

What Motivates Software Piracy in China: Q-Methodology Perspective

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and Kwangho Jung****

Abstract: This study explores why Chinese consumers use pirated software programs and how they think about their illegal use, relying on Q methodology. We developed 32 Q statements that outline reasons for using pirated software and surveyed 30 respondents from public officials, and software companies employees to students, professors, researchers, and the public. We developed four Q factors to describe four types of response to the use of pirated software. One group addresses a normative legal response, the second makes an economic utility argument, the third calls for punishing violators, and the fourth claims that they find themselves facing an uncomfortable dilemma in having to choose between the cheapness of illegal software and its illegality. Chinese respondents believe that government intervention can reduce the extent of illegal use (normative legal) and that intellectual property should be protected (economic utility). Furthermore, they acknowledged that the illegal use of software is a socio-structural problem across all social groups rather than a problem of a specific demographic group, such as a group of teenagers. Future research is required to explore not only whether or not perceptions regarding the use of illegal software vary from country to country but also how Confucian culture and norms are related to attitudes about the widespread use of counterfeit products in Asian countries.

Keywords: software piracy, Q methodology, comparative cultural analysis

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INTRODUCTION

The purpose of this study is to analyze why Chinese people use illegal software and how they perceive this illegal use by drawing on Q methodology. This study particularly focuses on users' deep-seated intentions. The reason why this study uses Q methodology can also be understood in this context. We review the literature on why people use an illegal software and how perceive the illegal behavior legally, economically, and morally and explain how Q methodology can be used to examine what perspectives are embedded in perceptions of the widespread illegal use of software in China. Relying on various sources, including interviews with Chinese government officials, software providers, office clerks, and researchers as well as previous papers, we generate a series of 32 Q statements on the illegal use of software and use them to assess how our 30 Chinese respondents perceive illegal software use (P sample).

Previous research has suggested various ways of understanding software piracy and means of reducing it (Asongu et al., 2016; Higgins, 2005; Lee & Yoo, 2009; Yoo, 2011). One approach is rational choice perspective, which focuses on deterrence efforts in reducing it (Moore & Dhillon, 2000). Other studies have emphasized non-legal or good governance approaches (Andrés & Asongu, 2013; Driouchi et al., 2015). Further research has also suggested the role of cultural differences in piracy and policy instruments that might be effective against it (Asongu et al., 2016; Yoo et al., 2014). However, these findings are relevant only in certain contexts, and moreover these accounts overlap or compete with each other in their explanation of why people attempt to use pirated software. We seek to identify perceptions about illegal software use that underlie these various factors by assessing a broad range of responses to illegal software use from software providers, users, regulators, including civil servants in charge of enforcement, to software company employees who develop software, groups of professors and experts, and the public. Of course, this study is limited in its representative sample because it targets a certain minority. It is this subject to the criticism that it is not possible to generalize the results of a Q-study based on a small number of subjects, that such generalization is only possible via random sampling (Kerlinger, 1973). However, this methodology has the advantage of being able to quantitatively measure the subjective aspects of human behavior. In particular, the subjectivity of policy participants in the administrative sector has a significant impact on policy outcomes. In this respect, analysis through Q methodology is useful (Kim, 2016, p. 105). The Q methodology allows researchers to understand a given situation in a representative fashion because the subjects are confronted with various responses to it through multiple Q statements (Brown et al., 1999). In addition, since Q factors are groups of people with similar views, perspectives, and values, the Q

methodology can be used to obtain a general view of these groups (Kim, 2016).

SOFTWARE PIRACY IN CHINA

In 2014, China had the highest illegal software usage rate in the world at 77%. The economic damage in the country from this illegal use was estimated to be USD\$8.9 billion (Business Software Alliance, 2014). According to a survey on software piracy awareness that was commissioned by Business Software Alliance and administered to 15,000 users in 33 countries, 57% of personal PC users have illegally copied or used counterfeit software, 31% of them on a regular basis and another 25% occasionally. These numbers demonstrate the urgency of developing appropriate countermeasures against the prevalence of software piracy through education and improved management mechanisms (Business Software Alliance, 2014).

Policy Efforts to Eradicate Software Piracy in China

Using pirated software is not considered immoral by Chinese consumers (Lin, 2015), and for this reason, the problem is hard to tackle. Chinese consumers tend not to be aware of copyright law, and there are fewer penalties for illegal copying in China; moreover, individual consumers are not punished for using pirated products (Lin, 2015). These factors together contribute to China's having "the world's highest piracy rate." But Since 2000, the Chinese government has made an active effort to address the problem of China being seen as a "piracy haven." The State Council issued a "notice on the use of authorized software by government agencies and on the eradication of pirated software" in 2001 and "a notice on the use of authorized software by local governments" in 2004. In 2012, the State Council organized a "luncheon meeting to promote the use of authorized software" in 15 departments. Its purpose was to organize the use of authorized software among local governments by the end of 2013 (Son, 2012).

The efforts of the Chinese government enabled 135 national institutions to install authorized software by May 2011. By June 2012, 31 provinces across the country had installed authorized software. The private sector, however, has faced difficulties in promoting the use of authorized software (Son, 2012). Due to the lack of enforcement in the civilian sector and the difficulty of supervision, it is estimated that there is still much unauthorized use of software in the private sector. It is the policies of the Chinese government that account for the difference between the public sector and the private sector when it comes to illicit software use rather than any difference between

public and private sector employees. It was only in 2006 that the central government and the State Council decided to actively promote the use of authorized software by companies. In February 2007, nine departments, including the National Copyright Office, came together to form a “practical consultative body on the use of authorized software by enterprises.”¹ The difference in the use of authorized software between public and private sectors thus arises from the fact that private companies were the last to be targeted by the state council (Son, 2012, pp. 1-2) and from the fact that foreign software companies have distributed or supported illegal software in order to maintain their monopoly position in the Chinese market. The private sector is not as closely supervised by the central government as is the public sector, and so the private sector has more opportunity to use illegal software distributed by foreign companies (Son, 2012).

Theories Regarding the Use of Illegal Software

Recent studies on the use of illegal software come mainly from the fields of economics and business administration, sociology, and criminal law. Theories can be broadly divided into four categories: expected utility theory, deterrence theory, social learning theory, and positive general prevention theory.

Expected utility theory holds that individuals build their expectations based on consistent preferences and maximize their expected utility by minimizing risks in a given situation (Gopal & Sanders, 1988, 2000). To maximize the expected utility, the individual chooses the less expensive option if it is as effective as more expensive ones and the more effective one if all options cost the same. Deterrence theory maintains that individuals make a decision about whether to engage in illegal activities by comparing the benefits of those activities with the punishment they can be expected to receive if those activities are detected (Gibbs, 1975, p. 58). In other words, an individual is less likely to commit a crime if the certainty and severity of punishment is high.

According to the deterrence theory, then, the greater the perceived threat of punishment for using illegal software, the less likely it is the individual will engage in piracy (Nill & Schibrowsky, 2010). While expected utility theory and deterrence theory focus on individual psychology, social learning theory focuses on how individuals respond to the environment (Yoon, 2004). Because individuals learn about crime through environmental influences, how to control these influences is an important

1. National Copyright Administration Bureau, Ministry of Information Industry, Department of Commerce, Ministry of Finance, State-Owned Asset Management Committee, National Federation of Commerce, Bank Supervisory Board, Securities Supervisory Board.

factor in crime prevention. Individuals learn through contact with their surroundings, by being compensated for good behavior and punished for bad behavior, and by imitating others (Yoon, 2004). According to positive general prevention theory, the government seeks to prevent crime by changing consciousness through education (Hong, 2015). This theory argues that individuals internalize norms through education, while social learning maintains that they absorb them through their interaction with their environment (Yoon, 2004).

RESEARCH METHOD AND SUBJECTS

Q Methodology

Q methodology is a quantitative technique for evaluating human subjectivity (Stephenson, 1953; Brown, 1980). The methodology, which received attention with the emergence of postbehaviorism, enables analysis of the deep-seated, subjective opinions of research subjects (Kim, 2007). Because software piracy is illegal, people who engage in it are not inclined to express their personal opinions openly. Q methodology is a tool that can help us see inside the subjective world of research subjects who use illegal software. Procedurally, a Q analysis consists of the creation of Q statements, the selection of P samples, and Q sorting.

Design of Sample Statements

The statements used in this study were drafted based on previous research and interviews with subjects regarding software piracy. While previous studies focused more on verifying one theory or another, this study seeks to test multiple theories simultaneously. Table 1 lists the 32 statements that taken together reflect the four theories we have outlined.²

Statements 1-4, 14, 21, and 29 reflect the perspective of expected utility theory. These statements relate to the price of authorized products, the convenience of purchasing pirated software, the quality of illegal software, the time it takes to purchase authorized products, and ease of use of authorized as opposed to illegal copies of software. There are many domestic and international studies explaining the use of

2. This study is a follow-up study of a study on software piracy in Korea. For this reason, this study uses the same statements as the first study. For more information, see Kim and Jung 2016.

illegal software in terms of expected utility (Gopal & Sanders, 1998; Douglas, Cronan, & Behel, 2007; Kim, 2004; Yu, Kim, & Choi, 2008).

Statements 6, 7, 9, 18-20, and 22 reflect the perspective of deterrence theory. These statements reference poor enforcement, certainty that authorized use will be encouraged by improved enforcement and knowledge on the part of potential pirates of the severity of punishment, the importance of education and publicity in preventing use of illegal software, and the role of technology in detecting use of illegal software. Deterrence theory accounts for illegal software use in terms of rational choice. These statements draw on domestic and international research on deterrence theory (Gibbs, 1975; Nill & Schibrowsky, 2010; Yoon, 2004; Lee, 2011).

Statements 5, 10, 11, 13, 24, and 25 reflect the perspective of social learning theory. The use of counterfeit software is common; it is a structural societal problem. Usage of illegal software is encouraged through socialization, by the practices of friends and communities.

We formulated statements 16, 23, 28, and 30 based on studies that examined software piracy from an economic standpoint. The statements reference the effect of illegal software use on related industries, the importance of intellectual property rights and their connection with unemployment, and the overpricing of authorized products. Considering the fact that the most common reason for using illegal software is the high price of authorized software, the economic point of view is important. This study also uses these items in attempt to test the extent to which the respondent group accepts such economic perspectives (Jo, 2010).

Statements 8, 12, 15, 26, 31, and 32 were devised based on interviews and related news articles. These statements refer to purchasing unauthorized software for testing purposes and out of simple curiosity, to a belief that the first distributor of illegal software is more responsible than those who subsequently use it, and to the notion that the issue resolve itself in time.

Table 1. List of Q Statements

Number	Q statements
1	I have no choice but to use illegal copies of software because the authorized product is too expensive.
2	It is more convenient to download illegal copies from the internet than to buy the authorized product.
3	The quality of counterfeit software is almost equal to that of authorized software.

4	Although I can afford to purchase licensed software, I would rather spend the money on somewhere else.
5	The use of pirated software is common and is not limited to particular individuals.
6	I do not think my use of pirated software will be detected and thus feel safe from punishment via copyright enforcement.
7	Improved detection of counterfeit software will increase the purchase of authorized software.
8	I buy illegal copies for a test run before purchasing authorized software.
9	The certainty of being punished for software copyright violation will surely lead to an increase in the use of licensed software products.
10	It is unfair that I should have to use authorized products while others use counterfeit products.
11	The reason why people use illegal copies of software is a social rather than personal problem.
12	I use illegal copies just out of curiosity.
13	Although I generally do not intend to use counterfeit software, I end up using it at the suggestion of people around me.
14	I use counterfeit software because it takes too long for authorized products to be distributed.
15	When it comes to software piracy, the fault of the first distributor of the pirated copy is greater than that of downloaders.
16	Growing use of pirated software will contract the relevant industry, resulting in a reduction in jobs.
17	No matter how expensive, we must use authorized products instead of pirated software.
18	More stringent punishment will greatly reduce the use of pirated software.
19	To increase the likelihood of detection, the manpower, organization, and budget of the relevant enforcement bodies need to be beefed up.
20	In order to establish the use of authorized products as a cultural norm, persuasion and understanding through education and publicity must be prioritized over legal enforcement and punishment.
21	I try to use authorized products whenever I can because using pirated software often causes unnecessary inconveniences.
22	Using information technology that facilitates detection of software piracy will solve the problem more effectively than other means.
23	Intellectual property rights must be strictly protected, and doing so will result in enhanced quality of life.

24	The use of counterfeit software is not pervasive throughout society but rather is limited to a segment that includes youth.
25	The press exaggerates about the use of illegal copies of software, and people overestimate the graveness of the problem.
26	Using illegal copies is different from stealing; I don't feel guilty when I use counterfeit software.
27	The replication and distribution of software without permission is unlawful and morally wrong.
28	Economic crises and increasing unemployment force many people to illegally copy and distribute software for money.
29	Purchasing an authorized product seems to be a losing proposition, since the products will be updated with newer versions soon after.
30	Authorized products are overpriced compared to their development cost, so using authorize products is promotes economic inequality.

Design of P Sample

The purpose of this study is to analyze the perception of illegal software use and to draw conclusions from that analysis that might guide future policy. To that end, we not only included illegal software users in the study's P sample but also experts on illegal software use and enforcement officers because they participate in the policy process. Given that all 30 respondents answered that they had used illegal software more than once in their preliminary interview, however, all of them could have been included in the "user" category as well. The greatest number of illegal software users was found among the respondents in their twenties and thirties (52% and 25% respectively), and so this study focuses on that age range.³ The exact composition of the P sample is shown in table 2.

Table 2. -P Samples

Occupation	Government Officials (General Public Servants, 2); Police, 3; Software Company Employees, 4; Professors and Researchers, 5; College Students, 13; Office Clerks, 3
Age	20s (13), 30s (9), 40s (7), 50s (1)
Gender	Male (17), Female (13)
Total Respondents	30

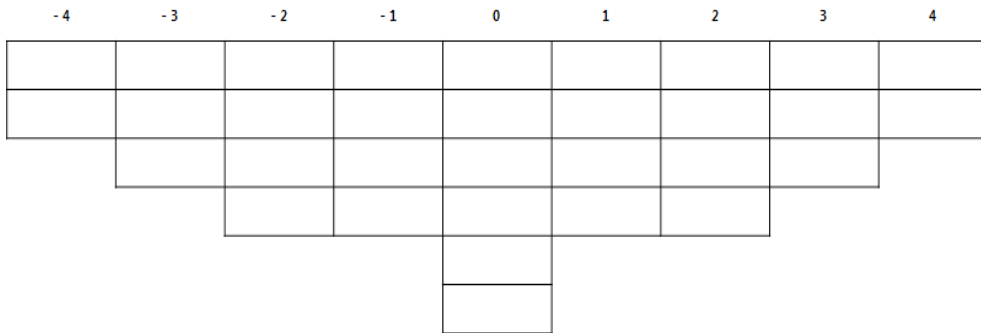
3. The ratios for all other age groups were as follows: teens, 4%; forties, 11%; fifties, 6%; and sixties and older, 2% (Jo, 2010).

Q-Sorting Procedure

There are two ways to sort Q statements: by forced distribution or by free sorting. In forced distribution, participants are asked to sort the statements according to their subjective significance and rank them by from “strongly disagree” (-4) to “strongly agree” (+4). Respondents put statements that they do not feel strongly about one way other are assigned a value of 0. The result is a set of statements with a normal distribution around zero and a standard deviation (Brown, 1980). On the other hand, the free-sorting method allows respondents to freely distribute the statements (Kim, 2007: 50).

This study employs the forced distribution method because of the advantage a set of normally distributed answers provides. Specifically, respondents were asked to assign the 32 Q statements onto 32 spaces as shown in figure 1. A conventional 9-point scale was used with -4 representing “strongly disagree” and +4 representing the “strongly agree.” The ordered statements provided by the 30 different respondents were entered into the PQMethod (2002), which automatically generated normally distributed values (including frequency) through factor rotation. Table 3 is an analysis table that shows the results.

Figure 1. Questionnaire for Q classification



EMPIRICAL RESULTS

Classification among Different Perception Types

When performing a Q analysis, the researcher can arbitrarily specify the factors. When designating a factor, the researcher usually conducts a Q analysis by specifying

three to five factors and then selects the factors with the highest total explanatory power (Kim, 2008). In China, as shown in table 3, the explanatory power of each factor was 20%, 15%, 10%, and 9%, respectively, with a total explanatory power of 54%. The breakdown among the 30 Chinese respondents is as follows: factor 1, 10; factor 2, 9; factor 3, 4; and factor 4, 3.

Table 3. Factor Analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Profession	Age	Sex
1	0.3943	0.4451*	-0.0026	0.1996	college student	20s	M
2	0.6570*	0.0422	-0.4508	0.0203	college student	20s	M
3	0.6212*	0.1472	0.1304	0.5773	college student	20s	F
4	0.6064*	0.0503	0.1187	0.5862	college student	20s	M
5	0.2419	0.5908*	-0.0469	-0.1538	software company employee	20s	F
6	0.2939	0.4309	0.0272	0.6012*	software company employee	20s	M
7	0.6829*	0.3445	0.2360	0.1783	police officer	30s	M
8	0.2110	0.4435*	0.0799	0.2844	police officer	30s	M
9	0.7513*	0.1836	0.0994	0.2748	police officer	30s	F
10	0.2118	0.6242*	-0.0132	0.1970	researcher	30s	M
11	0.4815*	0.0645	0.0834	-0.0043	researcher	30s	M
12	0.1567	0.2031	0.6654*	-0.0977	college student	30s	M
13	0.6732*	0.3690	-0.1117	-0.0522	college student	30s	F
14	-0.2462	0.3191	-0.3755	0.3100	college student	30s	F
15	0.4257	0.4205	0.0665	0.2340	college student	30s	F
16	-0.0043	0.7477*	0.2196	0.1305	college student	30s	F
17	0.2020	0.5774*	0.4374	-0.0192	college student	30s	M
18	0.6527*	0.4590	0.3246	-0.0958	college student	30s	M
19	0.3662	0.5047*	0.1120	0.2365	office clerk	30s	M
20	-0.0837	0.6754*	0.2238	-0.1299	software company employee	30s	F
21	-0.2340	0.3682	0.1054	0.5259*	software company employee	30s	M
22	0.1083	0.3342	0.5353*	0.2418	civil servant	40s	M
23	0.3573	0.3084	0.4727	0.3102	civil servant	40s	F
24	0.7288*	0.0999	0.0461	0.1369	professor	40s	M
25	0.0682	-0.0756	-0.0645	0.6036*	researcher	40s	M

26	0.3754	0.6234*	0.2477	0.2522	student	40s	M
27	0.3827	-0.0247	0.6484*	0.4234	student	40s	M
28	-0.3165	0.0754	0.5889*	-0.1344	office clerk	40s	M
29	0.3652	0.1629	0.3799	0.1976	office clerk	40s	F
30	0.7444*	0.0534	0.3597	-0.0331	professor	50s	M
% (Total=54)	20	15	10	9			

Notes: %= explained variance; *= statistically significant at 0.05.

Each perception pattern is distinguished and categorized based on factor scores of the statements, as table 4 shows. In a research using Q methodology, Q factors are analyzed by examining statements to which respondents assign extreme values (+4, +3, -3, -4) and classifying research subjects into groups based on their sharing similar viewpoints on a set topic (Brown, 1980; Kim, 2007). The factor scores shown in table 4 are for each statement and are the foundation for the classification of perception patterns outlined in the following section. Q methodology follows the same procedure for correlation analysis, factor extraction, and factor rotation as the factor analysis. However, Q methodology differs from factor analysis in that the P sample is a variable. In the traditional factor analysis, the analysis is based on the correlation among the background variables of the sample. In a Q study, however, the correlation between the P samples forms the center of analysis. Q analysis extracts the factors into groups of subject that share similar views based on the correlation between the P samples. In a Q study, factors are extracted via centroid analysis and principal component analysis. In a Q study, the centroid method is the primary tool, which is not the case in factor analysis. The reason for using the centroid method in a Q study is related to the eigenvalue. In the factor analysis, the factor is determined based on the eigenvalue, and the minimum criterion is 1. However, the centroid approach is recommended in a Q study because the eigenvalue is not as important as the factor analysis. It is true that factors with a value of 1 or more have significance, but if the researcher judges that the eigenvalue is less than 1, the factor can be extracted (Brown, 1980).

If factors are extracted, rotation is performed to maximize discrimination of factors. There are two types of rotation: judgmental and objective. Objective methods include Varimax, Quartimax, and Equimax. William Stephenson and Steven Brown recommend maximizing the degree of subjectivity arbitrarily. This is because Q methodology is based on the uncertainty principle of quantum mechanics. However,

this approach is suitable for experienced researchers only, and therefore many researchers use Varimax, a deterministic rotation method, instead. The Varimax method calls for including as many research subjects as possible in the extracted factors. This method maximizes the variance difference between deterministic and specified factors. Thus, the difference in subjectivity between factors can be easily grasped (Kim, 2016, pp. 55-57). In this study, the factors were extracted by the centroid method and rotated by the Varimax method. Therefore, the extracted four types of recognition are comprehensive and differentiated.⁴

Table 4. Q-Sort Values of Factors for Each Statement

Q Statement Number	Factor 1	Factor 2	Factor 3	Factor 4
1	0	4	0	4
2	0	4	2	1
3	-2	1	3	-1
4	-1	2	-4	-2
5	0	2	-3	-1
6	2	0	-2	-1
7	1	1	4	2
8	-4	-3	-2	-2
9	-3	-3	0	-3
10	0	-1	-3	-2
11	3	2	-1	-1
12	-2	-3	-4	0
13	0	-2	0	0
14	-1	-4	-2	0
15	2	0	3	0
16	3	-2	-2	1
17	2	-1	0	-4
18	3	3	4	-2
19	4	1	2	1
20	1	1	1	3
21	1	0	0	3
22	1	2	3	0
23	4	3	1	4
24	-4	-4	-1	-4
25	-1	-1	-3	0

4. For a more detailed picture of the differences between the types of perception, see the table in the appendix that lists the descending array of differences between factors.

26	-2	0	1	-3
27	2	3	2	3
28	-2	-1	0	2
29	-3	0	1	2
30	-1	-2	-1	-3
31	0	0	2	1
32	-3	-2	-1	2
eigenvalue	9.57	2.80	2.06	1.75
% var	32	9	7	6

Notes: * = denotes a statistically significant factor loading (p-value<0.05). +4: strongly agree; -4: strongly disagree; 0=neutral.

Factors of Each Perception Pattern

The primary characteristics of each of the four perception patterns in China are as follows. People in the factor 1 group stress the role of government intervention. A common feature of this group is the perception that software piracy is a problem a societal rather than personal problem. Moreover, since members of this group believe intellectual property rights must be protected, they maintain that increasing the manpower as well as the budget of the relevant organizations is necessary along with stricter punishment in the case of violation. The perception pattern of people in the factor 2 group is a normative, utility-focused one. They believe people use counterfeit software due to the high price of authorized products and owing to how easy it is to obtain and use pirated software. Like the people in the factor 1 group, this group believes that stricter enforcement and punishment will reduce unauthorized copying. People in the factor 3 group view the use of counterfeit software as a social problem and also believe that enforcement and punishment can reduce piracy. People in this group also view the quality of counterfeit software as good and see the initial distributor of pirated software as the problem rather than consumers. People in the factor 4 group believe, as do their South Korean counterparts, that the use of counterfeit software must be eradicated and that education and publicity, rather than punishment, are appropriate policy alternatives. The difference between the factor 4 group in Korea and the factor 4 group in China is that the latter believes people use pirated software because authorized products are unaffordable.

Table 5. Perception Patterns

Factor	Core Concept for Each Factor
1	-normative legal model
2	- economic utility model
3	- punishment model
4	- dual dilemma model (competing legal and cost perspective)

Factor 1: Normative Legal Model

The factor 1 group includes the most respondents as well as occupations, consisting of 10 respondents (5 students, 2 police officers, 1 researcher, 2 professors, and 1 office clerk). The factor 1 group was conceptualized as embracing a normative legal outlook that supports government intervention because the respondents assigned high factor scores to statements 19 (“To increase the likelihood of detection, the manpower, organization, and budget of the relevant enforcement bodies need to be beefed up”) (+4), 18 (“More stringent punishment will greatly reduce the use of pirated software”) (+3), and 23 (“Intellectual property rights must be strictly protected, and doing so will result in enhanced quality of life”) (+4).

This factor also reflects the perspective of deterrence theory (statement 19, +4, statement 18, +3). According to deterrence theory, the higher the certainty and severity of punishment, the less likely an individual will commit the crime. However, statement 9 (-3) of this factor shows that there is a case where deterrence theory is not applied. This is because the people in the factor 1 group believe that the certainty of being punished for piracy alone will increase the use of authorized software. What this suggests is that the certainty and severity of punishment parts of deterrence theory should be judged separately. Respondents in these factor groups want the government to actively intervene in stamping out the use of illegal software. This is suggested by the -3 response to statement 32 (“People use illegal counterfeit software because the speed of development in the internet technology outpaces that of the cultural development; time will solve the problem”). People in this factor group think that illegal software use cannot be tackled by the current workforce (statement 19, +4) and that protecting intellectual property rights will enhance the quality of life (statement 23, +4). They also recognize that using illegal software is morally wrong and regard the use of illegal copies as a structural societal problem (statement 11, +3). This view can also be seen in the acceptance of statement 16 (+3), which specifies that the use of counterfeit software leads to the contraction of the relevant indus-

try. Under the expected utility theory, individuals act to maximize their expected utility (Gopal & Sanders, 1998; Gopal & Sanders, 2000). According to the respondents in the factor 1 group, individuals are not only maximizing their expected utility when they act but are also reflecting a societal trend. Table 6 summarizes the primary statements for respondents in the factor 1 group.

Table 6. Key Statements of Factor 1

Q Factor Score	Q Sample Statement
4	To increase the likelihood of detection, the manpower, organization, and budget of the relevant enforcement bodies need to be beefed up (19).
	2 Intellectual property rights must be strictly protected, and doing so will result in enhanced quality of life (23).
3	1 The reason why people use illegal copies of software is a social rather than personal problem (11).
	1 Growing use of pirated software will contract the relevant industry, resulting in a reduction in jobs (16).
	1 More stringent punishment will greatly reduce the use of pirated software (18).
-3	9 The certainty of being punished for software copyright violation will surely lead to an increase in the use of licensed software products (9).
	2 Purchasing an authorized product seems to be a losing proposition, since the products will be updated with newer versions soon after (29).
	3 People use of illegal counterfeit software because the speed of development in the internet technology outpaces that of the cultural development; time will solve the problem (32).
-4	8 I buy illegal copies for a test run before purchasing authorized software (8).
	2 The use of counterfeit software is not pervasive throughout society but is rather limited to a segment that includes youth (24).

Factor 2: Economic Utility Model

The factor 2 group reflects the economic utility model of a widespread use of pirated software. Factor 2 people say that the reason for using counterfeit goods is the high price of authorized goods and the convenience of purchasing them. For instance,

as table 7 illustrates, respondents in this group believe that while “intellectual property rights must be strictly protected (statement 23, +3) and “The replication and distribution of software without permission is unlawful and morally wrong” (statement 27, +3), people still use pirated software because authorized products are expensive (statement 1), because it is easy to purchase of counterfeit products (statement 2), and because the punishment for software copyright violation is not severe (statement 18, +3). These views all reflect the expected utility theory, according to the which an individual seeks to choose an action that will maximize his or her expected utility by weighing costs and benefits of each alternative. Fear of being punished as well as concern over social criticism and not just economic interests are factors in assessing costs and benefits.

Factor 2 respondents share statements 8, 9, 18, 23, and 24 in common with factor 1 respondents. Like respondents in the factor 1 group, those in the factor 2 group think that intellectual property rights should be protected (statement 23, +3). And they know that software piracy is not right (statement 27, +3). However, the fact that the punishment is not severe (statement 18, +3) and that illegal copies are cheaper and easy to access encourages piracy. Respondents in both the factor 1 and factor 2 groups also commonly regard illegal copying as a social structural problem (statement 24), but factor 2 respondents believe that individuals engage in illegal copying because of economic incentives, whereas factor 1 respondents believe that individuals engage in it because of lack of government control. Like factor 1 respondents, respondents in factor 2 also distinguish between the severity and certainty of punishment.

More clearly, factor 2 respondents show an active intention to use counterfeit software. They assign -3 to statement 8 that refers to purchasing illegal products for test purposes before purchasing the authorized product and to statement 12 that refers to using illegal products out of curiosity. In addition, they assign -4 to statement 14 that refers to the length of time it takes for authorized products to be distributed as well as to statement 24 that claims that the use of counterfeit products is not a problem in our society as a whole, which reveals their belief that they cannot be blamed for their personal use of counterfeit software. A total of 9 respondents including 1 police officer, 4 students, 1 researcher, 1 office clerk, 2 software company employees make up the factor 2 group.

Table 7. Key Statements of Factor 2

Q Factor Score	Q Sample Statement
4	1 I have no choice but to use illegal copies of software because the authorized product is too expensive (1).
	It is more convenient to download illegal copies from the internet than to buy the authorized product (2).
3	1 More stringent punishment will greatly reduce the use of pirated software (18).
	Intellectual property rights must be strictly protected, and doing so will result in enhanced quality of life (23).
	The replication and distribution of software without permission is unlawful and morally wrong (27).
-3	8 I buy illegal copies for a test run before purchasing authorized software (8).
	9 The certainty of being punished for software copyright violation will surely lead to an increase in the use of licensed software products (9).
	1 I use illegal copies just out of curiosity (12).
-4	I use counterfeit software because it takes too long for authorized products to be distributed (14).
	2 The use of counterfeit software is not pervasive throughout society but is rather limited to a segment that includes youth (24).

Factor 3: Expected Punishment Model

The respondents in the factor 3 group reflect a rational choice perspective on crime and believe that effective monitoring and harsh punishment can prevent the widespread use of illegal software. People in this factor group maintain that software piracy is prevalent it is hard to detect and because the punishment is not strict enough. The views of the respondents in the factor 3 group can be explained by deterrence theory. Deterrence theory compares the benefits of crime and the suffering from punishment. This theory suggests that as the certainty of severe and expeditious punishment increases, the incidence of crime decreases (Gibbs, 1975, p. 58). In line

with deterrence theory, those in the factor 3 group recognize that the benefits of illegal software use outweigh the costs because the punishment is not severe and probability of detection is low. Respondents in this group also hold the original distributor more accountable than consumers who purchase the illegal product (statement 15, +3). It is possible that respondents in the factor 3 group assign responsibility to the original distributor of the illegal software as a self-rationalizing mechanism (Cho & Lee, 2009). However, if there is no distributor, then there will be no illegal copy for individuals to purchase. Thus, preventing distributors from distributing illegal software should be a priority for enforcement.

As table 8 shows, respondents in this factor group see punishment as essential to protecting the ecosystem of the software industry. For instance, this factor group assigned +4 to statement 18 that refers to how harsher punishment will greatly reduce the use of counterfeit products as well as to statement 7 that refers to the role of improved detection of software piracy in increasing the purchase of authorized products. Respondents in this group also assigned +3 the statement 11 that describes the use of counterfeit software as a social structural issue. On the other hand, the group gave -3 to statement 10 that refers to using illegal software only because others around them happen to be using them. Respondents in this group thus can be said to be making an active choice use to use counterfeit products rather than simply passively following what others around them are doing. In dismissing the idea that illegal software users are merely passively following what others are doing, respondents in group can be said to reject basic tenets of positive general prevention theory, which maintains that influence of an individual's environment is paramount when it comes to crime. According to the respondents in the factor 3 group, people commit illegal acts irrespective of their surroundings and so interaction with law-abiding friends, colleagues, and parents will not necessarily prevent an individual from engaging in crime. Table 8 shows the key statements for the factor 3 group. The factor 3 group is made up of four respondents: two students, one civil servant and one office worker. This group, similar to factor 1 group, gives high factor scores to ease of detection and strictness of punishment; it also agrees on the matter of cost with the factor 2 group.

Table 8. Key Statements of Factor 3

Q Factor Score	Q Sample Statements
4	Improved detection of counterfeit software will lead to an increase in the purchase of authorized software products (7).
	More stringent punishment will greatly reduce the use of pirated software (18).
3	3 The quality of counterfeit software is almost equal to that of authorized software (3).
	When it comes to software piracy, the fault of the first distributor of the pirated copy is greater than that of downloaders (15).
	The reason why people use illegal copies of software is a social rather than personal problem (11).
-3	5 The use of pirated software is common and is not limited to particular individuals (5).
	It is unfair that I should have to use authorized products while others use counterfeit products (10).
	The press exaggerates about the use of illegal copies of software, and people overestimate the graveness of the problem (25).
-4	Although I can afford to purchase licensed software, I would rather spend the money on somewhere else (4).
	I use illegal copies just out of curiosity (12).

Factor 4: Norm-Centered Perception Pattern

Respondents in the factor 4 group illustrate the dilemma of being both a rational consumer and a moral citizen, as they simultaneously support two competing statements. A total of three respondents belong to this group: one researcher and two software company employees. The representative statements for the factor 4 group are shown in table 9. Factor 4 respondents emphasize social norms because they consider using authorized software a duty. This group assigned +4 to statement 23 that refers to strictly protecting intellectual property rights on the grounds that the protection of these rights enhances the quality of life and +3 to statement 27 that

refers to the making and distributing of pirated software as unlawful and morally wrong, which reveals their perception that using authorized software products is not only conducive to the individual pursuit of happiness and the prosperity of the state but also the legally and morally appropriate action. Acceptance of these statements reflects positive general prevention theory. While deterrence theory (negative general prevention theory) maintains that crime is prevented through the threat of punishment, positive general prevention theory maintains that crime is prevented by changing people's consciousness via education (Hong, 2015). Factor 4 respondents used counterfeit software because of the high price of authorized goods (statement 1, +4). However, the respondents in this group, unlike those in the factor 3 group, believe that persuasion through education and publicity will be more effective in reducing the use of illegal software than harsher punishment (statement 20, +3).

In addition, factor 4 respondents view the cloned product as inferior to the authorized product (statement 21, +3) but use it nevertheless because the authorized product is too expensive (statement 1, +4). That respondents in this factor group are influenced by price point, can be seen in their assigning -4 points to statement 17 ("No matter how expensive, we must use authorized products instead of pirated software"). For the respondents in this group, then, the solution to illegal software use would be a policy whereby it was required that authorized products be reasonably priced. Respondents in the factor 4 group also regard the use of counterfeit products as a structural problem of society (statements 24, -4). All four factor groups agree on this point.

In addition, this group believes that the certainty of punishment will not increase the use of authorized products (statement 9, -3) and that civic education and public campaigns will be more effective than enforcement and punishment in encouraging the use of authorized products (statement 20, +3). Thus respondents in this group deny the premise of deterrence theory, namely, that the certainty of punishment and the strictness of punishment will reduce crime.

Table 9. Key Statements of Factor 4

Q Factor score	Q Sample Statement
4	I have no choice but to use illegal copies of software because the authorized product is too expensive (1).
	Intellectual property rights must be strictly protected, and doing so will result in enhanced quality of life (23).
3	In order to establish the use of authorized products as a cultural norm, persuasion and understanding through education and publicity must be prioritized over legal enforcement and punishment (20).
	I try to use authorized products whenever I can because using pirated software often causes unnecessary inconveniences (21).
	The replication and distribution of software without permission is unlawful and morally wrong (27).
-3	The certainty of being punished for software copyright violation will surely lead to an increase in the use of licensed software products (9).
	Using illegal copies is different from stealing; I don't feel guilty when I use counterfeit software (26).
	Authorized products are overpriced compared to their development cost, so using authorized products promotes economic inequality (30).
-4	No matter how expensive, we must use authorized products instead of pirated software (17).
	The use of counterfeit software is not pervasive throughout society but is rather limited to a segment that includes youth (24).

Correlation between Factors

Table 10 shows that the highest correlation coefficient is between factor 1 and factor 2 at 0.5055 while the lowest is between factor 3 and factor 4 at 0.1909.⁵ The cor-

5. In general, if the correlation between factors is high, it can be said that the number of factors is excessively extracted. In this case, reextraction of the factors is required (Kim, 2016). For this reason, this study also examined all the correlations for three, four, and five factors. In the case of four factors, the correlation was relatively low. These results are also consistent with those of the four perspectives when conducting the preinterview. See the appendix for the correlation tables.

relation between factor 1 and factor 2 exceeds 0.5 because factor 1 and factor 2 have common statements 8(-4, -3), 9 (-3, -3), 18 (+3, +3), 23 (+4, +3) 4, -4). Statements 18 (+3, +3) and 23 (+4, +3) received higher scores among the statements that factor 1 and 2 have in common. Both factor groups agree that intellectual property rights need to be protected (23, +4, +3) and that punishment must be more severe than it is now to reduce the use of counterfeit products (18, +3, +3). In addition, respondents in these two factor groups oppose statements 8 (-4, -3), 9 (-3, -3), and 24 (-4, -4) and strongly oppose statement 24 (-4, -4). This suggests that both regard the use of counterfeit products as a social issue. It can also be assumed that their opposition to statement 8 (-4, -3) means they buy only authorized software. There are differences between the two groups, however. Statement 19 (+4), which reflects the viewpoint of deterrence theory, is commonly supported by factor 1 respondents, whereas statements 1 (+4) and 2 (+4), which reflect the viewpoint of expected utility theory, are commonly supported by factor 2 respondents. Therefore, it is necessary to divide these respondents into two separate factor groups. The correlation coefficients between factor 2 and factor 3 and between factor 2 and factor 4 are over 0.4, indicating that there are also many mutually supported statements among respondents in these factor groups.

Table 10. Correlation between Factors

Classification	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.0000	0.5055	0.3636	0.3193
Factor 2		1.0000	0.4237	0.4190
Factor 3			1.0000	0.1909
Factor 4				1.0000

Synthesis of Analysis Results

The purpose of this study is to analyze why Chinese consumers use illegal software and how they think about this from the Q-methodological perspective. We found four different patterns of perception. The first reflects a normative legal response, the second an economic utility argument, the third a deterrence argument, and the fourth a dilemma that is caused by the consumer having to choose between the cheapness of illegal software and its illegality. The perceptions of the respondents in the factor 1 and factor 3 groups can be explained by deterrence theory. However,

the mechanism of action is different for the respondents in each group. Both groups think that weak penalties and loose enforcement make the use of illegal software more attractive. However, the factor 1 group supports the expansion of enforcement bodies, while the factor 3 group advocates harsher punishment. The perceptions of the respondents in the factor 2 group can be explained by expected utility theory. On this view, consumers purchase illegal software because it is cheap and because there are weak penalties for doing so. The government can address this problem by setting a market price for authorized products and by levying harsher penalties. The perceptions of the respondents in the factor 4 group can be explained by positive general prevention theory. Consumers, on this view, believe that piracy is immoral but purchase illegal software nevertheless because of the high price of the authorized product. Setting a market price for authorized products as well as persuading consumers through education and publicity to not buy illegal products are the solutions to the problem for respondents in the factor 4 group. Table 11 summarizes these findings.

Table 11. Applied Theory and Causality for Each Factor

Classification	Model Name	Application Theory	Operating Mechanism	Policy Tools
Factor 1	Normative legal model	deterrence theory	weak punishment and loose control	expansion of manpower; expansion of budget
Factor 2	Economic utility model	expected utility theory	low penalty level and lower price and convenience of replicas	market control; harsher punishment
Factor 3	Expected punishment model	deterrence theory	weak penalty and low probability of detection	strengthening of legal regulations; harsher punishment
Factor 4	Norm-Centered Perception Pattern	positive general prevention theory	high prices of authorized goods	market control; education / publicity

Table 12. Shows the statements the respondents in the four factor groups hold in common. This finding suggests that Chinese consumers believe that enforcement bodies ought to make eliminating the use of pirated software a priority and that those who use illegal products should be harshly punished. However, Chinese consumers also believe that illegal use is common due to the cost of authorized products. Chinese consumers are thus confronted with dilemma. Other perceptions shared by respondents in all four factor groups are that illegal copying and distribution of software is against the law, that intelligence property rights must be protected, and that in order to crack down on the use of illegal copies, enforcement bodies need more manpower and larger budgets.

Table 12. Common Statements

Q Statement Number	Sample Statement	F1	F2	F3	F4
7	Improved detection of counterfeit software will increase the purchase of authorized software.	1	1	4	2
8	I buy illegal copies for a test run before buying authorized products rather than for using it.	-4	-3	-2	-2
19	To increase the likelihood of detection, the manpower, organization, and budget of the relevant enforcement bodies need to be beefed up.	4	1	2	1
20	In order to establish the use of authorized products as a cultural norm, persuasion and understanding through education and publicity must be prioritized over legal enforcement and punishment.	1	1	1	3
23	Intellectual property rights must be strictly protected, and doing so will result in enhanced quality of life.	4	3	1	4
24	The use of counterfeit software is not pervasive throughout society but rather is limited to a segment that includes youth.	-4	-4	-1	-4
27	The replication and distribution of software without permission is unlawful and morally wrong.	2	3	2	3
30	Authorized products are overpriced compared to their development costs, so using authorized products promotes economic inequality.	-1	-2	-1	-3

CONCLUSION AND IMPLICATIONS

In this paper, we have analyzed the subjective perceptions of Chinese respondents on the use of counterfeit software by applying Q methodology and derived four different perception patterns on illegal software use. These four perception patterns illustrate objective forms of the subjective world of the research subjects. Chinese consumers understand that software piracy is illegal but believe that illegal use is widespread due to economic utility and that the use of illegal copies is a structural problem of society. This may be a self-rationalization mechanism (Cho & Lee, 2009), but on the other hand, it also reflects the reality that illegal software use is rampant. A further implication is that those in the factor 1 and factor 3 groups believe that the practice of illegal copying is rampant due to a lack of manpower and insufficient budgets in organizations charged with regulating the software and due to lack of enforcement and punishment. These perceptions suggest that the Chinese government should intervene more heavily in the future and increase the level of enforcement and punishment (which is consistent with a recent finding that price factors are no longer a key determinant in software piracy in China [Lin, 2015]). All of these perspectives recognize that piracy is a structural issue and that continuous and consistent enforcement and stricter punishment are necessary to address it.

From a policy perspective, this study suggests that there are four different perception patterns regarding software piracy, which suggests that policies can be fine-tuned based on different subjective perceptions (Kim, Lee, and Kim, 2015). For example, respondents in the factor 1 and factor 3 groups feel that the punishment for illegal software use needs to be more severe. Although both groups do consider price to be a factor, they agree that piracy will be reduced if the punishment is made stricter.

Respondents in the factor 3 group regard the original distributor of pirated software is a larger problem than the use of an illegal copy by a consumer (statement 15, + 3). and that therefore, it is critical to eliminate distributors. Factor 2 and factor 4 respondents think that the high price of authorized goods is a problem and that in order to increase the use of authorized software, it is necessary to implement a policy whereby authorized products are reasonably priced. The government can make a policy to stabilize prices through price competition among suppliers.

Although this study has yielded significant findings, it has limitations. For one, it does not include teenagers in the P sample. For another, the difference between the public and private sectors when it comes to illegal copying cannot be accounted for solely by reference to the fact that private companies were the last to be required by the central government to ensure that authorized software was being used by their employees, and a follow-up study is thus needed. In addition, the significance of this

study is limited in that the views of respondents are subjective opinions and that the research subjects were not been able to disclose in detail the way in which illegal copying is carried out. Put simply, the Q methodology can generate hypotheses but cannot verify them. This study thus needs be supplemented by subsequent studies.

Piracy still poses a serious challenge in China, and a macro policy is needed to solve the problem. The patterns of perceptions found in both China and Korea suggest that it is necessary to make punishment more severe and to strengthen enforcement so that those involved in software piracy pay for their wrongdoing. However, enforcement and punishment alone will not resolve the issue; they must be coupled with an understanding of market principles, education, and a raising of public awareness about value of intellectual property rights.

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APPENDIX

Correlation between 3 Factors

Classification	Factor 1	Factor 2	Factor 3
Factor 1	1.0000	0.5718	0.6128
Factor 2		1.0000	0.3877
Factor 4			1.0000

Correlation between 4 Factors

Classification	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.0000	0.5055	0.3636	0.3193
Factor 2		1.0000	0.4237	0.4190
Factor 3			1.0000	0.1909
Factor 4				1.0000

Correlation between 5 Factors

Classification	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.0000	0.3371	0.4638	0.4868	0.5306
Factor 2		1.0000	0.3670	0.4013	0.1986
Factor 3			1.0000	0.3013	0.3095
Factor 4				1.0000	0.4224
Factor 5					1.0000

Descending Array of Differences between F1 and 2				Descending Array of Differences between F 1 and 3			
Number	Type	1 Type	2 Difference	No.	Type	1 Type	3 Difference
16	1.237	-0.685	1.922	16	1.237	-0.797	2.034
15	1.177	-0.099	1.276	11	1.281	-0.681	1.961
6	1.017	-0.181	1.198	6	1.017	-0.796	1.813
17	0.915	-0.265	1.180	23	1.546	0.266	1.280
19	1.657	0.510	1.147	10j	-0.160	-1.378	1.218
14	-0.524	-1.569	1.046	5	-0.152	-1.366	1.213
21	0.890	-0.018	0.908	21	0.890	-0.149	1.039
13	-0.087	-0.862	0.776	4	-0.447	-1.404	0.957
11	1.281	0.628	0.653	12	-0.813	-1.550	0.737
30	-0.430	-1.027	0.597	17	0.915	0.243	0.672
12l	-0.813	-1.335	0.521	19	1.657	1.036	0.622
23	1.546	1.255	0.292	14	-0.524	-0.992	0.468

Descending Array of Differences between F1 and 2				Descending Array of Differences between F 1 and 3			
Number	Type	1 Type	2 Difference	No.	Type	1 Type	3 Difference
7	0.535	0.291	0.243	25	-0.805	-1.247	0.442
24	-1.992	-2.161	0.169	20	0.424	0.355	0.070
10j	-0.160	-0.255	0.095	13	-0.087	-0.096	0.009
20	0.424	0.351	0.073	27	1.149	1.210	-0.061
31	-0.146	-0.201	0.055	1	-0.156	-0.052	-0.104
8	-1.280	-1.329	0.049	30	-0.430	-0.307	-0.123
9	-1.197	-1.193	-0.004	8	-1.280	-1.124	-0.156
18r	1.275	1.291	-0.016	18r	1.275	1.658	-0.383
22	0.658	0.726	-0.068	15	1.177	1.587	-0.410
27	1.149	1.503	-0.354	32	-1.234	-0.633	-0.602
25	-0.805	-0.422	-0.383	31	-0.146	0.589	-0.735
28	-0.934	-0.495	-0.439	22	0.658	1.430	-0.771
32	-1.234	-0.613	-0.621	28	-0.934	-0.120	-0.814
5	-0.152	0.709	-0.861	2	-0.335	0.722	-1.057
26	-0.864	0.191	-1.055	26	-0.864	0.282	-1.146
29	-1.107	0.179	-1.286	7	0.535	1.710	-1.176
3	-1.098	0.249	-1.347	9i	-1.197	0.126	-1.323
4	-0.447	1.147	-1.594	29	-1.107	0.305	-1.412
1	-0.156	1.865	-2.022	24	-1.992	-0.415	-1.577
2	-0.335	1.814	-2.149	3	-1.098	1.589	-2.687
Descending Array of Differences between F1 and 4				Descending Array of Differences between F2 and 3			
No.	Type	1 Type	4 Difference	No.	Type	2 Type	3 Difference
17	0.915	-1.547	2.462	4	1.147	-1.404	2.552
18	1.275	-0.985	2.261	5	0.709	-1.366	2.074
11	1.281	-0.444	1.724	1	1.865	-0.052	1.918
15	1.177	-0.340	1.516	11	0.628	-0.681	1.309
6	1.017	-0.459	1.476	10	-0.255	-1.378	1.123
19	1.657	0.320	1.337	2	1.814	0.722	1.092
22	0.658	-0.175	0.834	23	1.255	0.266	0.989
16	1.237	0.442	0.796	25	-0.422	-1.247	0.825
10	-0.160	-0.951	0.791	6	-0.181	-0.796	0.616
30	-0.430	-1.049	0.619	27	1.503	1.210	0.293
5	-0.152	-0.561	0.409	12	-1.335	-1.550	0.215
4	-0.447	-0.729	0.282	21	-0.018	-0.149	0.131

Descending Array of Differences between F1 and 2				Descending Array of Differences between F 1 and 3			
Number	Type	1 Type	2 Difference	No.	Type	1 Type	3 Difference
26	-0.864	-1.103	0.239	16	-0.685	-0.797	0.112
13	-0.087	-0.218	0.131	32	-0.613	-0.633	0.020
9	-1.197	-1.157	-0.040	20	0.351	0.355	-0.004
27	1.149	1.273	-0.124	26	0.191	0.282	-0.091
24	-1.992	-1.662	-0.330	29	0.179	0.305	-0.126
8	-1.280	-0.949	-0.331	8	-1.329	-1.124	-0.205
3	-1.098	-0.677	-0.421	18	1.291	1.658	-0.367
31	-0.146	0.388	-0.534	28	-0.495	-0.120	-0.375
14	-0.524	0.056	-0.580	17	-0.265	0.243	-0.507
7	0.535	1.123	-0.588	19	0.510	1.036	-0.526
2	-0.335	0.284	-0.619	14	-1.569	-0.992	-0.578
23	1.546	2.224	-0.678	22	0.726	1.430	-0.704
25	-0.805	-0.104	-0.701	30	-1.027	-0.307	-0.719
21	0.890	1.597	-0.706	13	-0.862	-0.096	-0.767
12	-0.813	-0.102	-0.711	31	-0.201	0.589	-0.790
20	0.424	1.327	-0.903	9	-1.193	0.126	-1.319
28	-0.934	0.833	-1.767	3	0.249	1.589	-1.340
1	-0.156	1.614	-1.771	7	0.291	1.710	-1.419
29	-1.107	0.781	-1.888	15	-0.099	1.587	-1.686
2	-0.335	1.814	-2.149	24	-2.161	-0.415	-1.746
Descending Array of Differences between F2 and 4				Descending Array of Differences between F3 and 4			
No.	Type	2 Type	4 Difference	No.	Type	3 Type	Difference
18	1.291	-0.985	2.277	18	1.658	-0.985	2.644
4	1.147	-0.729	1.877	3	1.589	-0.677	2.266
2	1.814	0.284	1.530	15	1.587	-0.340	1.926
26	0.191	-1.103	1.294	17	0.243	-1.547	1.789
17	-0.265	-1.547	1.282	22	1.430	-0.175	1.605
5	0.709	-0.561	1.270	26	0.282	-1.103	1.385
11	0.628	-0.444	1.072	9i	0.126	-1.157	1.283
3	0.249	-0.677	0.927	24	-0.415	-1.662	1.247
22	0.726	-0.175	0.901	30	-0.307	-1.049	0.742
10	-0.255	-0.951	0.696	19s	1.036	0.320	0.716
6	-0.181	-0.459	0.278	7	1.710	1.123	0.588
1	1.865	1.614	0.251	2	0.722	0.284	0.438

Descending Array of Differences between F1 and 2				Descending Array of Differences between F 1 and 3			
Number	Type	1 Type	2 Difference	No.	Type	1 Type	3 Difference
15	-0.099	-0.340	0.240	31	0.589	0.388	0.201
27	1.503	1.273	0.230	13	-0.096	-0.218	0.122
19	0.510	0.320	0.190	27	1.210	1.273	-0.063
30	-1.027	-1.049	0.023	8	-1.124	-0.949	-0.175
9	-1.193	-1.157	-0.036	11	-0.681	-0.444	-0.237
25	-0.422	-0.104	-0.318	6	-0.796	-0.459	-0.337
8	-1.329	-0.949	-0.380	10	-1.378	-0.951	-0.427
24	-2.161	-1.662	-0.499	29	0.305	0.781	-0.476
31	-0.201	0.388	-0.589	4	-1.404	-0.729	-0.675
29	0.179	0.781	-0.602	5	-1.366	-0.561	-0.804
13	-0.862	-0.218	-0.644	28	-0.120	0.833	-0.953
7	0.291	1.123	-0.831	20	0.355	1.327	-0.972
23	1.255	2.224	-0.969	14	-0.992	0.056	-1.048
20	0.351	1.327	-0.976	25	-1.247	-0.104	-1.143
16	-0.685	0.442	-1.126	16	-0.797	0.442	-1.238
12	-1.335	-0.102	-1.233	12	-1.550	-0.102	-1.448
28	-0.495	0.833	-1.328	32	-0.633	0.953	-1.586
32	-0.613	0.953	-1.566	1	-0.052	1.614	-1.667
21	-0.018	1.597	-1.614	21	-0.149	1.597	-1.746
14	-1.569	0.056	-1.625	23	0.266	2.224	-1.958