User Acceptance of a Picture Archiving and Communication System

Applying the Unified Theory of Acceptance and Use of Technology in a Radiological Setting

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Summary

Objective: The aim of this study is to gain insight into the individual user acceptance of PACS by the radiology department staff of the Ghent University Hospital. Hereto a basic – direct effects only – form of UTAUT was assessed.

Methods: Ninety-four questionnaires were distributed and 56 usable questionnaires were returned (19 radiologists – 37 technologists). The questionnaire consisted of scales of Venkatesh et al. [13] for performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC), social influence (SI), self-efficacy (SE), attitude (ATT), anxiety (ANX) and behavioral intention (BI), and a scale of Moore et al. [22] to assess the perceived voluntariness of PACS-use.

Results: The reliability of all scales, except FC and voluntariness, was acceptable to good. The voluntariness scale was divided into a mandatoriness (MAN) and a voluntariness (VOL) measure. Both radiologists and technologists seem to welcome PACS, with radiologists having higher ratings on PE, EE, ATT, VOL and BI. Only PE and FC were salient for predicting BI, while EE and SI were not salient. Variance explained in behavioral intention to use PACS was 48%.

Conclusion: Both radiologists and technologists were positive towards PACS and had strong intentions to use PACS. As other healthcare professionals, they appear to make their technology acceptance decision independent from their superiors, hereby focusing on usefulness rather than on ease of use. It is also important that support is supplied. Basic UTAUT is an adequate model to assess technology acceptance in a radiological setting.

Keywords
PACS, UTAUT, technology acceptance

Methods Inf Med 2008; 47: 149–156

doi:10.3414/ME0477

1. Introduction and Background

Radiological modalities (e.g. CT, MRI …) produce images which are stored in a digital format. In order to visualize these images both for radiologists who interpret them and clinicians who request them, a digital image management system is needed. PACS, short for Picture Archiving and Communication System, is the common denominator for the entirety of hard- and software responsible for the storage, distribution and visualization of radiological images within a hospital (and beyond its border).

In recent years, PACS has evolved from a basic storage system to an advanced platform where radiologists have access to advanced image processing functions and 3D-applications. The advent of PACS constitutes a major change of work patterns for radiologists and other hospital physicians [1]. Radiological information is no longer presented to them on conventional film but must now be reviewed on a computer monitor. This method of working offers more possibilities than before but the changeover to this new digital work environment can pose problems at the technological, organizational or individual level in the different stages of the change process [2]. These problems, if they are not overcome, can seriously threaten the success of the PACS project and compromise the acceptance and use of PACS.

Research on the acceptance of information technologies generated many competing models, each with different sets of determinants for acceptance or usage. The operationalization of user acceptance is perspective-dependent. First, from the social psychology perspective, intention-based models are used to predict usage. These models focus on the determinants of behavioral intention, serving as a surrogate for technology usage or technology acceptance. Second, models developed from a diffusion of innovations perspective focus on a variety of factors which are thought to be determinants of IT adoption and diffusion throughout the organization [3].

Throughout this paper we will take variance explained as an indication for model-fit. Variance explained is an indication of the predictive power of a theoretical model and fluctuates between 0 and 1, with 1 being perfect. Depending on the model tested, there is a great deal of variation in variance explained. Variance explained ranges from 0.04 [4] to about 0.70 [5-7]. Common values for variance explained are in the range 0.35-0.55 [3, 8-12].

Researchers constantly seek to improve the predictive power of existing models. Venkatesh et al. [13] addressed the need for a broader exploration beyond the existing models and made a review of eight prominent (technology) acceptance models: Theory of Reasoned Action (TRA) [14], Technology Acceptance Model (TAM/TAM2) [3, 5], Theory of Planned Behavior (TPB) [3, 6, 15], Combined TAM and TPB (C-TAM-TPB) [16, 17], Social Cognitive Theory (SCT) [18, 19], Motivational Model (MM) [20], Model of PC Utilization (MPCU) [21] and Innovation Diffusion Theory (IDT) [22, 23]. They found that none of the tested models could explain more than about 50% of the variance in user intentions to use a new technology; therefore they formulated UTAUT, based on

Received: February 8, 2007; accepted: May 24, 2007

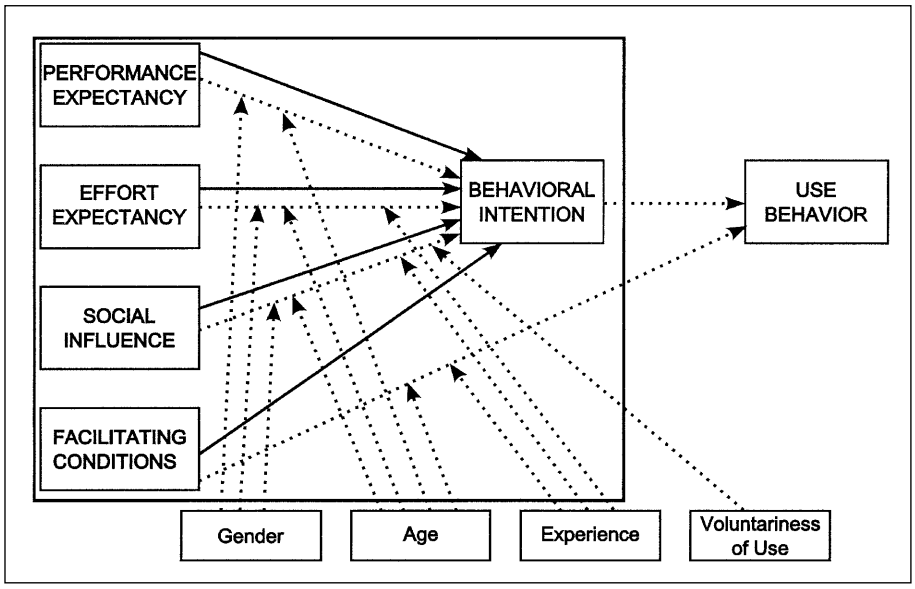

Fig. 1 UTAUT [13]. The basic, direct effects only, model tested in this study is in full lines, original UTAUT is displayed in dotted lines.

similarities and differences between these models. UTAUT contains four core determinants of behavioral intention (BI) and usage (Fig. 1):

- *performance expectancy (PE):* the degree to which an individual believes that using the system will help him or her to attain gains in job performance
- *effort expectancy (EE):* the degree of ease associated with the use of the system
- *social influence (SI):* the degree to which an individual perceives that important others believe he or she should use the new system
- *facilitating conditions (FC):* the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system

UTAUT incorporates up to four moderators – *gender*, *age*, *experience* (with the technology) and *voluntariness of use* (mandatory or voluntary setting) – that moderate the relationship between the determinants and the dependent variable intention or usage.

UTAUT is a relatively recent model and reports in the literature concerning UTAUT are scarce compared to other technology acceptance models. Schaper et al. [24] integrated UTAUT into the framework proposed by Chau et al. [25] in a paramedical context with occupational therapists, but unlike other technology acceptance models [16, 25-30], UTAUT has, to our knowledge, never been tested in a hospital setting.

As we are restricted both in sample size and setting, we have to restrict our research model to the four core determinants of behavioral intention. We will refer to this shortened model without moderators as the "basic" form of UTAUT, and compare our results to the reference material Venkatesh et al. [13] provided.

Healthcare professionals, the target population of this study, could differ from other populations that are commonly used in technology acceptance studies. Previous studies conducted in hospital settings that investigated physicians' acceptance of telemedicine technology [16, 25, 26, 28], internet-based health applications [27] or a physician order entry system [30] indicated that healthcare professionals react differently than people in a business setting. They appear to be more independent in their technology acceptance decisions and they focus primarily on the usefulness of the new technology rather than on its ease of use [16, 25-28, 30]. We must also be aware of other possible confounding factors. Li et al. studied the robustness of the different UTAUT scales over different subpopulations and they found that the performance expectancy and social influence scales were not robust over gender [31].

The target population of this study consists of two distinct groups, radiologists and technologists and some differences between these groups are expected as radiologists and technologists have to use PACS for different goals. Radiologists use PACS as a data repository. Their main goal is to review the images stored inside this system. Technologists use PACS as a storage system. Instead of printing films and delivering these to the radiologists, they are responsible for the correct entry of patient information and image storage.

2. Purpose of Investigation

First of all, the purpose of this study is to gain knowledge into the acceptance of PACS by the radiologists and technologists of the Ghent University Hospital, by assessing UTAUT [13]. The motive for focusing on this specific target population is twofold. First, using a rather homogeneous population makes it more likely to detect micro-level effects [32]. Second, the comments, wishes and concerns of the people in the radiology department will be very useful to gain insight into the acceptance of PACS by healthcare professionals that should be highly motivated to use PACS and who have to be the driving force to promote the use of PACS throughout the whole hospital.

To assess the individual acceptance of PACS, we will administer scales developed by Venkatesh et al. [13] to assess UTAUT and the Voluntariness of Use scale of IDT developed by Moore et al. [22]. The scales can be found in Appendix A.

3. Hypotheses

Performance expectancy or related constructs are the strongest predictors of behavioral intention [5, 6, 8-11, 15]. Previous research in hospital settings indicated that this

is also valid for clinicians or other healthcare professionals [7, 16, 25, 26, 30, 33]. Therefore we hypothesize that PE will be salient for predicting BI (H1, Table 1).

Effort expectancy or related constructs are found to be good secondary predictors of behavioral intention [5, 6, 8]. Venkatesh et al. [13] found effort expectancy to be more salient in the early stages of acquiring a new behavior, particularly for women and older people. This was not supported by research in hospital settings [7, 16, 25, 26, 34], nor by other research in business settings [5, 9, 10]. As our study is conducted prior to implementation of PACS, we expect that EE will not be a salient predictor of BI (H2).

Constructs related to *social influence* were not salient for predicting intention in voluntary settings, but each became significant in a mandatory setting [6, 8, 13, 15]. However, this research is conducted in a mandatory medical setting and Chau et al. [16, 25, 26] suggest that physicians – when making the technology acceptance decision – value their own assessments more than the opinions and suggestions of others. Hence, we hypothesize that SI will not be a salient predictor of BI (H3).

Some interesting findings about the effect of *facilitating conditions* were reported in previous research. According to Venkatesh [12], FC shouldn't exert an influence on BI in the presence of effort expectancy. Therefore there is a direct link in the original UTAUT model (Fig. 1, dotted lines) between facilitating conditions and usage behavior, and not with behavioral intention [13]. However, in our study, we cannot assess this as the administration of the questionnaire occurs prior to implementation of PACS. In healthcare settings, Chau et al. [16, 25, 26] found that compatibility and perceived behavioral control, two constructs related to facilitating conditions [13], were salient for predicting behavioral intention, even in the presence of perceived ease of use, a construct related to effort expectancy. Thus, consistent with Chau et al. [16, 25, 26] we assert that FC will be salient for predicting BI (H4).

Venkatesh et al. [13] limited UTAUT to these four predictors (PE, EE, SI and FC) and left attitude, self-efficacy and anxiety out of the model, although these variables proved to be salient predictors in their original models. As Venkatesh et al. [13] developed scales to measure these constructs, we included the scales in the questionnaire, to assess whether attitude, self-efficacy and anxiety are also redundant in a radiological setting given the structure of UTAUT (H5).

We expect that there will be some differences between radiologists and technologists. Physicians, including radiologists, are argued to have a higher [16, 25, 26]:

- level of competence,
- intellectual and cognitive capacity,
- adaptability to new technologies.

Radiologists should also have a better view on the problems and benefits associated with the use of PACS and they should also be able to better assess the support they can rely on in case of problems. Technologists just as nurses and other healthcare professionals value the usefulness of the technology more than it's ease of use [33, 35], but nurses appear to be more anxious towards the introduction of a new technology compared to physicians [36].

These differences between radiologists and technologists should lead to radiologists having higher ratings on the PE (H6a), EE (H6b), FC (H6d) and ATT (H6e) scales and lower ratings on the ANX scale (H6g). Ultimately, these expected differences should lead to radiologists having a stronger intention to use PACS than technologists (H7).

No differences are expected in ratings on the social influence (H6c), self-efficacy (H6f) and voluntariness of use (H6h) scales.

Table 1 Hypotheses

H1	PE will be salient for predicting BI	Supported
H2	EE will not be salient for predicting BI	Supported
H3	SI will not be salient for predicting BI	Supported
H4	FC will be salient for predicting BI	Supported
H5	ATT, SE and ANX will not be salient for predicting BI	Supported
H6a	Radiologists will find PACS more useful than technologists	Supported
H6b	Radiologists will find PACS easier to learn/use than technologists	Supported
H6c	No differences are expected in ratings on the SI scale	Supported
H6d	Radiologists will have higher ratings on the FC scale than technologists	Rejected
H6e	Radiologists will have a more positive attitude towards using PACS	Supported
H6f	No differences are expected in ratings on the SE scale	Supported
H6g	Radiologists will be less anxious towards use of PACS	Rejected
H6h	No differences are expected in ratings on the VOL scale	N/A
H7	Radiologists will have a stronger intention to use PACS than technologists	Supported

4. Materials and Methods

4.1 Setting

The Ghent University Hospital is the second-largest single campus hospital in Belgium. It is an 1169-bed hospital and it employs about 4800 people. The medical staff consists of 600 doctors while the nursing staff tallies up to 1700 people. PACS was introduced in different phases, starting with the radiology department. This department is situated on 7 different locations around the campus and employs about 120 people.

4.2 Population

We included all radiologists and technologists working for the radiology department in our study, except those selected for the pretest. Ninety-four questionnaires were distributed, 76 were returned. Prior to analysis, 18 were removed due to: too many missing values (n = 7), more than 20 missing or

Table 2 Descriptive statistics

	Overall (n=56)				Radiologists (n=19)			Technologists (n=37)			
Scale	ICR‡	range	mean	s.d.*	range	mean	s.d.	range	mean	s.d.	t-test†
PE	.91	1–7	5.14	1.63	3.33–7	6.00	1.01	1–7	4.70	1.72	t(54)=3.242, p=.001
EE	.92	1–7	4.93	1.45	3–7	5.36	1.13	1–7	4.71	1.56	t(54)=1.634, p=.05
SI	.76	1.5–7	4.45	1.45	2.5–6.67	4.54	1.32	1.5–7	4.40	1.52	t(54)<1
FC	.44	3.33–7	5.55	1.02	4.33–7	5.82	.70	3.33–7	5.42	1.14	t(54)=1.039, p=.15
ATT	.93	1–7	5.46	1.51	3.5–7	6.18	.82	1–7	5.09	1.65	t(49.079)=3.068, p=.002
SE	.69	1–6.75	5.06	1.02	3.75–6.75	5.25	.96	1–6.75	4.97	1.06	t(54)=1.134, p=.26 (2-tailed)
ANX	.86	1–6.25	2.55	1.51	1–6	2.32	1.36	1–6.25	2.68	1.58	t(54)<1
MAN°	.42	4–7	6.13	1.11	4–7	6.13	1.12	4–7	6.12	1.12	t(54)<1
VOL§	N/A	1–7	5.63	1.43	5–7	6.26	.81	1–7	5.30	1.58	t(54)=2.234, p=.03 (2-tailed)
BI	.77	3–7	6.25	1.02	6–7	6.63	.47	3–7	6.05	1.17	t(52.658)=2.116, p=.02

‡Internal consistency reliability: Cronbach alpha; *standard deviation; † 1-tailed tests for hypothesized significant differences between radiologists and technologists; °mandatoriness: items VOL-2 and VOL-3; §voluntariness: item VOL-4

"no opinion" answers (n = 7) or no answer on the dependent or independent variables (n = 4). Prior to analysis, two more subjects were removed as they were identified as outliers on the dependent variable. This resulted in a net response rate of 59.6%. Of the 56 remaining subjects, 19 were radiologists (7 females) and 37 were technologists (24 females).

4.3 Questionnaire

Our questionnaire was created using scales and items of UTAUT [13] for: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Attitude toward use, Self-Efficacy, Anxiety and Behavioral Intention. To assess the perceived Voluntariness of Use, we utilized a scale of IDT [22]. The items were translated and minor adaptations were made to fit in our study. The complete questionnaire is presented in Appendix A.

All items had to be assessed on a 7-point Likert scale, ranging from "complete agreement (1)" to "complete disagreement (7)". To analyze the data, scales were recoded so that 7 accords with "complete agreement" and 1 with "complete disagreement".

4.4 Pretest

Prior to administration of the questionnaire, a small pretest was set up with four subjects: an IT-engineer, a radiologist and two technologists. Each completed a first version of the questionnaire. The aim of this pretest was twofold: first evaluating the translation of the items, and second providing valuable feedback on the questionnaire as a whole. Some useful comments were given, leading to a) a slightly modified layout of the questionnaire, b) some minor wording adaptations, and c) the removal of one item from the facilitating conditions scale of Venkatesh et al. [13].

4.5 Data Collection

The questionnaires, with cover letter, were handed out and returned through the internal post of the radiology department.

4.6 Data Analysis

Data are analyzed in different stages using SPSS 12.0©. First the reliability of the different scales is assessed using Cronbach alpha (α). Then we calculate some descriptive statistics using the scale averages, to get a view on hypothesized differences between radiologists and technologists. Finally, regression analyses are performed to test UTAUT and the findings of Venkatesh et al. [13] concerning the redundant constructs with variance explained in behavioral intention serving as an indication for model-fit.

5. Results

5.1 Reliability Analysis

The reliability coefficients (Cronbach alphas) of the scales are displayed in Table 2. Most alphas met the minimal requirements of Nunnaly (>.70) [37], with PE, EE and ATT as positive peaks.

Prior to the analysis, two items (FC-2, VOL-2) had to be recoded, as they were negatively phrased. Although item VOL-1 is also negatively phrased we cannot recode it, as it expresses two thoughts ("PACS might be helpful" and "PACS is not compulsory in my job"). Therefore we removed this item from the scale. This left us with three items in this scale (alpha of this reduced scale was .28): one measuring the voluntariness of use, and two items measuring the mandatoriness of

use. As it is clear that an average score on this scale cannot properly be interpreted, VOL-2 and VOL-3 were averaged to get a "Mandatoriness (MAN)" measure (Cronbach alpha .64) and VOL-4 was used as a "Voluntariness (VOL)" measure. One more item (PE-4) had to be removed prior to the analysis, as it was completely irrelevant in this setting.

5.2 Descriptives

When administering a questionnaire, extreme responses (positive or negative) are preferred over neutral responses. This should lead to a nonnormal distribution of the responses, either skewed, as in this study, or bimodal. Therefore the data were normalized with a logarithmic (base 10) transformation. Table 2 shows an overview of the descriptives, overall and per group. The original data are reported here as they are more meaningful than the transformed data, but all analyses were run using the transformed variables.

No confounding effect of gender on scale ratings was found (t-tests not reported here). When we look at the range of the responses, we see that the technologists displayed more variability in their responses. As hypothesized some differences were found between radiologists and technologists in mean scale ratings lending support for hypotheses 6a, b, e, and no differences were found in ratings on SI and SE, supporting H6c and f. In both groups, intention to use PACS was very high, as expected higher for the radiologists than the technologists, supporting H7.

Two hypotheses were rejected: radiologists and technologists seemed to be equally aware of the existence of reliable resources (H6d) and both groups were equally at ease concerning PACS (H6g).

Hypothesis 6h could not be tested as the voluntariness scale had to be split up in a MAN and VOL scale. The VOL scale revealed that radiologists, more than technologists, perceive their use of PACS as voluntary.

5.3 Regression Analysis

To assess the predictive power of UTAUT, a linear regression analysis was performed.

Table 3 Results of regression analysis. Dependent variable: behavioral intention

Construct	UTAUT	UTAUT + ATT	UTAUT + SE	UTAUT + ANX
PE‡	.31 (p=.03)	.24 (p=.10)	.30 (p=.03)	.31 (p=.03)
EE‡	.23 (p=.08)	.11 (p=.47)	.24 (p=.10)	.20 (p=.16)
SI‡	-.08 (p=.49)	-.11 (p=.34)	-.07 (p=.53)	-.06 (p=.58)
FC‡	.42 (p<.001)	.41 (p=.001)	.42 (p<.001)	.42 (p=.001)
ATT‡		.22 (p=.21)		
SE‡			-.02 (p=.85)	
ANX‡				-.06 (p=.60)
Adj. R^2	.48	.49	.47	.47
F-test	F(4,51)=13.767, p<.001	F(5,50)=11.476, p<.001	F(5,50)=10.814, p<.001	F(5,50)=10.914, p<.001
§Sign. R^2 change		F(1,50)=1.630, p=.21	F<1	F<1

‡Values reported are the standardized Beta regression coefficients (significance level between brackets); §F-test of sign R^2 change

A summary of the results is displayed in Table 3. Facilitating conditions proved to be the strongest predictor of behavioral intention. This is consistent with H4 and in contrast with Venkatesh et al. [13] who claim that facilitating conditions should influence usage behavior and not behavioral intention. In contrast with earlier studies, performance expectancy was not the strongest predictor of intention. Nonetheless, H1 was supported; performance expectancy was salient for predicting behavioral intention. Both effort expectancy and social influence were not salient for predicting behavioral intention, supporting H2 and H3.

Three additional hierarchical regression analyses were run to assess whether attitude, anxiety and self-efficacy are also redundant in this setting with this specific population. The analyses revealed that these constructs have no added value given the structure of UTAUT. This is consistent with the assertions of Venkatesh et al. [13]. So H5 is supported.

6. Discussion

6.1 Reliability

Our scales proved to be quite reliable, with Cronbach alphas approximating those reported by Venkatesh et al. [13], except for the facilitating conditions scale. This scale and the mandatoriness scale didn't reach the acceptable level of reliability. Not surprisingly these two scales contained reverse-scaled items, and this could according to Herche et al. jeopardize the unidimensionality of the underlying scale [38].

A closer inspection of the FC scale reveals that this scale was in fact a composite of two scales: the Perceived Behavioral Control scale (TPB, C-TAM-TPB) and the Facilitating Conditions scale (MPCU). In MPCU, facilitating conditions are defined as objective factors in the environment that make an act easy to do, including the provision of computer support [21], while in TPB and C-TAM-TPB, perceived behavioral control refers to perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions [13]. So, an alternative explanation for the low reliability of the FC scale could be that the different items measure different dimensions of FC.

The original voluntariness scale had two underlying scales, one measuring perceived voluntariness, and the other perceived mandatoriness of use. The voluntariness scale consisted of only one item, while mandatoriness was measured by two items, of which one was reverse-scaled. These two

items seem to be conceptually close, if not reverse-scaled, but this was not confirmed by our results. This could indicate that scale unidimensionality was indeed threatened [38]. Our findings concerning the four-item voluntariness scale are in sharp contrast with those of Moore et al. [22]. They obtained a Cronbach alpha of .85 with all four items, while we found initially –.75 (before recoding) and –.03 (after recoding).

6.2 Descriptives

The descriptive statistics indicated that the radiology department staff seems to welcome the introduction of PACS and although use of PACS will be mandatory, both groups indicate that they will use PACS voluntary. The results also indicated that overall radiologists have a better view on the benefits and problems associated with PACS, leading to higher ratings on the PE, EE, ATT and BI scales.

Another important finding was that neither radiologists ($t(18) = 1.769$, $p = .09$) nor technologists ($t(36) = 1.601$, $p = .12$) experienced social pressure to use PACS, as mean ratings on the SI scale didn't differ significantly from the neutral point. This is an indication that healthcare professionals make their technology acceptance decisions quite independent. This is in contrast with earlier technology acceptance studies in mandatory business settings [13], but consistent with earlier studies in medical settings [16, 25, 26].

6.3 Regression

Conceptually, UTAUT seems to be a good model that can be used for a one-shot assessment of healthcare professionals' intentions to use a new technology. All hypotheses concerning the four core constructs and the three redundant constructs were confirmed. Performance expectancy was a salient predictor of intention, while effort expectancy was not, indicating that if PACS is useful, it doesn't matter how hard it is to learn or use PACS, which corresponds with earlier technology acceptance studies [7, 16, 25, 26, 30, 33, 34]. We have to keep in mind that this study was taken prior to the introduction of PACS, when our population lacked hands-on experience with PACS, so ease of use of PACS had to be estimated. Therefore the nonsaliency of effort expectancy could also be attributed to the timing of the study.

The nonsaliency of social influence cannot be attributed to the timing of the study. Both groups experienced some pressure to use PACS, however, this pressure has no influence on their intentions to use PACS. Although use of PACS will be mandatory, it is perceived by the radiology department staff as voluntary. This is reflected in the results of the regression analysis. So, our sample of medical workers prove indeed to be quite different from other target populations in mandatory settings [16, 25, 26]. The basic model we tested could also be a source of the nonsaliency of social influence. In UTAUT, social influence was only salient for predicting intention through 4- and 5-way interactions [13] and our basic model incorporates no mediating variables and hence no interactions.

In contradiction with earlier findings [12, 13], facilitating conditions were extremely important for predicting intention to use PACS, even in the presence of effort expectancy. It seems that as it is not clear how hard it will be to learn to work with PACS, it is really important that there exists some sort of support to rely on if problems should arise.

Variance explained in our study was higher than the comparable values reported in Venkatesh et al. [13]. UTAUT performed well; the basic form of UTAUT was able to explain 48% of the variance in behavioral intention, compared to 37% in Venkatesh et al. [13]. Although this is comparable to earlier technology acceptance studies, this is still a lot less than the 70% Venkatesh et al. [13] found when they assessed the full model with measurements on three separate times.

6.4 Limitations

In this type of research, it is common to work with large samples, as a lot of studies are performed in several organizations or companies examining various technologies. However, this was not the aim of this study. We wanted to examine the acceptance of only one specific technology (PACS) in a limited population that has to be the driving force to implement PACS throughout the whole hospital. Due to the setup of our study (sample and setting), we couldn't test the full UTAUT model. However, Venkatesh et al. [13] reported data on both the full model and a basic model without interactions. This offered us the opportunity to use the latter data as a reference for our results.

6.5 Future Work

Future work should try to overcome the limitations we met in this study, regarding the sample size and setting. UTAUT proved to be a good model for predicting intention pre-implementation, with variance explained of 48%. However, we didn't reach the 70% level reported in Venkatesh et al. [13] when pooling over three time periods. So further research on this matter should make use of multiple measurements, cross-sectional or if possible longitudinal, taken before and after implementation of PACS.

7. Conclusion

The basic form of UTAUT (without mediating variables) proved to be an adequate model for predicting the intentions of the people of the radiology department to use PACS. Variance explained by UTAUT in our study (48%) was higher than in Venkatesh et al. (direct effects only: 37%) [13]. Only performance expectancy and facilitating conditions were salient for predicting intention in UTAUT, while social influence and effort expectancy were not.

The expected nonsignificance of social influence to the prediction of intention to use PACS is attributed to our specific population and to the reduced model we tested, as we were unable to test all interactions due to our limited sample size. The expected nonsaliency of effort expectancy for predicting

intention could be attributed to the timing of the study and our specific population.

In short, our results indicate that above all, acceptance of a new technology in a hospital setting depends on the usefulness of this technology for the job in general, and on the support that can be provided in case of any sort of problems.

Our study also indicated that radiologists have a better view on PACS as a whole than technologists, especially on the benefits of PACS. This is quite obvious, as physicians are required to stay up-to-date when new techniques or technologies arise.

Acknowledgments
The authors would like to thank professor Eric Mortier, MD, Ph.D., for his critical review of the study proposal.

Appendix A

Questionnaire items

PE: Performance Expectancy
- PE-1 I will find PACS useful in my job
- PE-2 Using PACS will enable me to accomplish my tasks more quickly
- PE-3 Using PACS will increase my productivity
- *PE-4 If I use PACS, I will increase my chances of getting a raise

EE: Effort Expectancy
- EE-1 My interaction with PACS will be clear and understandable
- EE-2 It will be easy for me to become skillful at using PACS
- EE-3 I will find PACS easy to use
- EE-4 Learning to operate PACS will be easy for me

SI: Social Influence
- SI-1 People who influence my behavior think that I should use PACS
- SI-2 People who are important to me think that I should use PACS
- SI-3 The senior management of the hospital has been helpful in the use of the system
- SI-4 In general, the hospital has supported the use of the system

FC: Facilitating Conditions
- FC-1 I will have the resources necessary to use PACS
- FC-2 PACS will not be compatible with other systems I use
- FC-3 A specific person or group will be available for assistance with PACS difficulties

ATT: Attitude Toward using Technology
- ATT-1 Using PACS is a good idea
- ATT-2 PACS will make work more interesting
- ATT-3 Working with PACS will be fun
- ATT-4 I will like to work with PACS

SE: Self-efficacy
I will be able to complete a task using PACS
- SE-1 … if there was no one around to tell me what to do as I go
- SE-2 … if I could call someone for help if I got stuck
- SE-3 … if I had a lot of time to complete the job for which PACS is provided
- SE-4 … if I had just the built-in help facility for assistance

ANX: Anxiety
- ANX-1 I feel apprehensive about using PACS
- ANX-2 It scares me to think that I could lose a lot of information using PACS by hitting a wrong key
- ANX-3 I will hesitate to use PACS for fear of making mistakes I cannot correct
- ANX-4 PACS is somewhat intimidating for me

VOL: Voluntariness of Use
- *VOL-1 Although it might be helpful, using PACS is certainly not compulsory in my job.
- §VOL-2 My boss does not require me to use PACS
- §VOL-3 My superiors expect me to use PACS
- $VOL-4 My use of PACS is voluntary (as opposed to required by my superiors/ job)

BI: Behavioral Intention
- BI-1 I intend to use PACS in the next nine months
- BI-2 I predict I would use the system in the next nine months
- BI-3 I plan to use the system in the next nine months

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* Item removed from the scale
§ Items used for "Mandatoriness" measure
$ Item used for "Voluntariness" measure

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