A Strategically Designed Persuasive Tool For An iPhone

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Abstract: Obesity has reached epidemic proportions globally. WHO projects that by the year 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. This article is about designing a concept of a second generation persuasive tool for an iPhone and how it can help users fighting obesity. More than 1.7 trillion dollars are spent by the US every year in health care, less than 4% of those are spent on prevention and public health. Prevention services such as screening and disease management are receiving increasing attention and help to reduce the costs on the health care system. There are numerous applications in the market which claim to aid users fighting weight issues. What makes our concept different from others is the emphasis on usability at every stage of the design process which is fundamental to success. We started off with research on iPhone user profiles, demographics and health, moved on to user interviews, requirement analysis, interaction models, use objects, information architecture, visual design, and ended up with Hi Fidelity clickable mock ups of the application. The application is intentionally designed to change a person's attitude or behaviour in a predetermined way. The final result is a robust and user friendly persuasive tool for those who want to loose weight and get back into shape, with the age group of the target users being 18-40 years. The application leads the user through a step by step sequence of actions with relevant, customised interventions, providing the right kind of motivation and thereby providing a better user experience in turn making the process more engaging and enjoyable. The study develops a successful symbiotic relationship between the medical and mobile domain. The usability evaluation tests ensure that any potential issues are highlighted and fixed before the product is launched. The article also addresses the impact of usability on the final design and how it affects and is the key to the success of the application.

1 Introduction

The study addresses obesity and overweight as critical health issues. We have designed a concept for a wellness application which will aid users fighting these issues. More than 1.7 trillion dollars are spent by the US every year in health care, less than 4% of those are spent on prevention and public health. Prevention services such as screening and disease management that address populations at-risk, along with primary prevention with an emphasis on improving the environments where people live, work, play, and go to school, are receiving increasing attention and help to reduce the costs on the health care system [Pr07].

WHO's latest projections indicate that globally in 2005 approximately 1.6 billion adults (age 15+) were overweight and at least 400 million adults were obese. WHO further projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese [Wh09]. The data from The Annual Health Report, United States 2008, shows that among young adults between ages 18-29 about one-third are obese, and one-third are overweight [Na09]. Physical activity and nutrition are related to important burdens of diseases such as obesity, cardiovascular diseases, diabetes mellitus and certain forms of cancer [Wh09][CP09]. Large proportions of the populations of many countries world-wide engage in too little physical activity [CPC00][OHS02] and have undesirable eating habits, such as high intakes of energy, salt and saturated fat and low intakes of fruits, vegetables and fibre.

Therefore, there is a need for a effective intervention strategy to motivate people to adopt healthier diets and to increase physical activity. Studies to design effective motivational strategies have evolved over the years. It is important to understand which strategy a researcher should employ while using persuasion based computing technology (PCBT) as a tool, media or social actor. Persuasive computing technology is a computing system, device or application intentionally designed to change a person's attitude or behaviour in a predetermined way.

2 Methodology

There are various usability methods for data collection which can be used like stakeholder interviews [CR03], subject matter experts [CR03], user interviews [MG05], user observation [CR03], contextual inquiry [Ma99][BH97], literature review [CR03], competitive audits [CR03], market research [CR03] and user survey [Ba90]. The methods used in this study for data collection were literature review, user interviews [In09b][MG05], and market reports [Na09][Ru08]. Since we were working on Health Management, literature review gave us an understanding on Health Management and existing persuasive strategies. User interviews gave us insights into the user needs and goals. Market research reports provided statistical data for supporting data gathered by literature review and user interviews. The methodology followed can be seen in figure 2.1

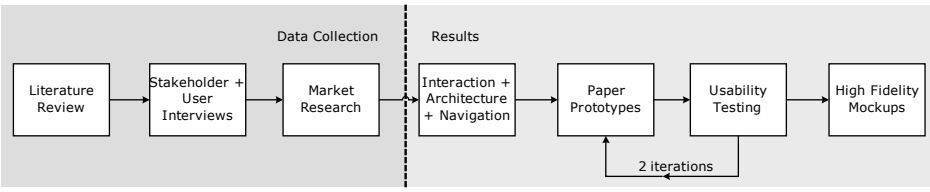

Figure 2.1 Complete design process

2.1 Literature Review

We conducted a literature review to get up to date with current literature on persuasive technologies and health management [Wh09][CPC00][OHS02]. We got an overview of the evolution of persuasive technologies [CP09][Pr07][Ke08][Fo03] and strategies used to develop persuasive applications. The evolution of PCBT can be seen in table 2.1. The most interesting and intriguing area is the intersection of these two domains, health and technology [CP09].

Year	**PCBT**	**Name**	**Example**
Late 1960s	1st Generation(1G)	Prescriptive systems	telephones, brochure/CDrom
1985-95	2nd Generation(2G)	Descriptive systems	web/internet, multimedia data, PDAs/cell phones
1999-2010	3rd Generation(3G)	Environmental systems	wireless sensors, context aware real-time sensing
2012-beyond	4th Generation(4G)	Automated systems	genetic integration, pervasive sensing

Table 2.1 Evolution of PCBT

2.2 Stakeholder Interviews

Stakeholder interviews are important for knowing the business needs and the reasons behind the requirements of starting a new project. [CR03] An interview with the Product Management of InterComponentWare AG (ICW) [In09a] was conducted. The information that is important to gather from the stakeholder includes: 1) What is the vision of the product? 2) What is ICW trying to accomplish by entering the mobile domain? 3) What are the stakeholders' perceptions of the users? For results please refer to section 3.3.

2.3 Market reports

Market reports provide statistical support to the data collected by the aforementioned methods and help finding out interview targets [CR03]. Our application is a health and lifestyle related application designed for the iPhone. We studied the user profile, demographics and usage patterns of iPhone users [Ru08]. A report by the Department of Health and Human Services [Na09], United States, provided us with an overview of health related problems encountered by the U.S. population. It also provided statistical data on the rise and fall of these problems over the years.

2.4 User Interviews

Contextual inquiry is probably the most effective tool in the designers' arsenal to gather qualitative data about users and their goals. Though it might be effective, it is not the most efficient. It takes almost one day to conduct a contextual inquiry and it requires larger design teams than user interviews [CR03]. We followed a semi structured interview technique [In09b] for user interviews. A semi structured approach was chosen because we wanted a deeper understanding of user goals and this is a great method to find out *Why* rather than *How many* or *How much*. This technique allowed us to be more flexible with the order of questions to be asked. Supplementary questions were asked to get a deeper understanding of the main agenda. We conducted six user interviews. For choosing the interview candidates there were two prerequisites: (1) the users should have had prior experience with health and lifestyle applications (2) the user should have an iPhone or a smart phone.

The main agenda of the interview was: (1) how the users maintained their health, (2) which applications they used on the iPhone, (3) in what context and for how long they used these applications, (4) which health problems they suffered from.

3. Results

3.1 Literature Review

The philosophers and scholars have been examining persuasion techniques since the late 1960s[CP09]. There are different strategies that a researcher can employ when setting the role of a persuasive-based computing technology (PBCT) as a tool, media, or social actor [CP09]. Our application would take up the role of a persuasive tool which would assist users in achieving their goal. We employ social dynamics, tunnelling, tailoring and suggestion as strategy for effective persuasion. By employing this strategy the application leads the user through a step by step sequence of actions with relevant, customised interventions, providing the right kind of motivation and thereby providing a better user experience in turn making the process more engaging and enjoyable.

3.2 Market Reports

Research on the age breakup of iPhone users [Ru08] revealed that around 75% of iPhone users fell in the age group of 18-40 years as can be seen by Figure 3.1. Research on Health [Na09] revealed that 2/3rd of the US population in the age group 18-40 years, was either obese or overweight as can be seen in Figure 3.2. Obesity as a problem has tripled in the last decade and became a global epidemic. The intersection of the two domains, shown in Figure 3.3, iPhone users and health, provided enough evidence that people between the age group of 18-40 years should be taken as the target group for our interviews and iPhone application concept. The application would address obesity and overweight issues.

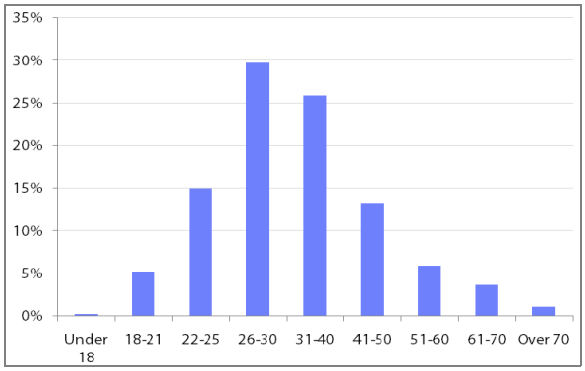

Figure 3.1. Age breakup of iPhone users [Ru08]

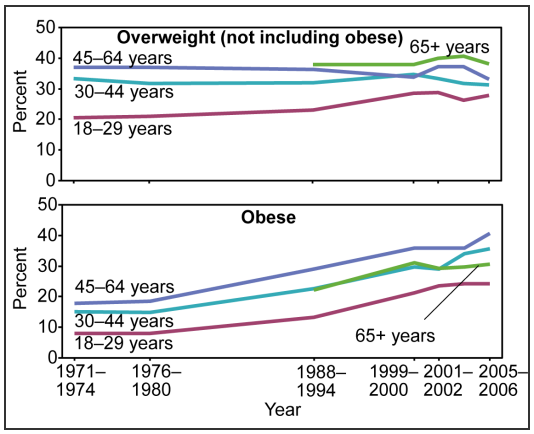

Figure 3.2. %Age breakup of US population [Na09]

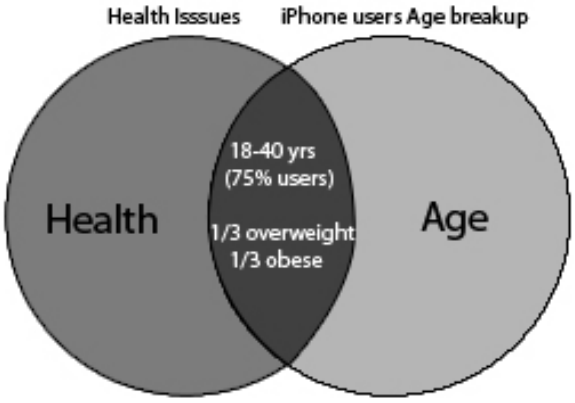

Figure 3.3. Intersection of 2 domains, iPhone users and Health

3.3 Stakeholder Interview

The vision of ICW is to be a global leader in the market of PHRs. The reason why ICW is venturing in the mobile domain is that the company wants to provide mobile health support to people who are always on the move. The idea is to provide the PHR as small and quick applications and then provide connectivity between the mobile device and the PHR. People can feed their personal information into these mobile applications while on the move and then transfer information from the mobile device to the PHR.

3.4 User Interviews and Requirement Analysis

User interviews help us to understand the domain, context of use, and constraints of a product [CR03]. The user interviews revealed insights into the user goals, problems, behaviours and attitudes. After the six user interviews were over requirement analysis was performed to extract the user needs, tasks and scenarios from the responses. We thought of scenarios by questioning why does the user need something? The user might have some need but the real question is Why? For example Jack jogs every evening. Jogging is a task. Now why does Jack jog every evening? This gives us our scenario which is to loose weight.

The most frequently occurring need was given a higher priority and marked as important like performing a workout. The users' goal and needs are presented in Table 3.1. We noticed some very interesting points during the interviews. For example: (1) Users made mistakes while typing on the small touch screen as a result users didn't like typing on the small iPhone screen unless it was absolutely necessary. (2) After completing the jog one of the users wanted to document the workout on their iPhone applications but because of sunlight falling on the screen of the iPhone they had problems reading. (3) Users spent maximum 2-3 minutes on an application on a day. Thus our application needed to be short and simple, easily readable under sunlight and require minimum typing.

User goal	Improving Fitness
User needs	- set time based goals and preferences - edit the goals - get recommendations for workout sessions - look at the recommendations before the workout - document his workout session - edit his workout data - delete his workout data - see results and sources of calculation - see all workout sessions - see results and progress - see the progress of his/her current goal and get recommendations - review the status of previous goals

Table 3.1. User goals and user needs

3.5 Interaction Design

Once all the user needs and goals have been identified we move on to task models. In these task models the user has to complete a task, fulfilling one or more user needs, in a given scenario. The result of task models is the action and reaction behaviour of the user and the system. In addition we end up with user objects [Ro05]. User objects are elements in the task models with which the user interacts. For example, in a use case of a task model the system provides the user with a form in which he has to enter his workout details. The fields of the workout form become the attributes and the workout form becomes a user object. Each user object is assigned attributes which define it. These attributes are derived from the response of the users during the interviews. The Table 3.2 presents the attributes for the user object *Workout*. To see the flow of the whole process from user goals to the creation of user objects check Figure 3.3.

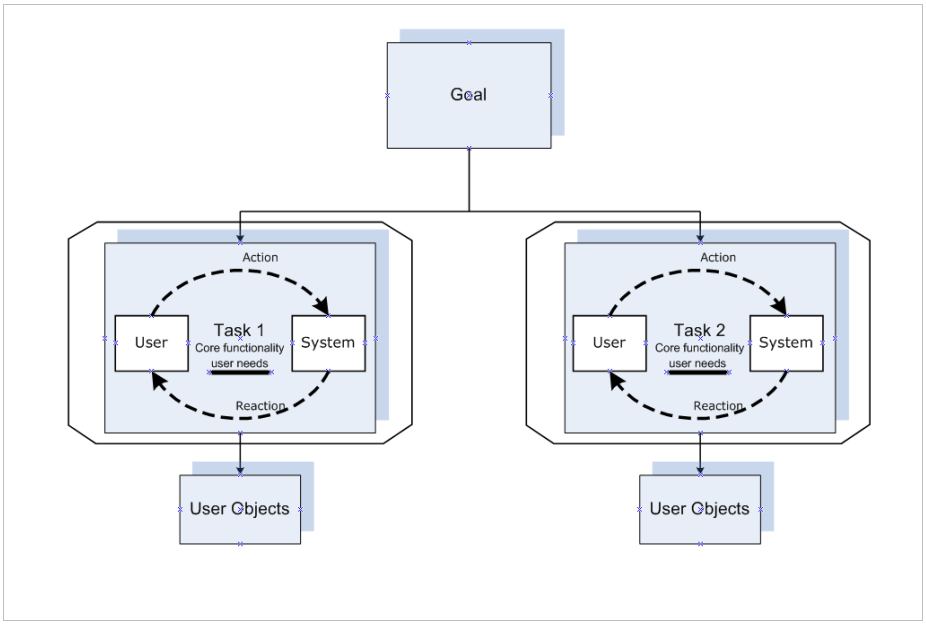

Figure 3.3. Creation of User Objects

Workout
• Type • Time • Frequency • Location • Duration • Speed • Proficiency • Route • Calories Burnt • Weight

Table 3.2. Attributes of the User Object, Workout

3.6 Information Architecture and Interaction Diagrams

Information Architecture (IA) made our application more structured and organized. The structuring is achieved by grouping tasks for each goal and finding relationships. For example tasks like viewing the recommended workout, documenting workout and viewing workout archive were grouped under a common heading of *My Workout*. IA also provides a better overview of how the information flow will happen in the application [Ga03]. It serves as the basis on which we build the navigation of the application. The IA and interaction diagram is shown in Figure 3.4. The visual vocabulary [Ga09] used in the IA diagrams is taken from Jesse James Garret.

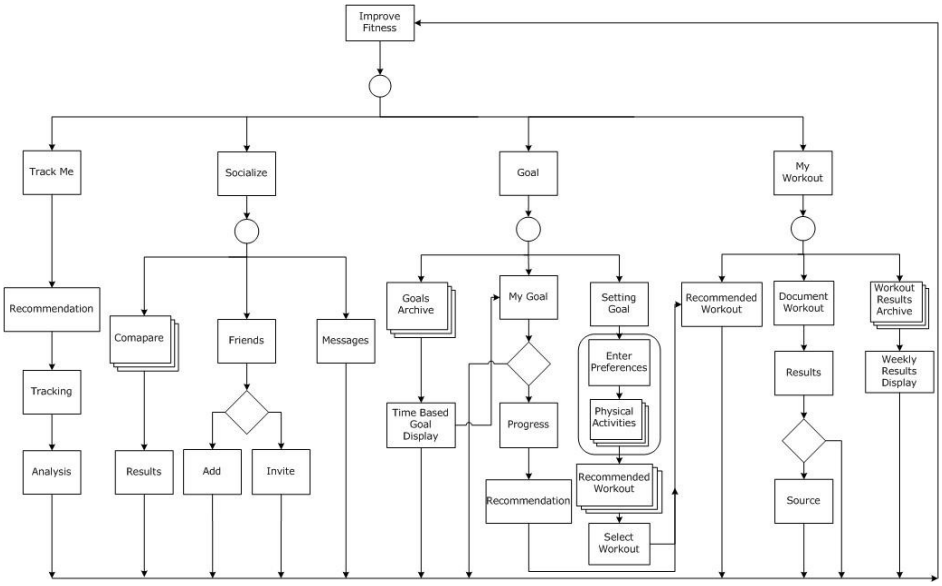

Figure 3.4. Information Architecture for Goal Improve Fitness

3.7 Navigation Design

Navigation design of interface elements facilitates the user's movement through the information architecture of the application [Ga03]. We built the navigation of the application keeping the interaction diagrams as the basis. We decided on how the user will switch from one page to another and which widgets he will interact with. From the interviews it was clear that users did not want to spend too much time with the application. To help the users in accomplishing their daily tasks like documenting his workout, the navigation of the application was restricted to a maximum of three to four levels. This ensures that users can finish the task quickly with less number of clicks. During the interviews we made a note of the jargons and words used by the interviewee for example workout and progress. These words were used as labels in the applications. The user can recognise and identify with these words. This helps the users to navigate and makes the application more intuitive.

3.8 Graphics Design

We chose a light background with dark coloured text for the entire application. This was done because it is difficult to read light text on a darker background in sunlight. This came up as a requirement from the user interviews. After finishing their workout the users want to document their workout so readability is important in sunlight. These small things make the application more user-friendly and usable.

3.9 Usability Testing and Evaluation

The Mock-ups were built on Axure [Ax09] and the testing was done on the same. We employed the 'user-based' think aloud usability testing method [Ja09]. The test was carried out with 7 users although according to Jacob Neilson [Ni09], testing with 5 users is enough. Each test user completed 5 tasks. The test results were then compared and evaluated. The test results helped evaluating three things: (1) If the user could navigate easily through the application. (2) If the user could comprehend the labels correctly. (3) If the user could interact with the widgets easily and complete the task.

All those places where the user made a mistake were noted as interaction failures. All the suggestions of the user on how to improve the application were noted. After all the tests were completed and evaluation was complete further changes on the mock-up were made based on the feedback of the test users. Test results of Task 1, User has to document his workout and see his workout results, are presented in Table 3.3. The tests were evaluated on: 1) Effectiveness, if the user can complete the task. 2) Efficiency, how many steps the user takes to complete the task. 3) Failure, number of mistakes the user makes while performing the task. 4) Assists, the number of times the user has to be assisted during the task. The Table 3.4 presents the usability test results of the five tasks.

	Task1(%)	Task2(%)	Task3(%)	Task4(%)	Task5(%)	Avg(%)
Effectiveness	100	100	100	100	100	100
Efficiency	97	100	93	100	100	98
Failure quota	29	0	29	0	0	12

Table 3.4 Test results of the 5 tasks

Task 1. User has to document his workout and see his workout results									
User completed task 1 (Effectiveness)	1	1	1	1	1	1	1	Effectiveness	100%
Number of steps: (Efficiency)	13	15	15	13	15	13	13	Efficiency	93,41%
Number of interaction failures:	1	0	0	1	0	0	0	Failure quota	29%
Number of Assists:	1	0	0	1	0	0	0	Assistance quota	29%

Table 3.3 Test results of Task 1

3.10 Features of the Application

As a PBCT our application takes on a mixed role of a tool and a social actor. The application aims to keep the user motivated until he has reached his goal. This is accomplished by:

1. Recommending a modified workout regime to the user keeping in mind the weather conditions, temperature and humidity levels of the day. For example on days with high temperature and humidity levels the application would recommend a shorter workout than normal.
2. Analyzing the workout results and providing recommendations to the user to improve his performance. For example if the user is jogging at a slow speed the application would recommend the user to increase his speed or switch to fast walking.
3. Provide the user with the results of his workout. For example telling the user the amount of calories he burnt during the workout and how many he should be consuming.
4. Comparing his workout results with those of his friends and thus adding a social dimension to the application.
5. Giving recommendations to the user based on previous workout performances so that the user sets realistic targets and stays motivated.
6. Providing suggestions for locations for workout depending on the performance level the user has reached.
7. Giving reminders to the user and providing the user with a language option for the recommendations in the settings. The language modes like strict and friendly use completely different language while sending reminders. This adds a fun element to the application.
8. The user can document his workout and transfer it to his LifeSensor [27] personal health record.

3.11 Comparison with other iPhone applications

The best 5 existing iPhone applications were chosen to be compared with our concept application. These applications, namely iFitness, MyTrainer, FitnessBuilder, iFitnessWorkout and iTrain are listed in the top 10 fitness applications, paid and free, on the apple app store [Ip09].

3.11.1 Criterion for selection

All the compared applications have the same scenario which is to loose weight and become or stay fit. The methods/tasks they use to assist the user might be different. So we decided to compare the user objects. The comparison is given in a Table 3.5 below:

User Objects	iLifeFitness (our application)	iFitness	MyTrainer	FitnessBuilder	iFitnessWorkout	iTrain
Workout	1	1	1	1	1	1
Goal	1	1	1	1	1	1
Progress	1	1	1	1	0	1
Recommendation	1	0	0	0	0	0
Compare	1	0	0	0	0	0
Physical Activities	1	1	1	1	1	1
Tracker	1	1	1	1	0	1
	7/7	*5/7*	*5/7*	*5/7*	*3/7*	*5/7*

Table 3.5 Comparison between our application and Top 5 fitness applications on Apple App Store

3.11.2 Analysis

These top five fitness applications lack two user objects 1) recommendations and 2) compare. The absence of compare user object means the applications do not provide comparison with other users for the application thus it does not provide the social motivational aspect. The absence of recommendations means that the user does not receive personalised and relevant support or help after workouts or before starting his workouts. These two user objects play an important part in keeping the user motivated to reach his goal.

4 Conclusion

The next step in the study is to develop this application and make a real iPhone application. It would help us to test the application even further. The usability tests have really high scores which prove that if an application is designed keeping usability methods in mind we do not miss any user requirements and needs which results in an improved application. Once the application is developed it will require less maintenance costs and will have less bugs. The comparison with existing iPhone applications shows that our application holds an edge over the top iPhone applications and if developed holds a good chance of being successful.

5 Limitations

We developed a high fidelity Axure [Ax09] mock-up for the application. Testing was done on the same. Testing on the real iPhone application would have been better as there are some iPhone specific widgets, like the picker, which cannot be simulated on Axure. In addition with a real application we could also have tested the extent to which the application can persuade the user in changing his behaviour and keeping him motivated.

7 Implications for future research

For every dollar spent to resolve a problem during product design, 10$ would be spent on the same problem during development and multiply to 100$ or more if the problem had to be solved after the products release as shown in figure 7.[Pr92] Most IT costs occur in the maintenance phase. Although much attention is spent on reducing bugs, only 20% of maintenance is due to bugs or reliability problems, whereas 80% of maintenance is due to unmet or unforeseen user requirements and other usability problems.[BM05] The importance of the use of usability methods in the design process of an application is immense and should be employed to reduce maintenance costs and develop successful applications.

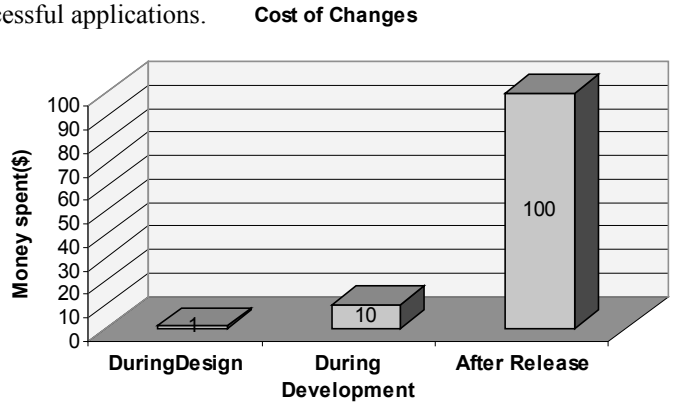

Figure 7. Cost of making changes in the application during different stages of development

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