



**ZOI**

**Department of Digital Fabrication**

# **Adapting machines to people not people to machines**

**Study on Human-Computer field about Analog and Digital User Interface  
for CAD and CAM processes**

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## **ABSTRACT**

### **Background and Purpose.-**

This research has more than 5 years of background and experimentations about creative people in field of Human-Computer Interaction. User Interfaces for analog and digital processes are explored. It is important for the future of creative expression by Computer Aided Design and Machining. The purpose is focus to contribute for the development of new products focused in human conditions and capable to adapt functions for digital and physical user needs.

### **Methods.-**

Quantitative methods have been applied to recollect information about habits and preferences a main profile denominated Creative User. Furthermore rapid prototyped and design process technics have been applied to propose a possible solution and finally quantitative and qualitative methods validate presented solution called The Bits and Atoms Pen.

### **Results.-**

The application of surveys and rapid prototyping displayed impressive information about Creative User and CAM and CAM processes. Additionally prototype contribute effectively on the study.

### **Conclusions.-**

Important findings have been discover for the acceptations that prototype have by Creative User. Possibly prototype would facilitate Human-Computer Interaction for people without previews knowledge in computing. Also findings could contribute with Computer Aided Design and Machining studies.

# ÍNDICE

1	INTRODUCTION	3
1.1	IMPORTANCE OF THE RESEARCH	3
1.2	OBJETIVES	3
1.3	OVERVIEW	3
1.4	LITERATURE REVIEW	4
2	METHOD	8
2.1	CONTEXTUALIZACIÓN INTRODUCTORIA	8
3	RESULTS	11
3.1	CREATIVE USER HABITS AND PREFERENCES	11
3.2	RAPID PROTOTYPE	12
3.2.1	Design process	13
3.2.2	Rapid prototype	13
3.3	VALIDATION	16
4	DISCUSSION	22
4.1	CONTRIBUTION OF RESEARCH	22
4.1.1	Significance of results of first survey	22
4.1.2	Significance of results of rapid prototype	22
4.1.3	Significance of results of second survey	23
5	CONCLUSIONS	24
5.1	OBJETIVES	24
5.2	MAJOR FINDINGS	24
5.3	IMPLICATIONS OF FINDINGS	25
5.4	CAVEATS AND LIMITATIONS	26
5.5	SCOPE OF FUTURE RESEARCH	26
	REFERENCES	27

## FIGURE INDEX

- Figure 1. Sketchpad: a man-machine graphical communication system. 5
- Figure 2. PLOTTER USED WITH SKETCHPAD. A digital and analog control system makes the plotter draw straight lines and circles either under direct control of the TX-2 or off-line from punched paper tape. Font (Sutherland, 2003) 5
- Figure 3 and 4. Actual CAD and CAM processes. 6
- Figure 6. Carpenter testing CNC milling machine with Bits and Atoms Pen. 9
- Figure 7. First sketch of Bits and Atoms Pen. 12
- Figure 8. Prototyping process of Bits and Atoms Pen 14
- Figure 9. Photography and digital illustration that describes Bits and Atoms Pen. 15

# **1 INTRODUCTION**

## **1.1 IMPORTANCE OF THE RESEARCH**

This research has more than 5 years of background and experimentations about the relationship between humans and tools with analog and digital user interfaces. It is important for the future of manufacturing and creative disciplines. It will contribute for the development of new products focused in human conditions and capable to adapt functions for digital and physical user needs. It will add an exploration of an intuitive digital and analog interface to use actual manufacturing technologies.

## **1.2 OBJETIVES**

The first objective of this investigation seeks to find an efficient Analog and Digital User Interface for CAD and CAM processes bringing an appropriate tool for creative users. Study is focus on Human-Computer Interaction with a design perspective about User Interface. This focus will help to understand if the user needs to adapt for machines or if the machines need to be adapted for the user.

Second objective aims to validate the rapid prototype developed to help creative users for the use of Computer Aided Machines measuring user acceptance.

## **1.3 OVERVIEW**

“Adapting machines to people not people to machines” research covers the adaptation process of creative user to CAD and CAM, analog and digital environmental interface, numeric controlled machines and the problem of complex analog and digital processes and environmental interface. Also quantitative method it is use to analyze an appropriate analog and digital interface for creative users and adaptation problems they have using numeric

controlled machines. Design process is involved to rapid prototype a possible solution and finally it is validate by users.

#### **1.4 LITERATURE REVIEW**

When computing started the paradigm of artificial intelligence appeared immediately and some new user's expectations were not filled by computers and programs. According to Bazjanac the promise of Computer Aided Design (CAD) at the beginning achieve to be a tool that would do almost all architects and designers work including design process. Nonetheless, the User Interface becomes the first problem to solve because communication between humans and computers was unfriendly defaulting interaction (Bazjanac, 1975).

User Interface (UI) is defined as a subcategory of a field of study called Human-Computer Interaction (HCI) that aims to join human and computer capabilities to satisfy human needs in the most efficient way. Galitz affirm that User Interface is part of a product that is directly related with user senses touch, sight, hearing, smell and/or taste. User interface in HCI context has two components input and output. Input is related with the information that user introduce to the computer and output is the mechanism that computer use to conveys with the user (The Essential Guide to, p. 4).

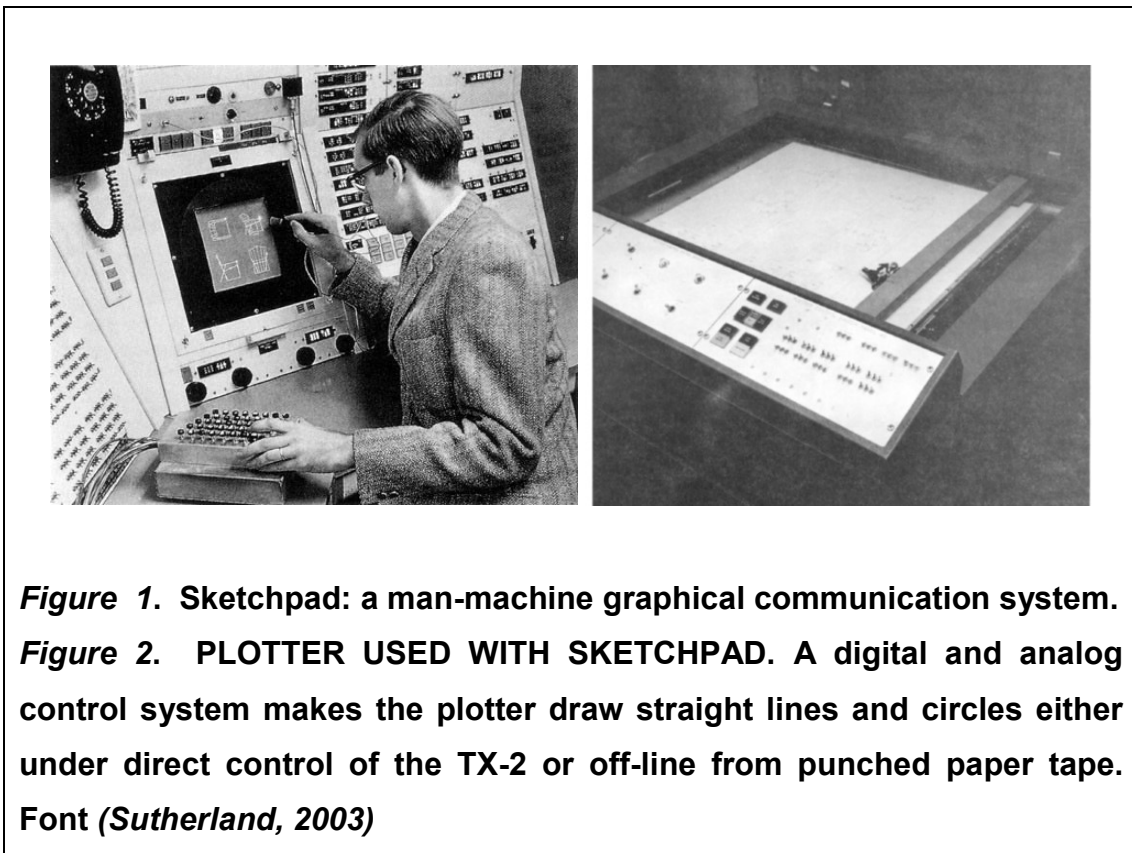
In Human-Computer Interaction the information that user and computer exchange it is being converted into analog and digital because computer need digital information to execute processes and humans senses perceive physically analog information.

In this research Analog and Digital User Interface ADUI will be mentioned. Understanding "User Interface" as Galitz defined, "analog" as physical characteristics or information of a product capable to be perceived by human senses and "digital" information or software that is processed inside a computer. At this point an Analog and Digital User Interface allow human to communicate

with computer and computer conveys with the user satisfy human needs in the most efficient way.

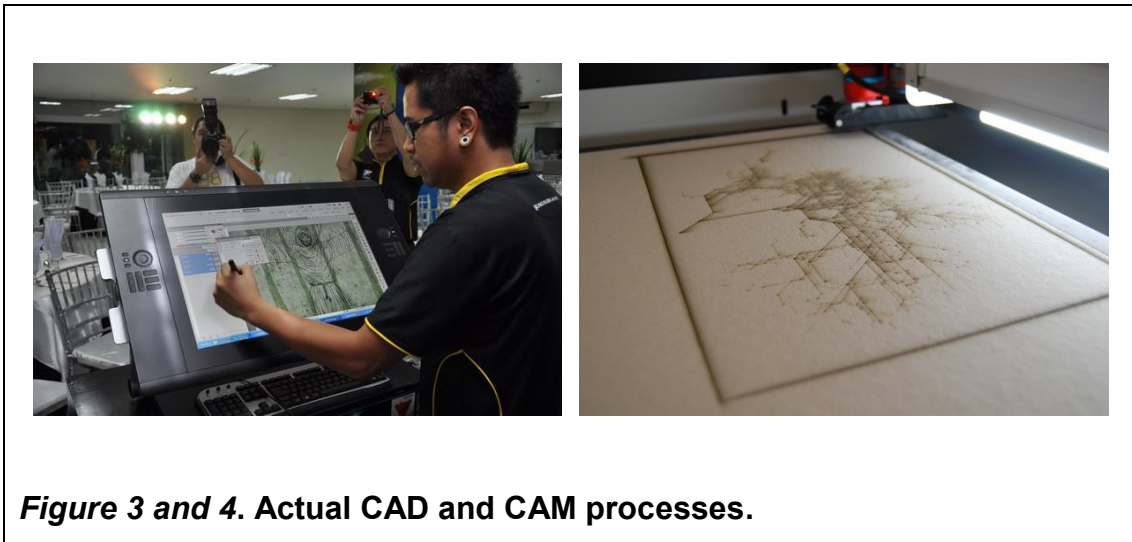
Creative User is defined in the following study as a user that implements creativity in his profession or daily work (Kwan, 2016).

In 60,s and 70,s Human-Computer Interaction and User Interface problems impulse Sutherland to propose “Sketchpad a Man-Machine Graphical Communication System” a system that allows user to communicate with computers by a graphical language with a pen and a screen simulating the process of drawing in paper (Fig. 1). Sketchpad facilitated the communication between users and computers adding augmented editable possibilities that were not possible at that time with existing technology. For example, move points and draw complex shapes without physical tool as ruler and compass (Sutherland I. E., 1963).



**Figure 1. Sketchpad: a man-machine graphical communication system.**  
**Figure 2. PLOTTER USED WITH SKETCHPAD. A digital and analog control system makes the plotter draw straight lines and circles either under direct control of the TX-2 or off-line from punched paper tape.**  
**Font (Sutherland, 2003)**

Figure 1 and 2 above shows Sutherland using a computer by Sketchpad and a plotter used with Sketchpad by TX-2 computer at MIT in 1963. This combination of analog writing system and computer processed system is understood as digital and analog control system (Sutherland, 2003). Where human introduce analogic data to the computer and computer process that information digitally and then it use Computer Aided Manufacturing (CAM) plotter to complete the draw analogically.



As Pinochet affirms, actual CAD software and CAM processes impede user to interact with tool-machine naturally because software has occult processes that user do not perceive when he/she is using CAD and CAM systems. Black-boxed or occult processes obstruct important machine's feedback or output to be perceived by the user defaulting design process instead of augment and aid (P. 33). This Interaction forces the user to adapt design intentions to machine logic replacing creativity and improvisation with parametric functions and generic algorithms that produce generic designs instead of augment the uniqueness of user identity and creativity (Pinochet, 2015).

Therefore, since computing started user expectations have not been filled completely. Starting with the paradigm of artificial intelligence doing designers work and design process and later with the manner that actual CAD and CAM



systems really aid the user interrupting important interaction between Human and Machine forcing the user to adapt design intentions into generic parameters and algorithms instead of augment creativity. Nonetheless, computing has been improving human live doing mechanical work and facilitating daily tasks and at the same time there are some Human-Computer Interaction problems that still need to improve continuously.

## **2 METHOD**

### **2.1 CONTEXTUALIZACIÓN INTRODUCTORIA**

The scope of this investigation is based on the assumption that Creative User need an appropriate Analog and Digital User Interface that reduce complexity of CAD and CAM processes to simplify creative tasks and design process. A first survey is applied to find relevant information about Creative User preferences, habits and relation with CAD and CAM processes. Then rapid prototype is applied according with first survey results. And finally a second survey is applied to verify user acceptance of prototype and it efficiency to facilitate interaction between Creative User and CAD and CAM processes.

To find relevant information a group of 40 creative users were selected by random order in two different places of Quito city, a university and a creative district. The group of creative people or Creative User for current study has a range of 20 to 45 years old of different professions: students, professors and professionals according with digital communication handcraft artisan, design, architecture and art disciplines. Half of the group has already used a CAM processes and the other half has not experience. The profiles selection about people experience and without experience in CAM will discard inequality of responses by previous experiences. By applying a survey the group is asked about preferences and habits.

Then the processes consists on the application of a survey to find quick and precise information about the Creative User continuing with the development of a rapid prototype solution and finally a second survey to validate prototype efficiency. According with first survey information obtained a rapid prototype is designed for creative users. Bruno Munari design method applied to produce rapid prototype synthetizing the problem in many parts and solving one by one in obtaining a possible solution (1983, p. 18). And finally the prototype will be

validated by Creative User using quantitative method base on the second survey and qualitative information about observation and user description about his/her perception according the prototype. The surveys are presented to the responders and the prototype with a brave description of its functions. Then responders are asked to use a numeric controlled machine with and without the prototype and give feedback about them experience. The machine presented in this study is a CNC milling router with cutting area of 1220 x 2440 x 200mm and controlled by Linux CNC software. The scope of this investigation is based on the assumption that Creative User need an appropriate Analog and Digital User Interface that reduce complexity of CAD and CAM processes to simplify creative tasks and design process. A first survey is applied to find relevant information about Creative User preferences, habits and relation with CAD and CAM processes. Then rapid prototype is applied according with first survey results. And finally a second survey is applied to verify user acceptance of prototype and it efficiency to facilitate interaction between Creative User and CAD and CAM processes.



**Figure 5. Carpenter testing CNC milling machine with Bits and Atoms Pen.**

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## 3 RESULTS

### 3.1 CREATIVE USER HABITS AND PREFERENCES

First survey has been applied on 2013 in a university located in Quito and showed some important information about Creative User preferences and work habits. It consists in three questions detailed below. The responses recollected resulted relevant to understand how digital and analog could work of Creative User, which User Interface they prefer for creative process and if they considered complex the use of CAM processes.

What type of tools do you use normally to your daily tasks?

According with survey 100% of the responders normally use the computer, 100% use a pen and 32.5% use hand tools in daily tasks. It clearly express that the most used tools in creative tasks are computer and pen.

In you experience. Which is the most important tool for creative work and design process?

When responders have been asked about the most important tool for creative work 70% affirm that is the pen instead of computer software. This information evidence the preference of creative people about interface for creative work, the majority selected the pen.

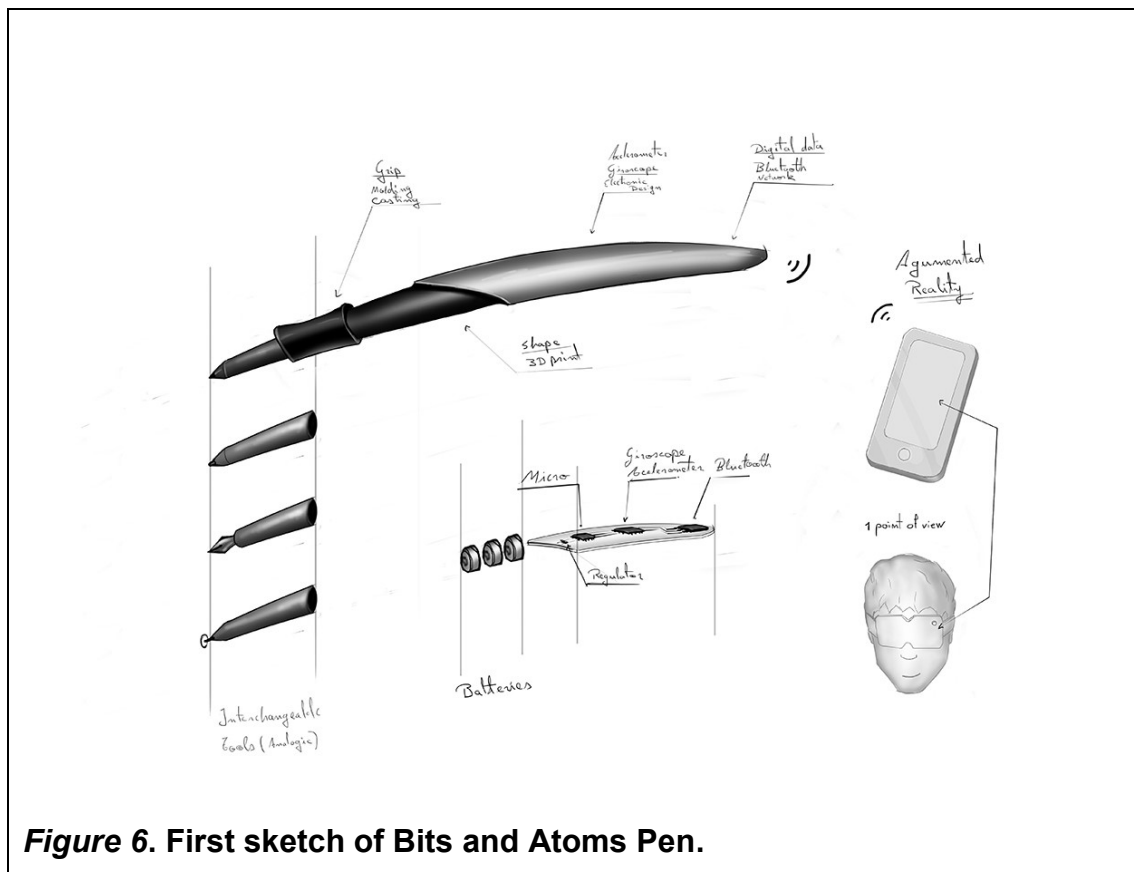
Do you think that use of CAM is complex to use?

Therefore, 92.5% of creative people think CAM is complex to use. Overall, creative people find complex to use Computer Aided Machines. This data validate the assumption of current study about Creative User considered CAM machines complex to use.

Analyzing first and second results of survey questions remark that creative people normally use pen and computers for daily tasks and most of them

believe that pen is more important than computer software for creative work and design process.

It exist a noticeable problem for 92.5% of creative people to communicate with CAM process because they affirm that are complex to use. Also this complexity could force creative people to adapt them intentions for computer needs and logic interrupting creative process as Pinochet affirmed.



**Figure 6. First sketch of Bits and Atoms Pen.**

### 3.2 RAPID PROTOTYPE

According with the first survey 100% of creative users manipulate computer and pen for daily tasks. Normally, Creative User prefers a pen for design and creative processes rather than computer software and thinks that the use of CAM is complex.

Certainly, a creative user prefers to manipulate a pen to express ideas and designs and currently also use computers to complement creative work. Therefore, the prototype needs to allow user to manipulate and express ideas graphically as a pen permit facilitating communication with Computer Aided Design software and simplifying Computer Aided Machining process.

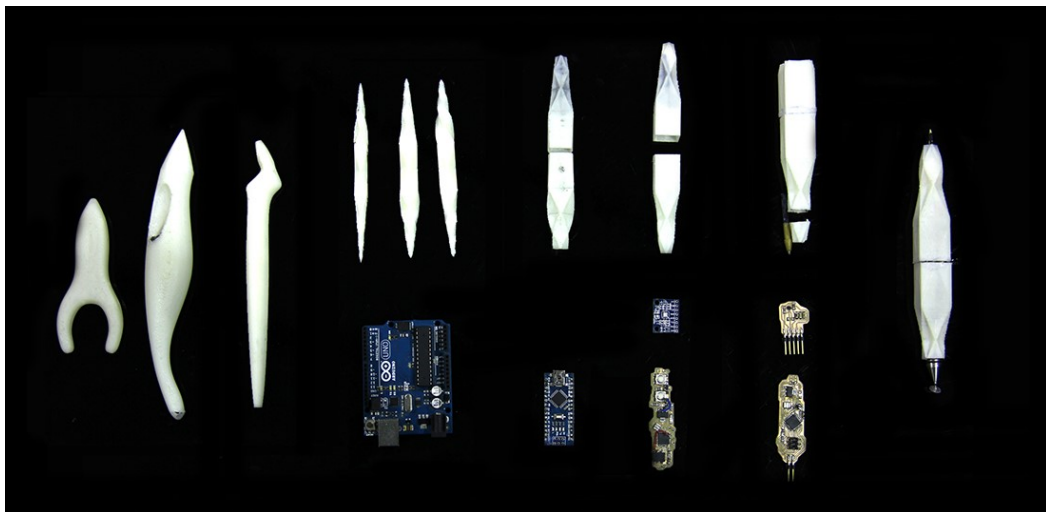
### **3.2.1 Design process**

In 2016 the prototype has been developed. Design process required two months to show a satisfactory result. And the realization of the prototype involved approximately three months. The first propose aims to have Augmented Reality CAD software to visualize designs and a tool with pen shape to facilitate Human-Computer Interaction by a familiar hardware User Interface and wireless connectivity. The use of prototype started with user intentions transmitted to a computer by an accelerometer and gyroscope embedded in the pen allowing the user to use Augmented Reality CAD software and finally the user send the final design to a machine controlled by CAM processes.

### **3.2.2 Rapid prototype**

When prototype was developing some functions needed to be simplified because the short time considered for design process of a solution. Augmented Reality function needed to be eliminated for the ideation because complexity and lack of experience developing this type of CAD software. And this was an important problem to manage because the elimination of Augmented Reality CAD software reduced the possibilities to propose a natural User Interface without returning to the traditional SKETCHPAD model with a screen, keyboard and computer mouse or pad as user interface (Fig. 1 and 3). At this point, the decision of eliminate completely CAD software of the process to find

new possibilities resulted tremendously valuable because now the user is able to control directly machines without software interpreter. The idea of Computer Aided Machining persists because user is aided by two microprocessors the first embedded inside the prototype and second embedded inside the numeric controlled machine. Without CAD software to visualize a new feature needed to be added to the prototype. Real-time function resulted beneficial for process because user is able to see graphically drawing movements by movements of the machine. Also design process added two physical functions to the pen, a pen nib to draw in paper and conductive nib to draw on screens. Thereby, the prototype is able to allow user to express ideas graphically physically and digitally by paper, touch screens and directly with numeric controlled machines helping the user with design process, CAD software interaction and simplify CAM processes.



**Figure 7. Prototyping process of Bits and Atoms Pen**

BAP

The prototype developed received the name of The Bits and Atoms Pen or BAP because allows the user to use analog and digital information at the same time.



According with Gershenfeld understanding of analog and digital operations between CAD and CAM processes the user will be manipulating bits and atoms at the same time by using this prototype (P. 50). BAP hardware has embedded a microcontroller, accelerometer and gyroscope, wireless connection and other electronic components to sense user movement and transport that information to a computer with CAD software or a microcontroller inside of a machine. Also Bits and Atoms Pen is designed with nibs and functions that facilitate user expression graphically on physical surfaces, digital screens, projected surfaces and even in holograms because 2D and 3D accelerometer and gyroscope capabilities of measure motion. The result of rapid prototyping has been completed successfully. And finally BAP needed to be proved by Creative User to know it efficiency as an Analog and Digital User Interface and determinate if the prototype could be accepted for creative work and tasks.



**Figure 8. Photography and digital illustration that describes Bits and Atoms Pen.**

### 3.3 VALIDATION

Second survey seeks to find relevant information about The Bits and Atoms Pen as an Analog and Digital User Interface and capability to improve actual Human-Computer Interaction on CAD and CAM processes to facilitate creative work and design processes made by Creative User.

Questions:

#### 1. Gender

Random selection provided a sample of 37.5% feminine and 62.5% masculine creative people. These numbers are not related with the selection process, probably are related with the place or the moment when surveys were applied. Places, University and Creative District have floating population and normally it is changing.

#### 2. What do you do for living?

Information illustrates variety of profiles in the group: 15% graphic designers, 10% industrial designers, 10% artisans, 2.5% activists, 10% electronic developers, 20% digital communicators, 10% publicists, 20% architects, 2.5% artists.

#### 3. Do you use a computer for your daily tasks?

The entire group uses a computer for daily tasks. Analyzing this data it can be mentioned that the use of computer it is awfully demanded by Creative User.

#### 4. Do you use CAD programs currently for daily tasks?

100% survey responders currently use CAD programs for daily tasks. Even artisans around the university and creative district use CAD programs usually. Out of the survey, the group was asked about the type of programs that they use frequently and most of them responded programs as Adobe Illustrator and AutoCAD and just activists and developers responded Inkscape and FreeCAD.

#### 5. Have you already used a Computer Aided Machine?

As it was mentioned before, 50% of the group has already used a Computer Aided Machine and 50% has not experience. This is the single aspect that was not

random in this investigation because the importance of criteria of experienced and not experienced user.

6. If you responded yes. Which Computer Aided Machine have you already used?

The statistics of CAM most used by creative experienced users are: 20% 3D printer, 30% milling machine, 40% laser cutter and 10% other. According with creative experienced user laser cutter is the most used machine, milling machine follows in the list and finally 3D printer.

7. Which steps of the process of CAD and CAM process are you able to complete?

- a. Turn on the machine: 100% of the entire group can complete
- b. Draw vector in CAD: 87.5%
- c. Generate Gcode: 30%
- d. Install software: 30%
- e. Use software: 30%
- f. Set the machine reference points : 30%
- g. Set materials: 30%
- h. Send file to machine: 30%

At this point each survey responders were asked to use the CNC router with basic instructions already given and a quick explanation about CAM process. Those without experienced in CAM were able to complete the first and second step and none of the other steps. Those with experience on CAM were able to complete the first and second step and just 30% of them complete all steps.

Furthermore 20% of experienced creative users could not operate the machine because they were not familiarized with software. They needed to get used to and understand that specific software even though they already have experience using CAD and CAM technology.

This information remarks an important problem with CAD and CAM Analog and Digital User Interface because 70% of people were not able to use the machine correctly even if 50% already know to use the technology. They needed to adapt them intentions to a logic that they did not understand.

8. Do you think that use of CAM is complex?

97.5% of survey responders affirmed that the use of CAM is complex and this numbers includes the 50% of the creative users that have experience using CAM technology. Concluding, Creative User thinks that actual CAM processes are complex to handle.

9. Do you think the process of using the Computer Aided Machine with BAP is complex?

87.5% of creative users think that is not complex to use a Computer Aided Machine with The Bits and Atoms Pen. The acceptance of a pen as an Analog and Digital User Interface for CAD and CAM is high and displays BAP as possible appropriate User Interface for Creative User.

10. What would you improve in Computer Aided Machine to better suit your needs?

70% of survey responses recommend improving digital User Interface with friendlier software. 50% mentioned projection features to interact with the machine. 20% refried to security improvements.

11. What would you improve in BAP to better suit your needs?

50% of survey responders recommended about ergonomic and include round design. 50% think that projection needs to be included.

12. Do you think that someone without previous knowledge in computing can use a Computer Aided Machine?

100% of creative users think that people without previous knowledge in computing cannot use Computer Aided Machine.

13. Do you think that someone without previous knowledge in computing can use a Computer Aided Machine with The Bits and Atoms Pen?

100% of creative users think that people without previous knowledge in computing can use a Computer Aided Machine with The Bits and Atoms Pen.

14. Do you think that someone without previous knowledge in computing could need access to Computer Aided Machine?

87.5% think that someone without previous knowledge in computing needs access to Computer Aided Machine.

15. Do you think that someone without previous knowledge in computing could need The Bits and Atoms Pen?

100% of responders think that people without previous knowledge in computing needs could need The Bits and Atoms Pen.

16. Do you prefer to adapt:

- a. Machine to your needs
- b. You will adapt to Machine needs

100% of survey responders prefer to adapt machines to them needs instead to adapt themselves to machine needs.

17. Which digital function of The Bits and Atoms Pen interested you more?

- a. Mousecontrol: controls mouse cursor on computer by moving BAP.
- b. Machinecontrol: controls head of Computer Aided Machine by moving BAP.

For 77.5% of creative users MachineControl function of the BAP more interesting than Mousecontrol.

18. Do you think that prototype presented contributes CAM to suit better to your needs?

Successfully 100% confirmed that presented prototype contributes CAM to suit better to them needs.

19. Why?

100% used the word "simple" or a synonymous to describe the experience of using the prototype. 30% refried that drawing is more natural language than try to understand software or code to use machines.

20. If you need to use a CAM processes it would be easier with The Bits and Atoms Pen?

100% of creative users affirmed that the use of CAM processes will be easier with the BAP.

Results for a simple of 40 creative users with and without experience in CAM displayed that all of them use currently computer, mouse and CAD software to daily tasks. Users with experience in CAM have use more frequently laser and milling machines. Just 30% of survey responders are able to use and complete CAM processes in the CNC Router presented for this investigation. More than 60% of CAM experienced users were not able to complete all CAM process. And 97.5% of creative users think that the use of CAM is a complex process. Finally, 70% of recommendations were focused to improve software, 50% were related with CAD projection and 20% around security features.

100% of responders admit that BAP facilitate CAM processes and affirmed that better suit to Creative User needs. All of creative users mentioned the word "simplicity" or synonymous to describe the experience of using BAP for interact with Computer Aided Machine and 30% assert that graphical language is better and more natural to communicate with Computer Aided Machines for creative tasks and design process. Recommendation for improvement coincide 50% on ergonomic

shape of BAP and 50% on projection or display user designs and features of machine.

Another important aspect to study that has been added to survey is the possibility to allow people without previous knowledge on computing to Computer Aided Machine processes. In the opinion of 78.5% survey responders, people without previous knowledge in computing will need access to Computer Aided Machining. Moreover all responders believe that without previous knowledge in computing will not be able to use Computer Aided Machining without Bits and Atoms Pen and probably need BAP.

Finally, all responders prefer to adapt machines to people needs instead of people to machine needs.

## **4 DISCUSSION**

### **4.1 CONTRIBUTION OF RESEARCH**

Current study evidence by three consecutive methods significant aspects about preferences and habits of creative users and problems that they have using CAD and CAM processes because User Interface. The develop of an Analog and Digital User Interface contributed significantly for Human-Computer Interaction between Creative User and CAM processes because presented prototype is appropriate for user needs.

#### **4.1.1 Significance of results of first survey**

User Interface for creative people needs to use graphical language to facilitate Human-Computer Interaction and also requires the possibility to communicate ideas and intentions digitally and physically on surfaces and digital projections. This Analog and Digital User Interface needs to have a familiar shape to be accepted by creative users. This study used pen shape for ADUI because 100% responders already use for daily tasks and probability of acceptance was high. Furthermore, most of creative users think that actual CAD processes are complex to use and all normally use computers and pen for daily tasks and design process.

#### **4.1.2 Significance of results of rapid prototype**

Rapid prototyping technic give the possibility to develop a possible solution in a brief time to study and prove concepts. The result of rapid prototyping an Analog and Digital User Interface produce a device called The Bits and Atoms Pen capable to allow user to express ideas graphically on digital or analog surfaces. Analogic feature is supported by nibs capable to write on physical surfaces and touch screens. Digital feature sense user movement and transform into digital information that is transferred to a computer with CAD



software or a microcontroller inside Computer Aided Machine. User can select to communicate with computer with CAD software or/and Computer Aided Machine.

#### **4.1.3 Significance of results of second survey**

Second survey aim to find relevant information about problems and difficulties that Creative User to use Computer Aided Design and Computer Aided Machines, perception of using CAM processes with BAP as an Analog and Digital User Interface and find the possibility that people without previous knowledge in computing could use CAM with BAP.

Normally, Creative User use computers and CAD software daily and most of them think that use of CAM is a complex process. Mainly creative people with experiences in CAM have already used laser cutters and milling machines.

Most of people around creative disciplines believe that Bits and Atoms Pen simplify the use of Computer Aided Machining because it interprets movement and allow user to interact with machine by graphical language. Some creative users recommend improving prototype ergonomics and adding projection to the experience. In addition, the idea to control a Computer Aided Machine with BAP interested more Creative User than control mouse computer cursor.

Most of creative users affirmed that people without previous knowledge on computing could be able to use Computer Aided Machines employing Bits and Atoms Pen. Moreover, many survey responders thinks that people without previous knowledge on computing could need access to CAM and would need BAP.

Creative User prefers to adapt machines to people needs instead people to machine needs.

## **5 CONCLUSIONS**

### **5.1 OBJETIVES**

The first objective of this investigation is completed because an efficient Analog and Digital User Interface to use CAD and CAM processes for Creative User has been found. Currently study slightly changed original focus orienting efforts more on CAM than CAD processes because in the investigation progress main problems were related with the use of CAM. Fortunately, all survey responders were familiarized with CAD processes and the main problem lies in complexity of CAM. Therefore, first objective has been achieved and moreover most of creative users think that machines need to be adapted for user needs instead of user be adapted to machine needs.

Second objective accomplished when second survey validates Bits and Atoms Pen as Analog and Digital User Interface utterly accepted by Creative User for facilitate Computer Aided Machine use.

### **5.2 MAJOR FINDINGS**

The probability to find creative people that use computers and cad software daily is high on universities and creative districts on Quito city.

Majority of survey responders consider Computer Aided Machining complex to handle and enter group coincide that use of Analog and Digital User Interface simplify significantly interaction and machines use.

Bits and Atoms Pen is entirely accepted by Creative User because better suit to customer needs for CAD and mostly CAM applications.

An important finding of current study is based on entire group of survey responders' assertion that people without previous knowledge in computing could be able to use Computer Aided Machines with BAP.

For both cases CAM without BAP and CAM with BAP the responses were similar according improvement projection features for interact with Computer Aided Machine.

### **5.3 IMPLICATIONS OF FINDINGS**

The most optimal places to find Bits and Atom Pen users are universities and creative districts in north of Quito. Other places with similar characteristics could also proportion more users for Bits and Atoms Pen.

It exist the possibility that most of creative users would accept Bits and Atoms Pen as an appropriate Analog and Digital User Interface to simplify CAD and CAM processes in different places around the world. Furthermore, BAP could be appropriate for other analog and digital proposes different than CAD and CAM processes.

If the assumption that people without previous knowledge in computing could be able to use Computer Aided Machines with Analog and Digital User Interface as Bits and Atoms Pen could be demonstrated an enormous ground of possibilities would emerge contributing to Human-Computer Interaction field by adding people without previews knowledge in computing to computing processes as Computer Aided Design and Computer Aided Manufacturing.

Evidentially projection method needs to be improved in CAM processes to bring and appropriate user interface for creative users.

#### **5.4 CAVEATS AND LIMITATIONS**

Present study it is limited of certain places in north of Quito city and moreover Creative User correspond to a simple of 40 creative people for varieties disciplines as graphic designers, industrial designers, artisans, activists, electronic developers, digital communicators, publicists, architects and artists. In the same way Bits and Atoms Pen validation information has been tested objectively with Computer Aided milling Machine and Linux CNC software.

Rapid prototype process has information has been reduced because current investigation priorities.

#### **5.5 SCOPE OF FUTURE RESEARCH**

Future of research will be focus on Human-Computer Interaction field and User Interface studies. Most of the intentions will be oriented to explore Computer Aided Design and Computer Aided Machining concepts in not usual analog and digital application.

Another important research to add to future exploration will be focused on the thesis that people without previous knowledge in computer could be able to use Computer Aided technology by manipulating Analog and Digital User Interface.

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