

# Computers and fun: a guide to the underlying relationships

Work stopped 2001

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## Preface

Written in connection with Monk's Computers and Fun workshop, and the associated special issue of Personal Technologies. But this should now probably be aimed at an HCI journal.

Related papers: short one for PeTe

One with Blay in a Phil. j.?

## ToDo: revision

Things to deal with:

0. Get a conceptual grasp, ready for more processing.  
 Check unintegrated bits on fun: Blay note [end of fun sec.]; Horizon [later section]  
 Pull out or add:
  - A goal stack case analysis of playing a game
  - A goal stack case analysis of learning (purposefully)
    - And of the modes of enjoyable learning
    - AND of how actual HE learning often misses both of these.
  - A goal stack case analysis of optimal experience
  - A goal stack case analysis of funfunfun / good time / partying.
- A. Priority
  - Alan Kay on hard vs. soft fun; keynote CHI98?
  - Lepper recent papers ? in AI&ED conf.?
  - Horizon on fun: Integrate the section on it: is there a problem?
    - Re-watch the video.
    - Find hand written notes on a scrap; add to diary;
  - Boden (p.14 of this TM)
  - Quinn stuff
  - Rutkowska on possible inbuilt mechanisms for curiosity / LBE / motivations for learning.
  - \*Curiosity. Analyse this separately. Is it a synonym for play? (process goal done to discover the outcome of those "rules" i.e. that process?)
- D2. More points
  - 
  - Book "interfacing through" the ch. by carroll&rosson and The paradox of sensemaking. Learning & doing cf. LBE vs. PBL. process this.
  - 
  - Quinn. His old ITF paper. My old and newer msgs on this / or to him.
  - Would PBL students say their course was fun? If so then contradiction; or it's fun because success at the task is unexpected (int. not ext. rewards) hence pleasure. OR is the "problem" a play goal?
  - 
  - Terry Mayes: Assimilation learning is fun, but schema restructuring is aversive. ?? Process this.
  - 
  - Computer games: read the lit.; kinds of fun motivation; kinds of game.
  - 
  - Learning dualism: but develop this elsewhere (mathG)?
- B. problems/paradoxes noticed to resolve [collect in 3.55]
  - Can learning be purposeful? if so, could it be fun (non-trivial).
  - Opposite of each e.g. fun: depression, boredom, ...
  - End each subsection with a) summary b) definition c) its ontological nature: state whether a thing, a relationship, a mode of thought, ...

- C. Old TMs: i.e. more poss. problems to resolve  
Old on fun, play, etc.  
my TM on DM.
- D. New concepts to work through: i.e. go to these sections and re-work  
Conclusion to whole paper  
Computer games  
Fun and learning: Dr. Fox etc.  
The philosophy of intention and goals  
Drama  
Happiness  
The function of fun  
The importance of fun as a determinant of a lot of human activity.  
Tech. defs. of duality, dualism, complementarity sec.4.4.2  
Doing& learning duality: work into learning section4.  
Insert ref. to JohnLong in intro: problems for the intro.  
Thomas asks: how do players of space invaders know they are progressing:  
Feedback at every move;  
series of layers/levels — external monitors of learning;  
internal monitors of learning.  
[Copied from a note to myself]:  
Cflow - DM - engage - low level play:  
a)Uflow for ops and rule based acts  
b) Most valued goals.
- E. Lit. to work through... I.e. need to read what everyone says, and edit the paper to comment and attribute properly on the views.  
Witt2  
Read and check Tog.  
Laurel: check out engagement  
Educ: Rieber, Quinn,  
Check which Rieber paper has the defs. in that I comment on.  
Games: Neil, Malone.  
Boden creativity.  
Long & Dowell: check!  
Carroll&Rosson. Paradox of the active user. the paradox of sensemaking.  
Freud on play in beyond the pleasure principle.  
More Makedon; his lit. review., ...  
Winnicott (theory of child play; denies that a child is ever alone: only in relation to a parent). BUT in fact kids do play alone.  
Habermas: and other theorists of play.
- Nuttgens,P. (1988) What should we teach and how should we teach it? (Wildwood House: Aldershot)  
p.68 discussion of "work": add to Fun TM. a) mutual (human) relationships; b) p-solving. I.e. these are the properties for satisfying work, as opposed to defs based on money, ..  
p.130 Play
- Fun vs. entertainment: fun is what you make (for) yourself.
- F. New model of flow. See TM Laurillard 3 for copy of email to itforum/Dolf. Idea of popping in and out of flow, monitoring, and self-adjusting challenge level to maintain flow. Also, that this is more necessary in activities, unlike painting, where there's an external standard you are worried about meeting.

## Running summary (abstract in note form)

### Concept of fun

Int/ext. motivation (both possible together)

Process/product goals

Importance [open-ended, curiosity-based learning can't have this?]

Play = process goal + aim of discovering the outcome

=> Fun = pleasurable play [intrinsically rewarding, process goal, to discover outcome, the intrinsic motivation has low importance.]

### Linguistic usage

Triviality: not serious, not connected to important goals, (not urgent)

Int. motivation (though could also have ext.).

### Learning

Rules are the content of (almost all) learning, (Langer arg.).

All play causes learning of the effect of rules => one mode of learning.

LBE vs. PBL. Dual modes of learning.

Each has a natural source of motivation: fun vs. situativity/authenticity.

Langer's arg against "rewards" and spurious amusement in learning.

### Computer games

Need new design method (and TA). Reqs. for games defined in human response NOT in objective tasks.

Games just need to please. Fun is most important, but non-fun pleasure too.

A key idea is motive from means as well as ends; possible motives at several levels at once.

Arousal and games: motives not fixed, but vary with the hour. Games may be wanted for u-flow as well as c-flow.

**Contents / plan for long paper****Intro** (why examine C&F)**Base concepts**

- Ext/int motivation
  - Explanatory perspectives
- Process vs. product goals
- Active vs. passive goals
- Joy (emotion)
- U-flow
- C-flow
- Importance
- Arousal (hence challenge, boredom, anxiety)

**Derived concepts**

- Work vs. play. Cultural values.
- Engagement
- Drama
- Play
  - Dewey on play
  - Simulation
  - Wittgenstein and games
- Fun
- DM
- Tog
- Optimal experience
- Interest
- Curiosity
- Child's play
  - Rutkowska
  - Howes
  - Dewey on play (and work)*
  - More on play: child's play.
  - Horizon
- Humour
- Philosophical distinctions on types of goal
  - Happiness?
- The function of fun
- Fun as a major mover of human life
  
- Problems (objections), egs., cegs.
- More lit. notes
- [Summary]

**[Bigger derived concepts]**

## Learning

- Rules and learning
- Play and learning in education
- Fun and learning
- Learning and motivation: summary
  - Cycle, duality, complementarity
  - TD/BU

- More

- Summary

- Cases

## Computer games

## UID. Its relationships with fun

- Intro

- Computer games

- Learning at work and school

- Learning as a subgoal

## Conclusion.

## Abstract

Key points for abstract, intro, conclusion: fun, play, learning, (games).

List foundation concepts, derived concepts, main points on learning, and on computer games.

## 1. Introduction

Why might fun be important for computers? Major reasons include:

- The computer games industry: large and important economically and perhaps culturally, and clearly oriented to helping users achieve not work but amusement. "Fun" could be a specification for the main design requirement for this large class of software.
- Educational applications. At least some people strongly believe that fun and games are important to designing successful educational applications (Malone, 1980; Malone & Lepper, 1987; Rieber, 1986; Rieber et al., 1998; Quinn, 1997).
- Fun may be a desirable aspect of all user interface design. It has repeatedly, if mainly frivolously, been argued that all software should be enjoyable or "fun" to use. This argument deserves at least careful rebuttal, if not agreement. After all, if you have two designs equal in all other measures (e.g. functionality, work accomplished, usability costs for all main types of user), but one is more fun than the other: which will get chosen and used?
- Even if this were not true for experienced users doing familiar tasks (and in fact many users are annoyed by "fun" animations intruding on and disrupting their work) it could still be true during each user's learning phase, if there is indeed a strong connection between fun and learning. Since learnability is an important part of any design, and given the rapid turnover in software technology that forces all users to spend a significant part of their lives "updating" i.e. having to learn new designs just to do the same jobs, this could make fun important to essentially all user interface design even if not to everyday computer use.
- Furthermore, fun may be related to the theories that explain a dominant paradigm for user interfaces — direct manipulation.

Before we can reason sensibly about the extent to which, and the ways in which, fun is important in designing computer systems and software, we need to be clear about what we mean by fun and whether it is the same thing as or distinct from enjoyment, interest, and so on. The heart of this paper is section 3, in which the concepts of most direct concern (e.g. fun) are discussed in terms of a set of "atomic" concepts, introduced in section 2, that are argued to be more basic and independent concepts.

...

The most important, although not the only, connection between computers and fun is the issue of learning. It quickly emerges that there are different senses of fun(?), and different motives for learning. Still, here I hope to offer a framework to remind the reader of the set of issues, and to indicate what their various relationships are.

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Overview; examples of why it's a puzzle; e.gs of possible applications,

Fun: derogatory/trivialise (even if actually a deep pleasure). How can it mean triviality, yet actually fun seems to move huge parts of human life (in many cultures).

(So many enjoy (bits of) work but hesitate over saying it's fun.)

WORD animation is annoying (but they were just trying to make it fun)

Many games fail; only have to please a few %: unlike work UID.

John Long & Dowell: faulty def. for usability and design. I.e. taking "fun" or enjoyment seriously as a design requirement implies a major revision for our ideas on design methods.

## 2. Foundational concepts

In order to explicate the concepts we are originally interested in — fun, play, flow, humour, interest — this paper first presents a set of underlying core concepts, from which accounts of the other concepts may be constructed.

### 2.1 Extrinsic and intrinsic motivation

It is often useful to distinguish extrinsic from intrinsic motivation. The former refers to indirect, often external, reasons for action (e.g. working for pay, doing chores for a relative), while the latter refers to a person's inherent enjoyment in the activity for its own sake (e.g. eating, going to a movie). This is essentially the same distinction as instrumental vs. expressive e.g. when distinguishing the motives attributed to crimes such as fraud from those such as vandalism, and is essentially the distinction between actions done as a means to some other end, and those that directly achieve an end or are an end in themselves.

It is important to realise that these are not mutually exclusive alternatives, and some actions may be motivated in both ways (e.g. having a job that's interesting, being paid to be a rock star, taking the kids to a funfair both because they ask and because you want to go on the rides yourself). When people say they did something for fun, they are drawing attention to the existence of intrinsic motivation for the action, but that doesn't itself mean there cannot have been extrinsic motivation too. Conversely, when they say they had to go to Hawaii for work, it doesn't prove they didn't enjoy it. We should therefore notice firstly that, while intrinsic and extrinsic are contrasted, they are independent attributes that may apply in all four combinations of presence and absence; and secondly that many — perhaps almost all — human actions have multiple independent motivations. (Later we shall also discuss how people may be motivated not just to achieve effects (ends) but also by the process (means) used.)

The concept has some similarity to that of work. However the concept of work involves cultural values, and the relationship is not a simple one, as discussed in a later section. Extrinsic motivation is (here) defined to refer to any indirect motivation for an action: where it is done not for its direct effect, but indirectly as a means to an end which is motivating.

In summary: extrinsic and intrinsic motivations are not opposites, but two independent attributes which often exist together. Work vs. leisure corresponds roughly to the extrinsic motivation attribute's presence or absence. Fun involves the presence of intrinsic motivation (without ruling out the presence of extrinsic motivation as well).

### 2.1.2 Explanatory perspectives

An agent's goals may be described from several perspectives, and what counts as a means, as opposed to a "first cause" or unanalysable drive to action, depends upon that perspective. For instance, we often think of hunger and sexual desire as mechanisms from the evolutionary viewpoint (to get nourishment and breeding to happen), but as first causes from the individual's viewpoint or consciousness. A simple case of this distinction is food: from an evolutionary perspective we get hungry and want to eat in order to get nourishment; but the individual just wants to satisfy their hunger and other shades of the intrinsic desire to eat; and obesity is a frequent sign that these two are not quite always the same thing. Three major perspectives are: the evolutionary, the individual, and the social / reactive one.

We see a person move out of the way of a landside, or obey a policeman's direction on not parking, and we attribute their actions as due to things external to themselves: extrinsic motivation. But also these actions are of course performed to serve some internal goal of the individual. Thus another way of expressing the same view is to say these actions were instrumental (an indirect means) to another internal goal of theirs (staying uninjured, avoiding prosecution). In education a similar but more tricky split occurs: a teacher may have a reason for an activity, but whether and how the learner shares that can be a different issue. A teacher may force a child to do something because it's "good for them" but the child hate it; and conversely, letting a child play at whatever they want is not very likely to maximise their educative gain. These things do not have to be at odds, but just like eating they aren't guaranteed to be automatically the same.

To say an action is intrinsically motivated is to say its motivation, from the individual perspective, is basic, direct, not instrumental but "expressive" i.e. directly reflecting a first cause. To say an action is extrinsically motivated is to say it is still caused by some internal, first-cause motive from the individual perspective, but only indirectly as a means to an end, via some external conditions which, if they change, would change the actions without changing that internal ultimate goal.

We should note that we make such attributions or explanations of motive to people's actions (and our own) all the time. Psychological studies show that these attributions are frequently wrong (we know that because they are made in predictably inconsistent ways). They are also frequently wrong because in reality all events and actions have multiple causes (multiple necessary conditions, varying any one of which would change the action and event), yet almost all such attributions and explanations deal with only a single cause. Because we are reasoning beings, we may of course operate both these levels ourselves: participate in (self-) management strategies, using words like "brain storming" to "explain" play-like sessions as "really work"; we may reason about our food intake as well as eating to follow our feelings; we may negotiate with teachers to agree learning activities rather than have them imposed without reasons being given. But both levels exist, and should be distinguished if we are to keep our arguments clear.

So the intrinsic/extrinsic contrast is one from the social or reactive perspective. All actions must ultimately be for intrinsic motivations, so the distinction is really one about whether the action is an end in itself (intrinsic) or a means to another end. The description "extrinsic" corresponds to the means case, and refers to indirect motivation that has been conditioned on some external circumstance. However the terms are best at

expressing commonsense social attributions; in reality, both elements are commonly in play e.g. if you ask someone why they work in most cases there are both intrinsic and extrinsic motivations involved.

## 2.2 Process vs. product goals

The most obvious kinds of goal (or reason for activity) are defined in terms of the state of the world that results: their outcome or product. A transport goal is satisfied when and only when the parcel or person arrives at the destination; a cooking goal is satisfied by the creation of the cooked dish; a manufacturing goal by the creation of the artifact. Often such product goals are the only ones considered. We most often give a product goal as a reason when asked to explain why we are doing something.

However some activities seem to be performed for the sake of the process of doing them, not for the end state that may result. Eating is usually done for the sake of the process (from the viewpoint of the eater's motivation, even if the evolutionary reasons for the physiological structures underpinning it are in product terms to do with nutritional states): that is why food manufacturers can consider producing food that is just as enjoyable to eat but has different or no nutritional consequences (e.g. fat-free cream substitutes, artificial sweeteners). Listening to a story, reading a novel, or going to a movie are also done for the process: otherwise reading a short synopsis would be just as good, and indeed better since it wouldn't have cost so much time, and we would only say we enjoyed the end, not the beginning or middle. A number of social activities may be best understood as process goals too, such as formal consultation processes (no guarantee that they affect the outcome) and many committees.

Play is generally about a process goal, typically following rules. Playing golf is not really defined by getting the ball in the holes: if it were, you would obviously just drive round and put the ball in by hand. Football is not in fact — despite the careless and inaccurate statements frequently heard — about putting the ball in the net. If it were you would just put it there by hand, and if someone got in the way you would get in a truck and push them out of the way; in fact, there would be machines for doing it, not expensive humans. Above all, the way the rules of games are frequently changed (every few minutes by young children, revised nearly every year in many international sports) shows that it is not the end state that is the real, defining goal or aim of the activity.

For process goals, performing the process (following the rules) defines whether or not you have accomplished the activity, whether that is playing a game of football or carrying out a public consultation. Frequently no (football) goals are scored in a match and no policy recommendations are changed through consultation, but the (process) goals have still been achieved.

Frequently the underlying motivation — the reason for investing time and effort in this activity rather than another — is quite different for different people. A professional may play golf for money and fame, while a retired person may do it to exercise, be outdoors, and socialise, and a businessman to provide an opportunity to maintain useful contacts and do deals. Thus in many cases, particularly those of play, games, and sport, there are three levels of "goal" evident: the top, most fundamental, level of motivation that ultimately determines participation in the activity, the middle level of the process goal that defines the game, and often an immediate short-term product goal attempted by participants as a defining part of the process (e.g. trying to hit the ball into the hole in golf).

The case of going for a walk in the countryside or the hills provides an even clearer case of a process goal, and one where rules are less evident or important. Again, the underlying motivation may vary widely between people, but often involves enjoying exercise and scenery; whether you can be said to be going for a walk is defined by the process; and often walkers will set themselves an immediate goal, for instance a hilltop, to further structure their activity. But to pretend that the hilltop is the point of it all cannot explain why you often see some people driving to a hilltop at the same time as others choose to walk, nor why a different hilltop may be chosen at the last minute.

Extrinsic and intrinsic motivation can form all combinations with process and product goals. For example (and allowing for the fact that not all people have the same kinds of motivation for the same activities): leisure golf (intrinsic, process), formal consultation (extrinsic, process), taking a shower to feel clean again (intrinsic, product), writing a report for work (extrinsic, product).

## 2.3 Active vs. passive goals

There are two senses of "goal" that are important here, but which do not always go together. One is about what is wished for, the other about what determines our actions. The first sense is that of any objective which we wish for, would welcome if it came about, and would make an effort to bring about if that seemed practicable. The second sense is an objective which has, is, or could directly determine our actions. Active

goals are goals in both senses (e.g. eating your next meal, going on holiday, speaking to your friends), passive goals only in the former sense. For many people, being rich and famous are passive goals: things they would enjoy and value if they happened but which they are not actively working to bring about. There are several different reasons for a goal being passive or latent: not knowing a plan to achieve it, not being able to carry out the only plans known, the goal being a "maintenance" goal not currently needing action (e.g. staying alive and healthy), or simply that other goals are more urgent or important for the time being.

Process goals may often be generated in an indirect attempt to achieve otherwise passive goals. A hill walker may go on walks hoping for a sublime view, even though until she sees it she won't know if the next view will be (for her) outstanding. A theatre or concert goer may hope to be moved profoundly, but knows that this happens only rarely, yet continues doggedly. A single person may go dancing: an active process goal that may eventually accomplish a passive goal of finding a lover.

Goals, then, are things you want. Active goals are things you are currently acting to achieve, while passive goals you are not although you would welcome them should they come about. Enjoying the view while travelling is very commonly a passive goal, while for most of us acquiring money is only an active goal (unless we inherit some). It is important to remember, however, that the same thing can mean different things for different people or even for the same person at different times: it could be active or passive, intrinsically or extrinsically motivated.

## 2.4 Joy

Fun might well be thought to be, or be related to, emotion. The theory of emotion has by no means reached full consensus, but on a view loosely following Oatley's (1992) we may see emotions as essentially a kind of alarm or interrupt signal when there is a sudden change of expectation in connection with "life plans": existing plans to do with an individual's core goals. Anger and sadness are reactions to a disagreeable surprise about an important goal, while joy is a reaction to an agreeable surprise. That surprise, in the sense of a deviation from expectation and what was planned, is an essential aspect is revealed by the way that racetracks and sports events stimulate more emotion than most other things exactly because there are clear outcomes that can be wished for, but cannot be predicted with certainty. Similarly, emotion about relationships is most evident at the start when things are newest and least certain (whether in courtship or at the birth of children). Romantics may fear that the lack of visible emotion during a permanent relationship shows lack of depth, but the depth is revealed if a sudden bereavement (or other disruption) occurs; while deaths that have long been anticipated may not cause much emotion.

However it is important to remember that there are three strands or aspects to emotion, and these are seldom properly synthesised or dealt with in a single theory:

- A) The social: emotions are social communicative signals e.g. smiling, frowning
- B) The physiological: emotions are physiological changes e.g. blushing, adrenalin from anger
- C) The cognitive: emotions are mechanisms that force the person's attention on to issues that disturb major life plans. Strong emotions tend to stop you from concentrating on anything else, and lead to persistent even obsessive "brooding". They may be thought of as analogous to the operating system process-switching mechanisms called "interrupts".

The theory sketched above is essentially a cognitive one, that would additionally view the physiological aspect as a low level implementation mechanism. The analogy with an operating system explains why a special physical implementation is needed, because this is the framework within which and by which other mental processing is controlled. It is however less successful at giving necessary emphasis to the social aspects of emotion, and explaining why there are special physical mechanisms not only for internal communication and mediation between an individual's different mental processes (e.g. via hormones like adrenalin) but also between individuals (e.g. by universal facial expressions).

Joy, then, is an emotion, and stimulated by the combination of surprise and goal success, not by either alone. This on the one hand gives a clue about pleasing people e.g. in computer games (surprise is important), and on the other explains why very important goal attainments may not be accompanied by strong emotion (if they were long foreseen), and why happiness seems to be a different phenomenon.

## 2.5 U-flow

The term "u-flow" is introduced here to refer to a smooth but unconsciously managed flow of actions by an individual. Examples might be driving on a familiar route, and arriving without being able to remember anything that happened along the way. The same applies to walking to work while thinking of something else, or performing any other routine action not requiring conscious attention. Note that while performing the activity, a person in u-flow may well be fully occupied in thinking about something quite unrelated.

In terms of Activity Theory (Leont'ev, 1974, 1989; Draper, 1992; Nardi, 1996), which describes human behaviour in terms of three levels or types of mental act, this corresponds to an activity performed exclusively at the lowest level, that of "operations". The term "flow" originates in an unrelated area from Csikszentmihalyi's work (1988, 1990), where he in turn attributes it to one of his interviewees, and is adopted because it felicitously alludes to the connected and effortless properties of these modes of action, but the initial letter "U" is added to distinguish two different modes of this kind. These two modes are here defined in terms of the actor's consciousness: either attending or not attending to their actions. They are names for kinds of subjective experience, phenomena of how people can feel or experience.

## 2.6 C-flow

"C-flow" is introduced to refer to a smooth flow of actions that, in contrast to u-flow, is managed by and fills the consciousness of the actor. Examples might be driving a car sufficiently fast and dangerously to require the driver's total attention; debugging a computer program by reacting to error messages and test output; playing an absorbing computer game; being completely absorbed by watching a movie or reading a novel. (Thus c-flow may not involve physical actions at all, but always involves complete mental attention.) At each step, the next action suggests itself unproblematically: the person is not at a loss to think of anything to do, nor puzzled by worrying about how to select between more than one possible next move or about whether they have forgotten to do something important.

In terms of Activity Theory, this is activity performed wholly at the middle level of "actions". In terms of other areas of psychology, it also corresponds to an optimum balance between boredom (when neither this nor any other available action seem important) and anxiety (when too many goals and actions seem important, urgent, and uncertain to be satisfied).

More commonly, of course, our activities do not achieve uninterrupted c-flow. While watching a movie, we get a bit bored and start wondering how much longer it is going to go on, or what that actor's name is; while debugging a program, we may stop and wonder if we should take a deeper view rather than just reacting to each error message; while playing a game we may feel we don't know what to try next and feel annoyed rather than challenged.

Flow is a property of mental experience, of cognitive processing. In principle, then, it applies to mental actions with no external physical counterparts e.g. not just making something or travelling, but understanding or thinking.

## 2.7 Importance

A person has many goals (things they would like to be or become true). One of the ways in which goals differ from each other is in importance: this would determine which were chosen if only one could be attained (perhaps due to resource constraints). Many of our goals are trivial (e.g. scratching an itch). We can think of our intrinsic goals as forming a whole spectrum from trivial to maximum importance.

This is relevant in entertainment and leisure as well as in work, since while trivial things may be amusing, the most highly valued entertainment (and art) engages our deeper, more important, values. It is not an accident that love and death are perpetually popular themes, nor that tragedy moves us more than comedy.

(Independent of importance is urgency, another property of goals: whether a goal must be acted on soon if it is to be satisfied. This is just as important in scheduling: the question of making moment to moment decisions about which goal to make active and pursue; but it seems to be less relevant here.)

## 2.8 Arousal

In psychology the Yerkes-Dodson relationship (Bernstein et al. 1998, p.342) between arousal (a general level of alertness or activation measured perhaps by brain electrical activity or heart rate) and performance (how well a person does a given task) is well known. The relationship is an inverted U, so that best performance is at intermediate levels of arousal. When arousal is low you are dozy and do not perform well, but also when arousal is very high you are, in colloquial terms, "stressed out", think poorly and revert to unthinking responses such as fight or flight. The optimal arousal level is higher for easy tasks than more difficult ones. (This is almost like a speed control: obviously fast execution is better only for easier tasks, and leaves less and less time for mental processing.)

Clearly we have mechanisms for changing arousal to match demand e.g. fright can raise your arousal level very quickly indeed, but these are imperfect. Studies of people in emergencies show that frequently they are either over-aroused (panic and failure to think effectively when this can be vital) or under-aroused (many people die in fires because they do not act urgently enough). Equally it is clear that these do not entirely

override other mechanisms such as our daily rhythm, and this underlies persistent performance problems with shift work, jet-lag, and so on.

Csikszentmihalyi (1990 p.74) has a graph of skills vs. challenges, with flow as the straight diagonal line where they are in balance. The regions on either side of the line are labelled boredom (too little challenge for the person's skills at the given task) and anxiety (too much challenge). This reflects the fact that people show a tendency to adjust the challenge to match their skill (not just to maximise their success by choosing trivial tasks), and most successful games and leisure activities in general allow a wide range of skill levels to be engaged.

However process goals are not necessarily challenges of any particular degree, and so this framework does not always apply. When someone messes about with a football on the beach or chats to a neighbour, they will usually adapt the pace of their activity not just to their skills but to their intrinsic arousal at the time: the activity within wide limits does not have a single definite level of challenge because it is primarily defined by a process, not an outcome (product). Note too that skill and challenge can be in balance over the full range of arousal levels: when the person is asleep (and both are minimal) and when they are fully aroused in a high thrills activity.

Thus neither the arousal-performance nor the skills-challenges graphs by themselves take into account that our level of arousal is partly but importantly determined by other factors. At some times of day we are sleepy and a low level of challenge is quite enough to prevent boredom (a lot of evening television may match this), while at other times the very same task (or TV programme) may seem boring because we are more alert. Boredom, then, comes from too much arousal relative to the person's skill at the current task (or equally, the lack of any task challenging enough for the person's current arousal level); while anxiety (perhaps experienced as annoyance in interactions with computers) comes from either too little arousal or equally too much difficulty (challenge) in the task. It is not enough to match skills and challenges, their balance must itself be matched to the person's current arousal level which varies to some extent independently.

### 3. Derived concepts

#### 3.0 Work vs. play. Cultural values.

A common distinction to draw is between work and play. This is somewhat similar to the concept of extrinsic motivation introduced above. As noted there, intrinsic and extrinsic motivation are independent rather than opposites, and many things may be both intrinsically and extrinsically motivating, just as work may be fun as well as being paid. However work is not just extrinsic motivation.

Firstly work has (at least) two other meanings, neither simply the same as extrinsic motivation. (1) Work used to refer to physical labour: as you might still say you were going to do housework, to work on your garden, or on repairing your home. (2) More recently, work refers to whatever you do for pay. Thus you may entertain clients as part of your work, go to meetings, talk on the telephone, though sometimes other people have trouble seeing that as work because it doesn't involve great physical effort nor physical production. As service industries, not to speak of managerial work, have expanded, a large part of the economy no longer revolves around physical production or labour. Furthermore this sense of work may be expanded to cover social obligations in general e.g. charity work.

Secondly, there are other kinds of extrinsically motivated activities that are not normally called work, such as food shopping, going to the dentist, filling in one's tax return. These are often not enjoyed by the individual, yet are not primarily done for external reward other than the avoidance of penalties.

Thus the intrinsic/extrinsic distinction has limited similarity to that of work (extrinsic) vs. leisure (intrinsic) (Rieber et al. 1998), since a) leisure tends to get defined as whatever no-one else pays you for including for example charity work; b) activities like mowing the lawn and going to the dentist don't fit properly into either work or leisure; c) many people enjoy at least parts of their job, so leisure vs. work does not reliably correspond to enjoyment vs. unpleasant activity.

In addition, Makedon (1996) draws our attention to the way different cultures value work and play differently. This matters most perhaps because very few discussions or judgements allow for more than one "reason" or benefit from an activity. But this is also about the perspective adopted. Just because (if this is true) Greece emphasised the value of play, but modern society work may not mean there was any difference in actual activities, just in what was said about them. Cultural values matter because they affect what people say in justifying their actions, affect what aspects and acts get valued and noticed, and what don't (e.g. children's early education and should it look like work or like play).

This imbalance has many symptoms, when you start to look at it. Pure science is play i.e. with no connection at all in advance with applications; but we continually have to make justifications about it in terms of potential applications. Our current culture just won't take play or pure research as ends in themselves. Another interesting case is how pay for jobs almost totally ignores the often very large value to the worker in adding skill and experience. If we really valued that, often workers e.g. lawyers, architects, doctors would pay their clients for the privilege of working for them, because it increased their professional skill and knowledge. This would apply even more to instructional designers. While such things are not quite unknown, by and large the custom is that the client pays for work done for them, and the worker gets the learning for free while not being allowed to draw attention to it: even though one of the main criteria for selecting a consultant is their past experience. There is a deep complementarity between doing and learning, but our society overwhelmingly values doing over learning.

*[attempt at summary]*

Work vs. play for children means, at the commonsense level, activities directed by adults vs. spontaneous activities. In adults, this corresponds to work vs. leisure. Within "work", while today the main distinction is paid vs. unpaid activities, there are still externally compelled unpaid activities e.g. filling in tax returns. Together these make up socially extrinsically motivated actions. The second major class are privately extrinsically motivated actions e.g. going to the dentist, housework, chores in general. Thirdly is true leisure which is close to play: activities done for their own sake, and not for their effect.

(As will be noted below, Dewey uses a contrast of work vs. play to mean something rather different, and as he himself admits, is a non-standard use of language. His distinction is about the degree of realism and complexity, or length of planned causal chains, in the activity, as opposed to arbitrary makebelieve.)

### 3.1 Engagement

Brenda Laurel (1986, 1990) chose the term "engagement" to refer to the most successful subjective experiences achieved in an audience by theatrical performances, and to apply it by analogy to the most desirable human computer interfaces. They entail c-flow, as they fill the consciousness, while awareness of time vanishes; but they additionally involve deeply valued (i.e. important) issues or goals of the individual. The case of theatre reminds us that the best experiences do not depend upon, and perhaps have no connection with, advanced technology or realism. Full engagement has always been and continues to be possible without props: we may be watching a modern man in indifferent costume in front of mud coloured canvas surfaces, and yet see Lear or Oedipus and feel transported into a world of the most profound feelings possible for humans.

The best drama thus entails full attention in both the senses of cognitive mechanism and of the importance of the relevant intrinsic motivation: i.e. of both means and ends. It thus involves two separate features: engagement, and importance (connecting with one's deepest interests). Engagement is the feature of all successful drama, not only the most moving but equally, say, a farce as long as it succeeds in engrossing your attention and mental involvement. Its essence is ignoring irrelevant aspects i.e. "suspending disbelief". Engagement is essentially, then, the identical to c-flow. However the case of drama (and other arts) reminds us that this mental phenomenon is not just about a person's external actions: it is as much about avoiding other intrusive things that might disrupt it by demanding attention. C-flow and engagement thus apply not only to user activities with essential physical aspects (such as moving a mouse, driving a car, sculpting a statue) but also just as much to user activities that have no particular external physical aspect but simply consist of understanding, thinking and other essentially mental activities. C-flow, then, is a type of active mental processing. It need not be associated with any external physical actions.

In summary: Engagement is essentially identical to c-flow: it is a mode of mental processing where difficulties do not disrupt it, and apparent problems or lack of realism do not prevent the person from being conscious only of the domain presented. C-flow / engagement apply equally to physical activities and to purely mental activities such as comprehension.

### 3.2 Drama

As Laurel reminds us, then, drama may be fun, may support c-flow (engagement), and may at its best connect to our most important values. Of course, a lot of drama does not address the latter but on the contrary, like much comedy and farce, intentionally addresses triviality and may be sought after in part precisely because of that. When tired from the stresses and fatigues of everyday life, easy processing and the absence of "serious", i.e. important, issues is often felt to be desirable.

Again following Laurel, we may find theories of drama of interest. Turley et al. (1999) survey three main such theories: Stanislavsky's realism which aims to arouse emotion, Brecht's objectivism which aims to engage thought, and Boal's spect-actor paradigm which by audience interaction aims to make them consider alternative possibilities for actions and outcomes in the situation presented.

The features of drama (and other art forms) raises these issues.

- Recognition. they try to work by depicting something, which then causes recognition in the audience, who then activate tacit rules and knowledge.

Stuff on that. on not preaching a moral.

- On why we don't want a synopsis but to see the unfolding

- Why do we ever watch re-runs?

Why do we ever watch re-runs? Can't say it's play to see what results? Like rereading, and Greek drama: yes we can: only the plot outcome is known, not really how it really does come from all the tacit rules activated by recog. [Sport re-runs much less attractive than fiction re-reading: because with art, the means are gripping, while with sport often it is mainly the outcome that's of prime interest So the most common sport re-run is tiny excerpts where flashes of outstanding technique; second most common, where it happened that there was high drama i.e. event approached art with ups and downs.]

----  
Is drama fun? (the Turley et al. paper in Monk's special issue). Is it "fun" to be harrowed by films like Private Ryan?

No: fails the triviality test. OR comedy only passes this, tragedy not?

Yes: it is entertainment. Maybe: it is "culture" i.e leisure activity, but engages (at its best) deeper, deepest goals.

Turley et al.'s 3 theories of drama; addressed to audience's feelings/concepts/actions (as in interactive drama exploring alternatives); recognition vs. reflection vs. action??

Yet it is about rules and explorations (drama as essentially thought experiments: new configs. of existing known rules, play as in simulation??).

So: play yes. C-flow yes. Importance: can well be. Fun:? not trivial. Fun: but play for int. motivation. So drama is fun or better (optimal experience).

But also key issue here (also applies to best art for audience): it engages rules by recog. not generation/action; the user activity is interpretation / reception / understanding.

### 3.3 Play

Play is a subtype of process goal characterised by the aim of discovering what the outcome (product) will be. Because of this, play necessarily leads to learning: perhaps only of the outcome of one random trial, or of which player is more skillful, but often of more general rules and skills.

It is a process goal because play is activity done for the sake of the process not the result — getting the same result by other means wouldn't be the same kind of thing. For instance however much you want to win, you have played even when you lose; while if you are declared a winner by default, you have won but cannot be said to have played. It is a subtype of process goal since there are other process goal activities that are not play e.g. committees, eating for pleasure. Play (like a simulation) is furthermore undertaken in order to discover what the end result or product will be (or will feel like), in contrast to other process goals where the result may be known but not the point. It is about exploring the consequences of rules by acting on them, whether these rules are accepted from outside or changed frequently during the play activity.

Rieber et al.'s (1998) definition is "Play is a voluntary activity involving active engagement that is pleasurable for its own sake and includes a make-believe quality." This definition is evocative in considering children's play, but does not fully cover play in all cases. The make-believe notion corresponds to the rule exploration, which however is a more general notion: playing chess is exploring the consequences of the game rules, but is not really make-believe. Similarly, it is sensible for a technician to say he will play about with a piece of equipment with a view to discovering what is wrong with it: this suggests that pleasure is not a necessary, even if it is a frequent, concomitant of play, and that the "voluntary" condition too is not fundamental. In other words, play may have any motivation, even if intrinsic motivation is common. Any professional sportsman can tell you that play isn't always enjoyable, and this is even more obvious if you watch children playing together: leaving in tears ("I don't want to play any more") is a quite common occurrence. Play need not necessarily be fun (enjoyable), although when the player chooses the rules, it probably will be.

Play impulses especially in children may be, among other things, a way of increasing their level of challenge to match an intrinsic level of arousal i.e. demand for action. Children, like the young of many animals, show frequent periods of high arousal, yet they have relatively few opportunities for purposeful action (product goals) within the range of their skills; play, a process goal, can be a way of finding activity to match this innate arousal level unrelated to the immediate demands of their environment. (An evolutionary theorist might then argue that the young have high arousal in order to cause them to play, which in turn causes learning, which is of adaptive advantage.)

We might almost say that all cases of c-flow are play. To achieve flow, the actor must be in a state of capability for that task where everything they do is a smooth flow of actions, where each action leads to a state that immediately suggests the next action and they do not (have to) worry about the overall effect. In a sense, what may have been a product goal becomes a kind of process goal, and so a candidate for play. When a programmer loses themselves in extending a program, or a painter in creating their next picture they are certainly in c-flow, but sometimes might describe themselves as playing too. Certainly creative work usually has an element of doing something new, whose outcome is not foreseen and planned in detail: the actor learns from seeing how it comes out. This learning aspect was observed and described by Csikszentmihalyi. However not all cases of c-flow seem to be like that e.g. driving hard, using a direct manipulation user interface for routine work. The difference is exactly the absence of a critical feature of play: following the process in order to learn what the outcome is. Much, but not all, c-flow is play.

### 3.3.1 Dewey on play (vs. work)

Dewey's ideas about play, mainly expounded in "How we think" (Dewey 1909), are somewhat different.

#### The spectrum (p.217)

Foolery -- play -- engaging work -- drudgery

When I tear a tissue into bits and flick the debris around, I'm fooling about. It seems to be play (it certainly isn't work, or malice), but it is not only anti-social, but also pointless and unrelated to learning. Dewey stresses an inherent connection between means and ends, process and product as motives for activity. Only at the extremes (foolery and drudgery) are these divorced. I think he is keeping in mind, what I and perhaps Makedon are probably not, how children have a great amount of fantasy in their play but that this gets converted to more and more notice of real world constraints. The greater value in play is associated with that greater component of realism. The play Makedon admires in ancient Athens wouldn't look admirable if it were only fooling around. Dewey calls the realistic principle "work" (while noting that this is perverting everyday English usage): and what he is identifying is very important: the mixture and different relative emphases on fantasy and realism (what if vs. what was?).

Can I assimilate this?

- He criticises the view that there is a simple contrast of process and product activities (p.164), and argues that most actual activities are a blend of process and product goals. I agree with this: the presence of one kind of motivation is often no indication that it is the only motivation.
- While I am interested in extrinsic/intrinsic motivation, and in process/product goals, Dewey thinks the dimension of interest in (children's) activities is of more or less connectedness in an action or activity: adding together into more complex chains of effect (or not). (He calls this work vs. play.)
- Foolery: a process goal but not play in my sense. It is done because it feels good, not to discover (learn) the outcome. So is this a case of non-play but fun? This is an important example because [see section below on Horizon programme] children especially can exhibit process goals for pointless activity — just to be doing something — which may be just for their own sake. If I reserve play for exploring (activity with an interest in the outcome), then I need another word for this. There are two things here: curiosity (leading to play in my sense), and foolery (impulse to action). And furthermore, perhaps fun is at root related to foolery more than curiosity. On the other hand, even foolery is still about rules, generally in new variations of combination, so possibly still some learning residue. On the third hand, foolery seems related to u-flow and the desire for (some) games to free the conscious mind, rather than occupying and stretching it.
- Otherwise, my view that play is for learning the outcome fits in: it is just what characterises the good middle of his spectrum but not the bad extremes.

#### Makebelieve / pretend

The key thing I need is an account of children's salient mode of play and activity: makebelieve (pretend, fantasy). Not all child's play is makebelieve (tag, playing with a toy or a rattle, ...); but a lot is. What are they up to? Trying out (process goal) adult activities without understanding the adult goal of those actions.

Dewey talks about work vs. play here, meaning the degree of realism, of accepting and assimilating real world constraints on the activity. And he is right that children are up for the rewards of realism where available: of

doing real activities, valued as such by adults.

Can all process activities be seen as pretend? No. But it is acting out "what if". It is simulation. It is acting to discover (play). More realism, more learning (on the whole). So Dewey is taking play and pretend seriously as supporting learning, and pointing out that to maximise gains here means increasing realism.

### Dewey text refs

"How we think":

ch.12 p.162 "Play is the chief, almost the only, mode of education for the child in the years of later infancy."  
"Playfulness .. is an attitude of mind.... The playful attitude is one of freedom." and the important thing: play being an instance or manifestation of it.

So work is used by him as the opposite principle of realism. It is not really the product/process distinction, but within process one of how constrained the process is.

p.164. Denies process vs. product as the interesting distinction. And says the real distinction is between activity leading and amounting to something, or being merely arbitrary and moment to moment.

p.167 utility vs. fun: a distinction for adults but not for kids.

ch.16 p.217 Process and product mentioned explicitly; the spectrum; "fooling".

P.219 "free mental play ... involves seriousness ... [and] exacts accurate noting of every result .. in order [to put it] to further use.". So actually he does have the idea of play to discover results.

p.220 Art, like research, is about exploring new results for society.

### **3.3.2 Simulation**

Simulation, whether done mentally, by acting out as in a wizard of Oz technique, or by running simulation software, is a kind of play by the definitions developed here. Simulations are needed to produce particular answers from predictive theories exactly when those theories specify processes but not analytic calculation methods that allow a jump direct to the answer i.e. when the rules but not the end states are known. Running a simulation is thus a process goal: the goal of executing those rules. Furthermore, they are executed in order to learn what the end result is, just as play was defined above.

However even though simulations are at heart a process goal (the purpose is to execute the rules, not to get a specific answer such as "3.4"), they are in practice very frequently closely wrapped up as a means to a product goal e.g. calculate tomorrow's weather forecast, or whether this bridge will fail under this load. Frequently this means a whole set of related simulations are run in order to find which input parameters give rise to a pre-determined target output value. Thus many, probably most, uses of simulation are even less playful than a match in professional football, because they have been recruited as a means to a different (product) goal.

### **3.3.3 Wittgenstein**

Witt2 famously (seems to have) said that you can't define the concept of "games" (can't give sufficient and necessary conditions).

I am offering an account of play. Do I have a defence?

a) Maybe Witt didn't say that ...

b) I am analysing "play" not "games".

c) I define play by process activity not by rules

d) Boden, in her writing on creativity, makes a distinction between prescriptive/restrictive vs. generative (creative) rules. My def. of play can be either of these. There are big differences in 1) whether the player will repeat actions and rule-use or not (try once vs. always obey/involve the rule); 2) Prescriptive rules are external in one form and are transformed by the player into internal p-rules for action: very different in form. (E.g. given the prescriptive rules of a game like chess, to play, you immediately create generative rules of tactics that are consequences of the rules.) Cf. BNF for language definition, vs. the rule tables for parsers.

### 3.4 Fun

Fun could be defined as pleasurable play (i.e. a subtype of play). That is, an (a) intrinsically rewarding (b) process goal activity, that is (c) performed to discover the result, effect, or outcome of that activity, (and hence (d) is of no intrinsic importance to the person).

Fun implies (without requiring) enjoyment that is unnecessary. To say something is fun is to say that the process is enjoyable and to be neutral about whether the product is valued. Thus you might say that eating at a great restaurant was fun; while if you eat as a remedy when trembling with hunger and cold, you would not say that was fun since the focus then would be on the end result (product) and not on the process. As this example also shows, fun and related concepts are not properties of activities, but of the relationship between an activity and a particular person's goals at that time.

Clearly most uses of simulation are not fun (play perhaps, but not for pleasure). This definition also explains why we do not usually say our deepest satisfactions (the achievement of our most important intrinsic motivations) are "fun" e.g. saving someone's life, the birth of a child: intrinsically motivated yes, but product not process goals (done for effect not for their own sake) and above all not performed just to discover their effect, even though they usually are important learning experiences. Is fun always a process goal, never a product goal? You might think that seeing the Taj Mahal or blowing up a rock on the beach are both fun (for some), yet are clearly product goals defined by an end state. However the fun component seems to be to do with discovering what the effect is, or feels like, to us: repeating it again and again seldom feels like "fun". Tourists for instance typically continually go to new destinations, rather than picking one and returning there repeatedly. If a holiday maker does return repeatedly, it doesn't look like a product goal (getting there) but a process goal (being there). The discovery, even if of an internal feeling, seems essential, and so it wasn't the end state that really defined the goal.

Note however a point discussed in a later section: how the thing called fun is by definition a motive that is neither urgent nor important, yet can attract big effort and time from a person, indeed whole societies.

To repeat, then: fun is pleasurable play, is generally unimportant (not pursued out of highly valued goals), and is not a property of an activity but a relationship of an activity to that actor's goals.

#### 3.4.2 Must fun be trivial?

Fun has the connotation of triviality because it denotes enjoyment that is unnecessary: either incidental to the activity, or pursued but not for any important (highly valued) goal. This fits with the learning aspect: you don't know when you set out to learn by exploration whether what you learn will be important.

Either (A) the play was undertaken not for as a means to an end but "for pleasure" i.e. for its own sake, for intrinsic motivation; so the top goal for it all cannot be important. [Unless you can make sensible the idea of having fun as your most valued aim in life.] Or else (B) the activity was undertaken for some important, exterior reason, but the enjoyment was incidental to that. So fun is play, but where there is incidental, intrinsic enjoyment from a process activity, or the process aspect of an activity. The activity could be important (undertaken to achieve important goals), yet the enjoyment denoted by "fun" is unrelated to the importance and due to some other goal and aspect.

*See also section on optimal experience; and the point that best experience is not fun because to do with pursuing valued (important, deep) goals.*

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*Keep this, del. it; move it somewhere e.g. intro or conclusion?*

I would now say that fun is pleasurable play, to express the idea that the pleasure, though crucial to its being fun, is incidental to the intentional actions of the actor, and to not rule out cases where a fighter pilot might say a mission was fun (even though serious, life threatening, and generally not trivial in terms of the importance of life goals). My trouble now is how to account for someone who says the business of their life is fun, fun, fun. I guess that just says that they have no more important goal (i.e. are unharrassed by other goals, not that fun is frighteningly, stressfully, important), not that they don't make that the centre of their actions.

•But remember, the most important goal may still be unimportant. Though see fun as a mover of society section: how can it be unimportant when it seems to drive so much, and take so many resources? So what is important to evol/sociology perspective may be unimportant to individual perspective. Most important just means it's got to the top of the active goal stack, and is being executed. And is often done impromptu, and for short opportunistic durations.

[add this to section on importance?]

### 3.5 Direct manipulation

Direct manipulation is a dominant style of human-computer interface design, and has been subject to considerable analysis in the literature. Shneiderman (1982, 1983) coined the term and defined it in terms of properties of the software that supported it such as rapid feedback. While useful for designers, this approach fails to analyse the user experience that determines the success of the design and motivates the whole analysis. Laurel's treatment of engagement (see section 3.1 above) is the opposite or complement to that, describing the qualities of good user experience independently of the technology used to induce or support it. We may say that direct manipulation is successful when it supports engagement (c-flow), but that engagement can be supported by a wider set of user interface styles. For instance, if speech technology becomes good enough, its users may well become engaged but not through direct manipulation. We may say, then, that direct manipulation is a subtype of the class of interfaces supporting engagement, which are themselves only one type of good interface design (as argued further later).

Hutchins et al. (1986) offered a synthesis relating the notion of engagement (the resulting phenomenal state experienced by the user) with technical features like Shneiderman's (what the machine does to support this), and cognitive mechanisms (what mental steps in the user support it) to provide an account of direct manipulation. The latter aspect might perhaps be extended by the concept of c-flow: direct manipulation can be absorbing, enjoyable, and engaging (only) to the extent that it supports c-flow, where user actions follow in an unbroken stream without either frustration or anxiety about omitting important actions.

The notion of "immersiveness" is now often encountered. Sometimes it refers to the deepest kind of mental absorption and so corresponds to engagement i.e. to c-flow or u-flow; but most often is simply refers to all-embracing sensory input as in virtual reality, taking over all input to vision and perhaps sound, touch, and motion-sensing too. In that case, it is like Shneiderman's approach to direct manipulation in terms of technical features alone. As Laurel reminds us, engagement may occur with low-tech. dramatic productions, and no technical feature is either necessary or sufficient to induce flow or engagement.

*Note that DM is always? enjoyable, but not always efficient. give e.g.s. generalise to all c-flow.  
Note too: DM can't go to u-flow. (so inefficient BUT always enjoyable?)*

Why are there the 3 aspects (of ph., cog. mechs., m/c features)?

In summary:

- DM is (only) one method for supporting flow (engagement), which is (only) one way of doing good UIDs.
- There are 3 aspects to a complete theory of DM: computer techniques, phenomenal experience, cognitive processing.
- If we take the phenomenal experience as defining, then we probably want to say DM does flow, mainly c-flow. But importance is a desirable but independent additional property.
- But we can't say that DM is just c-flow. It's got to be partly about techniques (using hand-eye? IRIO?) because c-flow (engagement) can be achieved by quite different, non-DM, techniques e.g. speech technology, watching a play.

### 3.6 Tog's theory of stage magicanship and successful interface design

Tognazzini (1993) has argued that excellent user interface design is analogous to stage magicanship, and that both require three things:

- Slick technical skills concealed from the users
- Psychology: predicting users' thinking, their inferences and sometimes what they will say or do next. This allows misdirection and other cases of guiding their behaviour in ways the designer/magician wants and needs.
- Showmanship: stage managing; making it a show i.e. fun, rather than just annoying or uninteresting.

Note that these correspond to the three aspects of a complete theory of direct manipulation (and perhaps of other types of successful design): technical computer features, detailed cognitive theories, and an account of the overall subjective phenomenon of flow (engagement) to be achieved. It also supports the claim that fun or showmanship (the user and designer sides of the same thing) may be one essential aspect of good design.

### 3.7 Optimal experience

Work by Csikszentmihalyi and others (1988, 1990) has led to a theory of "optimal experience" or happiness. This work mainly relies on questionnaire and interview instruments, and has tackled many subject groups such as painters and sculptors. It attempts to describe and investigate periods of positively valued total involvement they achieve or experience, referred to as "flow" or "autotelic experience". Referring to this work, Jones (1998) listed these as components of the experience:

1. Task that we can complete
2. Ability to concentrate on task
3. Task has clear goals
4. Task provides immediate feedback
5. Deep but effortless involvement (losing awareness of worry and frustration of everyday)
6. Exercising a sense of control over their actions
7. Concern for self disappears during flow, but sense of self is stronger after flow activity.
8. Sense of duration of time is altered.

In terms of the concepts introduced earlier, this is a complex construct, offering an explanation of optimal experience as the combination of acting on important goals and c-flow as the mental mode of acting. Properties 1,3,4,6,8 and possibly 2 apply to u-flow and examples such as driving to work while being absorbed in worrying about a problem at home. If we now consider the case of driving an injured person to hospital for emergency treatment, we would add properties 2 and 5, and have an example of c-flow. The extra crucial condition (most nearly referred to by property 7) is the importance of the goal — the relationship of the activity to the individual's deepest values. Driving dangerously fast will always achieve c-flow, but if done merely for a thrill may not be satisfying in the same way as if it also relates to a deep goal such as saving someone's life or winning a driving championship. Similarly becoming immersed in debugging a computer program may be fully satisfying, but may not for someone who has come to feel it is an unworthy occupation even though they may be equally absorbed during the activity.

A further problem with Csikszentmihalyi's approach, besides its conflating of independent properties of experience, is that an alert person may flick in and out of c-flow from moment to moment e.g. think for a moment of other concerns without it breaking the mood. Questionnaires and retrospective interviews are hopelessly blunt instruments for investigating moment to moment consciousness (Hedden, 1998a, 1998b). A full account of these phenomena may still be some way off.

As discussed in the section above on play, much, but not all, c-flow is play. Optimal experience, however, probably does entail not just c-flow but play and learning, as in the examples of creative painting or programming.

Thus we would probably not normally say that optimal experience is "fun", since it concerns the pursuit of important goals rather than "trivial" (unimportant) enjoyment.

An account of optimal (most greatly valued) experience, then, requires not just c-flow, but both importance (connection to a person's deepest values and goals), and play (and hence learning).

#### 3.7.2 Happiness

Does Csikszentmihalyi's concept and account of optimal experience amount to a complete account of happiness?

Happiness often seems to be not remembered, and not very conscious (unlike joy which grabs you by the throat).

Happiness is a state of being, not a state of the world? not a feeling?

Probably we have to add a freedom from anxiety overall. C-flow includes that freedom during action; but does not address other goals than the one currently being acted on. Optimal experience includes having one of one's most important goals being the active one: the one the activity is directed at. But perhaps we have to add the idea that no other important goal is a problem for the person.

### 3.8 Interest

It is hard to find a coherent account of a very common phenomenon: that of a person looking through a newspaper or magazine or museum for something or anything that interests them, rather than for a specific piece of information (such as the weather forecast or their football team's result) although of course that is also common. Yet it is obviously important to the design of those organs and to their corresponding

computer forms, and probably to the design of games and education (where again, learners often want to learn what is recommended or mandated, rather than learn the answers to prior questions; and furthermore will learn much more effectively if they become "interested"). Newspapers' structure seems to reflect this important type of goal: articles are not consecutive, but chopped up and spread over several pages to increase readers "happening to notice" items; they have big headlines, and opening paragraphs that are meant to help readers decide whether to continue reading. The only related common concept in the computer world is that of "browsing", but that term is systematically ambiguous between a method and a goal: the method of looking at things in an undetermined and haphazard order as opposed to finding a systematic access method to match the task, and the goal of looking for anything interesting as opposed to a specific piece of information specified in advance. People often use a browsing method for a systematic goal if the right search mechanism is unavailable (e.g. flipping through an institution's web pages for a research group if the site does not have an index to all small units), and a systematic method for a browsing goal e.g. type a few terms into a WWW search engine just to see if anything interesting comes back.

*N.B. re-evaluate this in the light of learning and LBE sections.*

"Interest" is a subtype of passive or latent goals: things we value if we stumble on them, but are not at this moment pursuing directly and systematically.

### 3.9 Curiosity

Is there some special motivation?

Is our intrinsic motivation for play (for doing a process to discover its outcome): a desire for information? "To discover" is an intrinsic motive? Or perhaps "to discover" is the evolutionary perspective on it, while the individual consciousness is just "to do" i.e. to execute the process / rules.

### 3.10 Child's play

XXXX

#### 3.10.1 Rutkowska

XXXX

#### 3.10.2 Howes (1992)

Pretend play. Basically does seem to fit doing to see what happens, what it feels like. I think she says that pretend play starts as solitary, then is done in sync., by imitation (comm. by repetition and coord.), then more intentionally doing that so as to plan to comm. both receive and transmit, then differentiate roles, ... A lot of the pretend play is working on things seen or things evoking anxiety or excitement: so doing it to see what happens (exploring one's internal rule-based models by running them). Pretend play also quickly becomes interactive: depending on the other's actions. So again it needs to be performed in order to tell how it comes out.

In a sense, all play is pretend, in that it is "what if": executing rules to see what the outcome is, when the situation or basic motives do not require this action.

#### 3.10.3 Dewey on play (vs. work)

XXXX

#### 3.3.4 More on play. Child's play

'As we say in occupational therapy, "a child's work is play; a child's play is work." -- George S. Tomlin, PhD, OTR/L [in email to ITFORUM August, 1999.]

#### 3.10.5 Horizon on fun, play, ADHD

- Laughing is a cross-species standard signal
- It is not triggered by jokes, mainly, but by social interactions.
- It starts (in development) by tickling. A start of social interaction: scary but safe for the recipient.
- Play if withheld/blocked is just done more later: as if it were a fixed drive. (BUT normal play social).
- ADHD is caused by too little play. Play slowly causes development. Frontal lobe regulation of social behaviour. ADHD is (shows) a deficit in this. Play is an innate impulse in all: it spills out.
- Many teacher responses are in the wrong direction: they reduce play still further (can't cope/don't want to encourage it/ punishment; as if you punish a clamour for food by starvation).
- Why the ADHD epidemic in very recent years? There's been a recent change in cultural demands on children's self-control.

- Play in the sense of infant play, rat play: roughhousing, tickling, role reversal. Trying these "rules" out? To see what they feel like?
- Not all play is social. (contrary to some of the args. on Horizon).
- Play is being gripped by a desire to execute an action and see what it feels like; or just a desire to do it. Skiing; parachuting, exploring by going.

Play as I've defined it is interactive: with world or with others. But I defined it as a desire to execute rules already in the individual. Tickling seems against that: tickling is about being engaged by others, not having the first impulse yourself.

### 3.11 Humour

Humour is one, although only one, way to have fun and enjoyment. It is worth a brief mention here, because it is not uncommon to include humour in user interfaces in an attempt to produce fun (though sometimes it can seem that the only fun was had by the designers, not the end users).

One of the problems with humour is that, like some emotions, it has a strong social component: people are much more likely to laugh in an audience of other laughing people. Another feature is that like most cases of satisfying an "interest" goal, it involves surprise in its content or timing or delivery. That is why humour in interfaces is seldom satisfactory: most interfaces are meant to be used more than once. Even in computer games, that is the case. It is also related to "interest" in that on the whole, humour works best for topics which already interest that audience. Jokes about cars are unlikely to amuse those who don't use them, just as jokes about food processors will probably fail for those who don't cook.

*The case of "the grump": I can't remember what this example is? The trash can icon/animation MAG had/has -- "the grouch"?*

### 3.12 Philosophy of intentions and goals

There is a philosophical literature and debate on concepts of the mental states to do with generating intentional actions. The concepts (or at least words) relating to this and perhaps expressing many important distinctions, include: Goal, want, need, desire, intention, joy, happiness, motivation, satisfaction, pleasure, achievement.

My contributions to this are:

- Process as well as product goals.
- Arousal: goals and satisfaction are NOT fixed, but move about from hour to hour independent of the state of the world and of cognitive ideas.
- Intrinsic motivation affects means as well as ends: that is the lesson of flow. It's not just what you achieve as a result, but the mental/cognitive mode of the action as well.

### 3.13 The function of fun

[Move eventually to section on fun? or is separate issue/ consequence?]

They have cloned from some of your cells an 'improved' version of you. This clone is identical in its genetic and functional (explain this?) composition to you except for one particular difference, namely that it cannot experience fun. We could allow that since your clone has no experience of fun, it could not therefore distinguish those activities which are fun from those which are not ON THE BASIS OF ITS OWN EXPERIENCE. It would, however, be able to recognize the classifications made by others and therefore be able to use the word 'fun' correctly. (For all I know such people may exist). It could even publish books with titles like 'Physics can be fun'. It seems therefore that the raw psychological claim that fun has a function is false. Your 'improved fun-free' twin is in no way disadvantaged. .. Or imagine a whole species/group like this. And ask about evolutionary pressures for and against fun.

If we imagine an android or mutant unable to have fun, then they would probably be a drug addict. They would only be motivated (only act on) product goals, and have no motivation to enjoy actions for their own sake. Would probably have a lot of trouble learning, above all as infants (cf. Horizon programme on new thesis that children have a strong innate play/fun drive; and frustrating them just gets you "hyperactive disorder": it's going to come out, better adapt school and society for it.) Would be like the few freaks with no pain: actually at huge risk of dying. In fact a person with no fun drive may be more or less a depressed person: dysfunctionally reduced activity. They would manufacture only established products and be unable to invent new kinds, or to create new markets — only to follow up observations that some user had

discovered a new use for a product. They could never either do research or vote for its funding (whether from national or corporate funds), except when it had been shown definitely that there was a clear probabilistic return on particular research strategies (e.g. oil well prospecting, drug company R&D following standard procedures).

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The function of fun. Evolution and fun.

Recent research suggests children are full of intrinsic process motivation; this is close to fun, but not it exactly. It is likely to promote learning but a) not guaranteed: children do a lot of foolery too; may need curiosity too to get learning; b) animals where it is unsafe for the young to play, they don't. Strongly suggesting it is not an essential function. c) Need / weak tendency in adults to exercise is similar "drive"/"need".

Fun entails not being important (in the current judgement of the agent). This is important to people, but perhaps most to adults, as a relaxation from duty; but this makes it relative to their arousal level. Note that for both kids and adults, we want some importance and some not: too much triviality is not nice, nor too much seriousness. I.e. arousal again.

### 3.14 The magnitude of fun as a determinant of human activity

Point out how much time, money, resource is devoted to fun.

### 3.55 Problems, examples, counterexamples

"It's still the greatest championship, and we'll probably wake up on Monday morning and say, 'God, I had fun' but right now in the heat of the moment we don't like it."

Greg Norman quoted in "The Independent" Sat. 17 July 1999, front page "Anyone for crazy golf?" by Richard Williams. Greg Norman is a previous golf world champion??, and a competitor in the July 1999 Open Championship at Carnoustie, Scotland, where an unusually tough course exacerbated by bad weather produced unusually poor scores and many complaints from the competitors. (Spectators however found it rather *more* interesting than usual, and it moved to the front page of newspapers.)

Analysis: Angry because too challenging for their skill, when their deepest professional ambitions are engaged i.e. high importance for the competitors. But fun because it allowed and required unusual problem solving: unusual shots and plays; i.e. exercised their skills in new and unusual ways; so not just play to find out who wins and what score you're going to get, but play in sense of exercising new rules and situations.

#### Fun that isn't flow

Fun is pleasurable play. If there is real uncertainty, but you still want to know, then fun that isn't flow. E.g. if you have pleasure at the top level, but the means to that end involve real uncertainty. Still play because a process goal where you want to learn the outcome.

E.g.s. Courting (high uncertainty, non-routine). Early stages of learning a sport; or working out a new game (i.e. designing its rules).

#### Leisure that isn't fun

Going to the dentist, DIY, mowing the lawn.

#### Enjoyment that isn't fun

Where the pleasure isn't from play, but from other sources: sensual, revenge, winning, being praised, ....

#### Can fun ever/also be a product goal? xx

#### Serious play (that isn't fun)

There will be cases of play and LBE for work purposes first, enjoyment only second. Studying for a degree, or research as a career are often like this: play for serious rather than fun, yet intrinsically as well as extrinsically rewarding.

### 3.99 Summary: stuff not in summary at front

Optimal experience = c-flow + importance:

full attention in both means and ends:

as cog. mech. (c-flow or higher AT level), and top level goal being active.

the c-flow level of means, with deepest intrinsic motivation values/motives.

### Means and ends

#### Means

Flow or not: the AT levels are the cog.mech. alternative means:

- a) P-solving, activity, some stress.
- b) C-flow, actions, rule based, but uses c. attention.
- c) U-flow, operations. Doesn't use attention.

#### Ends

Extrinsic motivation

Intrinsic: Direct payoff:

Product goals e.g. massage, doing a birthday card for someone, ...

Process goals:

Committees, goals for own sake, eating.

To discover the effect/product [play]

*Learning*

*To experience it: learn the experience, not an idea or procedure*

## 4. Learning and its relationships to fun

Play is strongly related to learning, although it is more problematic whether fun is.

### 4.1 Rules and learning

All learning except the most alienated rote memorisation of isolated and meaningless facts is in an important sense the learning of rules. This is true not only (obviously) of learning procedures, but also of learning concepts: a general concept is a rule relating members of a class to each other and to an abstract description defining the class. To learn what "force" is in physics it is not enough, in fact is of hardly any use at all, to learn the words "a force is a push or a pull": you have to relate this phrase to the force between your hands and a supermarket trolley (stops as soon as contact is lost), the pervasive force of gravity (keeps on pulling even when the body isn't moving because it is on the ground, and also keeps on pulling even while a thrown ball is still moving upwards), and the invisible reaction force that a table applies to support a mug resting on it. We may, then, sensibly regard learning as centrally concerned with discovering the relationships between rules (including generalisations) and their consequences. If learning rules is essential, then exercising those rules is likely to have a crucial role. Langer (1997) argues that even learning normally conceived of as about rote learning of basic skills must be seen like this, at least if learning is to be effective.

Since play is about discovering the outcome of a process (the consequences of some rules), learning of some kind will always result from play. All play thus causes and supports learning, although it may not be done for that reason, and when we see kittens (or lion cubs) playing we commonly say they are training their hunting, fighting, and social skills. But it is not true that all learning is play. Play was defined above as a process goal with the aim of discovering what the outcome will be. Exercises (whether gymnastic exercises, maths problems, or French translations) are process goals from a pedagogical viewpoint i.e. the teacher believes the benefit is in doing the process, not in producing an answer useful for something else. But so often they are not play because they are not done by the learner to explore the outcome. Instead they are typically set and understood by the learner as product goals ("get the right answer") even if any surviving learning benefit comes from the process i.e. is the same as if it were done as a play activity.

### 4.2 Play and learning in education

However there are many educational arguments (although not consensus) that all learning should be play. Such arguments are closely related to Langer's (1997), to constructivism (Watzlawick, 1984) and its central tenet that learning depends upon learners building links from their own experience, activity, and discoveries to what is learned, and to the work on deep and shallow learning (Marton et al., 1984). Firstly, if learners are trying to get the right answer (product) when the pedagogical reason for the activity is in terms of the process, then the mismatch leads to many undesirable symptoms such as cheating, reproducing what the teacher expects without any belief or relationship to the evidence, learning test-passing techniques not domain competences, and so on. Secondly, a pervasive practice of those who can successfully manage their own learning is to set themselves artificial targets (as in games): a programmer who needs to learn a new language

will set themselves as an exercise a programming project of some intrinsic interest but not demanded by an outside requirement; someone who wants to learn to cook will not invite important guests to dinner, but set themselves interesting exercises and eat the results themselves. Furthermore, part of the exercise will probably not be to produce the perfect soufflé (or whatever) as defined by prior external standards but rather to explore a recipe (a set of rules) in order to see how it comes out and whether it evolves into something they themselves like. In other words, cooking (for those who are successful at it, enjoy it, and please others with it) is not really about fixed outcomes but about an interplay of methods and outcomes and discovering the relationships between them. It is coming to be recognised that this applies to programming as well. In old official stories of software engineering, you start with requirements and programming means creating software that exactly matches them. In reality, in Human Computer Interaction, and in current accounts of software engineering, it is only by creating software (often called "prototypes") that the real requirements are discovered. In this case the process is about discovering what the product is, and so is a form of play in which software engineers learn what the requirements are.

Nevertheless, despite those arguments for organising learning as play, there are also other important educational ideas that centre on organising learning around product goals and so seem to imply that neither fun nor play have much place in learning. Problem-based learning (Boud & Feletti, 1991) is increasingly being adopted by medical schools, and also some law schools and engineering departments. In this approach, lecture exposition is dropped in favour of setting learner groups a problem based on something a practitioner might face (e.g. here is a casualty from a road accident with an open fracture and extensive bleeding: what should you do?). The learners' task is to use resources (e.g. the library) to answer the problem. The feature of this approach is the organisation of learning around real world tasks: the opposite of taking a set of rules (or concepts) and playing with them to explore their range, implications, and uses. The "situativity" ideas about learning developed by Jean Lave and others are even more oriented to specific outcomes and real world settings. The essential model here is that of apprenticeship, and scaffolding learners as they acquire skills that contribute to a product outcome. These ideas also are associated with strong motivational benefits for the learners, but in a way diametrically opposed to fun: learners find them motivating exactly because they see a strong and direct connection between their learning and the real world situation they are being empowered to contribute to. This is the opposite of both frivolous enjoyment and learning for its own sake. This suggests that if play has a role, it can at most be one component or approach; and if learning can be enjoyable, fun is not the only way in which that can be so.

In fact there is a profound duality here, applying to learning both in education and in research (which is learning on behalf of a community), and perhaps in design (e.g. architecture). One half of it takes a rule or concept and explores all its implications (what does it do? what does it mean? what is it good for?). The other half takes an application or need or task, and asks what resources, methods, tools can be used to satisfy it (how can I do this? what can I use? how do I design something to perform exactly this function?). This is in fact the task-artifact cycle (Carroll et al., 1991) considered not for artifacts but for knowledge. We could call it the play/problem-solving cycle. Play corresponds to the first half (what are all the things we could use this bit of knowledge for?), but cannot directly help with the second (what are all the bits of knowledge could we use for this problem?) which corresponds to problem-based learning, applied research, functional design, and apprenticeship learning.

### 4.3 Fun and learning

If we accept the idea of that duality, then it seems we might be able to convert half of learning into play, and then that might become fun although we haven't yet discussed any reason for the added intrinsic motivation that would be necessary. However the other half of learning, associated with problem-based learning, could never be fun under the definitions used here. That is not to say, though, that such learning could not be enjoyable and intrinsically motivating: it just wouldn't be play and hence fun. Indeed, the motivational advantages of problem-based learning are widely reported, but seem to be associated with the strong perceived relevance of the learning, rather than "fun". There is a dualism of motivational sources corresponding to the duality of learning modes. This is important, not just in clarifying the terminology used here, but in understanding how learning can be motivating to learners, and how computer design could affect this; and this more general concern applies equally to how learning through play could be made enjoyable.

It might be argued that problem-based and apprenticeship learning are often intrinsically motivating because they are in fact taken as play by the learners. After all, the medical students are not faced (at this stage) with the responsibility for real casualties, just with the imagined problem; and an apprentice is not faced with the sole responsibility for producing something, just with the opportunity to contribute. It is not play because it is not process-oriented (exploring rules to see what happens), but product-oriented (seeking rules to achieve a fixed outcome). They are not like children playing at doctors and nurses (adopting surface behaviour with no underlying functionality), but are in contrast searching out the knowledge that will make them effective at

healing without having anyone role-play the patients (or nurses). Furthermore the source of the intrinsic motivation is different in kind.

Another indication comes from examining the obvious idea that has been pursued by some educational software designs of adding enjoyment as a rewarding extra ingredient e.g. by attractive sounds and pictures, and by game structures superposed on top of the pedagogical aims.

*BUT: Dr.Fox, ... amusing learners.*

*Fun as a side show, the porter in Macbeth. So manage relief; but no focus on it.*

*Memorable demos in RI lectures. Striking AND relevant.*

*Humour in the classroom is for social reasons, not learning motivation; and for change of (mental) pace: like shakespeare again.*

However Langer (1997, especially ch.3) argues that to make learning enjoyable it is best not to add "fun" because that sends the message that it is work that needs such extrinsic rewards added to it. In other words, adding a sugar coating sends the message that this learning is inherently unpleasant, when without that they might well be brought to experience it as intrinsically enjoyable. It seems probable that learning activities are, or perfectly well could be for most learners, intrinsically enjoyable and satisfying. But that is not their main motive; nor is it useful to make pleasure the main, overt goal for adult learners (young preschool children are different matter). Focussing on the pleasure does not maximise or aid the learning. Rather we may hope for the main goal to be learning; for the means to be sometimes a set of play activities, sometimes a set of task-oriented problem-solving activities; and for enjoyment to be a frequent side-effect. In fact enjoyment in learning may be like pain for bodily injuries: a useful signal worth paying attention to, but not the main point or something that cannot be ignored once duly considered.

If you ask adult learners whether their educational learning is fun, they often hesitate, and hesitate more than if you ask whether they are enjoying it. This is partly because it involves more effort than most things described as "fun", but also can be more deeply satisfying because it can engage much deeper goals. It is this deeper engagement — greater importance — we should be aiming for where possible.

#### **4.4 Learning and motivation: summary**

The two modes of learning discussed above — LBE and PBL — have complementary sources of motivation. LBE will be fun as it is defined in this paper, the enjoyment of finding out what happens if I do ... PBL has a quite different source: learning how to do or to be something that is socially respected, or otherwise desired by the learner.

To qualify as fun, learning (LBE) should have been done for enjoyment as opposed to as a means to some other end. Or at least, the intrinsic enjoyment should be unrelated to ulterior motives (cf. pilots saying flying was fun). However having other motives for the learning activity (e.g. getting it done by a deadline to avoid marks penalties) may in practice swamp any enjoyment so it is not noticed, and equally may lead to the activity being done in a different mode that prevents enjoyment.

#### **4.4.2 Cycle, duality, or complementarity**

Is the relationship of LBE (learning by exploration) and PBL (problem-based learning, or goal-directed learning) that of a cycle (as in the task-artifact cycle), a duality, or complementarity?

Dualism is a mathematical concept in which either: a) the same situation may be analysed using two apparently quite different frames of reference and description which are in fact strictly equivalent; b) given one situation, a systematic substitution may be followed to generate another different but equally true situation (lines  $\leftrightarrow$  points in perspective geometry). If that were true here, then every situation that could be seen as LBE could also be reanalysed as PBL. That is almost certainly not true in all cases, even if true in some. So dualism is not what it is.

If the relationship is a cycle then we would be in a position a bit like the M-acts in Laurillard's model of the LTP: to learn properly, a learner would always have to do both PBL and LBE on each topic, perhaps in alternation. This could also be described as complementarity: they are opposites, but you need both.

In reality, their relationship seems more tricky. We see many cases where LBE is recruited as a component, a means, for PBL; and also vice versa. For instance a programmer who is directed to learn a new programming language (or a craftsman, a new tool or machine) has therefore to do LBE: learning about an activity, not the creation of a specific product. But to do so, they will frequently set themselves a pretend project: a pretend PBL. In building something specific, they will learn much about how to operate the new thing and what its properties are. Conversely, an apprentice whose overall learning job is task-directed e.g. to

learn to be an airline pilot, may be encouraged at some times during training to play, to learn by exploration what happens when you move the controls of the trainer aircraft or simulator experimentally. There is no priority: LBE may be a tool as part of PBL, and PBL may be a tool for LBE.

Both are involved. Nesting is common. ....

Add bit on duality of motivation!!

#### 4.4.3 BU/TD

In any problem situation, you can choose to work from the end point backwards to find the solution and hopefully end up at the "start" with the given resources or starting conditions: I'll call this TD (top down, from the desired goal).

OR you can work forwards from the starting point to find a solution and hopefully stumble on a nice end-point. I'll call this BU (bottom up, from the "givens").

In a real physical maze, or a treasure hunt, you have to work BU.

In design (of a building, a piece of jewellery, whatever), TD is working from the brief; while BU is playing about with some notion, a sketch, old pieces in the studio to see what comes out: some interesting design for which a use and/or justification can be found after it is created.

In learning, TD is purposeful, learning how to do a pre-determined goal; and is like problem-based learning, and students who know they want to be a doctor and will learn whatever that takes, however otherwise boring; while BU is playful learning by exploration: taking some tool or rule and exploring what it does or means by using it.

Put like that, it seems obvious that both are equally useful, necessary; and sometimes one may work by itself (though both have an equal chance of getting lucky like that), and in hard problems, both must be pursued until they meeting in the middle (like digging a tunnel from both ends at once).

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What are the relationships among:

TD BU

Work Play

Product process

ends means

Test hyp-gen

TD/BU is the same as PBL/LBE for learning.

Because of cultural values? work is often equated with TD and play with BU; but this is wrong. Work and play are closer to product vs. process goals, and these in turn are very close to TD/BU.

#### 4.5 More

So we must surely need both methods or modes of learning — LBE and PBL — but currently there is often an over-emphasis on the criterion-driven PBL mode. We here this in government testing even of young children, in the squeezing out of play from primary schools, in students demanding what the use of this or that topic or subject is, in employers from small firms demanding what the use of anything except a skill that will be used in the first week of work.

## 4.6 Summary

### Note form

Rules are the content of (almost all) learning, (Langer arg.).

All play causes learning of the effect of rules => one mode of learning.

LBE vs. PBL. Dual modes of learning.

Each has a natural source of motivation: fun vs. situativity/authenticity.

Langer's arg against "rewards" and spurious amusement in learning.

### Abstract form Delete?

- Play was defined above as a process goal with the aim of discovering what the outcome will be. Thus all play causes learning
- Play may be done in order to learn, but is more usually done for some other reason with learning as a side-effect: for instance a person might play in order to experience being the winner, and even though they will thus learn one way of winning that may not be their main goal.
- Some educational arguments suggest that all learning should be done through play, although other more gruelling and less effective methods are widely employed.
- However there are other arguments tending against that conclusion. Play is only one mode of learning; the other complementary mode is to take a result and search for the rules to generate it.
- A play/problem-solving duality is proposed, suggesting that while play is one fundamental mode for learning it is complemented by and cannot replace another such mode consisting of task-oriented problem-solving. Two basic modes for (purposeful) learning: 1) LBE 2) Apprenticeship / learning to a fixed end spec.
- The (possible? typical?) motivations for each are also different: 1) Fun (curiosity) 2) Authenticity, achieving prior ambitions for one's own ability, and the social payoffs that come with that because capability is closely linked with social role, ID, status [in ALL societies I am claiming here].
- Intrinsic motivation for learning, then, is broader than fun, which is at most a subtype of it.
- It is this intrinsic motivation that we should seek to promote in supporting learning of all kinds (and fun is only a partial aspect of it).
- What is true for learning, applies also to design and research (which perhaps are learning on behalf of society or a company. Design, too, may be executed either in goal-driven mode (TD design) OR by exploration (esp. art school mode; fool around with an object or tool and see what comes out. That's not even bricolage but pure design.

## 4.7 Cases etc.

What are all the ways learning can be enjoyable??

Classify/divide by ext/int; as in each of ex/intrinsic ex/internal.

- Prior experience [Terry mayes; enjoy if assim; pain if accomodate?] just any rel.? Or new explanation for old experience? stories
- Connection to prior motive/desire to know something? be able to do x.?

## 5. Computer games

### Bits

• A salient feature of this area is a) what a big variety of kinds of (computer) game there is b) what a narrow section of it is addressed in most papers on it.

Standard 2 types.

Kamaguchi life things.

Card games/chess/...

A quiet game for use when tired at an airport at the end of the day.

Games for the under-aroused; and other games for the tired and over-aroused.

- Eventual joy, strong emotion.
- In games, learning happens, but is incidental? i.e. not a c. goal?

### Plan

- Distinguished as an application where intrinsic motivation is the primary requirement.
- Not just fun but direct pleasure too allowed/sought by this req.
- Fun: int. motivation for the means as well as the ends.
- Need lists/review of types of (int.) motivation.
- And review of types of game (see above).

**Draft**

We will assume here that computer games are played for amusement or fun (ignoring the possibility that they might be played professionally, and that that might require a different design) — in other words, for intrinsic motivation. We assume that computer games are designed to satisfy intrinsic motivation, and that this is the primary requirement. (This is a striking req: implications for design methods, discussed in a later section.)

Many different kinds of intrinsic motivation are possible (Malone, 1980; Malone & Lepper, 1987; Neal, 1990) including for example "idle" curiosity (who will win the match on TV? what graphics will appear on the next level of this computer game?) and arbitrary learning goals (will I get a higher score than last time? can I learn to score the maximum?). As those authors and others note, a number of different intrinsic motivations are addressed, often in combination, in computer game design.

Not all the ways a computer game may attempt to give enjoyment (i.e. satisfy various kinds of intrinsic motivation) are by play, and hence fun as it is defined here: fun is only a subtype of intrinsic motivation. The use of sensory (indeed sensuous) features e.g. colour, video, sound, music all may be attractive and rewarding to game users without being play, and indeed information as in trivia quiz answers and fact based dramas may be of this type too.

Fun seems to involve play, and play to involve performing a process for its own sake, while the wider notion of enjoyment or intrinsic motivation may equally only require a product or end state. Computer games, like any entertainment, can aim at providing both kinds of satisfaction: fun is not necessarily the whole story.

An important point to note, however, is that motivation and so fun is not in fact a property of an activity, but a relationship between that activity and the individual's goals at that moment. Most things that you find fun in the middle of a day on holiday you do not find fun when woken in the middle of a night during a work week. Furthermore, the demand level of a game if it is to be fun must be matched to the player's arousal level, which in part varies independently of the game, for instance with the time of day. One should expect to design different games for different arousal levels: for falling asleep over at night versus for being the main activity of a day. High-challenge, high arousal arcade games address one kind of user demand, but TV schedules suggest there is also a great demand for low-challenge material. As noted, it is a mistake to think this is about different user types: it is at least as much about how one individual varies from hour to hour in arousal and in how challenged they wish to be.

Similarly while one use for games is to absorb the players' attention, concentration, and abilities to the maximum extent, another use is to occupy the hands with an unconscious more or less automatic activity, leaving the mind free either to rest if tired or to brood on an unrelated problem: like going for a walk while continuing to think about the day's problems. Obviously the design of a game to require maximum mental consciousness and effort is different from the design of a game of the latter kind, to be soothing and undemanding.

## **6. User interface design, and its relationships to fun**

### **6.1. Introduction**

At least if we neglect such possibilities as electric massage attachments or microelectrodes inserted into the brain's pleasure centres, the issue of computers and fun is largely about the possible relationships between software design and fun. Since fun is a user response or experience, user related aspects of design, including the user interface, will be of central importance. This section offers some analysis of the relationships between fun and software design: where fun could and couldn't be involved.

Fun cannot be part of all software design, despite occasional libertarian claims to the contrary, at least if design is to follow users' needs and wants. If software use were always fun, it could never be a transparent means to an end: it would always be obtruding on the user's attention. This is not always what is wanted. Personal digital assistants, pocket calculators, flight deck safety systems, and so on, like the processor in your microwave oven, should surely be designed to fade into the background. Fun requires conscious attention, and we often do not want to give that when we are trying to achieve something else, just as we do not want a difficult user interface to intrude on and distract from a work task.

However there are three different major cases where fun is, or could usefully be, important in user software.

## 6.2. Computer games

The key point is that in games, the main user goal (and design requirement) is to satisfy the user's intrinsic motivations. These include fun; but also may include non-fun intrinsic motives e.g. product goals e.g. sensual pleasure from VR immersiveness. Such design must address both process and product goals; and address both those ends (goals) and also the "means" or cognitive modes i.e. whether to use flow. Flow is probably the best current theory of pleasant means.

However we have to realise that a range of kinds of needs should be addressed by a full theory of games design. This includes games to occupy the automatic while the conscious mind addresses something else, as well as games that absorb the whole mind. Furthermore, the level of challenge and absorption partly depends on the user's level of arousal e.g. due to fatigue and time of day effects: different games are required for different such levels.

The major challenge is to take full account of designing for users' intrinsic motives and NOT for work motives, externally defined. This has major implications for software design methods and theories. Whenever software is designed for leisure use i.e. where the user's main goal or "task" is amusement, and the software is designed to serve that end, then fun is centrally relevant. This in itself is an important point to recognise for HCI and software design in general. Dowell & Long (1989, 1998) conceive of human factors, cognitive engineering, and HCI as inherently about work and work systems. This is not an incidental feature of their analysis: they see the external work domain as the sole locus of benefits for the interaction and the user as the locus of (usability) costs. It is an important feature of their analysis that the purpose and benefits are external and "objective": they do not address the implications of user-centered design suggested by the case of computer games — that the chief requirements for a design could be located in a human response (did the user have fun?), not in some external work product. Their approach is thus clearly inadequate to cover the computer games industry (now said to have a global turnover greater than that of Hollywood), let alone the cases discussed below where human users may enjoy the interaction even though that is not the governing purpose. None of the peer commentaries published with their second paper mentions this point, and equally most task analysis methods cannot cope with "tasks" that are user mental phenomena rather than external states of the world. This suggests that it requires emphasis, theoretical attention, and exploration of the consequences for methodological formulations. Fun is a serious business for computers, whether measured in dollars or in the changes to design methods now clearly required if published methods are to match the needs of actual practice in major industries.

## 6.3. Learning at work and school

The second major area where fun could be important to computer applications is wherever learning is an important part of the work domain, and computers are at the centre of that work. In skilled jobs, particularly "professional" ones, where each project is different, the worker learns more about the work domain in finding the solution to the current project, and so becomes more experienced and more valuable to clients. In jobs where software is at the centre of work (not a low level tool, but the main means to major work goals), then in principle it should be designed to promote this domain learning. Furthermore, there are educational applications, where learning is the whole purpose of the software. There are arguments that play and fun could be inherently involved.

See the arguments in earlier sections.

We may perhaps conclude that fun raises issues that are important to designing software that supports learning, but that while related, it is not at the root of the matter. If play has a role, it can at most be one component or approach: there seem to be two complementary major modes of learning (by exploring, and by apprenticeship to a definite end), and play/fun applies only to the former. Similarly, in considering the motivations for learning, if learning can be enjoyable, fun is not the only, and perhaps not the best, way in which that can be so: fun is not the motive for apprenticeship. It could be the motive for LBE, but may not be the best motive even for that.

## 6.4. Learning as a subgoal

Most software involves the user in some new learning of the interface. As hardware and operating systems change regularly, most users are involved in regular retraining whether they like it or not. Could fun be relevant to this learning as a means to end?

In principle we might expect fun to make a contribution, applying the issues about learning discussed above to the case of learning a user interface. However this seems to be a most difficult area. Humour wears thin instantly, and "rewards" such as little animations are very often resented if they take any time or attention

during a work goal. So often such "features" seem to be much more amusing and motivating to the programmer who created them than they do to the end user. The key almost certainly is the user's goals at the time: fun is not a property of software, but a relationship with the user's goals at that moment. If they are trying to get work done, then any feature that obstructs that will be as unwelcome as a phone call in the middle of the night to invite you to a party. We should probably conclude that tutorials might possibly be designed as fun (where learning will be the main goal), but on-the-job help (where learning is at most a subgoal) probably can not.

Like DYK, offering learning through play is good iff it can be always available, never intrusive. Tutorials can be designed as fun; but on the job help probably cannot. Text below is missing the point on DYK, Owen, its adoption by microsoft.

## 7. Conclusion: computers and fun

*Can't write this? till paper ideas complete*

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What is meant by fun. Types of fun.

All benefits of designs -> fun -> different types of fun.

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*Draft: conclusion from short paper:*

The view taken in this paper is that fun is pleasurable play: that is, to satisfy some intrinsic motivation. Since intrinsic and extrinsic motivation are independent, fun may often co-exist with additional "work" motivations. Play is activity defined by a process, undertaken to discover what the result will be. It will result in learning, but is often undertaken for other reasons; just as much learning does not involve play. Enjoyment (intrinsic motivation) is the main aim of computer games; but fun is only one kind of enjoyment, so game design may consider other kinds as well.

The issues raised by and involved in understanding fun are important in many ways to designing computer software, and should be taken seriously. However the relationship is not simple: for instance it is not true to say that all software should involve fun. The main connections seem to involve two things. Firstly, learning has an important connection with play, and so with fun, and almost all computer use involves human learning. Secondly, providing enjoyment is now a defining requirement of an important class of software, and this has not been sufficiently recognised in our analyses and design methods. Furthermore there seem to be several ways in which this can be important: as an end in itself, or as a property of the mental processing accompanying interactions aimed at something else. These "flow" experiences relate to the deepest absorption seen in software users, and are clearly a design aim for both computer games and educational software, even when users would not choose the word "fun".

## Acknowledgements

This paper originates in the problem implied and posed by Andrew Monk's decision to organise a workshop on "computers and fun". To decide whether and in what way that topic is important, required an analysis like the one attempted here.

It also owes a debt to the discussion on ITFORUM (an email discussion list concerned with computers and education); in particular, to Joe Beckmann's strong recommendation of Langer's book, and Lloyd Rieber's papers on fun and educational software.

Blay Whitby.

Clark Quinn?

GIST and ChrisJ session(s).

**xx. Huizinga**

Move this tmp. section e.g.: to Makedon, and culture and play.  
 OR to play in general: what is it.  
 This book now has George Steiner intro.

p.10 "[Play] is an activity which proceeds within certain limits of time and space, in a visible order, according to rules freely accepted, and outside the sphere of necessity or material utility. The play-mood is one of rapture and enthusiasm, and is sacred or festive in accordance with the occasion. A feeling of exaltation and tension accompanies the action, mirth and relaxation follow." Steiner adds "Seriousness is, most emphatically, not the opposite of play. Play can be, and very frequently is, of the utmost seriousness. Thus the cheat is far less hated or chastised than the spoil-sport, the man who somehow subverts and shatters the validity, the importance of the game." [and has no clear opposite.]

"genuine, pure play is one of the main bases of civilization".

Steiner ends by saying it's enjoyable, but not trustworthy as a book: the evidence is low quality and arb. selected; and it seems to ignore all the 20C work on the nature of play. It takes a gloomy view (like Makedon) that play is not valued now as it always has been in previous cultures; but this may be based on a false and rosy view of earlier cultures as colourful.

So: certainly about rules; close links to war, at least war with rules.

His essential claim is that play is a deep aspect of culture: not a part or a product.

p.20 He rebuts the notion, common even then, of explaining play in animal as training with the arg. that that doesn't explain why its fun: absorbing, enjoyed, .... why is it intense, ...

p.21 [fun] "As a concept, it cannot be reduced to any other mental category. No other modern language known to me has the exact equivalent of the English 'fun'.". [Huizinga was a linguist and historian.]

**xx2. gilmore**

Move this tmp section: to section on fun for all UIDs.

Quinn argued against my arg. that fun will detract from UID transparency for getting things done; and ref. to Golightly & Gilmore (1997).

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