

**MINISTRY OF EDUCATION AND SCIENCE OF THE  
REPUBLIC OF KAZAKHSTAN**

**JSC “Kazakh-British Technical University”  
Department of Computer Engineering**

**ADMITTED TO DEFENCE**

Head of Computer  
Engineering Department

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“\_\_\_\_\_” \_\_\_\_\_ 2013

Student \_\_\_\_\_

Vadim Kotov

**MASTER’S THESIS  
XXXXXX – Information Systems**

Theme: **“Game Mechanics for Stimulating High Performance of  
Project Participants”**

Almaty, 26<sup>th</sup> of May 2013

# ASSIGNMENT

## for graduation work planning

*Student:* V. Kotov

*Major:* Information Systems

*Theme:* “Mini-Game ‘Simulation Of The Image Enhancement’ And Visualization Of The Learning Scripts To The Lectures ‘Computer Vision’”

*Approved by:* KBTU, act # 148-P dated 8th of October, 2010

*Submission deadline:* 23<sup>th</sup> of May 2011

*Initial data to the project:*

International standards (e.g. IEEE 1063-1987, ISO 12207, ANSI/IEEE 983, State Standard 34.201, etc.).

*List of questions for graduate work development:*

**Analytical review**, perspective on edutainment and usage of video games in education, examples, “DBB-Crackers” game mechanics

**Designing**, analysis of image enhancement techniques used in Computer Vision, opportunities for PDF-rendering in Unity game development environment, designing prototypes of “Image Enhancement Tool”, “PDF-Reader”, “PDF-Converter”

**Development**, the “Image Enhancement Tool” with following functionality:

- Custom LUT/transfer function based image modification (with complex logical functions available)
- Threshold
- Histogram equalisation

“PDF-Reader” and “PDF-Converter” implementation

**Application and experiments**, testing of “Image Enhancement Tool”, application of thesis results to production: possible challenges, benefits and opportunities

*List of diploma project advisers in connection with the diploma paper sections:*

<b>Section</b>	<b>Adviser, department</b>
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*Date of assignment receipt:* 10<sup>th</sup> of January 2010

Supervisors

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Student

Vadim Kotov

“\_\_\_\_\_” \_\_\_\_\_ 2011

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c.t.s., assistant professor

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B. K. Dlimbetov

“ \_\_\_\_\_ ” \_\_\_\_\_ 2011

**SCHEDULE**  
**for graduation work**

*Student:* V. Kotov

*Major:* Information Systems

*Theme:* “Mini-Game ‘Simulation Of The Image Enhancement’ And Visualization Of The Learning Scripts To The Lectures ‘Computer Vision’”

*Supervisors:* Prof. Dr. Nailja Luth, Senior Lecturer R. M. Duzbayeva

Type of work	Deadline
1. Diploma title and supervisor settlement.	October

Type of work	Deadline
<ol style="list-style-type: none"> <li>1. Arrival at HAW-AW<sup>1</sup> university</li> <li>2. Introduction to the “DBB-Crackers” game. Discussion of the project assignment</li> <li>3. Definition of goals and objectives of the project. Clarification of goals and objectives priority</li> <li>4. Formulation of research objectives and its characteristics</li> <li>5. Analytical review: perspective on edutainment and usage of video games in education, examples, “DBB-Crackers” game mechanics</li> <li>6. Familiarisation with software (Unity) and game prototype</li> </ol>	January
<ol style="list-style-type: none"> <li>1. Analysis of image enhancement techniques and algorithms of used in Computer Vision, opportunities for PDF-rendering in Unity game development environment</li> <li>2. Designing prototypes of “Image Enhancement Tool”, “PDF-Reader”, “PDF-Converter”</li> <li>3. Gaining necessary background information of the thesis papers</li> </ol>	April

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<sup>1</sup>University of Applied Sciences Amberg-Weiden

Type of work	Deadline
<ol style="list-style-type: none"> <li>1. Development of algorithms, specific for the target platform</li> <li>2. Testing the software on possible logical errors</li> <li>3. Experimenting and comparing the results of the work of Image Enhancement Tool with such software, as Adobe Photoshop. Summing up appropriate conclusion</li> </ol>	March
<ol style="list-style-type: none"> <li>1. Submission of the results of the project to the University of Applied Sciences Amberg-Weiden. Finding possible issues and benefits.</li> <li>2. Preparation the graphic material for the thesis report</li> <li>3. Preparation of the explanatory note</li> <li>4. Presentation of the thesis project</li> </ol>	May

Head of Computer Engineering Department

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B.K.Dlimbetov

## **Abstract**

Here you should write your Abstract. Use this command to see the no of the last page: 63. Compact list:

- Item 1
- Item 2

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1.1 Pros and cons of iterative methodics . . . . . 30

# Introduction

Dean Spitzer's report on work attitudes.

Motivation for IT/creative people (Drive). Odds of old motivational strategy. Experiment with children and drawing.

A list of problems, connected to startups / estimation, etc.

Market of productivity apps.

The reason to make another app, despite the hype: a lot of similar apps, several "make things different", project managers' "secret knowledge".

# 1. Project management techniques for small teams and startups

In the past project management was different. Not only because the formal discipline was mostly applied to the large projects lasting several years and costing millions of dollars, but also used a different approach, evolved from ancient military regimes, where relatively few people directed large number of others [1].

Project definition, as a temporary endeavour with a defined beginning and end [2], undertaken to meet unique goals and objectives [3] extends to the simple premise: everything is a project. For example important presentation or “career development” project, or even employee development (each employee represents a single “project” in which it is required to keep track of performance and plan to help him or her develop). Pursuing goals makes project management techniques essential to get things done, and especially important for personal ones.

Downscaling project management to apply to the personal projects or small businesses required a different approach. In comparison to traditional “water-fall” model, which is inflexible and can potentially lead to a harmful consequences, a number of new methods emerged.

## 1.1 Agile methods

A group of such methods, called “Agile” are a reaction to traditional ways of developing software and acknowledge the “need for an alternative to documentation driven, heavyweight software development processes”.

The core of these methods consists of adaptive planning, evolutionary development and delivery, an iterative approach, and rapid and flexible response to change.

In 2001 the Manifesto for Agile Software Development [4] was published to define the approach now known as agile software development.

Some of the manifesto’s authors formed the Agile Alliance (<http://www.agilealliance.org/>), a nonprofit organization that promotes software de-

velopment according to the manifesto's principles.

### The Agile Manifesto:

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Meaning, that self-organisation and motivation are important, working software will be more useful and welcome as a presentation for clients in meetings, collaboration leads to a better product, effectively tailored to the customer needs and quick changes allow higher quality of product.

According to Kent Beck,[5] the Agile Manifesto is based on twelve principles:

1. Customer satisfaction by rapid delivery of useful software
2. Welcome changing requirements, even late in development
3. Working software is delivered frequently (weeks rather than months)
4. Working software is the principal measure of progress
5. Sustainable development, able to maintain a constant pace
6. Close, daily cooperation between business people and developers
7. Face-to-face conversation is the best form of communication (co-location)
8. Projects are built around motivated individuals, who should be trusted
9. Continuous attention to technical excellence and good design
10. Simplicitythe art of maximizing the amount of work not doneis essential
11. Self-organizing teams
12. Regular adaptation to changing circumstances

Agile development is popular in a certain types of environment, including small teams. However a number of thing may negatively impact the success of an agile project:

1. Large-scale development efforts (>20 developers), though scaling strategies [6] and evidence of some large projects [7] have been described.

2. Distributed development efforts (non-colocated teams). Still there are examples of successful companies (37 Signals).
3. Forcing an agile process on a development team
4. Mission-critical systems where failure is not an option at any cost (e.g. software for air traffic control).

Agile methods have been extensively used for development of software products and some of them use certain characteristics of software, such as object technologies. However, these techniques can be applied to the development of non-software products, such as computers, motor vehicles, medical devices, food, and clothing.

## **1.2 Scrum**

One of the implementations of Agile philosophy is Scrum.

Authors describe Scrum, [8] as a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value.

### **1.2.1 The Scrum team**

The Scrum Team consists of a Product Owner, the Development Team, and a Scrum Master. Scrum Teams are self-organising and cross-functional. Self-organising teams choose how best to accomplish their work, rather than being directed by others outside the team. Cross-functional teams have all competencies needed to accomplish the work without depending on others not part of the team. The team model in Scrum is designed to optimise flexibility, creativity, and productivity.

Scrum Teams deliver products iteratively and incrementally, maximising opportunities for feedback. Incremental deliveries of “Done” product ensure a potentially useful version of working product is always available.

### **1.2.2 Scrum events**

Prescribed events are used in Scrum to create regularity and to minimise the need for meetings not defined in Scrum. Scrum uses time-boxed events, such

that every event has a maximum duration. This ensures an appropriate amount of time is spent planning without allowing waste in the planning process.

Other than the Sprint itself, which is a container for all other events, each event in Scrum is a formal opportunity to inspect and adapt something. These events are specifically designed to enable critical transparency and inspection. Failure to include any of these events results in reduced transparency and is a lost opportunity to inspect and adapt.

### **1.2.3 Scrum artifacts**

Scrums artifacts represent work or value in various ways that are useful in providing transparency and opportunities for inspection and adaptation. Artifacts defined by Scrum are specifically designed to maximise transparency of key information needed to ensure Scrum Teams are successful in delivering a “Done” Increment.

## **1.3 RAD – Rapid Application Development**

RAD is an integrated set of techniques, guidelines and tools that facilitate deploying a customer’s software needs within a short period of time. This pre-defined timeframe is called a “timebox”. The software product evolves during the RAD development process based on continued customer feedback. In addition, the whole software product is not delivered at once, but is delivered in pieces by order of business importance. [9]

The RAD process defies a linear definition of steps carried out in a sequence. [9]

### **1.3.1 Phases of RAD**

1. Requirements Planning phase – combines elements of the system planning and systems analysis. During this stage, a definition of the project scope is completed along with some preliminary data/process analysis, risk assessment and estimating.
2. User design phase – during this phase, users interact with systems analysts and develop models and prototypes that represent all system processes,



inputs, and outputs. The RAD groups or subgroups typically use a combination of Joint Application Development (JAD) techniques and CASE tools to translate user needs into working models. User Design is a continuous interactive process that allows users to understand, modify, and eventually approve a working model of the system that meets their needs.

3. Construction phase – focuses on program and application development task similar to the SDLC. In RAD, however, users continue to participate and can still suggest changes or improvements as actual screens or reports are developed. Its tasks are programming and application development, coding, unit-integration and system testing.
4. Cutover phase – resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training. Compared with traditional methods, the entire process is compressed. As a result, the new system is built, delivered, and placed in operation much sooner.

In addition to using such techniques as timeboxing, chunking and customer-driven product delivery, RAD is based on the premise that software development is a discovery process.

## **1.4 TDD – Test-Driven Development**

Test-driven development (TDD) is a software development process that relies on the repetition of a very short development cycle: first the developer writes an (initially failing) automated test case that defines a desired improvement or new function, then produces the minimum amount of code to pass that test, and finally refactors the new code to acceptable standards. Kent Beck, who is credited with having developed or ‘rediscovered’ the technique, stated in 2003 that TDD encourages simple designs and inspires confidence.

### **1.4.1 TDD Cycle**

The TDD techniques is particularly interesting in terms of feedback, which helps to fail fast, be flexible and get a feeling of moving towards a goal. This is reached by using the following cycle.

## **Add a test**

In test-driven development, each new feature begins with writing a test. This test must inevitably fail because it is written before the feature has been implemented. (If it does not fail, then either the proposed “new” feature already exists or the test is defective.) To write a test, the developer must clearly understand the feature’s specification and requirements. The developer can accomplish this through use cases and user stories to cover the requirements and exception conditions, and can write the test in whatever testing framework is appropriate to the software environment. This could also be a modification of an existing test. This is a differentiating feature of test-driven development versus writing unit tests after the code is written: it makes the developer focus on the requirements before writing the code, a subtle but important difference.

## **Run all tests and see if the new one fails**

This validates that the test harness is working correctly and that the new test does not mistakenly pass without requiring any new code. This step also tests the test itself, in the negative: it rules out the possibility that the new test always passes, and therefore is worthless. The new test should also fail for the expected reason. This increases confidence (though does not guarantee) that it is testing the right thing, and passes only in intended cases.

## **Write some code**

The next step is to write some code that causes the test to pass. The new code written at this stage is not perfect, and may, for example, pass the test in an inelegant way. That is acceptable because later steps improve and hone it.

At this point, the only purpose of the written code is to pass the test; no further (and therefore untested) functionality should be predicted and ‘allowed for’ at any stage.

## **Run the automated tests and see them succeed**

If all test cases now pass, the programmer can be confident that the code meets all the tested requirements. This is a good point from which to begin the final step of the cycle.

## **Refactor code**

Now the code can be cleaned up as necessary. By re-running the test cases, the developer can be confident that code refactoring is not damaging any existing functionality. The concept of removing duplication is an important aspect of any software design. In this case, however, it also applies to removing any duplication between the test code and the production code for example magic numbers or strings repeated in both to make the test pass in step 3.

## **Repeat**

Starting with another new test, the cycle is then repeated to push forward the functionality. The size of the steps should always be small, with as few as 1 to 10 edits between each test run. If new code does not rapidly satisfy a new test, or other tests fail unexpectedly, the programmer should undo or revert in preference to excessive debugging. Continuous integration helps by providing revertible checkpoints. When using external libraries it is important not to make increments that are so small as to be effectively merely testing the library itself, unless there is some reason to believe that the library is buggy or is not sufficiently feature-complete to serve all the needs of the main program being written.

## **1.5 FDD – Feature-Driven Development**

FDD allows to manage projects at a very high level and apply other methodologies (such as TDD) at a lower level of abstraction. It is an iterative and incremental software development process, which primary focus is on being able to set estimates and schedules and to report on the status of a project, or its part.

### **1.5.1 Phases of FDD**

FDD consists of five basic activities. For accurate state reporting and keeping track of the software development project, milestones that mark the progress made on each feature are defined.

## **Develop overall model**

The project started with a high-level walkthrough of the scope of the system and its context. Next, detailed domain walkthroughs were held for each modelling area. In support of each domain, walkthrough models were then composed by small groups, which were presented for peer review and discussion. One of the proposed models, or a merge of them, was selected which became the model for that particular domain area. Domain area models were merged into an overall model, and the overall model shape was adjusted along the way.

## **Build feature list**

The knowledge that was gathered during the initial modelling was used to identify a list of features. This was done by functionally decomposing the domain into subject areas. Subject areas each contain business activities, the steps within each business activity formed the categorised feature list. Features in this respect were small pieces of client-valued functions expressed in the form “{action; ;result; ;object;”, for example: ‘Calculate the total of a sale’ or ‘Validate the password of a user’. Features should not take more than two weeks to complete, else they should be broken down into smaller pieces.

## **Plan by feature**

After the feature list had been completed, the next step was to produce the development plan. Class ownership has been done by ordering and assigning features (or feature sets) as classes to chief programmers.

## **Design by feature**

A design package was produced for each feature. A chief programmer selected a small group of features that are to be developed within two weeks. Together with the corresponding class owners, the chief programmer worked out detailed sequence diagrams for each feature and refines the overall model. Next, the class and method prologues are written and finally a design inspection is held.

## **Build by feature**

After a successful design inspection a per feature activity to produce a completed client-valued function (feature) is being produced. The class owners develop the actual code for their classes. After a unit test and a successful code inspection, the completed feature is promoted to the main build.

## **1.6 Lean**

Lean development is based on traditional lean principles, which are derived from the Japanese manufacturing industry. Generally “Lean” is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service, “value” is defined as any action or process that a customer would be willing to pay for.

Lean development can be summarised by seven principles, very close in concept to lean manufacturing principles:

1. Eliminate waste
2. Amplify learning
3. Decide as late as possible
4. Deliver as fast as possible
5. Empower the team
6. Build integrity in
7. See the whole

### **1.6.1 Lean manufacturing principles**

#### **Eliminate waste**

Everything not adding value to the customer is considered to be waste (muda). This includes:

1. unnecessary code and functionality
2. delay in the software development process
3. unclear requirements
4. insufficient testing, leading to avoidable process repetition

5. bureaucracy
6. slow internal communication

In order to be able to eliminate waste, one should be able to recognise it. If some activity could be bypassed or the result could be achieved without it, it is waste. Partially done coding eventually abandoned during the development process is waste. Extra processes and features not often used by customers are waste. Waiting for other activities, teams, processes is waste. Defects and lower quality are waste. Managerial overhead not producing real value is waste. A value stream mapping technique is used to distinguish and recognise waste. The second step is to point out sources of waste and eliminate them. The same should be done iteratively until even essential-seeming processes and procedures are liquidated.

### **Amplify learning**

Software development is a continuous learning process with the additional challenge of development teams and end product sizes. The best approach for improving a software development environment is to amplify learning. The accumulation of defects should be prevented by running tests as soon as the code is written. Instead of adding more documentation or detailed planning, different ideas could be tried by writing code and building. The process of user requirements gathering could be simplified by presenting screens to the end-users and getting their input.

The learning process is sped up by usage of short iteration cycles – each one coupled with refactoring and integration testing. Increasing feedback via short feedback sessions with customers helps when determining the current phase of development and adjusting efforts for future improvements. During those short sessions both customer representatives and the development team learn more about the domain problem and figure out possible solutions for further development. Thus the customers better understand their needs, based on the existing result of development efforts, and the developers learn how to better satisfy those needs. Another idea in the communication and learning process with a customer is set-based development – this concentrates on communicating the constraints of the future solution and not the possible solutions, thus promoting the birth of the solution via dialogue with the customer.

## **Decide as late as possible**

As software development is always associated with some uncertainty, better results should be achieved with an options-based approach, delaying decisions as much as possible until they can be made based on facts and not on uncertain assumptions and predictions. The more complex a system is, the more capacity for change should be built into it, thus enabling the delay of important and crucial commitments. The iterative approach promotes this principle – the ability to adapt to changes and correct mistakes, which might be very costly if discovered after the release of the system.

An agile software development approach can move the building of options earlier for customers, thus delaying certain crucial decisions until customers have realised their needs better. This also allows later adaptation to changes and the prevention of costly earlier technology-bounded decisions. This does not mean that no planning should be involved – on the contrary, planning activities should be concentrated on the different options and adapting to the current situation, as well as clarifying confusing situations by establishing patterns for rapid action. Evaluating different options is effective as soon as it is realised that they are not free, but provide the needed flexibility for late decision making.

## **Deliver as fast as possible**

In the era of rapid technology evolution, it is not the biggest that survives, but the fastest. The sooner the end product is delivered without considerable defect, the sooner feedback can be received, and incorporated into the next iteration. The shorter the iterations, the better the learning and communication within the team. Without speed, decisions cannot be delayed. Speed assures the fulfilling of the customer's present needs and not what they required yesterday. This gives them the opportunity to delay making up their minds about what they really require until they gain better knowledge. Customers value rapid delivery of a quality product.

The just-in-time production ideology could be applied to software development, recognising its specific requirements and environment. This is achieved by presenting the needed result and letting the team organise itself and divide the tasks for accomplishing the needed result for a specific iteration. At

the beginning, the customer provides the needed input. This could be simply presented in small cards or stories – the developers estimate the time needed for the implementation of each card. Thus the work organisation changes into self-pulling system – each morning during a stand-up meeting, each member of the team reviews what has been done yesterday, what is to be done today and tomorrow, and prompts for any inputs needed from colleagues or the customer. This requires transparency of the process, which is also beneficial for team communication. Another key idea in Toyota’s Product Development System is set-based design. If a new brake system is needed for a car, for example, three teams may design solutions to the same problem. Each team learns about the problem space and designs a potential solution. As a solution is deemed unreasonable, it is cut. At the end of a period, the surviving designs are compared and one is chosen, perhaps with some modifications based on learning from the others – a great example of deferring commitment until the last possible moment. Software decisions could also benefit from this practice to minimise the risk brought on by big up-front design.

## **Empower the team**

There has been a traditional belief in most businesses about the decision-making in the organisation – the managers tell the workers how to do their own job. In a Work-Out technique, the roles are turned – the managers are taught how to listen to the developers, so they can explain better what actions might be taken, as well as provide suggestions for improvements. The lean approach favours the aphorism “find good people and let them do their own job,” encouraging progress, catching errors, and removing impediments, but not micro-managing.

Another mistaken belief has been the consideration of people as resources. People might be resources from the point of view of a statistical data sheet, but in software development, as well as any organisational business, people do need something more than just the list of tasks and the assurance that they will not be disturbed during the completion of the tasks. People need motivation and a higher purpose to work for – purpose within the reachable reality, with the assurance that the team might choose its own commitments. The developers should be given access to the customer; the team leader should provide support



and help in difficult situations, as well as ensure that skepticism does not ruin the teams spirit.

## **Build integrity in**

The customer needs to have an overall experience of the System – this is the so-called perceived integrity: how it is being advertised, delivered, deployed, accessed, how intuitive its use is, price and how well it solves problems.

Conceptual integrity means that the systems separate components work well together as a whole with balance between flexibility, maintainability, efficiency, and responsiveness. This could be achieved by understanding the problem domain and solving it at the same time, not sequentially. The needed information is received in small batch pieces – not in one vast chunk with preferable face-to-face communication and not any written documentation. The information flow should be constant in both directions – from customer to developers and back, thus avoiding the large stressful amount of information after long development in isolation.

One of the healthy ways towards integral architecture is refactoring. As more features are added to the original code base, the harder it becomes to add further improvements. Refactoring is about keeping simplicity, clarity, minimum amount of features in the code. Repetitions in the code are signs for bad code designs and should be avoided. The complete and automated building process should be accompanied by a complete and automated suite of developer and customer tests, having the same versioning, synchronization and semantics as the current state of the System. At the end the integrity should be verified with thorough testing, thus ensuring the System does what the customer expects it to. Automated tests are also considered part of the production process, and therefore if they do not add value they should be considered waste. Automated testing should not be a goal, but rather a means to an end, specifically the reduction of defects.

## **See the whole**

Software systems nowadays are not simply the sum of their parts, but also the product of their interactions. Defects in software tend to accumulate during the development process – by decomposing the big tasks into smaller tasks,

and by standardising different stages of development, the root causes of defects should be found and eliminated. The larger the system, the more organisations that are involved in its development and the more parts are developed by different teams, the greater the importance of having well defined relationships between different vendors, in order to produce a system with smoothly interacting components. During a longer period of development, a stronger subcontractor network is far more beneficial than short-term profit optimising, which does not enable win-win relationships.

## **1.7 Summarising agile, RAD and lean**

There is a common feature in all of the considered methodologies. According to table 1.1, that is constructing a continuous feedback, which allows early failure and indicates whether a project goal is correct (or it should be adjusted) and a team progress. Each methodology provides its own level of abstraction and suggests tools to reduce chaos and uncertainty.

Comparing iterative methodologies to traditional waterfall model it is possible to say, that they appeared because of emergent projects with elements changing fast (goals, business processes, markets, etc.). Nonetheless traditional project management provides tools to cope with uncertainties, called PERT (section 1.7.1).

Ability to get instant feedback and adjust goals is defined by a natural human attribute as pursuing order in consciousness. This claim will be considered in section 2.4 on page 49.

Table 1.1: Pros and cons of iterative methodics

Name	Pros	Cons
Agile	Minimises feature creep by developing in short intervals resulting in miniature software projects and releasing the product in mini-increments.	Short iteration may add too little functionality, leading to significant delays in final iterations. Since Agile emphasises real-time communication (preferably face-to-face), using it is problematic for large multi-team distributed system development. Agile methods produce very little written documentation and require a significant amount of post-project documentation.
Lean	Creates minimalist solutions and delivers less functionality earlier; per the policy that 80% today is better than 100% tomorrow.	Product may lose its competitive edge because of insufficient core functionality and may exhibit poor overall quality.
RAD	Promotes strong collaborative atmosphere and dynamic gathering of requirements. Business owner actively participates in prototyping, writing test cases and performing unit testing.	Dependence on strong cohesive teams and individual commitment to the project. Decision-making relies on the feature functionality team and a communal decision-making process with lesser engineering authority.

Table 1.1: Pros and cons of iterative methodics

Name	Pros	Cons
Scrum	Agile framework. Improved productivity in teams previously paralysed by heavy “process”, ability to prioritise work, use of backlog for completing items in a series of short iterations or sprints, daily measured progress and communications.	Reliance on facilitation by a master who may lack the political skills to remove impediments and deliver the sprint goal. Due to reliance on self-organising teams and rejection of traditional centralised “process control”, internal power struggles can paralyse a team.

### 1.7.1 Program Evaluation and Review Technique

Let’s also consider traditional “waterfall” methodology statistical tool, designed to analyse and represent the tasks involved in completing a given project called PERT (Program Evaluation and Review Technique).

PERT was developed for the U.S. Navy Special Projects Office in 1957 to support the U.S. Navy’s Polaris nuclear submarine project [10]. It was able to incorporate uncertainty by making it possible to schedule a project while not knowing precisely the details and durations of all the activities. It is more of an event-oriented technique rather than start- and completion-oriented, and is used more in projects where time is the major factor rather than cost. It is applied to very large-scale, one-time, complex, non-routine infrastructure and Research and Development projects. An example of this was for the 1968 Winter Olympics in Grenoble which applied PERT from 1965 until the opening of the 1968 Games.

### Conventions

- A PERT chart is a tool that facilitates decision making. The first draft of a PERT chart will number its events sequentially in 10s (10, 20, 30, etc.) to allow the later insertion of additional events.

- Two consecutive events in a PERT chart are linked by activities, which are conventionally represented as arrows.
- The events are presented in a logical sequence and no activity can commence until its immediately preceding event is completed.
- The planner decides which milestones should be PERT events and also decides their “proper” sequence.
- A PERT chart may have multiple pages with many sub-tasks.

## **Advantages**

- PERT chart explicitly defines and makes visible dependencies (precedence relationships) between the work breakdown structure (commonly WBS) elements
- PERT facilitates identification of the critical path and makes this visible
- PERT facilitates identification of early start, late start, and slack for each activity,
- PERT provides for potentially reduced project duration due to better understanding of dependencies leading to improved overlapping of activities and tasks where feasible.
- The large amount of project data can be organised and presented in diagram for use in decision making.

## **Disadvantages**

- There can be potentially hundreds or thousands of activities and individual dependency relationships
- PERT is not easily scalable for smaller projects
- The network charts tend to be large and unwieldy requiring several pages to print and requiring special size paper
- The lack of a timeframe on most PERT/CPM charts makes it harder to show status although colours can help (e.g., specific colour for completed nodes)
- When the PERT/CPM charts become unwieldy, they are no longer used to manage the project.

## Uncertainty in project scheduling

A real-life project will never execute exactly as it was planned due to uncertainty. It can be ambiguity resulting from subjective estimates that are prone to human errors or it can be variability arising from unexpected events or risks (which can drastically affect motivation of project participants, as the new information is in conflict with personal structure of goals). The main reason that PERT may provide inaccurate information about the project completion time is due to this schedule uncertainty. This inaccuracy is large enough to render such estimates as not helpful.

One possibility to maximise solution robustness is to include safety in the baseline schedule in order to absorb the anticipated disruptions. This is called proactive scheduling. A pure proactive scheduling is a utopia, incorporating safety in a baseline schedule that allows to cope with every possible disruption would lead to a baseline schedule with a very large make-span. A second approach, reactive scheduling, consists of defining a procedure to react to disruptions that cannot be absorbed by the baseline schedule.

Another approach incorporates Monte-Carlo analysis and simulates potential effects of schedule shifts.

### 1.7.2 Tracking status of a project

So, there is a technique to collect feedback in a large-scale projects. As any project could be considered as a system, it has different number of parts. As complexity of a system increases exponentially /citeoconnor, PERT tries to define relations and predict possible system states.

Use of iterative methods simplifies the system, and makes cause-and-effect relation clear.

Now team working on a project is able to collect necessary feedback in order to understand the state of a system. Thus it is possible to measure effectiveness (and make necessary adjustments to processes). But team members should be motivated in order to perform best.

## 1.8 “Action Method” application and concept behind

This section describes an interesting technique, created by Behance company [11]. It will be further used to construct an effectiveness guide.

The Action Method begins with a simple premise: everything is a project. Most creative people struggle to make progress in all of their projects, with the greatest challenge being the sheer number of projects before a person! But once everything has been classified as a project, it is possible to break each one down into its primary components: Action Steps, References, and Backburner Items.

Every project in life can be reduced into these three primary components.

### 1.8.1 Primary components of “Action Method”

#### **Action Steps**

Action steps are the specific, concrete tasks: redraft and send the memo, post the blog entry, pay the electricity bill, etc.

#### **References**

References are any project-related handouts, sketches, notes, meeting minutes, manuals, websites, or ongoing discussions to refer back to. It is important to note that references are not actionable—they are simply there for reference when focusing on any particular project.

#### **Backburner Items**

Backburner items – things that are not actionable now but may be someday. Perhaps it is an idea for a client for which there is no budget yet. Or maybe it is something you intend to do in a particular project at an unforeseen time in the future.

Every project in life can be reduced into these three primary components.

Lets consider a sample project for a client. Assume a folder with that clients name on it. Inside the folder there is a lot of References – a copy of the contract, notes from meetings, and background information on the client. The Action Steps (to-do list) could be written as a list, attached to the front of the folder. On a sheet stapled to the inside back cover of the folder, Backburner list could keep track of the non-actionable ideas that come up while working on the project.

With this hypothetical folder in mind, it is possible to imagine that the majority of focus would be on the Action Steps visible on the front cover. These Action Steps are always in plain view, while other parts accessible during the review phase.

Personal projects can also be broken down into the same three elements. The Action Method starts by considering everything with a project lens and then breaking it down.

### 1.8.2 Action Steps in detail

Action Steps are the most important components of projects. The actual outcome of any idea is dependent on the Actions Steps that are captured and then completed by you or delegated to someone else. Action Steps are to be revered and treated as sacred in any project. The more clear and concrete an Action Step is, the less friction a person will encounter trying to do it. If an Action Step is vague or complicated, a person will probably skip over it to others on the list that are more straightforward.

To avoid this, it is required to start each Action Step with a verb:

- Call programmer to discuss...
- Install new software for...
- Research the possibility of...
- Mock up a sample of the...
- Update XYZ document for...

Verbs help to pull into Action Steps at first glance, efficiently indicating what type of action is required. For similar reasons, Action Steps should be kept short.

Ideas dont reveal themselves only in meetings, and neither should Action Steps.

**An unowned Action Step will never be taken.**

Every Action Step must be owned by a single person. While some Action Steps may involve the input of different people, accountability must reside in one individuals hands. Some people who lead teams or have assistants will capture Action Steps and delegate them to others. However, Action Step must still be owned by the person ultimately responsible.

**Every Action Step must be owned by a single person.**



The reason comes down to accountability. The practice of simply emailing someone a task to complete does not provide any assurance that it will be completed. For this reason, Action Steps that a person is ultimately responsible for should remain on your list until completed even when a person has delegated them to others. Simply marking that the Action Step has been delegated and to whom is sufficient.

**Managerial Action Steps should be treated differently.**

Aside from the Action Steps that are personal, there are three other types of Action Steps one should keep in mind as the leader of a project. The first type is delegated Action Steps. The second type is “Ensure Action Steps.” Sometimes one will want to create an Action Step to ensure that something is completed properly in the future. Rather than being a nag to a team, one can create an Action Step that starts with the word “ensure.” Creating “Ensure Action Steps” is a better alternative than sending numerous reminder emails to team members.

**The last type of managerial Action Step is the “Awaiting” Action Step.**

When one leaves a voicemail for someone, send a message to a potential customer, or respond to an email and clear it from the inbox, it is possible to forget to follow-up if the person fails to respond. So one should create an Action Step that starts with “Awaiting”. In the online task manager one will set a target date for one week later. After a week passes, one will be reminded to follow up.

**Foster an action-oriented culture.**

A team needs an action-oriented culture to capitalise on creativity and effectiveness. It may feel a bit aggressive to ask people to capture an Action Step on paper, but fostering a culture in which such reminders are welcome helps ensure that Action Steps are not lost.

## 2. Team-motivation strategies and personal productivity

In the study, conducted by Dean Spitzer, as many as 50 percent of workers said they only put enough effort into their work to hold onto their jobs. And 84 percent said they could work better - if they wanted to. [12]

Employee motivation is usually treated as a problem of individual worker. Motivation programs and initiatives try to inspire employees to work harder, but they do nothing about the work conditions that continue to demotivate those same employees.

Thus motivating a team is often more challenging than motivating a single individual. Individuals within teams operate with different goals, values, beliefs, and expectations. Yet the variety of team member personalities can be a positive force if each performer contributes his or her unique capabilities when and where needed [13] in the correct environment.

### 2.1 Motivation in Daniel Pink's "Drive"

Daniel Pink in his book, called "Drive" shows that much of beliefs about motivation are not true. He also states the problem of a large number of organisations haven't caught up to the new understanding (introduced by Harlow and Deci a few decades ago), and operate from assumptions about human potential and individual performance that are outdated, unexamined, and rooted more in folklore than in science.

Author suggests to call a system of motivation, that is based on survival needs "Motivation 1.0". "Motivation 2.0" was built around external rewards and punishments, so called "carrots and sticks" method., but it's incompatible with some of the modern thinking, organisations and tasks. The next motivation system is called "Motivation 3.0."

When carrots and sticks encounter ones third drive, strange things begin to happen. Traditional "if-then" rewards can give less of what a person want: They can extinguish intrinsic motivation, diminish performance, crush creativity, and

crowd out good behaviour. They can also give more of what one doesn't want: They can encourage unethical behaviour, create addictions, and foster short-term thinking (meaning not taking into account long-term outcome).

Carrots and sticks are still can be an effective instrument for rule-based routine tasks – because there's little intrinsic motivation and not much creativity involved. And they can be more effective still if those giving such rewards offer a rationale for why the task is necessary, acknowledge that it's boring, and allow people autonomy over how they complete it. For non-routine conceptual tasks, rewards are more perilous – particularly those of the “if-then” variety. But “now that” rewards – noncontingent rewards given after a task is complete – can sometimes be okay for more creative, right-brain work, especially if they provide useful information about performance.

Daniel Pink also states, that Motivation 2.0 depended on and fostered Type X behaviour – behaviour fueled more by extrinsic desires than intrinsic ones and concerned less with the inherent satisfaction of an activity and more with the external rewards to which an activity leads. Motivation 3.0, the upgrade that's necessary for the smooth functioning of twenty-first-century business, depends on and fosters Type I behaviour. Type I behaviour concerns itself less with the external rewards an activity brings and more with the inherent satisfaction of the activity itself. For professional success and personal fulfilment, one needs to move himself from Type X to Type I. Positively, Type I people are made, not born – and Type I behaviour leads to stronger performance, greater health, and higher overall well-being.

A person naturally seeks to be autonomous and self-directed. Unfortunately, circumstances – including outdated notions of “management” – often conspire to change that default setting and turn a person from Type I to Type X. To encourage Type I behaviour, and the high performance it enables, the first requirement is autonomy. People need autonomy over task (what they do), time (when they do it), team (who they do it with), and technique (how they do it). Companies that offer autonomy, sometimes in radical doses, are outperforming their competitors.

While Motivation 2.0 required compliance, Motivation 3.0 demands engagement. Only engagement can produce mastery – becoming better at something that matters. And the pursuit of mastery, an important but often dormant

part of the third drive, has become essential to making ones way in the economy. Mastery begins with “flow”-optimal experiences (to be considered in detail in section 2.4) when the challenges faced are exquisitely matched to abilities. Smart workplaces therefore supplement day-to-day activities with “Goldilocks tasks” – not too hard and not too easy. But mastery also abides by three peculiar rules. Mastery is a mindset: It requires the capacity to see abilities not as finite, but as infinitely improvable. Mastery is a pain: It demands effort, grit, and deliberate practice. And mastery is an asymptote: Its impossible to fully realise, which makes it simultaneously frustrating and alluring.

Humans, by their nature, seek purposea cause greater and more enduring than themselves. But traditional businesses have long considered purpose ornamentala perfectly nice accessory, so long as it didnt get in the way of the important things. But thats changingthanks in part to the rising tide of aging baby boomers reckoning with their own mortality. In Motivation 3.0, purpose maximization is taking its place alongside profit maximization as an aspiration and a guiding principle. Within organizations, this new purpose motive is expressing itself in three ways: in goals that use profit to reach purpose; in words that emphasize more than self-interest; and in policies that allow people to pursue purpose on their own terms. This move to accompany profit maximization with purpose maximization has the potential to rejuvenate our businesses and remake our world.

For example, in April 2008, Vermont became the first U.S. state to allow a new type of business called the low-profit limited liability corporation. Dubbed an L3C, this entity is a corporationbut not as we typically think of it. As one report explained, an L3C operate[s] like a for-profit business generating at least modest profits, but its primary aim [is] to offer significant social benefits.

Meanwhile, Nobel Peace Prize winner Muhammad Yunus has begun creating what he calls social businesses. These are companies that raise capital, develop products, and sell them in an open market but do so in the service of a larger social missionor as he puts it, with the profit-maximization principle replaced by the social-benefit principle.

Motivation 2.0 suffers from three compatibility problems. It doesnt mesh with the way many new business models are organizing what we dobecause were intrinsically motivated purpose maximizers, not only extrinsically motivated

profit maximizers. It doesn't comport with the way that twenty-first-century economics thinks about what we do because economists are finally realizing that we were full-fledged human beings, not single-minded economic robots. And perhaps most important, it's hard to reconcile with much of what we actually do at work because for growing numbers of people, work is often creative, interesting, and self-directed rather than unrelentingly routine, boring, and other-directed. Taken together, these compatibility problems warn us that something's gone awry in our motivational operating system. But in order to figure out exactly what, and as an essential step in fashioning a new one, we need to take a look at the bugs themselves.

One of Lepper and Greenes early studies (which they carried out with a third colleague, Robert Nisbett) has become a classic in the field and among the most cited articles in the motivation literature. The three researchers watched a classroom of preschoolers for several days and identified the children who chose to spend their free play time drawing. Then they fashioned an experiment to test the effect of rewarding an activity these children clearly enjoyed.

The researchers divided the children into three groups. The first was the expected-award group. They showed each of these children a Good Player certificate adorned with a blue ribbon and featuring the child's name and asked if the child wanted to draw in order to receive the award. The second group was the unexpected-award group. Researchers asked these children simply if they wanted to draw. If they decided to, when the session ended, the researchers handed each child one of the Good Player certificates. The third group was the no-award group. Researchers asked these children if they wanted to draw, but neither promised them a certificate at the beginning nor gave them one at the end.

Two weeks later, back in the classroom, teachers set out paper and markers during the preschools free play period while the researchers secretly observed the students. Children previously in the unexpected-award and no-award groups drew just as much, and with the same relish, as they had before the experiment. But children in the first group—the ones who'd expected and then received an award—showed much less interest and spent much less time drawing. <sup>2</sup> The Sawyer Effect had taken hold. Even two weeks later, those alluring prizes so common in classrooms and cubicles had turned play into work.

To be clear, it wasn't necessarily the rewards themselves that dampened the children's interest. Remember: When children didn't expect a reward, receiving one had little impact on their intrinsic motivation. Only contingent rewards if you do this, then you'll get that had the negative effect. Why? If-then rewards require people to forfeit some of their autonomy. Like the gentlemen driving carriages for money instead of fun, they're no longer fully controlling their lives. And that can spring a hole in the bottom of their motivational bucket, draining an activity of its enjoyment.

Lepper and Greene replicated these results in several subsequent experiments with children. As time went on, other researchers found similar results with adults. Over and over again, they discovered that extrinsic rewards in particular, contingent, expected, if-then rewards snuffed out the third drive.

These insights proved so controversial after all, they called into question a standard practice of most companies and schools that in 1999 Deci and two colleagues reanalyzed nearly three decades of studies on the subject to confirm the findings. Careful consideration of reward effects reported in 128 experiments lead to the conclusion that tangible rewards tend to have a substantially negative effect on intrinsic motivation, they determined. When institutions families, schools, businesses, and athletic teams, for example focus on the short-term and opt for controlling people's behavior, they do considerable long-term damage.

As one leading behavioral science textbook puts it, People use rewards expecting to gain the benefit of increasing another person's motivation and behavior, but in so doing, they often incur the unintentional and hidden cost of undermining that person's intrinsic motivation toward the activity.

This is one of the most robust findings in social science and also one of the most ignored. Despite the work of a few skilled and passionate popularizers in particular, Alfie Kohn, whose prescient 1993 book, *Punished by Rewards*, lays out a devastating indictment of extrinsic incentives we persist in trying to motivate people this way.

Of course, all goals are not created equal. And let me emphasize this point—goals and extrinsic rewards aren't inherently corrupting. But goals are more toxic than Motivation 2.0 recognizes. In fact, the business school professors suggest they should come with their own warning label: Goals may cause systematic problems for organizations due to narrowed focus, unethical behavior,

increased risk taking, decreased cooperation, and decreased intrinsic motivation. Use care when applying goals in your organization.

Offer a rationale for why the task is necessary. A job that's not inherently interesting can become more meaningful, and therefore more engaging, if it's part of a larger purpose. Explain why this poster is so important and why sending it out now is critical to your organization's mission. Acknowledge that the task is boring. This is an act of empathy, of course. And the acknowledgment will help people understand why this is the rare instance when if-then rewards are part of how your organization operates.

Allow people to complete the task their own way. Think autonomy, not control. State the outcome you need. But instead of specifying precisely the way to reach it, how each poster must be rolled and how each mailing label must be affixed, give them freedom over how they do the job.

Here's what you shouldn't do: Offer an if-then reward to the design staff. Do not stride into their offices and announce: If you come up with a poster that rocks my world or that boosts attendance over last year, then you'll get a ten-percent bonus. Although that motivational approach is common in organizations all over the world, it's a recipe for reduced performance. Creating a poster isn't routine. It requires conceptual, breakthrough, artistic thinking. And as we've learned, if-then rewards are an ideal way to squash this sort of thinking. Your best approach is to have already established the conditions of a genuinely motivating environment. The baseline rewards must be sufficient. That is, the team's basic compensation must be adequate and fair, particularly compared with people doing

similar work for similar organizations. Your nonprofit must be a congenial place to work. And the people on your team must have autonomy, they must have ample opportunity to pursue mastery, and their daily duties must relate to a larger purpose. If these elements are in place, the best strategy is to provide a sense of urgency and significance and then get out of the talent's way. But you may still be able to boost performance a bit more for future tasks than for this one through the delicate use of rewards. Just be careful. Your efforts will backfire unless the rewards you offer meet one essential requirement. And you'll be on firmer motivational footing if you follow two additional principles.

The essential requirement: Any extrinsic reward should be unexpected and

offered only after the task is complete.

Holding out a prize at the beginning of a project and offering it as a contingency will inevitably focus people's attention on obtaining the reward rather than on attacking the problem. But introducing the subject of rewards after the job is done is less risky. In other words, where if-then rewards are a mistake, shift to now that rewards as in Now that you've finished the poster and it turned out so well, I'd like to celebrate by taking you out to lunch.

As Deci and his colleagues explain, If tangible rewards are given unexpectedly to people after they have finished a task, the rewards are less likely to be experienced as the reason for doing the task and are thus less likely to be detrimental to intrinsic motivation.

First, consider nontangible rewards. Praise and positive feedback are much less corrosive than cash and trophies.

Second, provide useful information.

Amabile has found that while controlling extrinsic motivators can clobber creativity, informational or enabling motivators can be conducive to it.

## 2.2 Gamification

Following the success of the location-based service Foursquare, the idea of using game design elements in non-game contexts to motivate and increase user activity and retention has rapidly gained traction in interaction design and digital marketing. Under the moniker “gamification”, this idea is spawning an intense public debate as well as numerous applications ranging across productivity, finance, health, education, sustainability, as well as news and entertainment media. Several vendors now offer “gamification” as a software service layer of reward and reputation systems with points, badges, levels and leader boards.

This commercial deployment of ‘gamified’ applications to large audiences potentially promises new, interesting lines of inquiry and data sources for human-computer interaction (HCI) and game studies and indeed, “gamification” is increasingly catching the attention of researchers [24,48,58].

Whereas “serious game” describes the design of full-fledged games for non-entertainment purposes, “gamified” applications merely incorporate elements



of games (or game “atoms” [10]). Of course, the boundary between “game” and “artifact with game elements” can often be blurry is Foursquare a game or a “gamified” application? To complicate matters, this boundary is empirical, subjective and social: Whether you and your friends ‘play’ or ‘use’ Foursquare depends on your (negotiated) focus, perceptions and enactments. The addition of one informal rule or shared goal by a group of users may turn a ‘merely’ ‘gamified’ application into a ‘full’ game. Within game studies, there is an increasing acknowledgement that any definition of ‘games’ has to go beyond properties of the game artifact to include these situated, socially constructed meanings [19,67]. For the present purpose, this means that (a) artifactual as well as social elements of games need to be considered, and (b) artifactual elements should be conceived more in terms of affording gameful interpretations and enactments, rather than being gameful. Indeed, the characteristic of ‘gamified’ applications might be that compared to games, they afford a more fragile, unstable ‘flicker’ of experiences and enactments between playful, gameful, and other, more instrumental-functionalist modes.

As can be seen, this level model distinguishes interface design patterns from game design patterns or game mechanics. Although they relate to the shared concept of pattern languages [26], unlike interface design patterns, neither game mechanics nor game design patterns refer to (prototypical) implemented solutions; both can be implemented with many different interface elements. Therefore, they are more abstract and thus treated as distinct.

So to restate, whereas serious games fulfill all necessary and sufficient conditions for being a game, gamified applications merely use several design elements from games. Seen from the perspective of the designer, what distinguishes gamification from regular entertainment games and serious games is that they are built with the intention of a system that includes elements from games, not a full game proper. From the user perspective, such systems entailing design elements from games can then be enacted and experienced as games proper, gameful, playful, or otherwise this instability or openness is what sets them apart from games proper for users.

Similar to serious games, gamification uses elements of games for purposes other than their normal expected use as part of an entertainment game. Now normal use is a socially, historically and culturally contingent category. How-

ever, it is reasonable to assume that entertainment currently constitutes the prevalent expected use of games. Likewise, joy of use, engagement, or more generally speaking, improvement of the user experience represent the currently predominant use cases of gamification (in the definition proposed in this paper, gameful experiences are the most likely design goal). Still, we explicitly suggest not delimiting gamification to specific usage contexts, purposes, or scenarios. Firstly, there are no clear advantages in doing so. Secondly, the murkiness of the discourse on serious games can be directly linked to the fact that some authors initially tied the term to the specific context and goal of education and learning, whereas serious games proliferated into all kinds of contexts [61]. Thus, in parallel to Sawyers taxonomy of serious games [61], we consider different usage contexts or purposes as potential subcategories: Just as there are training games, health games, or newsgames, there can be gameful design or gamification for training, for health, for news, and for other application areas.

To summarize: “Gamification” refers to the use (rather than the extension) of design (rather than game-based technology or other game-related practices) elements (rather than full-fledged games) characteristic for games (rather than play or playfulness) in non-game contexts (regardless of specific usage intentions, contexts, or media of implementation).

This definition contrasts gamification against other related concepts via the two dimensions of playing/gaming and parts/whole. Both games and serious games can be differentiated from gamification through the parts/whole dimension. Playful design and toys can be differentiated through the playing/gaming dimension (Figure 1). In the broader scheme of trends and concepts identified as related, we find gamification or gameful design situated as follows: Within the socio-cultural trend of ludification, there are at least three trajectories relating to video games and HCI: the extension of games (pervasive games), the use of games in non-game contexts, and playful interaction. The use of games in non-game contexts falls into full-fledged games (serious games) and game elements, which can be further differentiated into game technology, game practices, and game design. The latter refers to gamification (Figure 2).

### **2.2.1 Game mechanics list**

### **2.2.2 Appropriate game mechanics for the basic project management**

Summarizing the conducted results, the following list of requirements for successful productivity application was made: Achievement game mechanics supports desire to perform tasks Pride game mechanics supports retention of joy from executed tasks Avoidance game mechanics helps a person return to application Cascading Information Theory allows to introduce difficult concepts of GTD (Getting Things Done) and increase a persons activity in the application Communal Discovery is used in collaborative tasks / task delegation Progression Dynamic helps visualize improvement and progress to a goal. Techniques used in animation to create believable characters can help to establish an emotional connection to the person

## **KPI – Key Performance Indicator**

### **2.3 Goal commitment formula**

Our lack of adequate emphasis on motivation at work has, in my view, retarded our attempt to maximize performance. In their review of leadership studies, Hogan Curphy and Hogan (1994) found that only about 30 percent of line managers are able to adequately motivate the people who report to them. They imply that in most circumstances, motivation accounts for about half of all performance results.

The late Tom Gilbert, one of the clearest thinkers in performance improvement, was fond of saying that when two people had equal abilities, the enthusiastic member of the pair would achieve about 70 percent more than the unenthusiastic person. Even more troubling is that evidence that a majority of the published studies of organizational development strategies that report measured increases in motivation are fatally flawed (Newman, Edwards and Raju, 1989; Roberts and Robertson, 1992). Strategies that may not work as powerfully or as consistently as claimed include popular employee empowerment strategies, contests, job redesign, leaderless teams and various performance recognition techniques.

If you doubt the importance of motivation in performance, check your an-

swers to the following questions. Why is enthusiastic commitment to work goals so difficult to achieve with many people, even when we pay people well? Why is it onerous, and sometimes impossible, to convince people at work to persist at vital work goals when they encounter interesting but much less important alternative goals? Why do employee reward programs and empowerment strategies sometimes fail or backfire? Do we have to pay people more to get them to work harder? Are people from different cultural backgrounds motivated differently? Is the motivation of knowledge work similar to the motivation of physical work? Is team motivation different than individual motivation? Why is it that committed people often fail to invest enough effort to fully achieve work goals even though they believe the goals to be important to them and to their organizations? These are some of the questions that trouble human performance consultants.

In the CANE model, motivation is defined as two interlinked processes. The first process leads us to make a commitment to a performance goal and persist the face of distractions from appealing but less important alternative goals. The second motivation process is concerned with the amount and quality of the mental effort people invest in achieving the knowledge component of performance goals. These two motivation processes, committed, active and sustained goal pursuit on the one hand, and necessary mental effort to tackle goal-related problems, on the other hand, are the primary motivation goals in the CANE model.

In todays complex work environments the variety of job tasks that confront all of us change constantly over time. We cannot commit ourselves equally to all tasks. We must prioritize and focus on important tasks in order to be successful. Commitment problems happen when people resist assigning adequate priority to important job tasks. Research on motivation suggests that people with commitment problems may avoid a task altogether and/or argue that the task is less important than some other set of tasks.

Three factors have been found to increase (or decrease) work goal commitment. The first factor is task assessment. All of us will analyze any task we are assigned to determine whether we can successfully complete the task. We all tend to ask ourselves two questions about new tasks - Can I do it? and Will I be permitted to do it?. If we think that we have the ability to accomplish the

goal and that we will be permitted to accomplish it, our commitment will increase (Bandura, 1997; Ford, 1992). If we doubt our ability or the organizations willingness to let us use our skills, commitment will decrease.

Emotion and commitment. The second factor influencing commitment is our mood or emotions. All positive emotions facilitate commitment and all powerful, negative emotions discourage goal commitment (Bower, 1983; 1995; Ford, 1992). This may seem like a minor issue but for temperamental people or in organizations where pressure is high and/or change is constant, negative emotional undercurrents can be strong. Angry or depressed people find it nearly impossible to make a commitment to work goals.

Values and commitment. The final factor that influences the strength of goal commitment is our personal value in the goal. It is my experience that values are the most important element in increasing or decreasing the strength of our commitments. Psychologists now have good evidence that the most important value at work is our belief about whether the achievement of a work goal will increase our personal control or effectiveness (Shapiro et al, 1996; Locke and Latham, 1990). The more we believe that achievement of a work goal will make us more successful, the higher our level of commitment to the goal. The reverse is also true. Few of us will give a high priority to tasks that we sincerely believe will lead us to fail or be perceived as incompetent Utility, Interest and Importance Values.

#### Task Assessment Solutions

Solving task assessment problems require that we convince people that they can do a job and that existing barriers to their performance will be removed. Pointing out familiar, past examples of job performance that are similar to the new task helps increase confidence. In addition, job aids can bolster confidence. Involving staff in the elimination of any procedural or policy barriers to performance reduces resistance based on task assessment. The service technicians had excellent job aids which increased their confidence about the form task. The key element here is to persuade or empower people to believe that they can succeed at the task they are avoiding. Bandura (1997) provides extensive examples of solutions in this area.

#### Mood solutions.

Mood problems often take more time to develop than task assessment or

value problems. I find mood problems to be key elements in organizations where a major culture or job change is occurring. This is particularly true in organizations that are changing from a civil service to a business culture.

Solutions that have been found to change mood states have included listening to positive mood music; writing or telling about a positive mood-related experience; watching a movie or listening to stories that emphasize positive mood states; and emotion control training through environmental control strategies including the choice of how we complete work tasks, adjusting work space and positive self talk.

#### Value solutions

The solution to most commitment problems and opportunities is to convince people that completing the task they are resisting will make them more effective and/or perceived as more effective. People simply will not do what they believe will make them less effective or less successful. Many people are suspicious of change simply because they feel that they will be perceived as less effective under novel, negative or uncertain conditions. They must be convinced that if they commit themselves to the avoided task(s) they will become significantly more effective or successful. The specific solution that accomplishes this goal may be quite different for different individuals and work cultures. Some organizations have adopted various employee empowerment solutions to value problems. In many empowerment settings staff are asked to choose their own work goals in order to get them to value their work. There is good research evidence that this is not necessary.

In cases where participatory goal setting is not possible, they find that value for the goal is enhanced if people perceive the goal to be: 1) assigned by a legitimate, trusted authority with an inspiring vision that reflects a convincing rationale for the goal (importance value), and who; 2) provides expectation of outstanding performance (importance value) and gives: 3) ownership to individuals and teams for specific tasks (interest value); 4) expresses confidence in individual and team capabilities (interest value) while; 5) providing feedback on progress that includes recognition for success and supportive but corrective suggestions for mistakes (utility value).

#### Motivation Solutions

Value problems are often multi-level issues in an organization. In this orga-

nization, there were a number of beliefs and patterns that had to be considered. The managers of the technicians had their own motivational issues to handle. For example, the senior manager acting as sponsor for the motivation project placed a number of constraints on a value solution for the technicians.

Two types of motivation are important at work, persistence and mental effort. Commitment (persistence at a task) is increased by convincing people that: a) the organization will remove unnecessary barriers; b) that achievement of the work goal will make the person more personally effective; and c) that the manager requesting the goal is credible, trustworthy, optimistic (about the person or teams ability to achieve the goal), able to clearly communicate the vision connected to the goal and willing to give ownership for the accomplishment. Mental effort is enhanced by insuring that the goal assigned is very challenging. Managers must work with people to adjust their confidence level whenever they become over confident (and thus refuse to take responsibility for errors or poor performance) or under confident (and thus find an excuse to procrastinate or avoid the goal altogether).

## **2.4 Mihaly Csikszentmihalyi's concept of "Flow"**

The author has been studying for over 20 years the states of optimal experience—those times when people report feelings of concentration and deep enjoyment. These investigations have revealed that what makes experience genuinely satisfying is a state of consciousness called flow—a state of concentration so focused that it amounts to absolute absorption in an activity.

Everyone experiences flow from time to time and will recognize its characteristics: people typically feel strong, alert, in effortless control, unselfconscious, and at the peak of their abilities. Both a sense of time and emotional problems seem to disappear, and there is an exhilarating feeling of transcendence. Flow: The Psychology of Optimal Experience describes how this pleasurable state can be controlled, and not just left to chance, by setting ourselves challenges—tasks that are neither too difficult nor too simple for our abilities. With such goals, we learn to order the information that enters consciousness and thereby improve the quality of our lives.

The studies have suggested that the phenomenology of enjoyment has eight

major components. When people reflect on how it feels when their experience is most positive, they mention at least one, and often all, of the following: 1. We confront tasks we have a chance of completing; 2. We must be able to concentrate on what we are doing; 3. The task has clear goals; 4. The task provides immediate feedback; 5. One acts with deep, but effortless involvement, that removes from awareness the worries and frustrations of everyday life; 6. One exercises a sense of control over their actions; 7. Concern for the self disappears, yet, paradoxically the sense of self emerges stronger after the flow experience is over; and 8. The sense of duration of time is altered. The combination of all these elements causes a sense of deep enjoyment that is so rewarding people feel that expending a great deal of energy is worthwhile simply to be able to feel it.

**A Challenging Activity that Requires Skills** Optimal experiences are reported to occur within sequences of activities that are goal-directed and bounded by rules—activities that require the investment of psychic energy (attention) and that could not be done without skills. Please note that activities do not need to be physical and skills also need not be physical skills. For instance, the most frequently mentioned enjoyable activity the world over was reading, followed closely by being with other people. For those who do not have the right skills, an activity is not challenging; it is simply meaningless. Challenges of competition were found to be stimulating and enjoyable. But when beating the opponent takes precedence in the mind over performing as well as possible, enjoyment tends to disappear. Competition is enjoyable only when it is a means to perfect one's skills; when it becomes an end in itself, it ceases to be fun.

**The Merging of Action and Awareness** One of the most universal and distinctive features of optimal experience is the people become so involved in what they are doing that the activity becomes spontaneous, almost automatic; they stop being aware of themselves as separate from the actions they are performing. It often requires strenuous physical exertion, or highly disciplined mental activity to enter a continuous flow.

**Clear Goals and Feedback** Unless a person learns to set goals and to recognize and gauge feedback in their activities, she will not enjoy them. For activities that are creative or open-ended in nature, a person must develop a strong sense of what she intends to do or negotiate goals and rules during the



activity. These goals and rules provide benchmarks for feedback. The kind of feedback we work toward is in, and of itself, often unimportant. What makes feedback valuable is the symbolic message it contains: that I have succeeded in my goal.

**Concentration on the Task at Hand** One of the most frequently mentioned dimensions of the flow experience is that, while it lasts, one is able to forget all the unpleasant aspects of life. The task requires such concentration that only a very select range of information can be allowed into awareness.

**The Paradox of Control** The flow experience is typically described as involving a sense of control—or more precisely, as lacking the sense of worry about losing control that is typical in many situations of normal life. What people enjoy is not the sense of being in control, but the sense of exercising control in difficult situations. However, when a person becomes dependent on the ability to control an enjoyable activity then he loses the ultimate control: the freedom to determine the content of consciousness. While experiences are capable of improving the quality of existence by creating order in the mind, they can also become addictive, at which point the self becomes captive of a certain kind of order, and is then unwilling to cope with the ambiguities of life.

**The Loss of Self-Consciousness** When in a flow experience, what slips below the threshold of awareness is the concept of self, the information we use to represent to ourselves who we are. And being able to forget temporarily who we are seems to be very enjoyable. When not preoccupied with our selves, we actually have a chance to expand the concept of who we are. Loss of self-consciousness can lead to self-transcendence, to a feeling that the boundaries of our being have been pushed forward.

**The Transformation of Time** One of the most common descriptions of optimal experience is that time no longer seems to pass the way it ordinarily does. Generally, after the experience we do not know where the time went; however, during the actual experience, time seems to stand still. The key element of an optimal experience is that it is an end in itself. It is an autotelic experience. The term "autotelic" derives from two Greek words, "auto" meaning self, and "telos" meaning goal. It refers to a self-contained activity, one that is done not with the expectation of some future benefit, but simply because the doing itself is the reward. Teaching children in order to turn them into good citizens is

not autotelic, whereas teaching them because one enjoys interacting with children is. Most enjoyable activities are not natural; they demand an effort that initially one is reluctant to make. But once the interaction starts to provide feedback to the person's skills, it usually begins to be intrinsically rewarding. Flow in the family context has five characteristics: Clarity: children know what parents expect from them; Centering: children know that their parents are interested in what they are doing in the present; Choice: children feel that they have a variety of possibilities from which to choose; Commitment: trust that allows the child to feel comfortable enough to set aside the shield of defenses and become unself-consciously involved; and Challenge: providing increasingly complex opportunities for action.

## **2.5 General guidelines by XXXXXX**

## 3. Productivity mobile applications analysis

### 3.1 Popular applications and their description

Habit List. <http://habitlist.com/> Habit List is an application to create good habits and break unhealthy ones. Habit List allows users to track habits and provide visual representations on progress. This encourages more success by seeing the results of hard work or lack thereof. The app is quick to load and the design is simple but effective. Its essentially a list of items that a user would like to complete on a certain schedule. Each habits status is communicated through a green or red indicator. Inside the colored indicator is the streak of days that a habit has been completed or not been completed. Carrot. <http://meetcarrot.com/> Carrot encourages users to get tasks done in a timely matter and they're rewarded with points that lead to unlockable features. But if they don't accomplish tasks then the app will get angry. Clear. <http://www.realmacsoftware.com/clear/> Clear uses the hierarchy of color, which is utilized to represent priority within the app. The idea is that to-do list becomes a heat map, where the warmest areas (i.e. the ones with the strongest shade of red) are the tasks should be attended first. Remember the milk. <http://www.rememberthemilk.com/> Remember the milk offers a lot of GTD functionality: tag clouds, custom task lists, geo location, Gmail extension, Google Calendar integration, etc. Wunderlist 2. <https://www.wunderlist.com> Wunderlist 2 comes with a number of features: online syncing, filtered lists, and Facebook integration, collaboration. The design spans across the multitude of different devices Wunderlist works on, giving it a single, unified interface. Flow. <http://www.getflow.com/> Flow provides all the collaboration tools needed to manage a project (files, deadlines, tasks and discussion) online in one centralized place for everyone. It allows to discuss projects, set deadlines, take notes, and keep everyone on the same page online, even when they're out of the office. Things. <http://culturedcode.com/things/iphone/> Things features a daily review to plan a day on the go: to-dos that are scheduled for today automatically appear at the top of Today list, together with to-dos that have become due; instant action to find the right tasks for the current context using tags;

predefined lists, such as today, next, scheduled, someday.

## **3.2 Game mechanics in use**

Achievement definition: A virtual or physical representation of having accomplished something. These are often viewed as rewards in and of themselves. Pride definition: the feeling of ownership and joy at an accomplishment. Avoidance definition: the act of inducing player behavior not by giving a reward, but by not instituting a punishment. Produces consistent level of activity, timed around the schedule. Communal Discovery definition: The game dynamic wherein an entire community is rallied to work together to solve a riddle, a problem or a challenge. Immensely viral and very fun. Cascading Information Theory definition: The theory that information should be released in the minimum possible snippets to gain the appropriate level of understanding at each point during a game narrative. Progression dynamic definition: this is a dynamic in which success is granularly displayed and measured through the process of completing itemized tasks. Most of the listed applications made a different approach to these mechanics. But only one application tried to develop an emotional connection to a person. It is Carrot, which uses natural language and color-coded emotions in order to response to actions of a person. If a person didnt achieve anything in a period of time, Carrot becomes angry. In addition, this application used the most of introduced game mechanics.

## **3.3 What to learn from productivity apps**

Summarizing the conducted results, the following list of requirements for successful productivity application was made: Achievement game mechanics supports desire to perform tasks Pride game mechanics supports retention of joy from executed tasks Avoidance game mechanics helps a person return to application Cascading Information Theory allows to introduce difficult concepts of GTD (Getting Things Done) and increase a persons activity in the application Communal Discovery is used in collaborative tasks / task delegation Progression Dynamic helps visualize improvement and progress to a goal. Techniques used in animation to create believable characters can help to establish an emotional

connection to the person

## 4. Methodology for stimulating high-performance of project participants

### 4.1 Team-wide productivity

Motivating a team is often more challenging than motivating a single individual. Individuals within teams operate with different goals, values, beliefs, and expectations. Yet the variety of team member personalities can be a positive force if each performer contributes his or her unique capabilities when and where needed.

The first critical issue in team motivation is to be clear about the definition of a team. Nearly everyone who studies teams emphasizes that it is unnecessary to use team motivation strategies when teams are defined as any group of two or more people with similar skills who are simply working together to achieve a common goal (Bandura, 1997). For a team to exist (for motivational purposes), team members must play different roles or bring different skills to the table. Those different skills must be required to achieve team goals. So a team is an inter-dependent group of individuals, each possessing a different set of skills but who collectively possess all of the skills required to achieve team goals.

Foster Mutual Respect for the Expertise of All Members Teams on which one or more members believe that they are working with people who lack adequate skills to achieve team goals have a major motivational problem. In some cases, this belief is simply incorrect. Highly competitive people sometimes distort the real situation and develop the self-protective view that one or more people on their team are inadequate. Competitive spirit is good. But bolstering self-confidence at the expense of others is immature and destructive. Bandura (1997) describes many studies in a variety of fields where weak link doubts about team member expertise have significantly reduced team effectiveness. Even though all team members vary in their expertise levels, when individuals respect and support one another, less-able team members tend to perform significantly better and work hard over time to increase their skills. Since individual team members tend to be self-focused and so think more about their own

contributions and ability, team members need to be reminded about the skills of other members. One effective way to accomplish this task is to actively attribute successes to each team members expertise.

**Help Weaker Members Believe That Their Effort Is Vital to Team Success**  
Occasionally teams must accommodate members who are novices or who for some reason are not able to do the best job for the team. When teams can't replace weaker members, what works best to preserve team motivation? Jackson and LePine (2003) have recent and solid evidence that when team members believe that their weakest member is merely inexperienced or has faltered for some uncontrollable reason (for example, illness, accident, or a family crisis) and can improve, they will give support provided that the person is investing effort to do so. The biggest motivational challenge on a team is faced by the weakest member. That individual must believe that what he or she contributes to the team is vital to the team's success and that the other members expect him or her to improve and succeed. Feedback to members who are working to improve must emphasize effort, not ability. When they make progress, it is best to attribute the progress to effort. When no progress is forthcoming, they need to be urged to get busy, get serious and work harder. Avoid attributing success or failure to ability. Belief that performance is due to ability tends to discourage hard work.

In many teams the motivational challenge is not a weak link, but instead a lack of cooperation and collaboration.

**Support a Shared Belief in the Team's Cooperative Capabilities**  
Healthy teams are made up of team players who cooperate with each other. One uncooperative person can damage the motivation of even the most capable team. The obvious example is the arrogant, self-focused prima donna who invests most of his or her effort trying to look good with managers and clients at the expense of the team. Less obvious but equally destructive is the outwardly supportive but silently devious back-stabber, whose primary goal is to make his or her own work highly visible.

**Hold Individual Members Accountable for Contributions to the Team Effort**  
One of the first team motivation studies (described in Williams, Karau, & Bourgoin, 1993), performed just after the turn of the century, established the principle that has been called social loafing. When people pulled as hard as pos-

sible against a rope connected to a strain gage, their best effort was recorded. When another person was added to the rope and two people pulled together, each person invested less effort in a collaborative effort than he or she did when alone. As more people were added to the rope, each person pulled less forcefully. When interviewed, most people seem unaware that they are not working as hard in a group situation as they did when alone.

Direct the Teams Competitive Spirit Outside the Team and the Organization Competition can be highly motivating for individuals or teams. Salespeople seem to thrive on it, and many people who are raised in Western cultural traditions seem to like a bit of it. One of the most common motivational team-building exercises favored by organizational consultants is a field experience where teams compete with other teams to bond and build team spirit. These events are scheduled off site and are ideally held in unfamiliar settings to interrupt habitual patterns formed at work for relating to others. Teams are challenged to do something highly novel, such as build structures or navigate difficult terrain to reach a target sooner or more effectively than other teams. Individuals are asked to notice how hard they are working, how much they are collaborating, and whether they have a real desire to win.

Teams are defined as collections of individuals with different skill sets working together to achieve goals that require members to collaboratively apply their different skills. Collections of individuals with similar skills who tackle problems do not require team motivation strategies. In addition to motivational strategies that work with individuals, interdependent teams are most motivated when they trust both the expertise and collaborativeness of other team members as well as the determination of weaker members on Direct the Teams Competitive Spirit Outside the Team and the Organization Competition can be highly motivating for individuals or teams. Salespeople seem to thrive on it, and many people who are raised in Western cultural traditions seem to like a bit of it. One of the most common motivational team-building exercises favored by organizational consultants is a field experience where teams compete with other teams to bond and build team spirit. These events are scheduled off site and are ideally held in unfamiliar settings to interrupt habitual patterns formed at work for relating to others. Teams are challenged to do something highly novel, such as build structures or navigate difficult terrain to reach a tar-



get sooner or more effectively than other teams. Individuals are asked to notice how hard they are working, how much they are collaborating, and whether they have a real desire to win. In general, team-building exercises have been found to be very effective, but they also have a potentially ugly, unintended side effect. Druckman and Bjork (1994) reviewed all studies of team building for the US National Academy of Sciences. The variety of team-building methods shared the common goal of attempting to get members of work teams to bond, collaborate, and work efficiently toward common goals by competing with other teams. The researchers concluded that many different approaches worked, but they were surprised to find that after team-building exercises, a significant number of teams were competing in a nearly suicidal fashion with other teams in their own organization. Stories include misguided team members who were found to be modifying or deleting the electronic files, intentionally misplacing or rerouting team resources, and spreading negative rumors about members of other teams in their organizations. Apparently, fostering constant, intense rivalry can help when it is directed at the organizations competition, but it can also engender a destructive level of internal competition and focus attention and energy away from organizational goals. The obvious motivational issue in this situation is to make certain that team-building exercises focus the teams competitive energy on competing organizations not on other teams within the same organization.

### Summary

Teams are defined as collections of individuals with different skill sets working together to achieve goals that require members to collaboratively apply their different skills. Collections of individuals with similar skills who tackle problems do not require team motivation strategies. In addition to motivational strategies that work with individuals, interdependent teams are most motivated when they trust both the expertise and collaborativeness of other team members as well as the determination of weaker members on their team to invest maximum effort to build their expertise. In addition, team members must believe that their own contributions to the team effort are being constantly and fairly evaluated along with the performance of the entire team. Finally, team competitiveness must be focused on opposing organizations that are struggling for the same customer base, not on teams in their own organization.

## **4.2 Personal productivity**

## **4.3 Automatisation**

## **5. Building productivity mobile application**

### **5.1 Abstractions and games**

what part does mobile application could take in the scheme of performance

#### **5.1.1 Concept of time limitation**

Describe the idea of resource limit as the mobile screen.

### **5.2 Game mechanics in use**

Describe the mechanics of the app and then check game mechanics.

### **5.3 Feedback**

Feedback is important, as a part of a flow.

### **5.4 Prototype**

Screens of the application, presentation

### **5.5 Development plan**

Next steps: how to fill the scheme

## Conclusion

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