Goalchase

A motivation-driven design and evaluation framework for interactive systems

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Abstract

This thesis presents Goalchase, a motivation-driven design and evaluation framework for interactive systems. By addressing an underlying question: *How can a product best support the goals of its stakeholders?* Goalchase aims to help HCI practitioners create or improve interactive products around the things people want to achieve.

While several goal-oriented methods exist in HCI, some dating back to the late 1960s, Goalchase takes up new opportunities identified in the literature. These include defining the goals of all product stakeholders consistently, discovering which goals are most important to them, and showing the relationship between user and business goals more explicitly.

With these insights, Goalchase bridges into the design or evaluation process. It aims to give HCI practitioners a springboard for creating or improving an interactive product by telling them what its stakeholders want to achieve, and what success criteria should be fulfilled.

In this thesis, three websites are used as action research case studies to evaluate how usable and useful Goalchase is in practice. The findings are presented in a critical reflection of each study, describing the usability refinements made and insights derived.

While more work is necessary to validate Goalchase's effectiveness, the case study results suggest it is usable and useful in practice. More specifically, they show that Goalchase can be used effectively to improve the user experience, while also helping to cost-justify the user-centred approach.

Contents

1 Introduction

What is a goal? According to Oxford Dictionaries (2008), it is "an aim or desired result". Similarly, the Collins (2007) dictionary defines it as "an aim or purpose". For this project, the important part to take away from these definitions is the essence of a goal: it is something people aim to achieve, something purposeful and desirable, a motivation or incentive.

So what is this project about? From an overall perspective, it is about helping people achieve their goals with interactive products such as websites, desktop programs and mobile applications. More specifically, it is about creating a new design and evaluation framework that helps HCI practitioners improve the user experience by taking a goal-oriented approach.

To demonstrate how technology can affect goals, consider the following everyday scenario:

Shopping at the e-supermarket

Sue normally drives to the supermarket because she lives nearby, and it sells food her family like at a reasonable price. However, she has heard that the supermarket provides an online shopping facility. Apparently it offers special discounts and could be *more convenient* than visiting the store. She decides to give it a try.

With her grocery list next to her, Sue looks at the homepage wondering what to do next. She sees a large advertisement across the page promoting double clubcard points on petrol, which is ironic because leaving the car at home is the main reason to shop online! On closer inspection, she sees a link called 'Groceries' and follows it.

Next, the site requires her to register. This starts to frustrate Sue a little because the purpose of coming here is to buy groceries *conveniently*, not to register. She registers anyway, questioning why the supermarket needs so many personal details.

What she sees next is a list of grocery categories, although the labels look unfamiliar. She wonders why they do not just match the ones in the store that she knows well. After spending some time clicking around, she eventually comes across the items on her list, adding them to the virtual basket - the whole process takes a lot longer than expected. Luckily she recognises most of the items from the store, because their descriptions are not very helpful and the prices are difficult to see at a glance. Also, in the store, she can always see most of what her basket contains. Here, she has to follow a link each time she wants to check.

When she has all the items, she enters the checkout process and has to fill in more forms about her payment details. After confirming everything is correct, she sees that the delivery times are not very convenient – only letting her choose *morning* or *afternoon*. When she visits the store, she gets her groceries there and then! Sue begins to wonder whether buying groceries online is *actually* more convenient than visiting the store. Nevertheless, she chooses a delivery time and completes the purchase – less than satisfied.

Sue's goals

Whether visiting the store of shopping online, Sue's overall goal at the supermarket is to:

- Buy groceries my family enjoy, at a reasonable price and in a convenient way.

But what makes this a goal – what criteria? Looking more closely, three criteria need to be fulfilled:

- Buy groceries my *family enjoy*, at a *reasonable price* and in a *convenient way*.

While the tastes of Sue's family and their budget constraints are largely outside the realm of technology, helping her shop in a *convenient way* is not. Breaking *convenience* down into more measurable criteria might reveal the following subgoal:

- Buy my groceries *quickly* and *easily*.

In the scenario above, shopping online takes Sue longer than expected and is not as easy as she would have liked – showing how technology can adversely affect her efforts to buy groceries conveniently (her goal).

1.1 Motivation behind this project

In my opinion, the objective of HCI is to ensure that Sue achieves her goals when performing tasks with an interactive product, such as a website, by creating a positive user experience.

While studying HCI over the past couple of years, I have found a mixture of models, methods and processes that either incorporate user goals explicitly, or tend to sideline them in favour of tasks. Cooper, Reimann, & Cronin's (2007) fairly recent Goal-Directed Design process, for instance, pivots on user goals, while more traditional methods such as task analysis, cognitive walkthrough and usability testing (Kirwan & Ainsworth, 1992) focus on what users will do with a product.

With this in mind, I was interested in helping to align HCI activities with a goal-oriented approach for a number of reasons. Firstly, goals represent things we want to achieve with technology - the motivations for using it in the first place. Establishing what people want to achieve before looking at how they will achieve it helps practitioners understand what makes a positive user experience before they start trying to improve it. Secondly, goals can help explain why improving the user experience (UX) is worthwhile to business – something UX practitioners have often struggled to convey in practice (Bias & Mayhew, 2005). As the next chapter shows, goals can highlight the benefits of HCI activities to those funding them.

While methods such as the Goal-Directed Design process (Cooper, Reimann, & Cronin, 2007) do already centre themselves on goals, I found several new opportunities to develop goal-oriented methods. The next chapter begins by reviewing the current HCI literature and pointing out those opportunities. Before that though, I will define the objectives of this project.

1.2 Project objectives

Given the opportunities identified in the literature, the overall objective of this project is to develop a new goal-oriented design and evaluation framework that takes them up. To achieve this, three subgoals that can be attained within the scope of this project have been set. These are:

1. Identify opportunities to develop new goal-oriented methods;
2. Take up those opportunities by developing and presenting a possible solution;
3. Ensure that the solution is usable and useful in practice.

The remaining chapters of this thesis are aimed at achieving these three objectives.

2 Goal-oriented models, methods and processes

As Blandford & Green (2008) argue, developing a new method should be based on an opportunity that stems from an unfulfilled need. Without a need, the justification for developing a new method is questionable. In the same way a new product might struggle in a market of satisfied customers or one where there is little demand, so too might a new method.

The aim of this chapter is to address the first objective of this project by identifying opportunities to develop new goal-oriented methods. It begins by reviewing the salient models, methods and processes in HCI history that utilise goals - summarising their use of goals, their scope, and what they deliver. It then goes on to compare the similarities between methods and identify needs they do not appear to fulfil. Based on these needs, it points out opportunities to develop new methods and what the potential benefits might be. Finally, it looks at developing and evaluating a new method, which is relevant to the third objective this project sets out to achieve: *Ensure that the solution is usable and useful in practice*.

2.1 Hierarchical Task Analysis

Dating back to the late 1960s (Annett & Duncan, 1967), hierarchical task analysis (HTA) is a method used to describe the tasks and subtasks performed in order to "meet a system's goals" (Kirwan & Ainsworth, 1992). According to Kirwan & Ainsworth (1992), system goals are "desired states of systems under control or supervision". Shutting down a power plant efficiently and safely, for example, could be seen as a desirable system state. Taking a more human-centred perspective, Sharp, Preece, & Rogers (2007) edge away from traditional systems thinking by saying "the starting point [of HTA] is a *user* goal". In either case though, it is agreed that HTA begins with a goal. Moving on to scope, HTA can be used in both design and evaluation. Dubrovsky (1989) describes the use of task analysis in systems design, with HTA being suitable for what he refers to as "allocation of functions" between operators and machines. At the same time, Pinelle & Gutwin (2003) present a groupware evaluation framework called Collaboration Usability Analysis (CUA) that is based on HTA for its "flexibility in the ways tasks are composed". For both design and evaluation, HTA delivers descriptions of the tasks people perform (or will perform) in order to achieve goals. Kirwan & Ainsworth (1992) detail two popular ways of representing HTAs: hierarchy diagrams and tables. Both serve as a springboard for further task analysis methods such as prototyping and walk-throughs (Kirwan & Ainsworth, 1992).

2.2 GOMS

Borrowing the hierarchical structure from HTA, GOMS (Goals, Operators, Methods, and Selection rules) is a method developed by Card, Moran, & Newell in the early 80s for modelling human behaviour and predicting task performance based on a "top level goal" (Card, Moran, & Newell, 1983). They define a goal as a "state of affairs to be achieved", where *editing a document* could be seen as a top level goal for example. John (1995) gives a

more user-centred definition by saying "Goals are simply the user's goals, as defined in layman's language". Looking at GOMS in terms of scope, it can be employed in design and evaluation, similar to HTA. Raskin (2000) demonstrates the GOMS keystroke-level model (KLM-GOMS) in calculating how long it will take 'Hal' (a fictitious user) to perform a temperature conversion task with two different interface solutions. In Raskin's example the objective is to minimise the time it takes to complete the task (or maximise efficiency). This could be seen as a valid objective in either designing a new interface or improving an existing one. What GOMS delivers to design or evaluation is a detailed breakdown of rudimentary actions required to achieve a goal and, when using KLM-GOMS, predicted completion times. Card, Moran, & Newell (1983) give an example of KLM-GOMS by describing the actions required to complete a text editing task with a number of different editors. With the results, they were able to compare performance times. Taking an objective such as Raskin's (2000) 'maximising efficiency', GOMS can inform design decisions empirically by revealing the most efficient interface solution.

2.3 The Action Cycle

Moving into the late 80s, Norman's (1988) Action Cycle model explains why people perform tasks (to achieve goals), how they execute them, and how they evaluate the outcome. Norman (1988) defines a goal as "something to be achieved, often vaguely stated". For example, someone might want to be entertained, and there may be a number of ways to achieve this such as reading a book, watching television or surfing the Internet - Cooper (2004) points out this 'one-to-many' relationship between goals and tasks by saying "Tasks change as technology changes, but goals have the pleasant property of remaining very stable". As well as providing a goal-directed (or top-down) model of human behaviour, the Action Cycle can be used as a design aid. Stone, Jarrett, Woodroffe, & Minocha (2005) propose a method for improving prototypes using cognitive walkthroughs and questions based on the Action Cycle. Others such as Webb (2008) highlight its usage in predicting where different types of error may occur. The Action Cycle relies on further strategies such as these for deliverables. Norman (1988) agrees that "each stage of action requires its own special design strategies".

2.4 Usability and User Experience goals

More recently, certain methods have focused on the criteria that are important to users when performing tasks – referred to as usability and user experience (UX) goals (Sharp, Preece, & Rogers, 2007). Sharp, Preece, & Rogers (2007) define usability goals as "being concerned with meeting specific usability criteria", while UX goals are "concerned with explicating the nature of the user experience". Common usability goals include *effectiveness*, *efficiency* and *learnability*, while UX goals could be *satisfaction*, *enjoyment* and *excitement* (Sharp, Preece, & Rogers, 2007). Shneiderman (2002) points to an even broader set of *life experience* goals created by the psychologist Abraham Maslow. Maslow's goals include *safety*, *love*, *affection* and *belongingness*. Moving on to scope, usability and UX goals cover design and evaluation. In design they serve as non-functional requirements for a product, such as *learnability*, while

in evaluation they can be used as assessment criteria. Nielsen (1993) demonstrates how a low-level criterion, *user errors per hour*, can be improved with usability evaluation methods such as user testing and heuristics. What usability and UX goals deliver is the high-level criteria from which low-level metrics can be elicited. Pheasant & Haslegrave (2005) illustrate the use of such high-level criteria in designing an ergonomic chair. Here, *comfort* is a high-level design criterion that is achieved by satisfying low-level criteria such ensuring the *seat height* is no greater than 406mm.

2.5 The Goal-Directed Design Process

While usability and UX goals can be seen as high-level design and evaluation criteria, Cooper's (2004) Goal-Directed Design process (GDD) looks straight through the eyes of the user. Cooper (2004) expresses user goals from a first-person perspective, encapsulated in a *persona*. He goes on to classify goals in three categories reflecting Norman's (2004) three levels of cognitive processing. *Experience goals*, such as having fun, reflect *visceral* processing; *end goals*, such as getting home safely, reflect *behavioural* processing; and *life goals*, such as being a good person, exhibit *reflective* processing (Cooper, Reimann, & Cronin, 2007). In terms of scope, the GDD covers the whole interaction design lifecycle. It starts with qualitative user research, personas and goals, before moving into scenarios, requirements and product design. Cronin (2003) argues that the GDD is compatible with software development processes such as the Rational Unified Process (RUP). When combined with development methods such as the RUP, the GDD process could in theory cover the whole software development lifecycle (SDLC).

Looking in more detail at the GDD process, two of its fundamental elements are personas and scenarios (Cooper, Reimann, & Cronin, 2007).

2.5.1 Personas

Created by Cooper around 2003, personas are a method for modelling a target user population by describing their common behaviours and goals (Cooper, 2003). They are primarily used in design. Blomquist & Arvola (2002) show how personas were used to help design a new company intranet portal, while Chang, Lim, & Stolterman (2008) describe them in creating "technology [that] enables a sustainable environment". Personas deliver a set of fictitious characters that represent archetypal users of a product (Hill & Bartek, 2007). In the GDD process, they are used as a springboard for scenarios (Cooper, Reimann, & Cronin, 2007). For example, a persona might want to have fun at the zoo and scenarios can be used to describe how they might achieve that with a digital product.

2.5.2 Scenarios

According to Cooper (2004), scenarios are a method for describing the ways in which personas achieves their goals with a product. Unlike personas though, scenarios were not invented by Cooper and so his recommended usage is not necessarily prescriptive. Rosson & Carroll (2002) for example offer a slightly different perspective by focusing on system and

opportunistic goals. A system goal is a user goal 'translated' into a 'software-oriented goal', and an opportunistic goal is a system goal that is triggered by the environment rather than a particular task (Rosson & Carroll, 2002). For example, a system goal might be an icon named 'Wage slips'. According to Cooper, Reimann, & Cronin (2007) though, Rosson & Carroll (2002) focus too heavily on task scenarios without taking a step back to describe goals first. Either way, scenarios are largely used to design interactive products. Rosson & Carroll (2002) use a classroom learning project called Virtual School to demonstrate design scenarios throughout their book. Others, such as Cooper, Reimann, & Cronin (2007) show how they could be used to design a personal digital assistant (PDA) for real-estate agents. For deliverables, scenarios provide a set of rich narratives describing users achieving their goals with a product. As Young & Barnard (1987) explain in an early exploration of scenarios, they are an "idealised but detailed description of a specific instance of human-computer interaction". Within the GDD process, that idealised interaction is amplified by using personas in scenarios (Cooper, Reimann, & Cronin, 2007).

2.6 Review

Looking at the models, methods and processes in the previous section, an implicit view they share is that goals are abstract. Returning to Norman's (1988) Action Cycle, in which human goals are "something to be achieved, often vaguely stated", the premise is that goals themselves are too detached from the real world to be physically achieved. As a result, tasks are performed in the real world to fulfil abstract goals – a concept Cooper (2004) implies too by explaining the detachment goals have from technology. For example, having a great holiday is a goal. But in order to achieve it, one might choose to swim in the sea, visit the zoo, or play a round of golf while abroad. Similarly, usability and UX goals are abstract. *Effectiveness*, *efficiency* and *learnability* are all conceptual criteria; they cannot be achieved without fulfilling low-level criteria in the real world. Instead, their purpose is to serve as high-level requirements that should be fulfilled by a product aiming to satisfy its users.

Despite their shared view of abstract goals, it becomes apparent that there are two different types of goal presented in the methods. The first type describes something someone wants to do. When trying to read a book as daylight turns to evening, Norman (1988) suggests "get more light" is a goal for example. These goals will now be referred to as *user needs*. The second type defines the necessary criteria to achieve something. *Efficiency*, *memorability* and *enjoyment* (Sharp, Preece, & Rogers, 2007) are all examples of what will now be referred to as *success criteria*. These criteria apply to any tasks performed to fulfil a need. In order to shut down a power plant *efficiently*, for instance, an operator must be able to perform the necessary tasks *efficiently*. Success criteria often need to be broken down into low-level metrics such as those illustrated by Nielsen (1993), if they are to measure a task objectively. A product might only be considered *effective* and *efficient* when *user errors per hour* meet a target figure for example (Nielsen, 1993). Common low-level usability metrics include *task success*, *task completion time* and *number of errors* (Tullis & Albert, 2008).

While two different types of goal emerge from the methods, it would appear they are compatible. Cooper (2004) goes part of the way by showing how success criteria can apply to a user need such as travelling from St. Louis to San Francisco. In this case, the success criteria for the journey are *speed*, *comfort*, and *safety*. Whichever way one chooses to travel, such as by car or plane, these criteria still apply (Cooper, 2004). Similarly, the design criteria used in Pheasant & Haslegrave's (2005) ergonomic chair example can just as easily be applied to a user need such as buying a chair. The design criterion is *comfort*. At the same time, a customer is probably looking for a *comfortable* chair. Both examples treat needs and success criteria separately, but it is possible to integrate them into a single definition that will now be referred to as a *user goal*. For example, 'Travel from St. Louis to San Francisco quickly, comfortably and safely' or 'Buy a comfortable chair'. Doing this not only makes a clearer distinction between goals and needs, but also puts success criteria in context.

Having seen that it is possible to capture needs and success criteria in single goal definitions, no method appears to address how user goals might differ by importance. In Norman's (1988) reading example mentioned earlier, is "get more light" more important to the reader than 'sit comfortably'? In other words, if the user could either have more light, but on an uncomfortable chair, or put up with less light on a comfortable chair, which would they choose? Of course, an ideal design would give the user the best of both worlds. But, as Rosson & Carroll (2002) amongst others argue: "software development activities are filled with tradeoffs". Likewise, Cooper's (2004) travelling example lists three success criteria but does not consider potential differences of importance between them. When travelling from St. Louis to San Francisco, is *speed* more important than *comfort*? In Sharp, Preece, & Rogers' (2007) list of usability goals, is *learnability* more important than *memorability* when interacting with a kiosk-based information point?

As well as not addressing the relative importance of user goals, no method appears to show explicitly how they relate to business goals to help cost-justify a user-centred approach. Cooper, Reimann, & Cronin (2007) point out that business goals "should also be modeled [*sic*] and considered" in the Goal-Directed Design process, but that is as far as they go. In Cooper, Reimann, & Cronin (2007), they present some common business goals such as *increase profit* and *increase market share*. Assuming these are probably valid for most businesses, it is not necessarily obvious how designing for a specific persona's goals will help achieve them. Chisnell & Brown (2004) go further with a case study demonstrating the "importance of matching user needs and business objectives", but their process does not explicitly show how these two interact. Due to organisational setbacks in the study, they found themselves "cobbling together methodologies" at the last minute. They admit that the setbacks forced them to improvise a lot and, as a result, their process was not as 'solid' and 'well thought-out' as it might have appeared (Chisnell & Brown, 2004). A study by Hornbæk & Frøkjær (2008) takes a more solid approach to considering business goals by explicitly asking evaluators to consider them when creating problem reports from think-aloud user testing. In their study, evaluators were asked to justify problems found by explaining how they 'jeopardise' business goals. While they do explicitly take business goals into

account, their method is only concerned with evaluating systems not designing them, and as a result they create relationships between business goals and problems rather than business goals and user goals.

Based on the evaluation of methods so far, several opportunities to develop a new goal-oriented method exist. Firstly, a method that integrates needs and success criteria would help distinguish goals from needs and tasks, while putting success criteria in context. In this case, it should be easier to identify which of the following two is a goal rather than a need: *buy a chair* or *buy a comfortable chair*. Secondly, a method that finds out the relative importance of goals could influence design tradeoffs and the prominence of interface components. For example, knowing that zoo visitors are more concerned with seeing interesting animals than finding good picnic spots might affect the way the zoo presents information in its guidebook and on its website. Finally, a method that explicitly shows the connection between user goals and business goals would help cost-justify a user-centred approach to those funding it. Using such a method, it should be more obvious to see that reducing the number of user errors in an e-commerce checkout task can improve sales. Here, the customer benefits from buying their goods with more ease, trust and satisfaction, while the business benefits from a sale that might previously have been lost.

2.7 Developing a new method

With opportunities to develop a new goal-oriented method established, Blandford & Green (2008) argue that the next logical step is to identify the benefits it will provide and what is required of it. As Blandford & Green (2008) point out, developing a method is costly in both time and resources, so it is important to define the benefits that will "accrue from that investment". They go on to mention two ways a method can be beneficial. Firstly, it could be employed in practice to help design or evaluate commercial products. Secondly, it could be used to aid research into method development or cognitive theories (Blandford & Green, 2008). To ensure a method is taken up in practice, they specify a list of requirements it should fulfil. For example, a method must be *usable* while also offering *useful* insights. This means that practitioners must be able to use it easily and effectively in practice (Blandford & Green, 2008).

After establishing the benefits a method will provide and the requirements it should fulfil, Blandford & Green (2008) suggest exploring the possibilities of 'adapting' existing methods to "encapsulate the new theory". The purpose of this stage is to find out how well existing methods address the needs a new method is hoping to satisfy. Blandford & Green (2008) give an example of assessing suitable methods for digital library development. They found cognitive walkthrough and heuristic evaluation useful to some degree, but neither gave enough "leverage" on why users were struggling so much with digital libraries. In addition, Blandford & Green (2008) explain that this "exploratory step" of adapting existing methods and theories is less relevant when an opportunity rather than a need has been discovered. In this case, they suggest that it may be more purposeful to "move swiftly on" to method

development (Blandford & Green, 2008); the reason being that an opportunity is likely to have resulted from a need that has no known solution or could be satisfied better.

Taking on board the possibility of adapting existing methods and theories, the final stages of development are: developing the method itself and testing it (Blandford & Green, 2008). As Blandford & Green (2008) point out, method development is a "creative step", which explains why it is difficult to document as a specific process. Instead, they offer an account of developing the CASSM method, including some of the design decisions and changes they made along the way. For example, they decided that attributes needed to be explicitly linked to their entities and changed the method to accommodate this (Blandford & Green, 2008). When it comes to testing a method, there appear to be two overall objectives. Firstly, a method should cover some formative implementation criteria such as *purpose*, *ethics* and *constraints*, for which Blandford & Green (2008) provide a question-based framework called 'PRET A Rapporter'. Question three, for example, asks 'What ethical considerations need to be addressed?' Secondly, a method should be effective for its purpose, whether taken up for commercial use, or research and theory. Various strategies have been used to evaluate method effectiveness, and the next section looks more closely at these.

2.8 Evaluating effectiveness

With a method developed and formatively tested, various techniques have been used to evaluate its effectiveness. Empirical studies in the early 90s, such as that by Jeffries, Miller, Wharton, & Uyeda (1991), assessed methods primarily by the number of problems they detected (their *productivity*). Their study compared performance differences between heuristic evaluation, usability testing, guidelines, and cognitive walkthrough. Based on their productivity criterion, heuristic evaluation performed the best. Towards the mid to late 90s, a broader set of criteria were introduced. Sears (1997) describes evaluation criteria originally presented by Bastien and Scapin in 1995. These are: *validity*, *thoroughness* and *reliability*. Thoroughness, for example, is measured by dividing the "number of real problems found" by the "number of real problems that exist" for a product (Hartson, Andre, & Williges, 2003). More recently, the set of possible criteria has been expanded further. Hartson, Andre, & Williges (2003) added *cost-effectiveness* and *downstream utility* for example, and Blandford & Green (2008) include *usability* and *learnability*.

While a variety of different criteria for evaluating methods have been presented in the literature, Wixon (2003) argues that the "application of [methods] to the development of products in real commercial enterprises" is the only criterion that has any useful value. Wixon (2003) claims that criteria used in the literature for evaluating methods so far are "irrelevant to applied usability work". For example, the number of problems detected, as used by Jeffries, Miller, Wharton, & Uyeda (1991) amongst others, is an insufficient criterion for comparison. In order to improve a product, those problems also need to be fixed. As a result, Wixon (2003) argues for a case study approach to method evaluation. He claims that product development in practice is "the only context sufficiently rich" to provide an understanding of how well methods perform (Wixon, 2003). He then goes on to demonstrate

the "inapplicability" of existing literature to practice by describing some of the factors, other than "purely methodological considerations", that influenced two successful case studies at Microsoft. These included organisational issues and integration with the development process.

Evidently, there appears to be conflicts of opinion and uncertainty about how best to evaluate methods. On the one hand, empirical studies have traditionally been used to quantitatively measure effectiveness – based on the number of problems found for example (Wixon, 2003). Along with Jeffries, Miller, Wharton, & Uyeda (1991), several others have evaluated methods in this way. Gray & Salzman (1998) review five such studies like the one carried out by Karat, Campbell, & Fiegel (1992). On the other hand, a more qualitative approach is suggested. Based on the conclusions of Gray & Salzman's (1998) review, Wixon (2003) argues that a "scientific approach" to method evaluation is "inconsistent" with the software engineering discipline, and that a more qualitative approach is necessary. Chattratichart & Lindgaard (2008) agree that passing judgements based on the number of problems found is "not meaningful". Regardless of approach, Blandford & Green (2008) express the uncertainty in establishing a stable set of evaluation requirements. In their opinion, some requirements may become irrelevant as the HCI discipline and technology move forward (Blandford & Green, 2008). With the introduction of automated usability tools, like West & Lehman's (2006) "automated data collection system", issues of reliability such as 'the evaluator effect' (Hertzum & Jacobsen, 2003) might become less applicable.

Consequently, the criteria for evaluating the effectiveness of a new method are not clearly defined, but should arguably stem from the method's objectives. As Blandford & Green (2008) point out, different methods have different objectives. One might address an opportunity to improve commercial products while another may aid research into method development and cognitive theories. Heuristic evaluation, for example, is arguably designed to improve interactive products rather than aid cognitive theories. As a result, it would seem logical to base the effectiveness criteria on what the method is trying to achieve. In this case, an "insights derived" (Blandford & Green, 2008) criterion might be more applicable to methods designed for commercial use, while *learnability* and *usability* may be the focus of methods looking to advance research and theory. For this project, the objective is to 'Ensure that the solution is *usable* and *useful* in practice' – justification for these evaluation criteria is given in chapter 4.

2.9 Summary

This chapter has first looked at existing goal-oriented models, methods and processes in the HCI literature to summarise their definitions of goals, their scope within the software development lifecycle and what they deliver. It has then gone on to review the methods to identify new opportunities. With these identified, it has looked at the processes involved in developing a new method. Finally, it has reviewed the current literature and debate surrounding the strategies for evaluating method effectiveness. While there is no clear set of evaluation criteria for new methods, arguably it should spawn from the method's objectives.

3 Goalchase

The previous chapter addressed the first project objective by identifying opportunities for new goal-oriented methods; this one tackles the second objective by presenting a possible solution: Goalchase. It begins by summarising the Goalchase framework, and then looks at the potential benefits it can offer. Finally, it describes the process and methods that make up the framework - leaving more detailed specifications to Appendix A: Goalchase User Guide.

3.1 Overview

Goalchase is a motivation-driven design and evaluation framework for interactive systems. It aims to help practitioners create or improve interactive products by addressing the motivations stakeholders have for using them. Stakeholders are the "persons, groups or institutions" in a particular environment that "may influence its outcomes" (IDeA, 2007), such as users of an interactive product and the business that supplies it. Motivations are the reasons for carrying out tasks in the world and can be represented by goals (Cooper, Reimann, & Cronin, 2007). In Goalchase, goals are used to address an underlying question: *How can a product best support the goals of its stakeholders?* The question is tackled in two parts: the 'who/what' part, and the 'how' part. The key stages of Goalchase attempt to tackle the first part of the question by identifying stakeholders and analysing their goals, while the additional stages deal with the second part by bridging into design or evaluation (Figure 1).

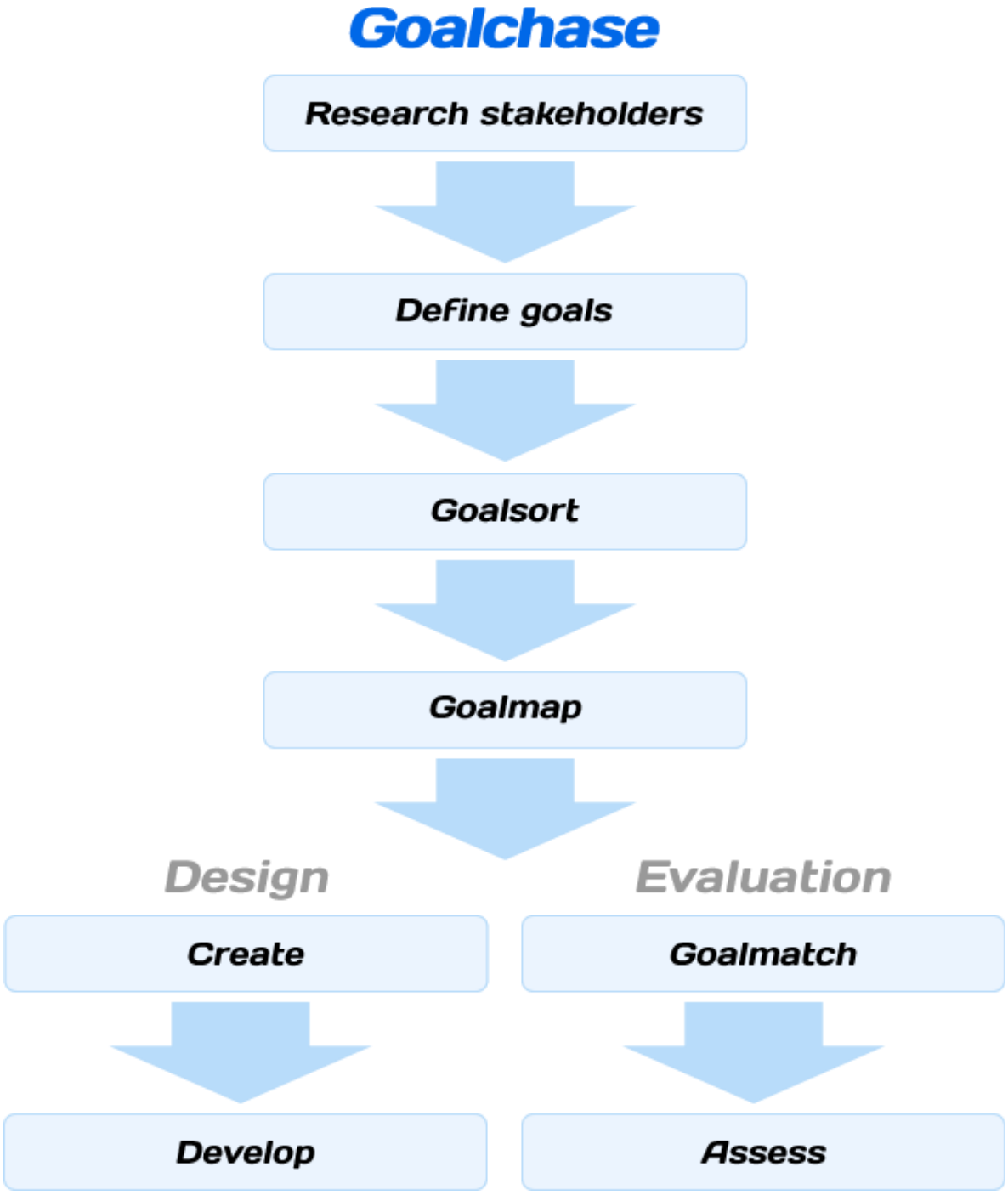


Figure 1: Goalchase process

It is worth mentioning here that, unlike Cooper, Reimann, & Cronin's (2007) Goal-Directed Design process, Goalchase does not attempt to cover the whole design or evaluation lifecycle. Instead, it guides practitioners into the creative or improvement process armed with insights into what a product's stakeholders want to achieve.

3.2 Proposed benefits

The benefit of this bridging approach is that Goalchase is design and evaluation method independent. This means that it can potentially integrate with established methods easily. For example, it could provide the overall goals for a task analysis, be a catalyst for scenarios and requirements, or act as an accompaniment to personas. With task analysis for example, a zoo visitor might want to plan their day at the zoo easily and conveniently. A HTA could then be used to explore the possible tasks the visitor might perform on the zoo's website to achieve this goal. Similarly, a scenario could create a rich narrative around planning a day at the zoo easily. Method independence also offers freedom of choice. Practitioners do not have to subscribe to a rigid process when designing and evaluating interactive products with Goalchase. For example, designers might choose to do a full blown task analysis around user goals, or they may be satisfied that scenarios based on user goals will lead to a sufficient set of requirements. The same principle applies to evaluators, who may choose cognitive walkthrough or user testing tasks that address goals identified by Goalchase. Or they may prioritise different heuristics around what is most important to the user. An added benefit of rooting design and evaluation methods in stakeholder goals is that it helps avoid what Cooper, Reimann, & Cronin (2007) call *self-referential design* – meaning designing for one's self. Pheasant & Haslegrave (2005) acknowledge this problem as one of the "five fundamental fallacies" of design: "This design is satisfactory for me – it will, therefore, be satisfactory for everybody else".

There are several other potential benefits of using Goalchase. Firstly, it aims to cover what Berry, Carbone, & Haeckel (2002) refer to as the *total customer experience*. According to them, simply offering a product or service is not enough. Instead, organisations must 'engineer' a total experience (Carbone & Haeckel, 1999) by designing a customer's journey "from the expectations they have before the experience occurs to the assessments they are likely to make when it's over" (Berry, Carbone, & Haeckel, 2002). Goalchase hopes to do this by looking beyond the tasks performed with a product to the context in which stakeholders are trying to achieve something, finding out what their expectations are. Secondly, Goalchase can cover usability and user experience. In this context, user experience refers to what Berry, Carbone, & Haeckel (2002) call the "emotional component of experiences" and what Norman (2004) calls 'emotional levels of processing'. For example, a museum visitor might want to buy a ticket *quickly* and *satisfyingly*. Here, the goal definition describes what the visitor wants to do (buy a ticket), what high-level usability criteria are important (efficiency), and how the user wants to feel (satisfied). Thirdly, Goalchase aims to be technology independent, which means goals are not tied to any particular platform or product. By using abstract goal definitions, as discussed in the previous chapter, Goalchase reflects human desires that are detached from technology. Taking the example above, the museum visitor wants to buy a ticket easily, which could potentially be achieved over the phone, through the website, or via mobile application. However, the goal definition itself does not specify any of these technologies, only what the museum visitor wants to achieve.

3.3 Process outline

Having looked at the potential benefits of using Goalchase, this section describes the process and its methods in more detail. Goalchase consists of two parts: the key stages and the additional stages (refer back to Figure 1). Under each stage, a description of its method is given.

3.3.1 Key stages

The key stages of Goalchase are followed for either design or evaluation. These are: Research stakeholders, Define goals, Goalsort and Goalmap.

Research stakeholders

The first key stage aims to identify the stakeholders in a particular context and discover more about them. Goalchase does not provide any new research methods, but a suitable technique for identifying stakeholders is *stakeholder analysis*. Each stakeholder identified can be classified as *primary*, *secondary* or *key* importance to a product (IDeA, 2007). Primary stakeholders are those "ultimately affected" by a product, while secondary stakeholders are "intermediaries" such as suppliers or contractors (IDeA, 2007). Key stakeholders, on the other hand, are those who are not ultimately affected by a product but do have "significant influence" over it, such as government regulators (IDeA, 2007). Typically, Goalchase is concerned with primary stakeholders. These are likely to be users of a product and the organisation that supplies it. Museum visitors who hire a digital audio guide are users of that product, while the museum is the organisation that supplies it. After identifying the stakeholders, suitable discovery methods are interviews, questionnaires and observation (Sharp, Preece, & Rogers, 2007). Researchers might choose to use a combination of methods and strategies such as structured and semi-structured interviews followed by a questionnaire. Alternatively, they could carry out a contextual enquiry or full ethnography (Sharp, Preece, & Rogers, 2007).

While Goalchase cannot offer a rigid discovery process to follow because every context is unique, practitioners should try to conduct their research in a way that will be useful to the next key stage: goal definitions. Looking at Cooper, Reimann, & Cronin's (2007) recommended interviewing techniques, for instance, questions could cover a number of goal-related topics. Interviewers might ask what tasks are satisfying and pleasurable, or frustrating and annoying for example. Following this, they could try to find out what makes those tasks satisfying or frustrating. Similarly, practitioners might use predefined usability and user experience criteria to help stakeholders articulate their goals. Drawing from the examples in Sharp, Preece, & Rogers (2007), questionnaires could include *efficiency* and *safety* in questions such as 'How important is it that you get task X done quickly, and does this affect the number of errors that occur?'. Again, researchers can begin to tease out the high-level success criteria for the various tasks stakeholders perform and begin to see where conflicts might exist within tasks e.g. speed-accuracy tradeoffs (Card, Moran, & Newell, 1983), or

between stakeholders e.g. museums want visitors to buy gifts from the shop, but visitors think they are too expensive.

Define goals

Drawing on the research from stage one, key stage two attempts to define the goals of each stakeholder. Practitioners start by defining the overall goal stakeholders have, and then look for the subgoals. Overall goals represent the main reasons (motivations) for performing tasks in a particular context, while subgoals are fulfilled to achieve it. For example, a museum visitor probably buys a ticket from the website in advance because they want to book the trip and look forward to it. In this case, their overall goal is likely be: 'Have a good day at the museum', and booking the trip is a subgoal that helps satisfy it. In practice, analysts might find it easier to identify the subgoals first in order to elicit the more abstract overall goal.

Like tasks in a hierarchical task analysis (HTA), Goalchase goals are also represented in a hierarchy. This structure is suitable for representing parent-child relationships such as overall goals and subgoals. In the example above, a museum visitor wants to have a good day at the museum, and in order to achieve that they probably want to plan their day easily and look forward to it, see the exhibits they are interested in when they get there, and maybe take home something nice to remember the museum by. Figure 2 shows how this might look in a goal hierarchy:

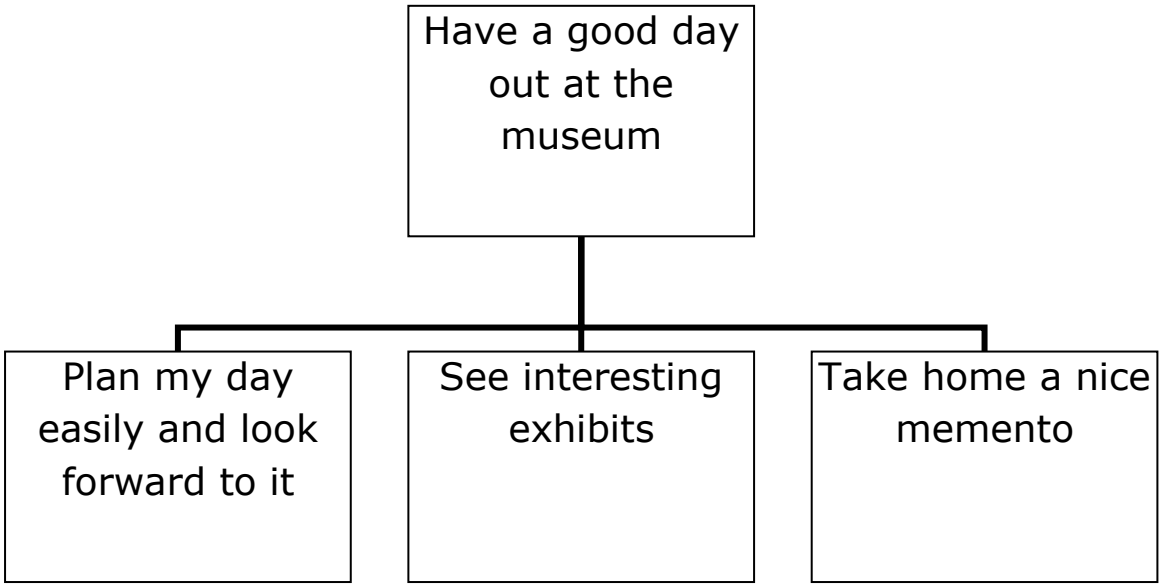


Figure 2: Typical museum visitor goals

The goal definition stage ends by defining any relevant attributes for each goal. Attributes are properties of a goal that help enrich it, such how often it is achieved (frequency) or how easy it is to achieve (difficulty). Goalchase does not provide a fixed set of attributes for every context because they might not be relevant, so practitioners choose whichever ones could be of value. Typical properties include:

- **Frequency** – how often a stakeholder tries to achieve the goal e.g. once a year, daily
- **Duration** – how long it takes a stakeholder to achieve the goal e.g. one day
- **Difficulty** – how hard the stakeholder believes the goal is to achieve e.g. very hard
- **Constraints** – external factors that might affect the goal e.g. physical/cognitive limitations, deadlines, weather conditions, technical limitations
- **Conditions** – factors that determine whether stakeholders want to achieve the goal e.g. if it rains then zoo visitors want to find cover quickly
- **Emotions** (that supplement any included in the goal definition) – how the stakeholder wants to feel during or after the goal e.g. satisfied, excited, thrilled
- **Cost** – how much it will cost the stakeholder to achieve the goal e.g. monetary, effort

When it comes to writing goal definitions and attributes, practitioners should use the Goalchase formatting conventions. First of all, goals adhere to a *verb-noun* naming convention. This appears to be an established convention in other methods such as task analysis (Kirwan & Ainsworth, 1992) and the Unified Modelling Language (Roff, 2003), along with many programming languages. It expresses what someone wants to do from a first-person perspective. In Goalchase, 'Engage with interesting exhibits' is a valid goal for example, while 'Exhibit engagement' is not. As discussed earlier, goals are also abstract - they do not refer to specific technologies, platforms or products in the real world. Bearing this in mind, 'Buy a ticket easily and conveniently' is valid, whereas 'Buy an e-ticket from the website easily and conveniently' is not. Finally, goals include success criteria – also discussed earlier. Success criteria are typically adjectives or adverbs used in the goal definition. They help differentiate goals from needs or tasks, and provide high-level design and evaluation criteria. In Goalchase, 'Buy a *comfortable* chair' is valid while 'Buy a chair' is not.

By the end of this stage, practitioners should have a set of goal definitions for each primary stakeholder and possibly certain key stakeholders, depending on the context. Figure 3 shows the set of user goals from the ZSL London Zoo case study undertaken for this project.

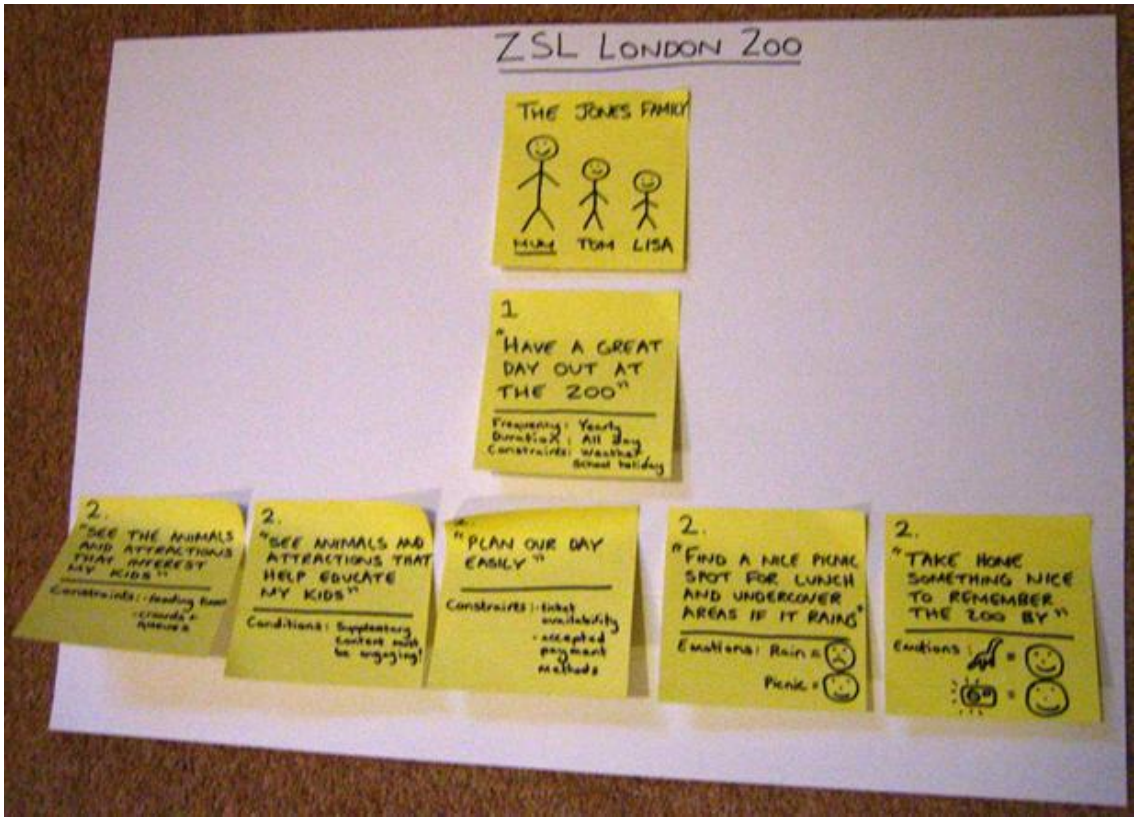


Figure 3: ZSL London Zoo user goals

Figure 3 presents the context (London Zoo), a primary stakeholder (the Jones family), and their goal hierarchy with relevant attributes. Where attribute information is extensive, it can be stored elsewhere such as a spreadsheet table – similar to the *task decomposition* method that accompanies hierarchical task analysis (Kirwan & Ainsworth, 1992). Also, each goal in figure 3 is labelled with the first part of a unique identifier (ID). At this stage, IDs just indicate a goal's level in the hierarchy. After conducting a Goalsort in the next stage, practitioners can make the ID unique by appending an order of importance value to it.

Goalsort

With stakeholder goals defined and organised into a hierarchy, the third key stage aims to discover their relative importance with stakeholders. The Goalsort method is used to sort goals in the hierarchy by order of importance. It can be carried out in a similar way to a *closed card sort* (Morville & Rosenfeld, 2007) by asking participants to order a set of predefined goals. In the ZSL London Zoo case study for this project, visitors were asked to sort all goals from the second level in the hierarchy – shown in Figure 4. Goalsorts are always carried out on goals from the same level in the hierarchy because 'cross-level' (or parent-child) sorting is ineffective. The hierarchical structure of goals dictates that a parent goal is achieved by fulfilling its child goals (subgoals), in the same way a HTA dictates that a parent task is completed by executing its subtasks. In this case, it would be ineffective to ask participants to decide which is more important: 'Have a great day out at the zoo' or 'Plan our day at the zoo easily', as the former (overall goal) is always ultimately most important.

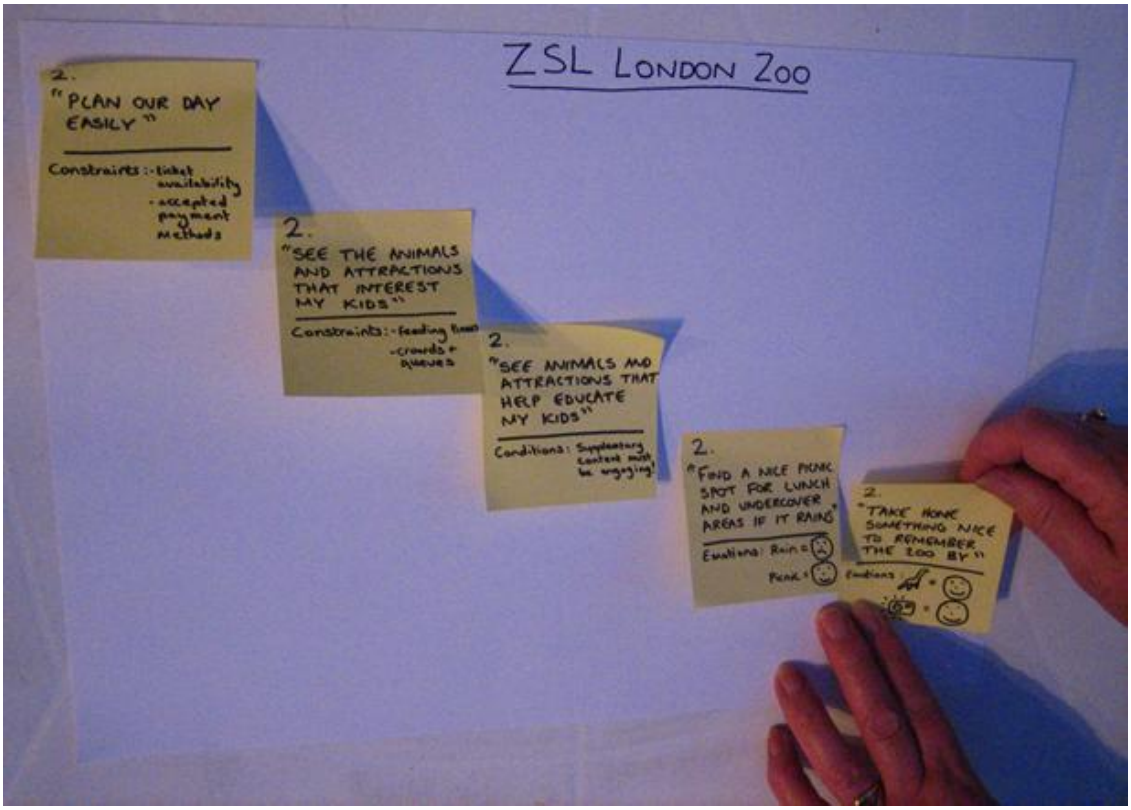


Figure 4: ZSL London Zoo participant performing Goalsort

For the ZSL London Zoo study, participants did the sort in person so that the author could observe and ask questions. However, the method could have been carried out remotely via email, phone, website or mobile application. After a Goalsort, the second part of the goal ID can be filled in. While the first part shows a goal's level in the hierarchy, the second part after the period indicates its perceived importance value on that level. In Figure 4, 'See animals and attractions that help educate my kids' would take the ID 2.3 as it is on the second level in the hierarchy, and participant P1 considered it to be the third most important goal in the set.

Goalmap

The fourth and final key stage attempts to map the relationships between the goals of different stakeholders, showing where they are mutually beneficial. In Goalchase, relationships are made when one stakeholder can benefit from the goals of another and vice versa. The point at which a relationship is made between stakeholders is called a *point of mutual benefit (PMB)*. As part of planning an enjoyable day at the zoo for example, a visitor wants to buy a ticket easily and conveniently. To do this, they might choose to buy it from the zoo's website. At the same time, the zoo might want to improve ticket sales by 5% over the next 6 months. If the zoo makes the online ticket buying process easier and more convenient, visitors are less likely to run into problems that cause them to abandon it. Being able to buy a ticket easily and conveniently means visitors have achieved their goal, while the zoo has improved ticket sales by reducing the number of abandoned purchases. Mapping

these stakeholder relationships as PMBs shows practitioners where user-centred design or evaluation activities could be worthwhile. For design, PMBs show what stakeholders expect to achieve with any product in a particular context. For evaluation, they link the success criteria of one stakeholder with another to form a basis for measuring success. Methods such as user testing could make the zoo's online checkout process *easier* and *more convenient* for customers while helping the zoo *improve* ticket sales by 5%.

Goalmaps can be represented in any form that is effective to the practitioner, but two suitable choices are diagrams (or *pictures*) and tables. Figure 5 shows part of the Goalmap diagram created for the ZSL London Zoo case study used in this project.

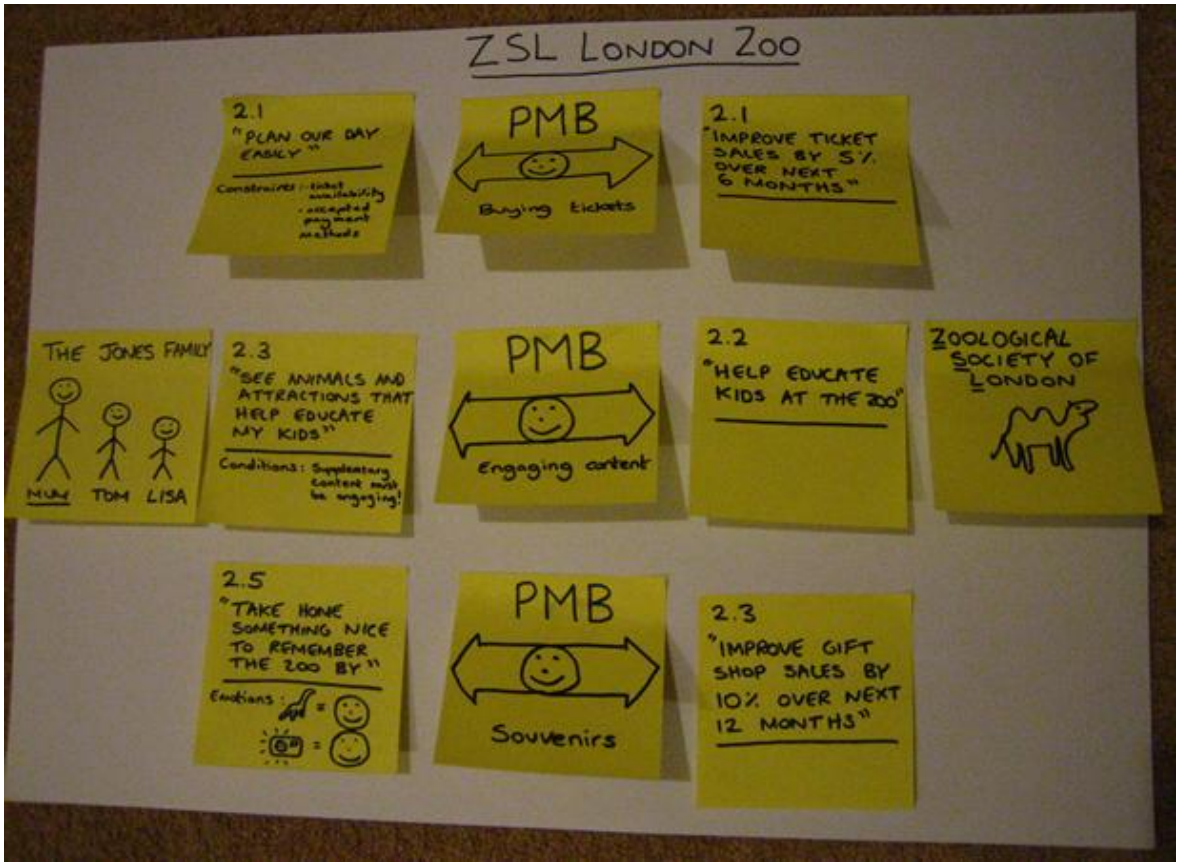


Figure 5: ZSL London Zoo Goalmap

From Figure 5, three PMBs highlight where zoo visitor goals can be mutually beneficial to ZSL and vice versa. The bottommost PMB, for example, suggests that the Jones family want to take home something nice to remember the zoo by. At the same time, ZSL want to improve gift shop sales. One way they might achieve this is to offer a selection of gifts that are of interest to the Jones kids. They might also ensure that the price of gifts the kids are interested in is within Mrs Jones' budget.

But what about potential conflicts? Figure 5 happens to be a somewhat simple and idyllic situation, where the Jones family can benefit from ZSL's goals and vice versa. An alternative way ZSL might try to improve gift shop sales though, is by increasing prices. At the same

time, the Jones family are looking to have an affordable day out. While Goalchase does not provide conflict resolutions to business problems, it can hopefully point out where a particular strategy taken by one stakeholder will conflict with the goals of another. In this case, it could warn ZSL that raising prices will negatively affect the visitor experience, and that other strategies such as better promotion and gift selection could be feasible alternatives.

At this point in the Goalchase process, practitioners should be able to understand what goals stakeholders want to achieve in a particular context, and what high-level criteria can be used to measure their success. They should also know how important different goals are to stakeholders, and how those goals can be mutually beneficial to others. With all the deliverables from the Goalchase key process, practitioners are ready to move on to design or evaluation.

3.3.2 Additional stages: Design

With a Goalmap drawn up, the additional stages for design aim to use it in the creative process.

Create

To start with, the intention is that designers use the Goalmap to focus their creativity on conceptualising products that support the goals of stakeholders. Conceptual design is about "understanding the problem space" by "conceptualizing what is currently the user experience" (Sharp, Preece, & Rogers, 2007). Looking at the Goalmap, designers should be able to get a holistic perspective of the problem space rather than focusing on its "nuts and bolts" (Sharp, Preece, & Rogers, 2007). With this view, it is arguably easier to think "outside the box" by detaching ideas from current technology – something Cooper, Reimann, & Cronin (2007) describe as "pretending it's magic". Methods used to create concepts might include brainstorming, sketching, storyboarding and focus groups. With brainstorming for example, designers could choose a particular user goal and come up with ideas for products that support it. A museum visitor might want to avoid crowds and queues as much as possible, while the museum wants to improve visitor satisfaction. Brainstorming around the user goal might spawn several concepts, such as a digital guidebook that shows the quietest route around the museum based on real-time crowd levels.

Develop

Taking the concepts worth pursuing, designers should be able to develop them further using established interaction design methods. Suitable methods include task analysis, scenarios, requirements, wireframing, and prototyping. Using the digital museum guidebook example just given, designers might use a HTA to describe the tasks visitors would need to perform to achieve their goals with such a device. An example might be adding exhibits into an itinerary. With this information, the digital guidebook would recommend the quietest route around the museum taking in those exhibits. Similarly, designers could use scenarios to describe a user achieving their goal with a conceptual product. Again, taking the digital

museum guidebook, a scenario might describe how a visitor (possibly represented as a persona) uses the device to navigate around the museum seeing the exhibits they are interested in, while avoiding crowds and queues. With a more established concept, designers should be able to start specifying user requirements. These can be classified as *data requirements* and *functional requirements* (Cooper, Reimann, & Cronin, 2007). Data requirements are the information objects a system must represent, while functional requirements are the actions it lets users take on those objects (Cooper, Reimann, & Cronin, 2007). In this case, a digital museum guidebook would need to represent an itinerary object somehow, and allow users to add exhibits to it.

3.3.3 Additional stages: Evaluation

Like design, the evaluation stages of Goalchase make use of the Goalmap, but this time in the improvement process.

Goalmatch

The first additional stage attempts to use the Goalmap to match stakeholder goals to the tasks a product provides – called Goalmatching. Goalmatching involves finding out what tasks are possible with a product, and matching them to user goals. Borrowing from task analysis, practitioners need to analyse a product to identify the tasks available. With each task, they try to match it to a goal – perhaps placing it on the Goalmap as a child node of a goal, or marking it in some way. For example, a goal of ZSL London Zoo visitors is to plan their day out easily. The zoo's website lets visitors find out about the animals, the opening times, the ticket prices, and how to get there. It also lets them buy tickets online. These five tasks are part of planning a day at the zoo and can therefore be matched to that goal. Figure 6 shows part of the Goalmatch from the ZSL London Zoo case study.

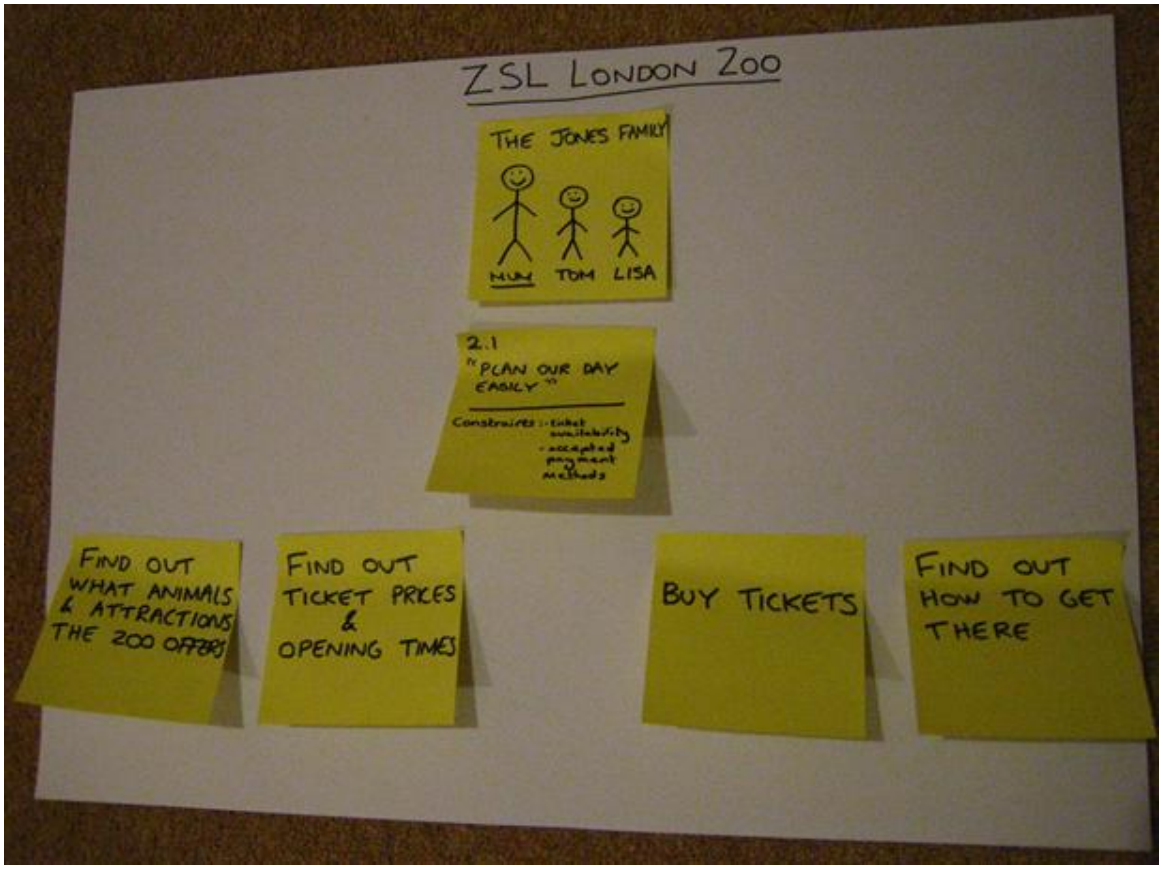


Figure 6: ZSL London Zoo Goalmatch

Goalmatching should tell evaluators which user goals are not supported by a product, and which tasks do not appear to address any user goal. Goals that are not supported at all suggest areas where a product does not fulfil its user requirements. In the ZSL London Zoo case study for example, participants said that they would like to find good picnic spots when planning a day at the zoo with their young children. However, the zoo's website did not provide this information, so the goal could not be achieved. As a result, there appeared to be a mismatch between what users wanted to achieve and what the zoo's website let them achieve. A similar principle applies the other way round. Tasks that cannot be matched to any user goal might be considered superfluous, or they might suggest there are goals missing from the Goalmap. In the former case, it might be beneficial to remove the task from the product because it is unnecessary – in line with the common 'less is more' usability principle (Nielsen & Loranger, 2006). But in the latter case, practitioners might want to revisit their research to see if a user goal was missed, adding it to the Goalmap if necessary.

Assess

At the assessment stage, the intention is to use the Goalmatch results to identify relevant success criteria and metrics for evaluation. Tasks that match user goals *inherit* their success criteria. This means that all tasks and subtasks matched to a particular goal should satisfy its success criteria, providing evaluators with high-level usability/user experience metrics to evaluate tasks with. For example, a zoo visitor wants to buy a ticket *quickly* and *easily*.

Buying a ticket from the zoo's website should therefore be quick and easy, and so on. Breaking *speed* and *ease-of-use* down into measurable metrics might give: *time to complete tasks*, *number of errors*, and perceived *satisfaction level* - all of which could be measured in a combination of user testing and satisfaction questionnaires (Sharp, Preece, & Rogers, 2007). This principle is similar to Pheasant & Haslegrave's (2005) chair example mentioned earlier, where the primary design criterion is *comfort*. In Goalchase, this would be expressed as a user goal such as 'Buy a comfortable chair'. Comfort would then be broken into low-level evaluation metrics such as *seat height* and *cushion size*, using fitting trials or anthropometry to find out the preferred dimensions with users.

3.4 Summary

This chapter has presented Goalchase, a motivation-driven design and evaluation framework for interactive systems. Goalchase addresses an underlying question: *How can a product best support the goals of its stakeholders?* by:

- Identifying the stakeholders in a particular context;
- Defining their goals;
- Finding out which goals are most important to them;
- Explicitly showing how user goals can be mutually beneficial to business objectives and vice versa;
- Using these insights to bridge into the user-centred design or evaluation process.

Goalchase also aims to benefit HCI practitioners by:

- Being design and evaluation method independent;
- Covering the total customer experience;
- Covering usability and user experience;
- Being technology independent.

With Goalchase described in this chapter, the next one starts to cover the third objective this project set out to achieve: *Ensure that Goalchase is usable and useful in practice*.

4 Research method

The last chapter presented Goalchase, a motivation-driven design and evaluation framework for interactive systems. This chapter begins to tackle the third objective of this project by describing the action research method used to evaluate Goalchase's usability and utility. It begins by justifying the decision to measure usability and utility, and then explains the iterative and reflective process taken to do so. Following that, it goes on to outline the three case studies used for the research.

4.1 Why measure usability and utility?

There are a number of reasons for choosing to evaluate the usability and utility of Goalchase for this project. Firstly, it is still a developing framework so evaluating it on certain other criteria at this stage, such as reliability and productivity, is inappropriate and possibly irrelevant. There seems little value in testing Goalchase with multiple evaluators to compare the similarity of results, before it has been tested individually. It is also questionable whether a qualitative process, such as Goalchase, would ever produce the same results across different practitioners, leaving doubt about the relevance of criteria such as reliability and productivity. Secondly, as Blandford & Green (2008) argue, a method should be usable and useful if it is to be taken up in practice. Hartson, Andre, & Williges (2003) agree that methods should be useful, adding their own *downstream utility* metric to the list of possible evaluation criteria. The final reason for choosing to measure usability and utility is that they are likely to have a strong influence over other criteria. Learnability, for example, is arguably easier if a method is usable, and not difficult and confusing. Similarly, the validity of results hinges on how useful they are in practice – with ones that are useful most likely being the ones that are valid or "correct" (Hartson, Andre, & Williges, 2003).

As Goalchase is a qualitative process and one that is still developing, a method known as *action research* (Lewin, 1946) appears to be a suitable approach to progressively evaluating and improving the two qualities chosen: usability and utility.

4.2 Action research

According to Lewin (1946), who coined the term, action research is a "spiral of steps each of which is composed of a circle of planning, action, and fact-finding about the result of the action". What Lewin (1946) refers to as a 'circular process', has more recently been described as iterative and critically reflective (Dick, 1999). Action research iterates on testing and feedback, much like user-centred design (Sharp, Preece, & Rogers, 2007). In both cases, researchers follow a process that "alternates between action and critical reflection" (Dick, 1999). Dick (1999) further describes the process as "emergent", meaning that refinements and improvements are made as new knowledge of a subject emerges from "fact-finding" (Lewin, 1946). In Goalchase, discovering that a particular activity is difficult, for example, would suggest that it needs refining in some way. Dick (1999) also describes

action research as “participative” and “qualitative”; he argues that refinements emerge more easily when “those affected by the change are involved”. The qualitative aspect he refers to implies a use of subjective techniques to gather and analyse ‘facts’ – typically those of the social sciences e.g. interviews, observation, questionnaires, and focus groups (Mahoney, 1997).

4.3 Case studies

To carry out the action research, three practical case studies were undertaken. All three focused on evaluating and improving existing websites with Goalchase. The first two looked at social networking sites at University College London (UCL), while the third looked at ZSL London Zoo’s official visitor website. The London Zoo case study was chosen because it was part of a previous piece of coursework, and a substantial amount of qualitative data had already been gathered for it. The following sections describe each study in turn.

UCL Additions

UCL Additions is a social networking site run by UCL Advances that aims to connect students and staff with business opportunities outside UCL (Figure 7).

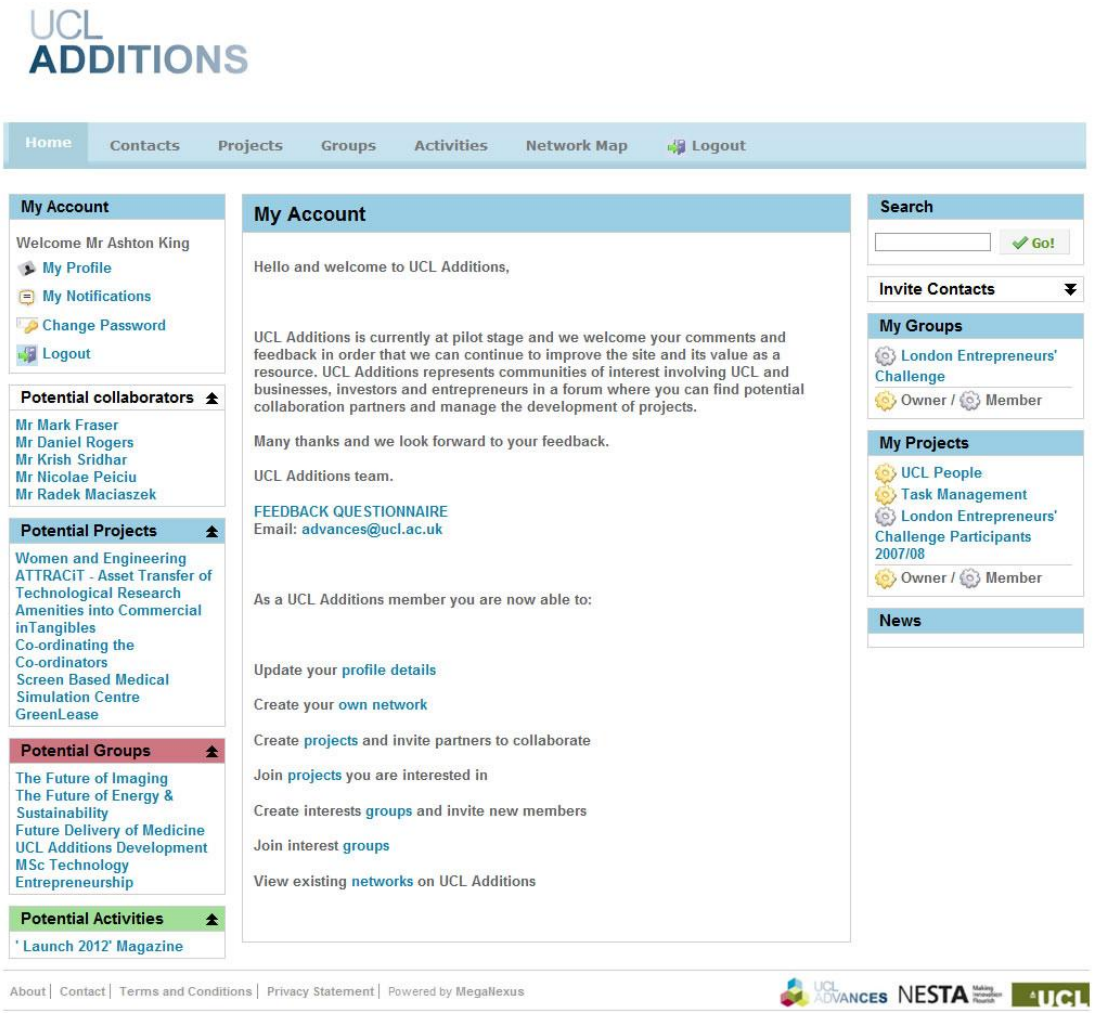


Figure 7: UCL Additions

It has been running for about a year, but has not had the uptake UCL Advances expected. With a full redesign planned for September 2009, the aim is to improve the site by increasing user uptake. To do that, UCL Advances hope to find out what users want to achieve from the site as a starting point for any redesign effort. Table 1 shows the details of this case study.

Table 1: UCL Additions case study information

Primary stakeholders	UCL Additions users, UCL Advances team
Secondary stakeholders	UCL
Total participants	6 (5 users and 1 project manager)
Length of study	2 weeks
Research methods	User interviews (8 questions, 10-15 mins) User observation (10 tasks, 25-30 mins) Project manager interview (semi-structured, 10 mins)
Data gathered	Interviews: Audio and notes User observation: Screen capture, audio
Sample project manager interview question	What are you trying to achieve with UCL Additions?
Sample user interview question	Why do you/would you use UCL Additions?
Sample user observation task	Find a project you're interested in and join it

The UCL Advances team research consisted of one interview with the project manager, while the user research consisted of five interviews and observation sessions. Table 2 presents details of the user research.

Table 2: UCL Additions user research information

Participant	Age group	Occupation	Previous experience
P1	20-24	UCL Advances adviser	No
P2	30-34	UCL Departmental Administrator	Yes
P3	25-29	UCL Research & Programme Development Manager	Yes
P4	25-29	UCL Departmental Administrator	Yes
P5	25-29	UCL web developer	No

As the site has only recently come out of a beta version, UCL staff users were chosen for the study because they have had more experience with UCL Additions than students. In the limited time available, it seemed appropriate to research this particular user group, because those who had previous experience would potentially be able to offer richer insights.

Skeegle

Like UCL Additions, Skeegle is also a website that tries to encourage UCL students to develop ideas into business opportunities by connecting through a social network (Figure 8).

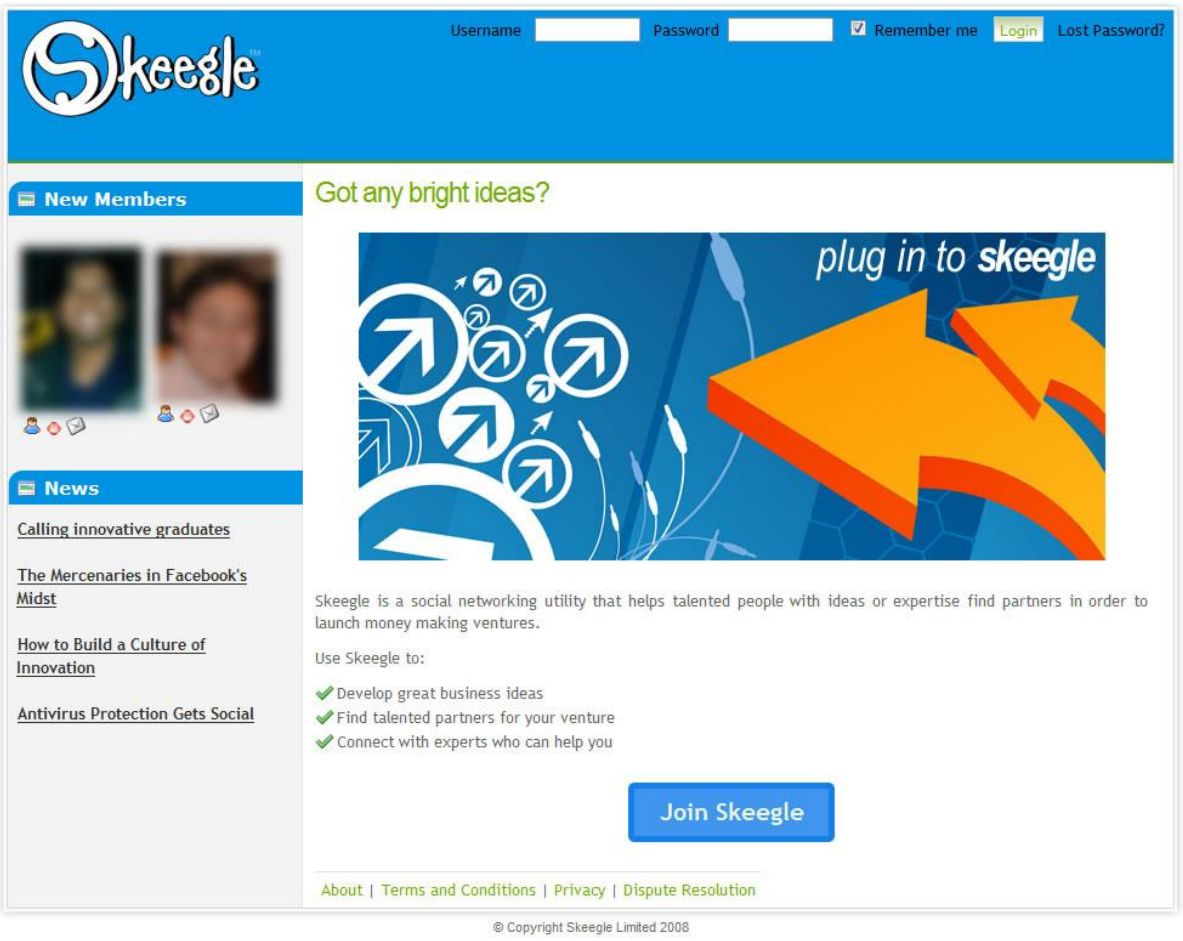


Figure 8: Skeegle

The site has been running for about a year and, like UCL Additions, has not had the uptake expected. The Skeegle team are continually looking for ways to improve the site and increase usage, so they were willing to find out what users want to achieve to help design a better experience. Table 3 shows details of this case study.

Table 3: Skeegle case study information

Primary stakeholders	Skeegle users, Skeegle team
Secondary stakeholders	UCL
Total participants	15 (14 users, 1 project manager)
Length of study	3 weeks
Research methods	Project manager interview (5 questions, 10-15 mins) Questionnaires (10 questions each, 14 participants)
Data gathered	Interview: Notes Questionnaires: Hard copies filled in by participants
Sample project manager interview question	What are you trying to achieve with Skeegle?
Sample user questionnaire question	How do you feel about sharing business ideas online?

The Skeegle team research consisted of one interview with the project manager, while the user research consisted of fourteen questionnaires handed out to new and existing users of the website.

ZSL London Zoo

Alongside running a zoo, the Zoological Society of London operate a website that aims to attract visitors to the zoo by providing information and services such as online ticket purchasing (Figure 9).

Figure 9: ZSL London Zoo

Unfortunately, there was no access to members of the ZSL project team for this study, so business goals were hypothesised. Nevertheless, the user research provided suitable material for a Goalchase evaluation – looking for ways to better support their goals. Table 4 shows the details of this case study.

Table 4: ZSL London Zoo case study information

Primary stakeholders	London zoo visitors, ZSL London Zoo team
Secondary stakeholders	ZSL Organisation
Total participants	3 users
Length of study	1 week
Research methods	Interview (5 questions, 10-15 mins) Observation (9 tasks, 20 mins per session)
Sample user interview question	What makes a great day out at the zoo?
Sample user observation task	Find out how to get to the zoo

Three users were observed using the website and interviewed afterwards – participant details are shown in Table 5.

Table 5: ZSL London Zoo user participants

Participant	Age group	Occupation	Previous experience
P1	56-60	Parent and Automotive Buyer	No
P2	56-60	Parent and Civil Servant	No
P3	51-55	Parent and Teacher	No

While the average age group for this study was probably not typical of current zoo visitors, each one had taken their children to zoos and other related attractions many times in the past. As goals tend not to change much over time (see chapter 3), there was arguably little reason why they would not be able to provide valuable insights.

5 Case study results

With the research method and case studies described in the last chapter, this one presents an action research account of the results. It reflects on each case study in turn by highlighting the major usability and utility findings that either helped make Goalchase more usable, or helped judge its utility value. In line with action research's iterative "fact-finding" and refinement philosophy (Lewin, 1946), each study can be seen as a milestone iteration of evaluating Goalchase.

5.1 UCL Additions

Usability

While performing stakeholder research for the first case study, it was found that users needed to be broken down into different roles. So far Goalchase has looked at users as a single stakeholder entity, but this case study showed that there were significantly different types of users. UCL Additions is aimed at staff, students and investors (Figure 10), and each of these users plays a significantly different role in the university system.

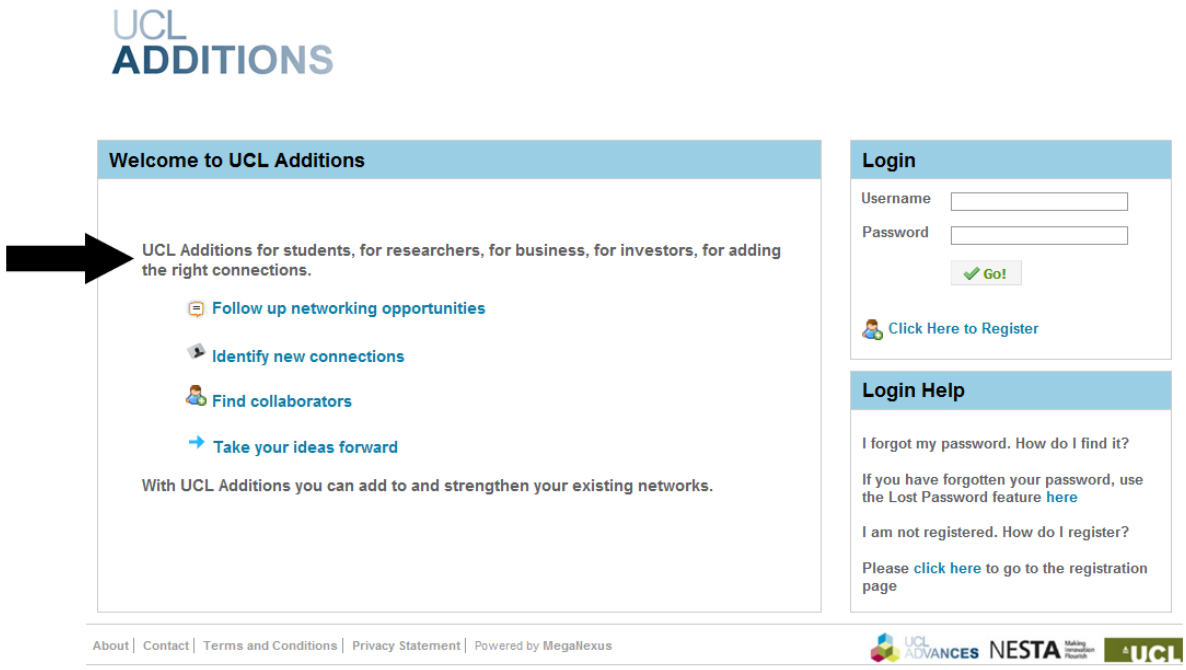


Figure 10: UCL Additions target user population

Students are at the university to learn from academics for example, while administrators make the learning process possible. Investors, on the other hand, are interested in tapping into resources within the university. Consequently, the stakeholder research pointed out that these different users have different motivations for using UCL Additions. Administrators, for example, use UCL Additions to connect academics and students with business opportunities

and investors. By contrast, students are more likely to be making social connections for themselves, rather than on behalf of others. To distinguish between these different users, personas were employed. Alternative options included simply defining user roles e.g. student, academic - but because the roles were significantly different, personas provided a richer way of making the distinction. Figure 11 shows the administrative staff persona created from the UCL Additions interviews and observation data.

Sarah Hunter

Sarah is 38, and works as a programme coordinator for the department of chemistry at University College London (UCL).

Generally she enjoys her job, but has been given a new remit to connect people within UCL to people outside who can collaborate on new ideas spawning from the chemistry department. As there is no obvious way to do this easily, she has been sending out lots of emails.

What she feels she needs is a convenient way to bring these people together, a sort of matchmaking tool.

As a long-term user of academic computing facilities, she is not afraid to try something new.

Figure 11: UCL Additions persona

Another difficulty encountered during stakeholder research, was that users often talked more about their needs than their goals during interviews. When asked *why* they would use UCL Additions, a number of participants described *what* they would use it for instead. P2, for example, said that they would "search for industry collaborators and see what kinds of research they were interested in", but did not say *why*. Similarly, P5 would use UCL Additions to "maybe post events that other people on the site might be interested in". To help overcome this problem, a simple interviewing technique similar to that proposed by Lamsweerde (2000) was adopted - that is to use 'WHY' questions to elicit goals from needs. With P2's response for example, a suitable 'WHY' question would be: 'Why would you search for industry collaborators?' Here, the 'WHY' question aims to reveal the goal behind the need by asking about P2's motivations. In the same way, a 'HOW' question can be used to discover *what* is needed to achieve a goal (Lamsweerde, 2000). Kavakli (2004) labels these two techniques as *abstraction* and *refinement* respectively.

With a sufficient amount of user research to define goals, it was sometimes difficult to see where they fitted in the hierarchy. Certain participants being interviewed and observed referred to parent and child goals at the same time, suggesting they were at the same hierarchical level. For example, P3's reason for using UCL Additions was to "coordinate work across UCL, and potentially find new collaborators who haven't worked together before." At a glance, these goals might appear to be on the same level, but finding potential collaborators can actually be seen as part of coordinating work across UCL. To help

differentiate between parent and child goals, a simple heuristic was created. Given two goals, X and Y, does the following statement seem logical: 'In order to [achieve X], users need to [achieve Y]'. For example, *in order to coordinate work across UCL, users need to find potential collaborators*. Swapping these goals around, on the other hand, appears illogical: *In order to find potential collaborators, users need to coordinate work across UCL*. If there is only one way the statement appears to make sense, then the parent-child relationship can be implied.

When it came to the practical aspects of defining goals and creating a Goalmap, a couple of problems were encountered. Firstly, the standard sized sticky notes used to represent goals were not always big enough to hold the goal definition and its attributes. Where a goal definition took up more than approximately 10 words, there was little space to include attributes (Figure 12).

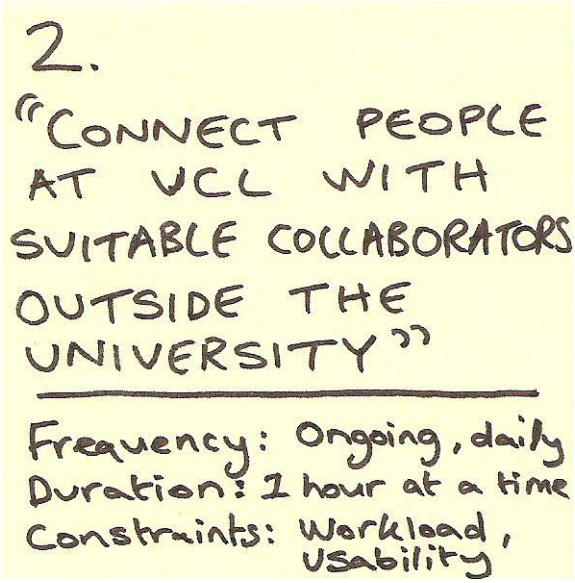


Figure 12: UCL Additions sticky note goal definition

As a result, a spreadsheet was created linking goals from the sticky notes to attributes such as frequency, duration and constraints. Alternative ways of doing this could have been to write in a smaller size at the expense of reduced visibility, abandon sticky notes and include everything in the spreadsheet, or use larger sticky notes. Another practical problem was that the piece of A3 sized white paper used as the 'context' backing for the Goalmap was not big enough. Unlike the goal definition stage, Goalmapping requires multiple stakeholder goals and PMBs (points of mutual benefit) to be shown at the same time. In this case, the backing paper was abandoned in favour of a larger desk surface. Other options were a larger sheet of paper or wall space.

Utility

Moving on to look at how useful Goalchase was for UCL Additions, the main insight it delivered was showing that administrators wanted to 'matchmake' people at UCL with

people outside UCL, and that UCL Additions did not support this goal particularly well. P1, for example, said "What I'm trying to do is build up a pool of people who are external from UCL, who could use some of the things [it] provides.", while P3 supported this by saying: "Our remit is to coordinate work across UCL and potentially find new collaborators and people who haven't worked together before". However, UCL Additions did not appear to be satisfying this goal because the site was dormant most of the time. Seeing how few events had been created, P4 said: "there doesn't seem like there's much going on" and that "I wouldn't really know why I would use it as opposed to email". P2 also expressed concern for the lack of activity, saying: "Content has to be updated regularly – daily". The other apparent lack of motivation for using UCL Additions was, according to administrators, due to the unsatisfactory way of finding collaborators. After registering, the homepage includes a small list of potential collaborators (Figure 13), but administrators were not sure how these matches were made, whether the list was just a snippet, and where they would find the entire list.

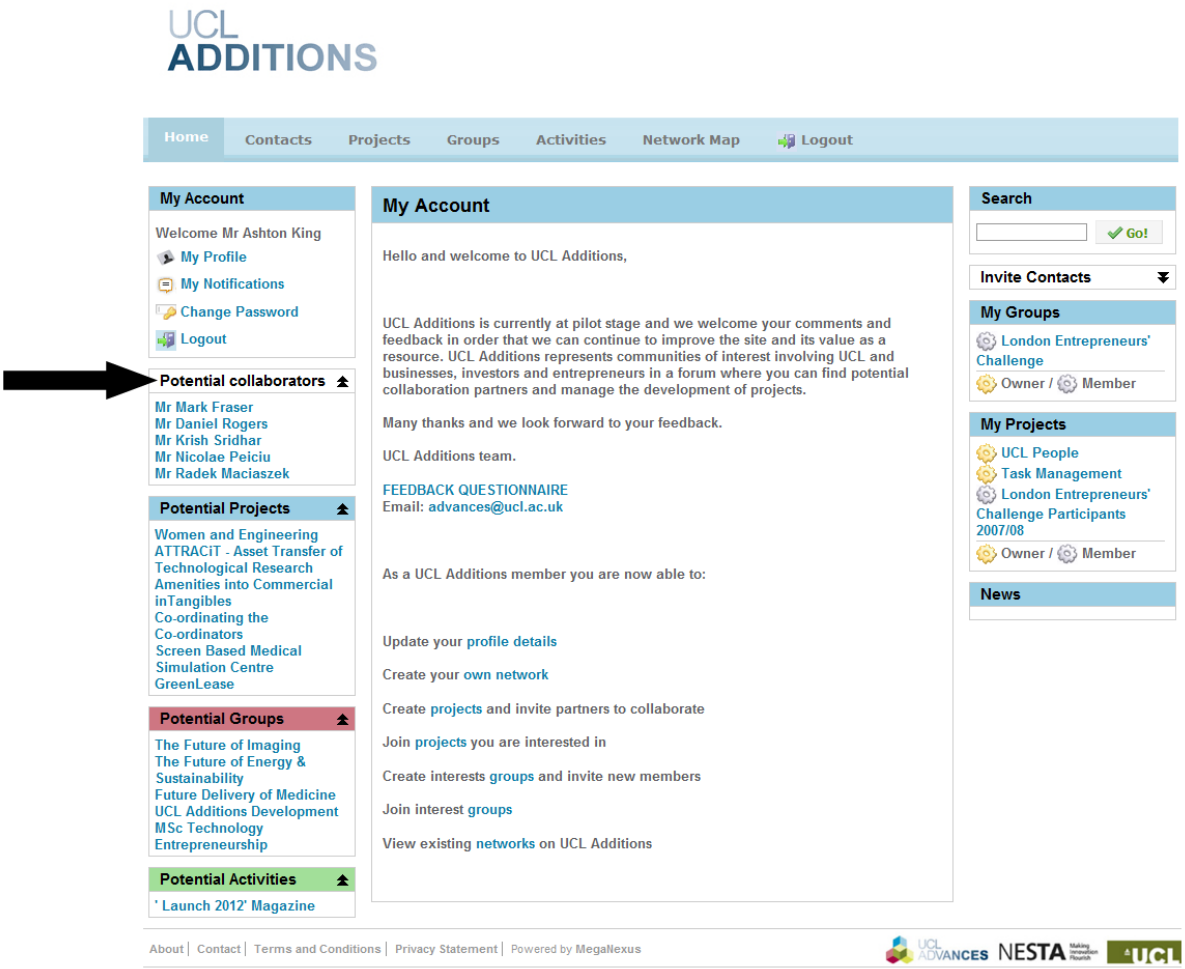


Figure 13: UCL Additions potential collaborators

Asked about the list of potential collaborators in the left margin, P5 answered: "I sort of assume it's a snippet - but having said that, I don't know because these lists [such as potential projects] look longer". Communicating these problems back to the UCL Additions team,

along with what administrators wanted to achieve, led to a number of recommended improvements. The first was to encourage more activity on the site by making forms more accessible and adding a commenting feature to user-generated content. The second was to create a 'news feed' component that aggregated all the activity from the site and presented it to users on the main homepage content area, which Figure 13 shows being occupied by static text. The aim was to help users feel that others were active on the site while making it easier to stay up to date with new content. The final recommendation was to revamp the tools for finding collaborators, making the 'matchmaking' features more prominent and easier to use. One suggestion was to integrate it with the news feed somehow so that it could occupy space in the main homepage area.

While Goalchase delivered some useful insights to the UCL Additions study, there were a couple of areas where it did not produce particularly valuable information. Firstly, the Goalmap was not especially useful because there was only one organisational objective: improve user uptake. In this case, mapping user goals to a single objective was of little value because the relationship was fairly obvious and could be implied. Secondly, Goalmatching added less value than it might have done. With no apparent mismatches between what users wanted to achieve and what tasks the site provided, the Goalmatch was valuable in so far as it produced a list of tasks and the high-level success criteria they inherit from goals. For example, administrators wanted to find potential collaborators quickly and easily, and the site had a way of doing this. Here, the only value of matching the goal to the task was to establish that it must be quick and easy to perform. Of course, producing a list of tasks in the first place is necessary for most types of evaluation, so the exercise did retain some value in that it substituted for a task analysis.

5.2 Skeegle

Usability

The second case study incorporated relevant usability refinements from the first. Despite not having the same user role separation as UCL Additions, a persona was still created to represent the students who use Skeegle. In this study it just helped understand the primary user stakeholder – students – better by describing their background and interests. To address the practical issues discovered in the first study, a spreadsheet was used to store goal definitions, goal hierarchies and the Goalmap. This was done experimentally to compare the technique with sticky notes and a large surface.

While the spreadsheet afforded infinitely more storage space, it felt less flexible and less collaborative than using physical materials. As opposed to the limited space on a sticky note, each spreadsheet cell could store goal definitions and all their attributes easily. Compared with the UCL Additions case study, where some attributes had to be kept separately from their goal definitions, the spreadsheet kept all related information together neatly (Figure 14).

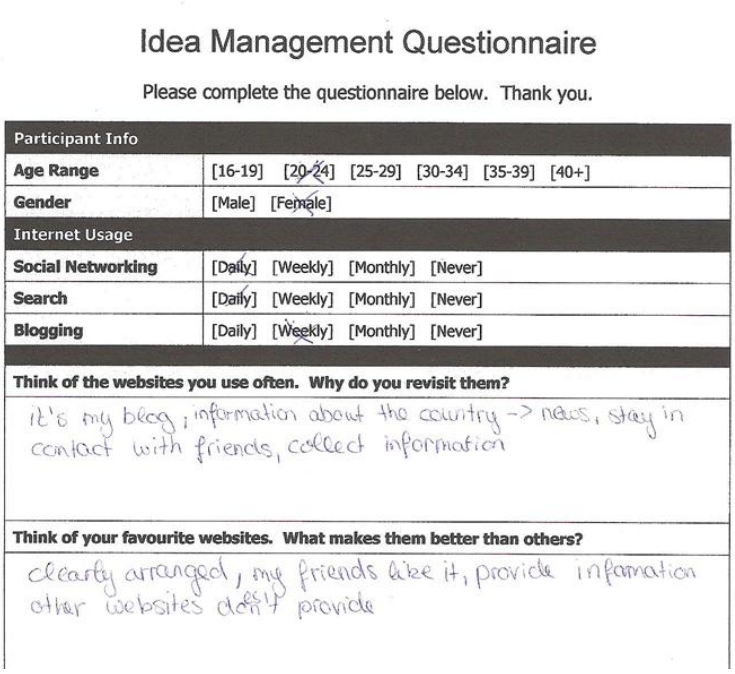
User: Daniel Wickham		
Goal	**Definition**	**Attributes**
2.1	Connect with colleagues who share similar business interests	Constraints: uni workload, social life, interests Emotions: excitement, involvement, fun Frequency: ongoing, daily
2.2	Learn more about entrepreneurship from quality sources	Constraints: free time, availability of sources Frequency: ongoing Duration: up to 1 hour at a time

Figure 14: Spreadsheet goal definitions snippet for user persona

In terms of usability, the spreadsheet was more efficient as it was quicker to read all information for a particular goal in one place and allowed searching/sorting. It was also less costly to make mistakes when compared to discarding sticky notes. Despite these advantages, the spreadsheet was harder to customise. With the sticky notes, information could easily be repositioned in any combination and augmented in a bespoke fashion with pictures and icons. In the spreadsheet, information had to retain a rigid format and was restricted to readymade icons and pictures. Furthermore, the spreadsheet felt less suited to a collaborative environment. While this case study was carried out individually, other projects involve multiple analysts, designers and evaluators who need to work together. Sticky notes attached to a surface, such as a wall or whiteboard, provide a shared physical space to display information and hopefully encourage collaboration. Spreadsheets can of course be projected onto a shared space such as a wall, but are more often used individually at a computer.

Another observation made during the stakeholder research stage was that, in most cases, there will be just two primary stakeholders. The first is the user of a product, in this case: UCL students. Users interact with a product and consume the experience it provides. For Skeegle, the intention is that students will use it to connect with others and collaborate on projects. The second primary stakeholder is the organisation that supplies a product, in this case the Skeegle team. They create and maintain Skeegle, hoping to get some benefit (or *return*) from doing so. In Skeegle's case, the organisation is a company spawned out of UCL who hope to encourage entrepreneurship amongst students and possibly monetise it in some way later on. This observation showed that, in most cases, Goalchase will be concerned with two primary stakeholders: users and organisations.

In this case study, users were researched with questionnaires, which proved less effective than the interviews from the previous study. One possible reason for this was the reduced level of interaction with participants. Questionnaires containing similar questions to those used in the interviews from the first study were distributed to students during a lecture, requesting that they be returned at a later date. However, the responses were often as much as 90% less than those from interviews in terms of word count – Figure 15 shows an extract from a typical questionnaire response.



Idea Management Questionnaire

Please complete the questionnaire below. Thank you.

Participant Info	
Age Range	[16-19] [20-24] [25-29] [30-34] [35-39] [40+]
Gender	[Male] [Female]
Internet Usage	
Social Networking	[Daily] [Weekly] [Monthly] [Never]
Search	[Daily] [Weekly] [Monthly] [Never]
Blogging	[Daily] [Weekly] [Monthly] [Never]

Think of the websites you use often. Why do you revisit them?

it's my blog; information about the country -> news, stay in contact with friends, collect information

Think of your favourite websites. What makes them better than others?

clearly arranged, my friends like it, provide information other websites don't provide

Figure 15: Extract from Skeegle user questionnaire

Having only a sentence or two to analyse, compared to the average 150 words yielded from interviews, meant more inferences had to be made. When asked how they felt about sharing business ideas on Skeegle, for example, P9 simply answered: "Not good. Don't want people to steal my idea". Another possible reason for receiving less response per participant was the limited input space available on the question sheet. Questionnaires had been handed out as hardcopies and each one occupied a single A4 side, which left a relatively small fixed space to enter information. It is worth noting, though, that most answers did not fill up an entire response space, suggesting participants were not trying to provide more information than the space allowed. Generally, the more data analysts can gather from stakeholders, the fewer assumptions they have to make, meaning interviews should be preferred over questionnaires. Where stakeholder interviews are not possible though, questionnaires are still a viable alternative for eliciting goals.

Utility

Looking now at how useful Goalchase was for improving user uptake at Skeegle, a key insight it delivered was the importance of security, trust and privacy when sharing business ideas. According to the questionnaires, users were hesitant to share their ideas on Skeegle because anyone could see them by default, even people they did not know. P7 for example expressed their concern in a few words: "[ideas] may be stolen", while P4 was more convinced: "they get stolen". Others took a more neutral position, saying that in theory it is a good idea, but they would need to be able to trust the people they were sharing with. What this meant to Skeegle is that they needed to find a way to satisfy users' goal of collaborating on potential business projects in a trusted environment. By default, all new projects were visible to every other Skeegle user. One of the recommendations to come from this case

study was to redesign the way projects are shared, making them private and unpublished to the community by default. When users are ready to share, they can choose to invite others to the project or open it up to a subset of the community. While this change has yet to be made by the Skeegle team, they acknowledge that the user goal is legitimate based on the research, and are likely to incorporate a new project structure into the next version. At the same time, a different insight Goalchase delivered sprung a complete rethink of how Skeegle should work.

As well as being cautious of sharing ideas on Skeegle, Goalchase showed that its target users were drawn to other sites by their simplicity and efficiency. This reflected badly on Skeegle, as the site was full of lengthy forms to fill in and multiple clicks to find information. In response to what makes their favourite websites better than others, users said: "ease of access to information", "clear and easy to use", "simple", and "fast". Knowing that users liked quick and easy sites, it was recommended that Skeegle do one seemingly simple thing really well – like Google or Twitter. These two sites in particular have arguably achieved a high uptake by their ability to do something very useful, very fast. After some brainstorming, it was suggested that Skeegle present users with a single text input box on the homepage asking what their idea was. Figure 16 shows a prototype of this new concept.

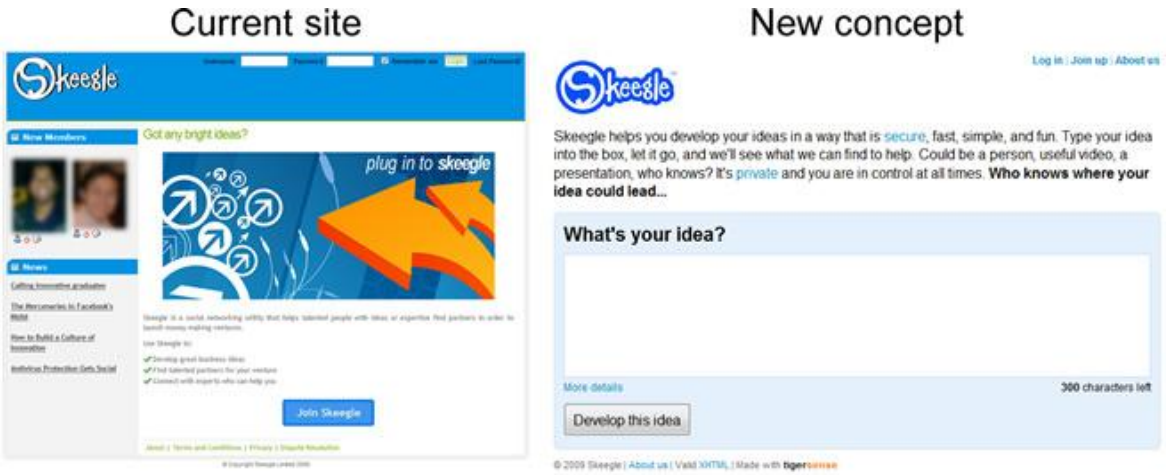


Figure 16: Skeegle current site and new concept

Without having to fill in lengthy registration forms, users are able to enter their ideas and retrieve a set of relevant data, such as potential collaborators, patent information, and competitor analysis. The idea is to quickly give users all the relevant information they need to get started developing their business ideas in a trusted environment. In terms of release, this new version of Skeegle is still in alpha, but the insights gained from Goalchase led to a complete redesign of the concept, and one that was innovative and unique.

While Goalchase initiated an innovative new concept for Skeegle, it failed to explicitly point out that Skeegle was too similar to many other community-based websites, and so there was not enough motivation to use it. Neither its design nor functionality is particularly different from other popular social networking software - there are even considerable similarities with UCL Additions. However, this problem did not emerge explicitly from the research, nor did

Goalchase have any particular method to consider the competition. What became more obvious from a closer analysis of the questionnaires, and after speaking with a couple of users, is that Skeegle lacked a unique selling point (USP). In the questionnaires, a couple of users pointed to other websites like Kluster that is, according to P3, an "interesting site using [the] community to source ideas". With a lack of originality, users did not appear to have enough motivation to use Skeegle, as most functionality was available on other social networks they already belonged to like Facebook – which most likely executed them better. In other words, they could achieve their goals better with other products. What was learnt is that Goalchase can inform project teams about what users want to achieve in a particular context, but it does not tell them how well users might be able to achieve those goals elsewhere - a type of competitor analysis. If Goalchase could have given Skeegle some sort of score relative to its competitors, perhaps it would have been a more explicit prompt to innovate and create a unique selling point.

5.3 ZSL London Zoo

Usability

The final case study took on board further usability refinements from the first two. Interviews and observation were used to research stakeholders, similar to the UCL Additions case study. These methods had proved more effective than questionnaires for analysing responses and synthesising goals. This time, the interviews adopted strategies developed in the first study, such as teasing out goals from responses about needs and tasks using 'WHY' questioning (Lamsweerde, 2000). Secondly, the goal definitions and Goalmap were created on sticky notes and paper, also similar to the UCL Additions study. While the spreadsheet used for Skeegle allowed more content to be stored together, the paper-based method was preferred for its flexibility and customisation.

Using interviews and observation again proved to be an effective way to tap into user goals, but a new method for discovering business goals had to be adopted. As mentioned in the previous chapter, there was no access to ZSL's web project team. In practice, it is quite likely that practitioners will not always have access to project managers who can give them time to talk about business goals. Without any empirical research data to use, the strategy adopted was to look at the main tasks available with the London Zoo website and question the motivation behind each one – again employing Lamsweerde's (2000) 'WHY' technique. For example, two of the main functions of the site are buying tickets (Figure 17: A) and reading content about the animals (Figure 17: B).

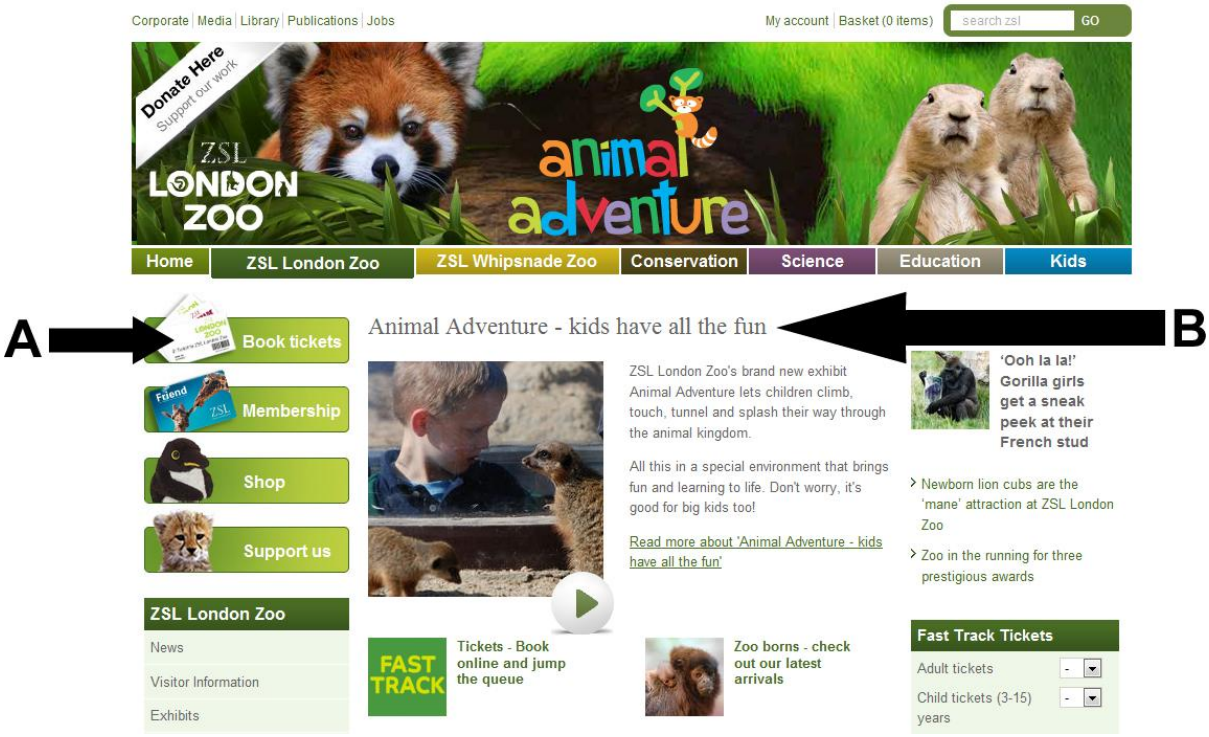


Figure 17: Buying tickets and reading animal-related content on London Zoo website

It was assumed that one of ZSL's goals would be to improve ticket sales, and the content might simply be there to entice visitors into buying tickets. However, ZSL might also be trying to help educate people – especially children – and so the content might support two objectives. The analytical strategy adopted here is riskier in practice because it relies on assumption. However, it did provide an unforeseen opportunity to add a contingency method when access to a project team is limited. It could also be used in combination with interviews to help validate stakeholder responses. For example, if a project manager says the objective of product 'A' is to achieve 'B', but on inspection of product 'A' it appears to be fulfilling 'C', practitioners could return to the project manager to verify.

Aside from creating an analytical approach to discovering business goals, the other main usability refinement made during this case study was the naming of the Goalmatch method. Originally this method was named *Taskmatch* to denote its close relationship with the tasks that a product supports. As it is fairly similar to task analysis, the name *Taskmatch* seemed appropriate. Using the word *task* also seemed more relevant to its overall purpose, which is to help evaluate the tasks a product supports. On closer thought though, Goalchase is about goals, and for consistency with other methods i.e. Goalsort and Goalmap, it seemed more appropriate to rename it *Goalmatch*. Initially the method was seen as matching tasks to goals, but equally it can be seen as matching goals to tasks. Arguably, the latter is actually more appropriate because the goal definitions already exist, whereas the tasks have yet to be identified at that stage.

Utility

Moving on to utility, it is not possible to describe how useful the insights Goalchase provided were to the ZSL project team as there was no access to them. However, on the assumption that one of their goals is to improve ticket sales from the website, a number of insights might have been valuable.

Firstly, the Goalmatch method highlighted a mismatch between what users wanted to achieve and what the site let them achieve. When asked what they would do to plan their day at the zoo, P3 mentioned taking a "picnic etc if necessary" and finding "covered areas in event of poor weather" – expressed as a goal in Figure 18.

Figure 18: London Zoo user goal

On inspecting the website with Goalmatch however, information about picnic spots and undercover areas was not available, and so the goal could not be matched to any task (a mismatch). As a result, two possible improvements might be recommended to the project team. The first, and most obvious, is to include information about picnic spots and sheltered areas on the site, making it easy to find. The second, and more creative improvement, could be to incorporate weather forecasts, dynamically changing the prominence of information about indoor or outdoor attractions based on it. For example, if the forecast looks sunny, then promote information about picnic areas, playgrounds, and where to buy ice cream. Using dynamic content to promote the benefits of visiting the zoo is likely to help increase the chances of selling tickets – especially if visitors are aware that the zoo offers indoor attractions in the event of poor weather for example.

Another potentially useful insight Goalchase delivered, and one that no doubt the ZSL London Zoo team are well aware of, is that adults plan zoo visits around the needs of children. Cross-referencing interview responses found that parents consider the needs of their children first and foremost when planning a day at the zoo. For example, P1 was most concerned about "whether they [the animals] are suited to the age of [their] children visiting", while P3 (a teacher), would want to give the "visiting children a focus e.g. conservation". An insight such as this may have been useful to ZSL by helping them play to the goals of their customers. Knowing that adults want to create a positive experience for children, they could entice them into buying tickets by leveraging this goal. For example, they might have a form component that asks for the children's age groups. Using this information, the system could

recommend suitable animals and a route around the zoo to see them all – taking in the feeding times, best picnic spots and a visit to the souvenir shop. Accompanying the route could be a ticket purchasing form, which already knows how many children are coming and whether they qualify for a child discount etc.

Interestingly in the example above, the goal of satisfying the needs of children did not come directly from interview responses, rather it was inferred using the 'WHY' questioning technique (Lamsweerde, 2000) adopted in the UCL Additions case study. Asking questions such as 'Why are parents concerned about the suitability of animals for their children?', and 'Why are teachers looking to give their pupils a focus when visiting the zoo?', helped infer that one important thing adults are trying to achieve when visiting the zoo is ensuring their children/pupils have a positive experience.

5.4 Summary

This chapter has addressed the third, and final, objective this project set out to achieve by giving an action research account of the salient usability and utility findings from each case study. In the UCL Additions study, usability findings included the need to separate different user roles, better interview strategies for eliciting goals, correct goal placement in the hierarchy, and alternatives to the paper-based approach. In terms of utility, Goalchase delivered useful insights into the collaboration tools offered by UCL Additions. In this particular study, neither the Goalmap nor Goalmatch were especially valuable though.

Moving on to Skeegle, a spreadsheet was used to represent goals instead of paper. Despite being able to store all related information together, it felt less flexible and collaborative. This case study also showed that questionnaires were not as effective as interviews, which were used in the previous study. Regarding utility, Goalchase provided insights into the trust and privacy issues concerning Skeegle users. It also helped initiate a complete rethink of Skeegle's concept, and how it could create a unique selling point. At the same time, Goalchase was unable to explicitly show that users lacked the motivation to use Skeegle, probably because they could achieve their goals better elsewhere.

For the final case study, ZSL London Zoo, a new way of eliciting business goals had to be adopted. While having no access to the project team is undesirable, this new method can act as a contingency. It could also serve as a useful validation technique for goals expressed by project stakeholders. During this case study, it seemed more appropriate to rename *Taskmatch* to *Goalmatch*, as it is more consistent with other Goalchase methods and more true to its purpose. While there was no way of measuring the utility of insights Goalchase delivered to the ZSL team, possible recommendations include resolving a Goalmatch 'mismatch' by providing information about picnic and sheltered areas, possibly integrating such information with dynamic weather data. Also, the team could personalise more of the site around the needs of children, providing recommended routes for example.

6 Discussion

The last chapter tackled the final project objective by reflecting on the three case studies used to evaluate Goalchase's usability and utility - describing the substantive improvements made and insights gained. With the last of the project objectives covered, this chapter begins by discussing the extent to which Goalchase achieved each one, and then looks at future work.

6.1 Did Goalchase achieve its goals?

While this question cannot be answered with a simple 'yes or no', it can be addressed by discussing each project objective in turn.

6.1.1 Identifying opportunities in the HCI literature

Having looked at a variety of goal-related literature dating back to the late 1960s, the opportunities to develop new goal-oriented methods appear to be genuinely unique. Goals have been a principal element in several HCI methods over the years. Annett & Duncan (1967) proposed a method that looked at the "hierarchical structure of tasks", which became known as hierarchical task analysis (HTA). Kirwan & Ainsworth (1992) pointed out that the purpose of HTA is to "meet a system's goals". More recently, Cooper, Reimann, & Cronin, (2007) have developed an entire design process around user goals, while others such as Sharp, Preece, & Rogers (2007) have used them as usability and user experience criteria. What appears to be missing though is a systematic way of defining goals, a means of discovering which ones are most important to stakeholders, and a way of explicitly showing how user goals relate to business objectives. These opportunities have been taken up by Goalchase, which attempts to provide a clear and convenient technique for defining goals, a way of sorting them on perceived importance, and a way of mapping the relationships between stakeholder goals to show points of mutual benefit (PMBs). The proposed utility of these methods is to help practitioners improve the user experience, while being able to cost-justify the user-centred approach.

Of course, Goalchase could be seen as overlapping with other HCI methods, models and processes in certain areas. Norman's (1988) Action Cycle and Cooper, Reimann, & Cronin's (2007) Goal-Directed Design process, for example, both look at goals from a first-person user perspective. However, neither of them look at the hierarchical relationships between goals and subgoals, nor do they offer a systematic way of defining them. They are also less clear about what constitutes a goal. Norman (1988) goes as far as saying that goals are "something to be achieved, often vaguely stated", while Cooper, Reimann, & Cronin (2007) go slightly further by saying that goals are "driven by human motivations" and that they "change very slowly – if at all – over time". Goalchase maintains Oxford Dictionaries' (2008) definition that goals are 'aims' or 'desired results', but it attempts to further define them for HCI by stating that they are abstract (unlike tasks) and include success criteria (unlike needs). Looking at other areas of potential overlap, Sharp, Preece, & Rogers (2007) utilise just the

success criteria element of Goalchase goals, which they call usability and user experience goals. The problem with this approach is that the success criteria (or goals) are taken out of context – they have no meaningful relationship to the product environment. Saying that 'enjoyment' is a user experience goal is valuable in so far as helping designers understand how users want to feel. But saying that users want to have 'an enjoyable day at the zoo' is arguably more effective as it combines success criteria with a high-level activity (visiting the zoo) to create a single goal definition in context, one that represents a human motivation. Another possible area where Goalchase overlaps is with Checkland's (1981) Soft Systems Methodology (SSM) rich picture method. Somewhat similar to a Goalmap, a rich picture plots stakeholders and shows relationships between them (Checkland, 1981). However, it is more concerned with conflicts of interest, attitudes, and unanswered questions (Checkland, 1981), than showing how stakeholder goals relate to form points of mutual benefit (PMBs).

6.1.2 Developing and presenting a possible solution

While Goalchase could be seen as overlapping with other methods, it was created on the back of new opportunities identified in the HCI literature, and also several philosophical themes. The first is, as Cooper, Reimann, & Cronin (2007) agree, that goals are more important than tasks in HCI. A product that supports hundreds of tasks has little value if there is no motivation to use it. On the other hand, a goal that has no means of achieving it presents a significant opportunity to create a product. The second theme is that HCI activities should begin with goals, not a task analysis. Contrary to what Pheasant & Haslegrave (2005) argued: "every good project starts with a task analysis", Goalchase is designed to start every good project with a goal analysis. Again, if a product does not address things people want to achieve, then its tasks have no value as there is no motivation to perform them. In that spirit, it is better to look at why people do things before looking at how they might do them. The third and final philosophy is that goals help resolve the cost-justification problem HCI activities have suffered from. One of the usability fundamentals Nielsen (2003) provides is a business case for it. Similarly, several books have been written with titles like 'Cost-Justifying Usability' (Bias & Mayhew, 2005), that aim to help UX practitioners sell the benefit of their work. By making the relationships between user and business goals explicit, Goalchase attempts to help practitioners point out the mutual benefits of improving the user experience.

Another philosophical issue Goalchase takes up, which was not mentioned in chapter 3, is its intention to encourage innovation and creativity. As Cooper, Reimann, & Cronin (2007) point out, goals are not constrained by "outmoded technology". This leaves designers free to create new ways of achieving things, whether it means building on existing technology or reinventing the wheel. While the latter is generally discouraged in software engineering, it does not apply equally to interaction design. A project by Google called *Wave*, for example, aims to reinvent email using shared data objects hosted on servers. While many of the programming techniques might be borrowed from other projects, the Wave concept itself is fundamentally different to email. Technology like Google Wave might become the latest in communications innovation, but there have been several other innovative landmarks along

the way. From letters to telephones and telegrams, to email and text messaging, to *poking* and *tweeting*; all these types of communication are significantly different from each other. Yet they all share one thing in common, the human goal they support: to connect and communicate with other people easily. Technology has been making this goal easier to achieve over time. Thinking about goals over tasks and technology does not always come naturally though. The car maker Henry Ford was quoted as saying "If I'd asked my customers what they wanted, they'd have said a faster horse." proposing that people will naturally think within their existing means. However, Ford looked beyond that and addressed the same human goal (wanting to travel more efficiently and comfortably), but with an innovative new technology: the automobile. By focusing on goals, Goalchase encourages innovation in this way.

6.1.3 Ensuring solution is usable and useful in practice

Usability

Combining action research with a case study approach was an effective way to evaluate and improve Goalchase's usability. Wixon (2003) supports this by arguing for a case study approach to method evaluation over traditional studies of effectiveness. Traditional studies such as those by Jeffries, Miller, Wharton, & Uyeda (1991) and Karat, Campbell, & Fiegel (1992) simply measured effectiveness by the number of problems an evaluation method produced (its productivity). On the back of Gray & Salzman's (1998) criticism, Wixon (2003) gives two example case studies where it was arguably more appropriate to evaluate a method by the utility of insights it produced in practice. The three case studies carried out for this project helped improve Goalchase's usability and utility. From the results, several usability refinements were made, such as establishing the most suitable way to represent goals on the Goalmap, and finding an effective way to represent different user groups. Of course, these improvements worked better for the author, but further testing is needed to see if they are better for others too.

Being able to use Goalchase effectively was one of the objectives of this project, but to use it one has to learn what it is first. Accompanying the description of Goalchase in chapter 3 is a user guide, which can be found in Appendix A. While chapter 3 tries to be as illustrative as possible within the limits of a thesis, the user guide has the space to elaborate. As Goalchase is still developing though, the user guide is a work in progress. If some of the future work outlined in the next section goes ahead, then the guide will need updating accordingly.

Utility

How useful was Goalchase in practice? For the first two case studies - UCL Additions and Skeegle - where results could be reported back to the project team, it was effective. In both cases, it helped root out the main problems with the websites that were causing a significant lack of uptake. It did this by finding out what users were trying to achieve, and how well both products supported them. With Skeegle for instance, users wanted to be able to share their business ideas in a trusted environment. By default, Skeegle let every member of the

community see every other member's ideas, which made students wary of using the site. Explaining this user goal to the project team, along with how improving it could increase uptake, we could brainstorm new solutions. In this case, simply changing the way ideas are shared around the community by default would most likely improve trust levels. However, looking at some of the other user goals, such as wanting to do things quickly and easily, a whole new concept for Skeegle was born (refer back to Figure 16). Still in alpha, the new Skeegle presents users with a simple form asking for their idea and returns useful information to help them get started developing it – quickly and easily.

Looking further at the utility of Goalchase, an interesting question is: how might Goalchase have helped avoid product failures in the past? The short answer is that it would hopefully have pointed out gulfs between what the product was going to do and what users wanted to achieve. The Sinclair C5 was a battery operated electric road vehicle sold in the UK in 1985 (Wikipedia, 2009). By most accounts it was a "commercial disaster" (Wikipedia, 2009), and the causes were most likely due to unintentionally violating user goals. Firstly, it is highly worth revisiting Cooper, Reimann, & Cronin's (2007) description of a particular user goal: When travelling from St. Louis to San Francisco, people want to do it quickly, comfortably and safely. With an increasing number of cars on the road in 1985, they were most likely perceived as a faster, safer and more comfortable alternative to previous modes of road transport. With these goals in mind, it is more obvious to see how the Sinclair C5 failed so badly. It was much slower than a car (with a top speed of 15 miles per hour), probably less comfortable than a car, and with a scarcely protected open chassis, "doubts were raised about the safety in traffic" (Wikipedia, 2009) and about drivers being exposed to bad weather. However, at a price of around £400 (Wikipedia, 2009), it was cheaper than a new car. A common goal amongst price sensitive people is that they look for a good bargain or a cheaper alternative. But in the C5's case, it was not worth risking one's life (and dignity) for (Figure 19).

Figure 19: Sinclair C5

6.2 Future direction

Looking finally at possible directions for the future, the most immediate task would be to test Goalchase for validity with other practitioners. In this case, validity is most likely be measured by how accurately stakeholder goals reflect the research. Goals that do not relate back to the research either directly or implicitly can be seen as false positives, while goals that can be elicited from the research but are overlooked are misses. As Goalchase hinges on stakeholder goals, their accuracy is the most important criteria for ensuring its validity. Using the Sinclair C5 example again, if the only customer goal identified had been to find a cheaper alternative to cars, then the C5 would have satisfied it well. However, customers also want to travel quickly, comfortably and safely. In this case, those three success criteria were either missed or ignored. Of course, measuring validity is susceptible to analyst biases, such as background discipline, experience level, and personal skills. Blandford, Green, Furniss, & Makri (2008) address the issue in justifying CASSM's validity. Like CASSM, Goalchase relies more on good research than good insight – contrary to other methods such as heuristic evaluation and cognitive walkthrough (Blandford, Green, Furniss, & Makri, 2008). By following Goalchase's research techniques, practitioners should not need to rely on their personal skills too heavily to elicit stakeholder goals. Where significant personal skills are needed is in creating successful solutions or recommending worthy improvements. But regardless of whether a solution is successful or not, Goalchase must ensure it is rooted in valid stakeholder goals.

After validating Goalchase with other practitioners to establish that it is indeed usable and useful, the next step would be to look at how it fits within the overall systems development lifecycle (SDLC). Fundamentally, Goalchase is used to design or evaluate interactive products, but these two activities are just part of building and maintaining a software product. Between design and evaluation, an interactive product must be developed. This requires programming, graphic design, information architecture, hardware configuration, and documentation amongst other things. To be taken up in practice, Goalchase needs to be able to integrate with the SDLC. Typical software development methodologies include agile models such as Scrum and Extreme Programming (XP), traditional iterative models such as the Rational Unified Process (RUP), and rapid application development methods such as the Dynamic Systems Development Method (DSDM) (Sommerville, 2007). If looking to integrate Goalchase with an agile model such as Scrum, for example, further research would be needed to find out how it works with Scrum's short development periods known as 'Sprints', in which user requirements cannot be changed (Sommerville, 2007).

A slightly lower priority task, assuming Goalchase is accepted in the SDLC, would be to develop a web-based application for it. This would make it easier to share information with a much wider audience and cross-reference different studies in a database. During the case studies, it was found that using a spreadsheet was less flexible and collaborative than sticky notes and paper, which would apply to a web application too. However, a bespoke application could be designed around the needs of Goalchase, making use of diagramming tools instead of a fixed grid and cells for example. Project teams could possibly carry out

Goalchase on paper or whiteboard, entering the information into a web application afterwards. A significant advantage of taking the time to do this would be the ability to share results easily with people outside the project team, and also build up a database of stakeholder goals. As goals tend not to change much over time (Cooper, Reimann, & Cronin, 2007), there is most likely some reuse value in them across different projects.

Looking more closely at reuse, it might be worth developing sets of goals for particular contexts that are shared by the HCI community – acting like a reference set. Whittaker, Terveen, & Nardi (2000) argue for something similar, but with tasks. Their concern is that HCI research has been overly focused on "radical invention", making it difficult to "compare different interaction techniques objectively" and build on the work of others (Whittaker, Terveen, & Nardi, 2000). To address this, they suggest the HCI community agree on a set of common tasks for a particular context such as "browsing and retrieval in speech archives" (Whittaker, Terveen, & Nardi, 2000). While this approach is a step in the right direction, it is arguably more effective to create a set of reference goals, rather than tasks. This is because goals represent things we want to achieve regardless of the task, and as a result, retain their validity more as technology changes – making them a better suited reference resource. Questioning *why a litigator* wants to browse and retrieve data from speech archives, for example, might reveal that it is to *get relevant witness statements to help prepare a court case*. Unlike the 'browsing and retrieval' task, this goal could be achieved in other, perhaps better, ways. A possible solution might recommend witness statements to the litigator as the court case is being prepared, meaning they have little need to browse and retrieve data themselves. In this context, the reference task proposed by Whittaker, Terveen, & Nardi (2000) begins to lose its validity. The reference goal, on the other hand, retains its value. For Goalchase, a set of reference tasks would not be aimed at shifting HCI research away from "radical invention" (Whittaker, Terveen, & Nardi, 2000), but it would help practitioners build on the work of others. At a basic level, it would save them having to carry out stakeholder research that has already been done. As the reference set develops, practitioners might also be able to share ideas about satisfying stakeholder goals with particular technologies.

Furthermore, there are likely to be goals in one context that also apply to others, meaning there is an opportunity to develop higher-level generic reference sets. In the context of zoos and museums, visitors have several goals in common. Parents, for example, probably want to take in attractions that interest their kids. They also want their kids to be safe. Both these goals apply to zoos and museums, as well as many other contexts such as theme parks. Creating a set of cross-context reference goals would allow practitioners to utilise stakeholder research that has already been done in a different context. It might also reveal new opportunities for improving the user experience across a range of contexts, such as creating a device that recommends the best route around a zoo, museum or theme park based on the attractions the kids are interested in.

Concluding this discussion with an interesting trail of thought that started during the Skeegle case study; it might be worth trying to calculate a user's level of motivation to use a particular product, something that could be referred to as their *Goal Satisfaction Level* (GSL).

Like UCL Additions, Skeegle was suffering from lack of user uptake. Goalchase can deliver the causes of the problem, in the form of user goals that either the product does not support or does not support well enough. In Skeegle's case, users wanted to share their ideas with trusted members of the community, rather than everyone, by default. Goalchase identified this goal, and helped recommend a solution to potentially improve uptake. However, what Goalchase cannot deliver is insights about how well other products support the same user goals – maybe even ones in different contexts. Coincidently, Skeegle and UCL Additions attempt to support very similar user goals – the result of two competing groups within the university. But given a choice, which one would new users choose, and how much better would one need to be to motivate existing users to switch from the other, taking into account the costs of doing so? Goalchase predicts that users will go with whichever one best supports their goals, but that is also the best prediction it can give. If it could calculate GSLs for both sites - whether a quantitative score e.g. 9/10 or qualitative value e.g. High - a simple comparison of the two competing values would inform practitioners of the potential winner.

Web browsers can be used to illustrate this. Microsoft's Internet Explorer (IE) has been the dominant browser for a long time for various reasons, still maintaining around 68% market share (Net Applications, 2009). At the same time, Mozilla's Firefox has been steadily gaining market share over IE, with a current user base of about 22% (Net Applications, 2009). This suggests that an increasing number of people are switching to Firefox - but why? Again, Goalchase suggests it is because Firefox supports web users' goals sufficiently better to motivate them to switch, taking into account the costs of doing so. In this case, costs would include the effort required to learn a new browser, transfer bookmarks, and install add-ons. In situations where users are switching from one product to another, offsetting these costs against the initial user motivation level for a product would give its 'true' GSL.

An interesting line of further work would be to investigate this Goal Satisfaction Level (GSL) concept. Firstly, one would need to figure out how an index value can be placed on 'how well a product supports the goals of its users'. This would be followed by working out the minimum GSL a product needs to achieve in a particular context for users to be sufficiently motivated to take it up at all. From there, it would be necessary to find out the GSL margin a product needs to gain over its competitors for users to be sufficiently motivated to switch, taking into account the costs of doing so. In markets where the satisfaction level is generally low, only a smaller margin is needed and vice versa. Take Google's Chrome browser for example. It has not achieved the same growth rate as Firefox most likely because it has not gained a big enough GSL margin, meaning there is not the same level of motivation to switch from Firefox to Chrome as there arguably was to switch from IE to Firefox. Calculating and comparing GSLs would potentially explain these uptake trends and be able to predict new ones.

7 Conclusion

This thesis has presented Goalchase, a motivation-driven design and evaluation framework for interactive systems. Goalchase stems from opportunities to develop new goal-oriented methods, and aims to address an underlying question: *How can a product best support the goals of its stakeholders?* The overall objective of Goalchase is to help HCI practitioners improve the user experience, while being able to cost-justify the user-centred approach. The objectives of this project were to highlight opportunities in the HCI literature, present a possible solution: Goalchase, and ensure its usability and utility in practice.

Looking at the first objective, the literature revealed a number of opportunities to develop new goal-oriented methods. One was to define goals consistently by combining needs and success criteria. Another was to discover the relative importance of different stakeholder goals, helping to inform design decisions. The last was to show the relationships between user and business goals, making a more explicit case for the user-centred approach.

To address the second objective, a new design and evaluation framework was presented. Goalchase considers the goals of all stakeholders, and provides a consistent way of defining them. Its Goalsort method then aims to discover which goals stakeholders value most. Finally, all goals are brought together on a Goalmap to show where points of mutual benefit (PMBs) exist. From there, Goalchase aims to deliver useful insights into either the design or evaluation process based on what stakeholders want to achieve.

Looking finally at the third project objective, a case study approach was taken to improve Goalchase's usability and assess the utility of insights it delivers. This action research process was successful as it revealed several usability issues, such as practical problems encountered with the paper-based method and interview techniques. Furthermore, it showed that Goalchase can deliver useful insights into the case studies, such as pointing out problems with collaboration to UCL Additions, the need for a more trusted environment to Skeegle, and the opportunity to be more child-focused to ZSL London Zoo.

With this in mind, Goalchase was found to be usable and useful within the scope of its three case studies. While more work is necessary to validate its effectiveness, the results show that Goalchase can be used effectively to improve the user experience, and also help cost-justify the user-centred approach.

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Appendix A

Goalchase user guide

Goalchase v1.0

User Guide

1 What is Goalchase?

Goalchase is a motivation-driven design and evaluation framework for interactive systems. It aims to answer one simple question:

1. **How can a product best support the goals of its stakeholders?**

To answer this, Goalchase first provides a process for identifying, defining and prioritising stakeholder goals*. It then provides a springboard for either designing or evaluating interactive products with the aim of supporting those goals in the best way.

The name *Goalchase* signifies the aim of chasing goals when designing or evaluating interactive products.

* Stakeholders are typically the users of a product and the organisation that supplies it

2 Why use Goalchase?

Goalchase is an effective way of designing and evaluating products to satisfy the goals of stakeholders. Using the concept of **success criteria**, Goalchase offers a structured and consistent way of defining goals. For example, someone might want to have a great day out at the zoo. As part of having a great experience, one of the things they need to do is plan their day at the zoo easily and conveniently. Using Goalchase, practitioners can articulate goals and success criteria in a **Goalmap**. Furthermore, Goalchase highlights **points of mutual benefit (PMBs)**. At these points, two or more stakeholders benefit from a particular task or activity. For example, someone who wants to have a great day out at the zoo needs to buy a ticket. At the same time, the zoo benefits from selling the ticket. Goalchase helps practitioners identify PMBs by highlighting them on the Goalmap. Finally, Goalchase offers a method for prioritising goals. Knowing which goals stakeholders value most helps practitioners understand the relative importance of tasks and their interface components. For example, a zoo visitor might value seeing interesting animals and attractions higher than easily finding out how to get there. Goalchase helps practitioners prioritise goals by conducting a **Goalsort**.

Other benefits of using Goalchase are:

- It covers both usability and user experience – what users want to do and how they want to feel;
- It is technology independent – Goalmaps are reusable blueprints that are always open to better ways of implementing solutions;
- It is design and evaluation method independent – practitioners can integrate Goalmaps with their preferred design and evaluation methods;
- It encourages creativity and innovation;
- Goalmaps sustain their validity and value over time; technology-specific Hierarchical Task Analysis diagrams do not;

- Goalmaps integrate well with Task Analysis;
- It aids communication and understanding between all members of a project team by creating a shared blueprint of what stakeholders are trying to achieve;
- It is designed for simplicity and ease-of-use;
- It helps designers and evaluators focus on stakeholder needs rather than their own.

2.1 Goalchase for design

As a design method, Goalchase provides a focus for creativity. Using Goalsort and a Goalmap, designers can create solutions around what their stakeholders are trying to achieve. Typically, a Goalmap can be used for brainstorming ideas about how best to support the goals it has identified. In addition, the Goalmap and resulting design concepts can be integrated with further user-centred design methods such as personas, scenarios, requirements and sketching. For example, a zoo Goalmap might tell designers that visitors try to avoid crowds and queues as much as possible. Using this goal, designers can brainstorm possible ways of helping visitors achieve this goal and describe scenarios in which they accomplish it.

2.2 Goalchase for evaluation

As an evaluation method, Goalchase is an effective way to improve existing products. Using the **Goalmatch** method, evaluators map the tasks a product supports to stakeholder needs defined in a Goalmap. Consequently, any goals there are not supported by the product are easily revealed. Also, when evaluators are looking to improve Points of Mutual Benefit they know which tasks to evaluate and what success criteria apply to them. For example, a zoo Goalmap might tell evaluators that visitors want to plan their day easily and conveniently. Evaluators can then assess how easy and convenient planning tasks such as buying a ticket are. Typically, success criteria are broken down into measurable metrics such as time to complete tasks and number of errors. From there, evaluators can use the most suitable methods such as cognitive walkthrough or user testing to make an assessment and recommend improvements.

3 How do I use Goalchase?

Figure 1 shows the entire Goalchase process.

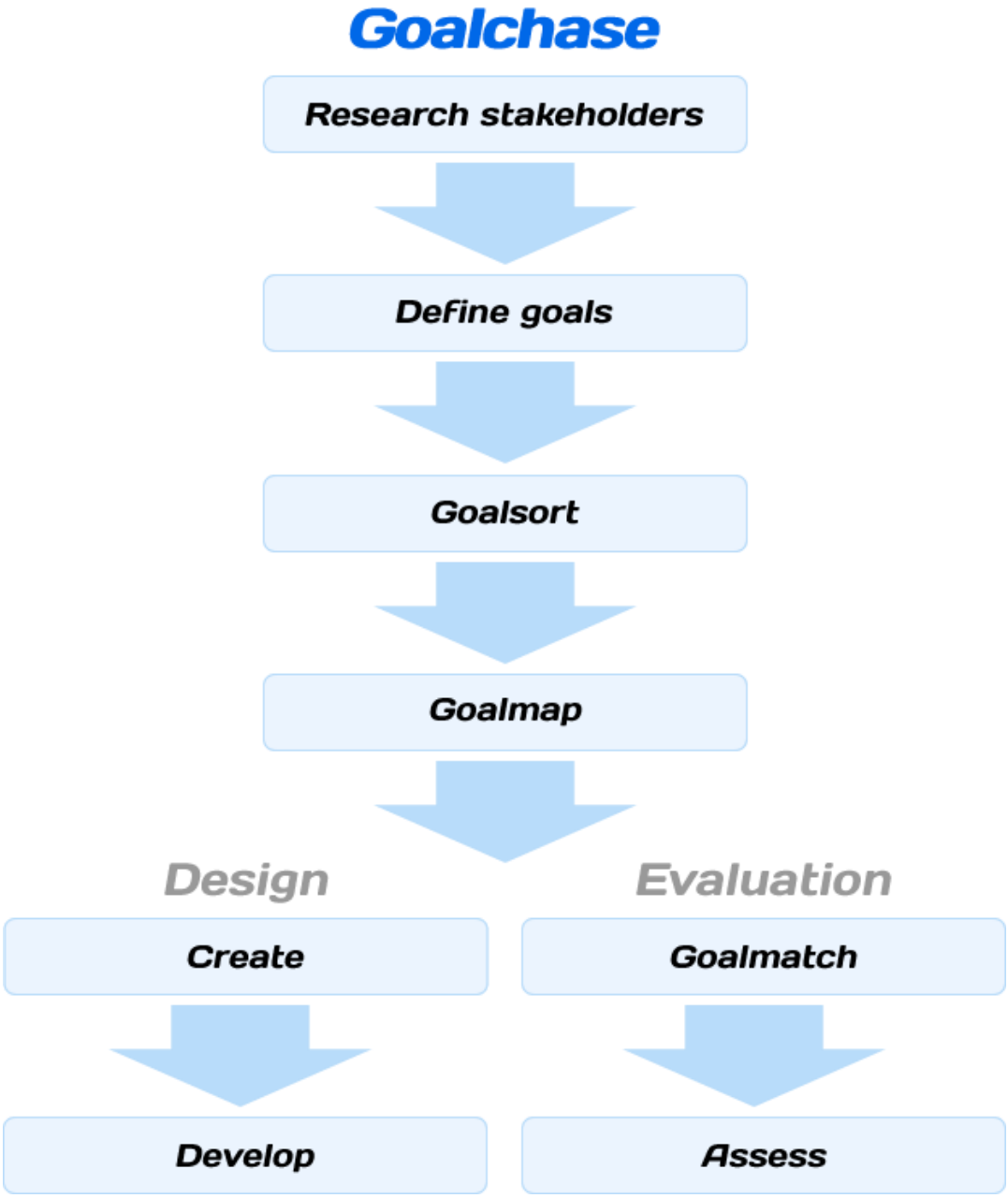

Figure 1 - Goalchase Process

The following sections describe the common Goalchase approach along with how to use Goalchase for design or evaluation.

3.1 Key stages

Regardless of whether you are designing a new product or evaluating an existing one, Goalchase always begins with stakeholder research, goal definitions, Goalsort and Goalmap.

3.1.1 Research stakeholders

The objective of Goalchase research is to discover what stakeholders are trying to achieve in a particular context. Usually, a stakeholder's overall goal is obvious enough to be assumed prior to research. For example, a zoo visitor wants to have a great day out with their family and friends. By hypothesising a stakeholder's overall goal, you have a starting point and focus for research.

There are a number of well-established HCI methods for gathering data about stakeholders and Goalchase does not aim to reinvent these. Instead, it offers some guidance on how to gather relevant data using any method:

- Understand who the stakeholders are. Typically, the main stakeholders are users of a product such as customers or employees and the organisation that supplies it. However, partners and governing bodies may also need to be considered depending on the product.
- Define the stakeholders before you try to define their goals. Target user populations can typically be defined by demographics such as their age-group, sex, nationality, occupation etc. You might find it useful to enrich your stakeholder definitions after research by creating personas.
- Use the overall goal to find out what the sub-goals are. When interviewing zoo visitors, for example, you could ask: *What makes a great day out at the zoo?* The aim is to discover what is needed to achieve the overall goal – the sub-goals.
- Try to avoid analysing tasks at this stage, and instead look for the motivations behind them (the opposite of task analysis). An office worker probably uses a word processor to create a report because it is quicker than writing it by hand, easier to edit and distribute, and looks more professional. However, there might be opportunities to satisfy these goals in other ways.

Procedure

1. Define the stakeholders and context
2. Define each stakeholder's overall goal
3. Use overall goals and suitable HCI research methods to gather stakeholder data

Example

1. Stakeholders in **London Zoo** context:
    i. **London Zoo visitor** (23-35yrs, male/female, parent of child/children 5-12yrs)
    ii. **London Zoo**
2. Overall goals:
    i. London Zoo visitor: Have a <u>great</u> day out at the zoo with my family
    ii. London Zoo: Attract <u>more</u> visitors to the zoo*

3. Suitable HCI research methods:
    i. Contextual enquiry (observation)
    ii. Interviews
    iii. Questionnaires

* This is an example of an **ongoing goal**. Business goals might also be attainable and measurable objectives such as: Increase zoo visitors by 15% over the next six months

Deliverables

- Stakeholder definitions and overall goals – typically a document, spreadsheet or webpage

3.1.2 Define goals

As goals are the most important aspect of Goalchase, defining them is the most important activity. Getting a realistic set of goals from your research is essential for designing products that fulfil real stakeholder needs. It also reveals worthwhile and justifiable areas for evaluation and improvement.

In Goalchase, goals are **abstract**. They deliberately lack the granularity to be physically carried out in the real world – that is the job of tasks. More specifically, they avoid being bound by technology. The benefit is that they retain validity and value over time. For example, a zoo visitor who wants to plan their day at the zoo easily and conveniently might have done so by telephone before the Internet arrived. Now, that same visitor might use the zoo's website, email, interactive TV or mobile applications to achieve the same goal.

Goals are also written in **verb-noun** format. This is for clarity and consistency. Firstly, goals are achieved by tasks and actions – things people actually do with objects in the real world. As verbs denote actions and nouns represent objects, it seems appropriate to use this format for goals, needs and tasks.

Furthermore, goals always include **success criteria**. This is what makes a goal and differentiates it from needs, activities and tasks. Success criteria are adjectives and adverbs used to signify a positive outcome. For example, *have a day out at the zoo* is not a goal. It creates ambiguity as to whether the day out should be good or bad – leaving us to presume that the visitor wants a good day out. Consequently, it omits any criteria for measuring success. We can break high-level success criteria down into measurable metrics by asking: *What makes a good day out at the zoo?* Continuing this strategy with sub-goals will identify low-level success criteria that are important to the stakeholder such as efficiency and errors when booking a trip on the zoo's website.

In addition, goals exist in **hierarchies** – similar to tasks in a Hierarchical Task Analysis (HTA). The overall goal can only be achieved if its sub-goals are achieved and so on. For example, having a great day out at the zoo might mean planning the day easily and conveniently, seeing interesting animals and attractions, and avoiding crowds and queues.

Goals also have **attributes**. Attributes are properties of a goal that help enrich the understanding of it such how often it is achieved (frequency) or how difficult it is to achieve (difficulty). Goalchase does not provide a fixed set of attributes for every context because they might not necessarily be relevant, so practitioners choose whichever ones could be of value. Typical properties include:

- **Frequency** – how often a stakeholder tries to achieve the goal e.g. once a year, daily
- **Duration** – how long it takes a stakeholder to achieve the goal e.g. one day
- **Difficulty** – how hard the stakeholder believes the goal is to achieve e.g. very hard
- **Constraints** – external factors that may affect the goal e.g. physical/cognitive limitations, deadlines, weather conditions, technical limitations
- **Conditions** – factors that determine whether stakeholders want to achieve the goal e.g. if it rains, zoo visitors want to find cover quickly
- **Emotions** (that supplement any included in the goal definition) – how the stakeholder wants to feel during or after the goal e.g. satisfied, excited, thrilled
- **Cost** – how much it will cost the stakeholder to achieve the goal

Finally, goals **inherit** success criteria and attributes. If zoo visitors want to plan their day out easily and conveniently, for example, then these criteria and attributes are inherited by any sub-goals, needs and (when integrated with Task Analysis) tasks in the hierarchy. This has the added benefit that they do not need to be repeated each time. If users found buying a zoo ticket online difficult, time-consuming and frustrating it would conflict with the success criteria defined in the parent goal.

Procedure

1. Write each goal on a separate piece of card or sticky note
2. Assign each goal a unique ID that represents its stakeholder and level in the hierarchy (similar to HTA – the overall goal is level 0)
3. Underline success criteria
4. Populate each goal with attributes
    i. Frequency
    ii. Emotions

Example

- Zoo visitor (user): U1.1 - Plan my day out at the zoo easily and conveniently.
    1. Frequency: Once or twice a year (inherited from parent)
    2. Emotions: Satisfying, Helpful, Pleasant

- Zoo (business): B1.1 – Sell more tickets through our website

Deliverables

- Goal definitions – on separate pieces of card or sticky notes

3.1.3 Goalsort

The objective of a Goalsort is to qualitatively weigh the importance of stakeholder goals to help make design and evaluation decisions. It consists of simply asking stakeholders to arrange their goals in perceived order of importance – using the goal definitions from the previous stage. Insight from a Goalsort can help determine the prominence of interface components (the more important ones being the most prominent) at the design stage. Also, it can help evaluators prioritise problem areas for investigation. For example, evaluators might have identified possible areas for improving both the zoo facilities locator and the ticket purchasing system on the website. Using the results from a Goalsort, they might find that improving the ticket purchasing system is a higher priority.

Goalsorts are always carried out on goals from the same level in the hierarchy because 'cross-level' (or parent-child) sorting is ineffective. The hierarchical structure of goals dictates that a parent goal is achieved by fulfilling its child goals (subgoals), in the same way a hierarchical task analysis (HTA) dictates that a parent task is completed by executing its subtasks. For example, it would be ineffective to ask participants to decide which is more important: 'Have a great day out at the zoo' or 'Plan our day at the zoo easily', as the former (overall goal) is always ultimately most important.

Procedure

1. Gather all stakeholder goals from a level in the hierarchy e.g. Level 1
2. Scatter stakeholder goals in no particular order onto a table or surface
3. Ask stakeholders to arrange them in perceived order of importance
4. Record the results – digital camera etc

Example

- Zoo visitor level 1 goals:
    1. See interesting animals and attractions
    2. Avoid crowds and queues
    3. Find facilities such as cafes and toilets easily
    4. Plan my day easily and conveniently

Deliverables

- Goalsort results – document, spreadsheet, photograph, webpage

3.1.4 Goalmap

The objective of a Goalmap is to understand how stakeholder goals interact in a particular context by highlighting **points of mutual benefit (PMBs)**. Goalmaps are also useful communication tools because they can be understood and shared by everyone on a project team. There are no hard rules for how a Goalmap looks visually but typically it is represented as a diagram or table.

Goalmap diagram or Goalmap table

- For diagram, use a sheet of A3 or larger sized paper. Attach goal definitions or rewrite them onto the sheet (if you are confident they are final).
- User goals are presented left to right (overall goal on far left)
- Business/Organisation goals are presented right to left (overall goal on far right)
- Colour coding stakeholder goals can help differentiate them
- PMBs should meet in the middle

Highlight points of mutual benefit (PMBs)

PMBs are interaction points on a Goalmap where two or more stakeholders benefit in some way from each others' goal. For example, a potential zoo visitor wants to plan their day easily and conveniently. As part of achieving that goal, they need to buy a ticket. At the same time, the zoo wants to sell more tickets. If buying a ticket is difficult, frustrating and confusing, there is a greater risk that the potential visitor will abandon this task. If their negative experience is severe enough, they might abandon visiting the zoo altogether and go to the museum instead. At this point, both the potential visitor and the zoo have lost out. In other words, it is mutually beneficial for the zoo to help the potential visitor plan their day easily and conveniently.

Highlight each PMB on the Goalmap in some way, e.g. green connecting line, and give it a unique ID e.g. PMB1. This helps everyone on the team understand where design and evaluation efforts should focus.

Procedure

1. Create Goalmap
2. Highlight PMBs

Deliverables

- Goalmap - A3+ sheet of paper, spreadsheet table, graphic image, webpage

3.2 Additional stages: Design

Goalchase is well suited to creating innovative products that support legitimate user needs and integrating with further user-centred design methods.

3.2.1 Create

Goalchase encourages creativity and innovation. Goalmaps are technology-independent so designers are not constrained by existing technical limitations at the outset. For example, planning a day at the zoo easily and conveniently does not necessarily mean using the web, email or telephone.

While Goalchase does not provide any new creativity methods, it integrates well with established techniques such as brainstorming and focus groups. In both cases, designers can focus on areas of the Goalmap and conceptualise innovative ways of supporting goals.

3.2.2 Develop

Goalmaps integrate well with further user-centred design methods. The following list briefly highlights some of these.

Scenarios

Choose a particular goal (or set of goals) and describe how a user ideally interacts with a product to achieve that goal.

Requirements

In order to achieve a goal, a user needs the necessary information and actions to perform a task. Using a particular goal, define the data and functional requirements needed to achieve it.

3.3 Additional stages: Evaluation

Goalchase can help assess how well a product supports the goals of its users.

3.3.1 Goalmatch

The objective of a Goalmatch is to discover which user goals a product supports and indicate the success criteria for evaluating the tasks it provides. By matching product tasks to user goals, any goals that are not supported at all are easily revealed. Also, any tasks that do not match a goal either suggest they are superfluous or that the goal definitions need to be revisited. For tasks that do match, use the success criteria from the parent goal as the basis for measuring task improvements. For example, buying a zoo ticket should be easy and convenient. If you decide to improve this task, you know that making it easier and more convenient is the basis for measuring success. Of course, these high-level criteria are too abstract to actually be measured so they need to be broken down into suitable low-level metrics such as time to complete tasks, number of errors etc.

Procedure

1. List the tasks available with a product (perhaps using basic Task Analysis). Spreadsheets and tables are useful for doing this.

2. For each task, try to match it to a low-level goal in the Goalmap and mark the goal's ID next to it. If it does not match any goal, make a note of it (or just leave the goal ID field blank).

Example

- Zoo visitor using London Zoo website
    - See interesting animals and attractions
        - Find out what animals the zoo has to offer
        - Find out about feeding times and special events
    - Plan my day at the zoo easily and conveniently
        - Find out how to get to the zoo
        - Find out how much tickets cost
        - Buy a ticket
        - Find out what child facilities they have and where they are

3.3.2 Assess

After identifying potential areas for improvement, you should choose a suitable usability or user experience evaluation method. Tasks are commonly tested for usability with cognitive walkthroughs, heuristic evaluations and user testing. User experience issues are often addressed with interviews and satisfaction questionnaires.

Appendix B

Sample UCL Additions user interview transcript

Participant #3	
Age Range	[16-19] [20-24] [25-29] [30-34] [35-39] [40-49] [50+]
Gender	[Male] [Female]
Occupation	Research and Programme Development Manager
How would you describe your computer experience level?	[Beginner] [Intermediate] [Advanced]
How often do you use the Internet?	[Daily] [Weekly] [Monthly]
Do you use social networks such as Facebook?	[Yes] [No]
Have you used UCL Additions before?	[Yes] [No]

Why do you/would you use UCL Additions?

"Basically, I work for the Institute of Global Health and our remit is to coordinate work across UCL and potentially find new collaborators and people who haven't worked together before. We thought it would be quite useful as a way to advertise our community rather than using all users emails and things like that, I think it would be quite a nice place to group people and allow them to talk to each other without having to physically have meetings and to identify people they might want to collaborate with without having to attend all of our meetings. We also thought it might be quite useful if we're putting together research proposals or for instance we were writing a long document – to be able to set up a group and post versions of draughts and comments on there. And one other idea was we wanted to start kind of almost like a blog but using UCL Additions on particular topics within the group, so that's why we wanted to use it."

Looking at the homepage, how easy is it to establish what UCL Additions is and what the benefits of joining are?

"I don't actually think it is that easy, um, going back a step before that – and I don't know whether it's just because it's a beta version but it's really hard to find UCL Additions. If you just type it in the UCL search, it doesn't come up and you end up having to go to UCL Advances and then UCL Additions so people that I've asked who have joined have found it

quite hard without me actually sending them an invitation. Once you're actually on the homepage, I don't think it really explains very well what it actually does and why you might actually want to join it. I know it's got these things here, but I think it does need a bit more information."

What is the most important part of UCL Additions to you e.g. Contacts, Projects?

"Um, the groups because we've set up our own group would probably be one of the most useful and the projects as well so that we can actually use it for particular things and use it as a place to store documents that everybody can access because it's a bit easier than setting up a new webpage that people would have to login to and look at."

What are your comments on the 'Activities' section of the website?

"I think it would probably be better to separate those two out, um, cos I wasn't assuming funding opportunities would be under activities. I didn't even realise that it included that."

How easy do you think it is to find people you might want to collaborate with?

"Fairly easy because you obviously get a list that comes up on the left hand side, but I don't know, I haven't looked recently, but I don't know how much information people end up putting in their profiles and I would probably end up looking for people on the UCL homepage and looking at their departmental profiles and then maybe coming back in there and joining."

With the list of potential collaborators on the left, in your opinion do you see that as being the entire list or do you think somewhere else there might be…that's a snippet and there's a full list somewhere?

"I think that's obviously just a snippet of potential people and I know that the kind of network diagram of all the people that are on there, and that's actually probably more a useful tool for seeing who people are already linked to and working out well…that person knows all the people I know so maybe they're actually interested in this as well. So that's actually really a useful page but when I've looked at it before it's sometimes not worked or taken absolutely ages, but it may well have improved since I looked at it last."

So, if you were looking for a full list of potential collaborators, which one of the sections would you head to?

"I have no idea, I'd have to have another look. I guess somewhere there must be a list of members that you can sort by the kind of areas of interest like biomedical science or anthropology – things like that, I'm guessing you can do things like that and look that way."

What do you think about the look and feel of UCL Additions?

"It's not bad, it kind of looks a bit boring and empty but then I don't think you'd want to fill it with too much information. It's only a login page, I just think it needs a bit more information on what it actually is before people log in."

What about the design of the rest of the site – the colour scheme, the fonts – does it appeal to you?

"I haven't really thought about, it's ok, it's not really great looking but it's not awful either and it does the job."

What are some of your favourite websites?

"Well I do use Facebook quite a lot and I find that easier to navigate than this, but that could just be because I don't use this very often. Um, I use website likes Amazon – all those general popular shopping websites. Trying to think what else I go to – Google all the time. But yeah, I use quite a lot of different websites – Pubnet that's another one I use quite a lot for work."

And so websites that are largely content-based such as Facebook, what brings you back to those sites?

"It's the fact that they're used a lot. So I've got a lot of friends that now rather than emailing people, do Facebook messages and put all their photos up on Facebook rather than putting them anywhere else so that's the way that people actually communicate and I think that where UCL Additions kind of falls down a bit is, particularly in our community, people haven't got used to using it. So I could probably count the number of times I've logged in on one hand because people just don't use it. And if they do use it, you don't know that they are because you don't get a kind of email reminder saying that somebody's posted something. I don't think, although I know I was talking to Person X about it and she said they might start doing it."

In general, what makes a good website?

"It's got to be easy to use and there's got to be a benefit of using it. So you need to know that if you've got log in and remember what your password is, that you're actually going to get some useful information rather than spending a lot of time trying to work out how to do things and find things when you can actually do it without using that website."

Sample Skeegle user questionnaire response

Participant Info	
Age Range	[16-19] [20-24] [25-29] [30-34] [35-39] [40+]
Gender	[Male] [Female]
Internet Usage	
Social Networking	[Daily] [Weekly] [Monthly] [Never]
Search	[Daily] [Weekly] [Monthly] [Never]
Blogging	[Daily] [Weekly] [Monthly] [Never]

Think of the websites you use often. Why do you revisit them?

it's my blog, information about the country -> news, stay in contact with friends, collect information

Think of your favourite websites. What makes them better than others?

clearly arranged, my friends like it, provide information other websites don't provide

If you came up with a business idea, what would you do to develop it into a business?

depends on the idea. I think there is not only one answer for this question

How do you feel about sharing business ideas online?

not good. When you share your ideas more people know about it. Perhaps someone will steal the idea

Additional comments:

Sample ZSL London Zoo Goalsort & Goalmap