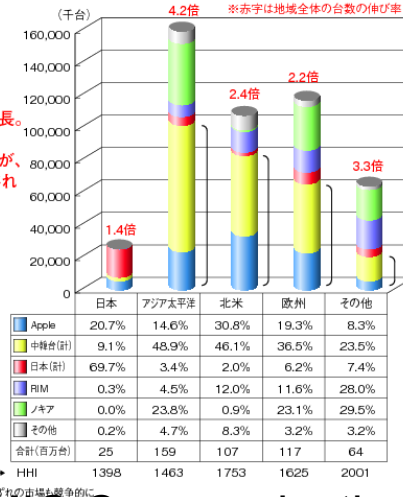
【メーカー別】

スマートフォンのエンドユーザ向け販売台数(2009年)



2014/6/24

スマートフォンのエンドユーザ向け販売台数(2011年)



Source: MIC Communication White Paper

## Feature Phones in Japan and S. Korea.

- Japanese feature phone provides **various useful services** like today's smart phone; mobile wallet, infrared-ray communication, dual camera, and carrier based platform service (e-mail, cHTML, settlement service, etc.).
- These **domestic proprietary services and software are very rich** in Japan.
- In S. Korea there was **no flat rate mobile data plan for feature phones** and most of user were contented just **using fixed broadband** instead of carrier based mobile services.

# The Impact of iPhone for Japan.

- Apple started to provide application market cross over the countries over the iPhone platform.
- But we must abandon familiar services over **carrier based platform and hardware**; cHTML based mobile web pages, mobile carrier based e-mail, mobile TV, infrared communication, mobile wallet, etc.

=> Here we should pay *higher switching cost*!



# Japanese Mobile Usage in Function.

Ranking	Service/ functions	Usage rate	Smart phone uswe
1	e-mail	92.0%	60.2%
2	Camera	77.0%	
3	Decoration	69.0%	
4	Internet	63.5%	78.2%
5	Photo mail	56.0%	
6	<b>TV player</b>	<b>39.2%</b>	
7	Applications Game	34.7%	63.0% 52.8%
8	Security	34.5%	
9	Movie	34.1%	
10	Video mail	32.5%	50.9%
11	PC file view	26.5%	
12	Ringtone songs download	24.8%	57.4%
13	Music player	24.7%	

2014/6/24

Ranking	Service/ functions	Usage rate	Smart phone usage
14	GPS	24.0%	49.5%
15	eBooks	19.5%	
16	SNS/Blog	19.3%	
17	Scheduling	17.2%	50.9%
18	<b>Infrared communication</b>	<b>17.2%</b>	
19	Wallpaper download	16.3%	
20	<b>Mobile wallet</b>	<b>16.0%</b>	
21	File download from PC	15.0%	
22	International roaming	15.0%	
23	Ringtone download	14.7%	
24	RSS	14.0%	
25	Twitter	13.5%	
26	Bluetooth	10.0%	

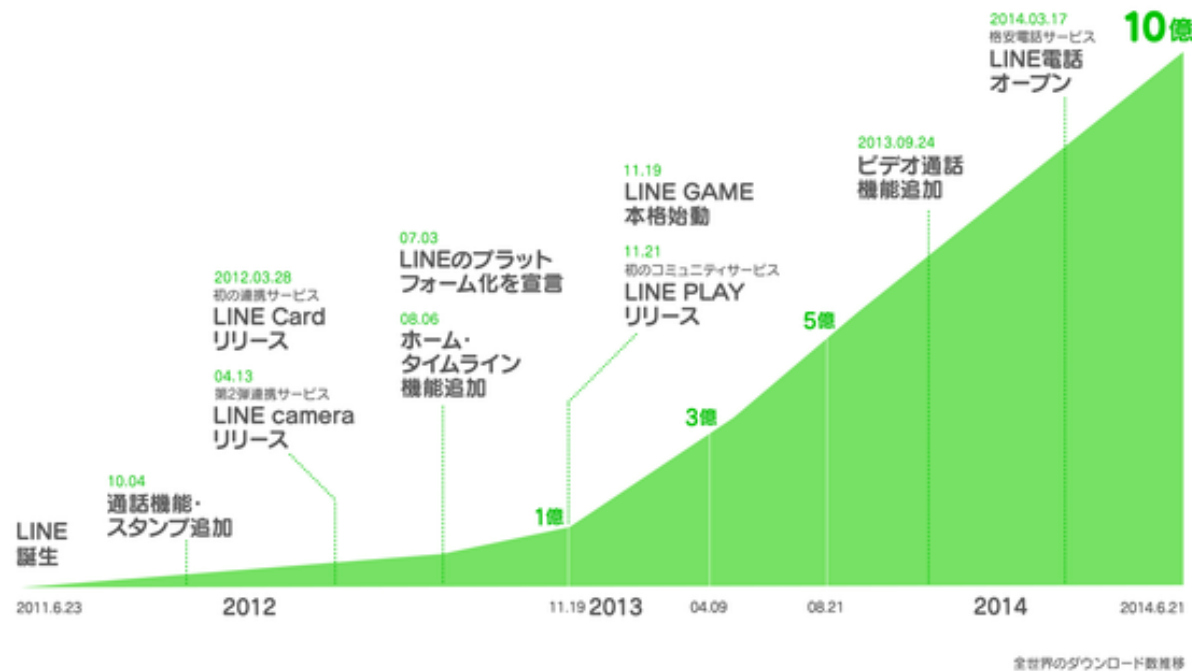
Source: CIAJ (2010)

# Service selection for them

	Functions	Importance (1 to 7)
BASIC FUNCTIONS	<i>Browsing</i>	<i>6.59</i>
	Carrier e-mail	5.68
	SMTP e-mail	5.90
	Any e-mail	5.82
SMART PHONE FUNCTIONS	GPS	5.81
	<i>LINE</i>	<i>5.91</i>
	Facebook	4.36
	Twitter	4.67
	Any SMS	5.53
	Online game	4.42
FEATURE PHONE FUNCTIONS	Mobile wallet (FPF)	3.27
	Mobile TV (FPF)	3.40
	<i>Infrared communication (FPF)</i>	<i>4.66</i>
	All of FPFs	4.00

# App: LINE

## 10億ダウンロードまでの道のり

























Source: <http://official-blog.line.me/ja/>

- Start at 2011/6/23.
- 100 M at 2013/11/19.
- 300M at 2013/4/9
- 500M at 2013/8/21
- 1B at 2014/6/21

# Messenger in the World

## GLOBAL REACH OF MESSAGING APPS

	 FB Messenger	 KakaoTalk	 LINE	 Pinger	 WeChat	 WhatsApp
	12%	1%	1%	8%*	1%	9%
	17%	1%	2%	-	2%	18%
	15%	-	1%	-	1%	49%
	19%	1%	4%	-	5%	22%
	29%	-	-	-	-	96%
	32%	-	4%	-	-	90%
	27%	-	26%	-	-	96%
	31%	-	14%	-	-	94%
	29%	-	1%	-	-	91%
	13%	-	44%	-	-	99%
	19%	-	1%	-	-	17%
	33%	-	3%	-	-	93%
	-	2%	11%	-	82%	15%
	21%	3%	46%	-	53%	96%
	18%	9%	71%	-	6%	8%
	6%	95%	12%	-	-	3%

- LINE: Japan
- KakaoTalk: Korea
- WeChat: China
- FB Messenger: US
- WhatsApp: Others

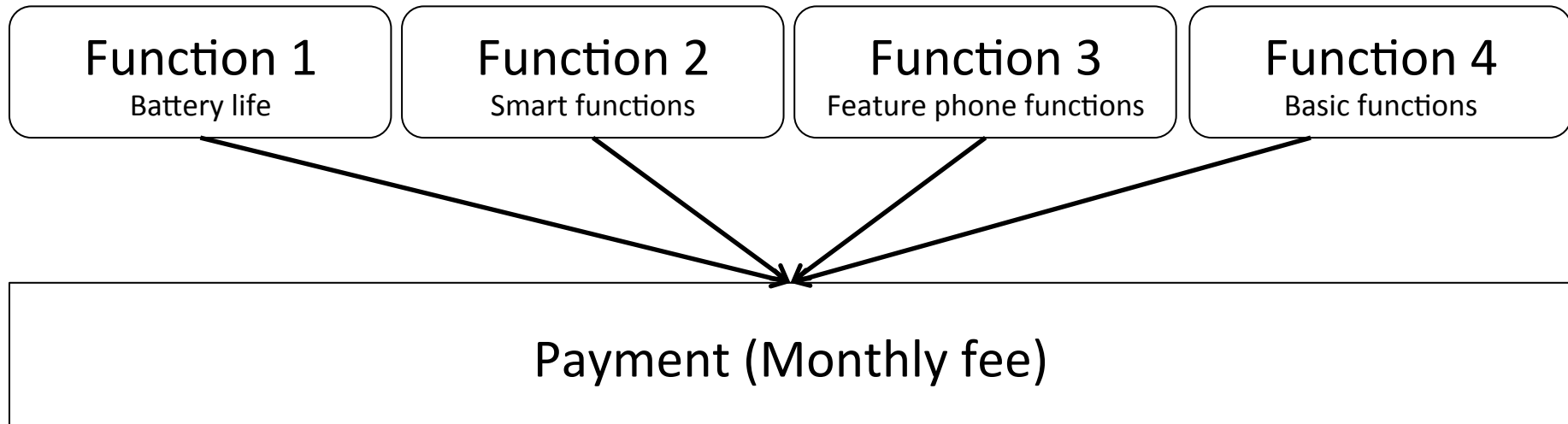
-> Domestic or Euro

# CONJOINT ANALYSIS

# Samples and Methodology

- A web survey on 252 university students in 8 Jan. 2014 to 12 Jan. 2014 in Kyoto.
- Request to select one profile card from five.
- To use conjoint analysis I calculate Marginal Willingness to Pay for each factors.
- Sample number for conjoint analysis is 1,519 and its log-likelihood is -1025.200185.

# Conjoint model



- Consumers' payment would be explained by selected functions.
- Monthly fee: communication cost + handset by monthly installments

# Four Profiles are shown from Listed Five Variable

Monthly fee: **3,000/7,000/10,000 Yen**  
Battery life: **5/20/30 hours**  
Basic functions: **Internet access/ + e-mail**  
Smart functions: **GPS/ + SNS/ + GAME**  
Feature phone functions: **Yes/No**

- Select one from five choice.
- Variables: monthly fee (inc. handset), battery life, functions (basic functions, smart phone, feature phone)

1Euro = 138.35 Yen, 1USD = 101.85 Yen, 1 GBP = 173.40 Yen (at 2014/6/23)



# A Sample of Selection Cards

Monthly fee: <b>3,000 Yen</b> Battery life: <b>30 hours</b> Basic functions: <b>Internet access + e-mail</b> Smart functions: <b>GPS + SNS + GAME</b> Feature phone functions: No	Monthly fee: <b>7,000 Yen</b> Battery life: <b>5 hours</b> Basic functions: <b>Internet access</b> Smart functions: <b>GPS</b> Feature phone functions: <b>Yes</b>
Monthly fee: <b>3,000 Yen</b> Battery life: <b>5 hours</b> Basic functions: <b>Internet access</b> Smart functions: <b>GPS</b> Feature phone functions: <b>No</b>	Monthly fee: <b>3,000 Yen</b> Battery life: <b>10 hours</b> Basic functions: <b>Internet access + e-mail</b> Smart functions: <b>GPS + SNS</b> Feature phone functions: <b>Yes</b>
<p style="text-align: center;"><b>Non of them</b></p>	

Five objects are set up, by assigning each standard of each design factor to an orthogonal table of an experimental planning method.

# Variables and its Statistic Values

- Marginal WTP (Willingness to Pay) for each factor.
- Exclude feature function all variables are significant in 99%.

Variables	Coefficient	t values	p values	
COST	-0.200667614	-15.24727762	6.10067E-49	***
HOURS	0.035464475	14.33509109	8.46923E-44	***
SMART	0.599918799	12.43746357	6.95526E-34	***
FEATURE	-0.031719369	-0.457029741	0.647715235	
BASIC	0.604994101	10.3418025	2.86571E-24	***

\*\*\*: 99%, \*\*: 95%, \*: 90%

# Marginal WTP

- largest WTP is BASIC (Internet access, E-mail), and then SMART (GPS, SNS, Game) while FEATURE (mobile wallet, mobile TV, and Infrared communication) is negative.

-> For our sample switching cost is **limited**.

	Marginal WTP (Yen/M)
HOURS (1 hours)	0.17673***
BASIC (+ e-mail)	3.01491***
SMART (+ 1 fnctn)	2.98961***
FEATURE (+ fnctns)	-0.15807

	Functions	Importance (1 to 7)
BASIC FUNCTIONS	Browsing	<b>6.59</b>
	Any e-mail	5.82
SMART PHONE FUNCTIONS	GPS	<b>5.81</b>
	Any SMS	5.53
	Online game	4.42
FEATURE PHONE FUNCTIONS	All of FPFs	4.00

# Imprecations

- Non-Tokyo young university students has very limited switching cost from feature phone to smart phone.
- Killer application for them is messenger LINE that enjoys network externalities.

# **MATHEMATICAL APPENDIX**

# Conjoint analysis: conditional logit

- Define  $U_{ij}$  as

$$U_{ij} = V_{ij} + \varepsilon_j = \beta x_{ij} + \varepsilon_j, j=1, 2, \dots, J.$$

$V$ : visible utility,  $\varepsilon$ : invisible utility,  $x$ : attribute vector

- Profile  $j$  is selected by probability  $P_j$ .

$$P_j = \exp(V_j) / \sum \exp(V_k).$$

- log-likelihood function LL as

$$LL = \sum \sum d_{ij} \ln \{ \exp(V_j) / \sum \exp(V_k) \}, \text{ d: dummy function (1/0) of respondent i select j.}$$

- First order condition as

$$\partial LL / \partial \beta = \sum \sum d_{ij} (x_{ij} - \mathbf{x}_i).$$

- Second order condition as

$$\partial^2 LL / \partial \beta \partial \beta' = \sum \sum P_{ij} (x_{ij} - \mathbf{x}_i)(x_{ij} - \mathbf{x}_i)', \mathbf{x}_i = \sum P_{ij} x_{ij}.$$

# Marginal Willingness to Pay (MWTP)

- Main effect model:  $V(x, c) = \sum \beta_k x_k + \beta_T T$ ,  
 $x$ : attribute variable,  $T$ : expense,  $\beta$ : parameter.  
 $\rightarrow$  Differentiate:  $\sum (\partial V / \partial x_k) dx_k + (\partial V / \partial T) dT = dV$ .
- $MWTP_{x_1} = (dT/dx_1) = -(\partial V / \partial x_1) / (\partial V / \partial T) = -\beta_1 / \beta_T$ .
- By utilise maximum likelihood method
- Parameter (repeat count  $t$ ) as  
 $\theta_{t+1} = \theta_t + \lambda_t \Delta_t$ ,  $\lambda$ : step size,  $\Delta$ : direction vector.
- First order condition as  
 $\{\partial \text{Ln} L(\theta_{t+1})\} / \partial \theta_{t+1} = \{\partial \text{Ln} L(\theta_t)\} / \partial \theta_t + H(\theta_t)(\theta_{t+1} - \theta_t) = 0$ ,  
 $H$ : Hessian matrices,  $H(\theta_t) = \{\partial^2 \text{Ln} L(\theta_t)\} / \partial \theta_t \partial \theta_t'$ .  
 $\theta_{t+1} = \theta_t + \{H(\theta_t)\}^{-1} \{\partial \text{Ln} L(\theta_t) / \partial \theta_t\}$ ;  
 $\theta_t \rightarrow N[\theta, \{I(\theta)\}^{-1}]$ ,  
 $N$ : normal distribution,  $I$ : Fisher's Information matrix,  $I(\theta) = E[\partial^2 \text{Ln} L / \partial \theta \partial \theta']$ .  
 $I(\theta) = \sum \mathbf{g}_i \mathbf{g}_i' = [\mathbf{G}_i \mathbf{G}_j']$ ,  $\mathbf{g}_i = \{\partial \text{Ln} L(\theta)\} / \partial \theta$ ,  $\mathbf{G} = [\mathbf{g}_1, \mathbf{g}_2, \dots, \mathbf{g}_n]$ .