# iART: CONSUMER-ORIENTED ICT SOLUTIONS FOR CREATIVE SMEs PROVIDING ART IN BESPOKE FASHION

**Lidia Zdzieszyńska**[1], **Michel Byvoet**[2], **Fabian Di Fiore**[3]

[1] *Waszyngtona 98 / 63, 04 – 015 Warsaw, Poland*
[2] *BivolinoServices.com R&I, Wetenschapspark 1/9, 3590 Diepenbeek, Belgium*
[3] *Hasselt University-tUL-Expertise Centre for Digital Media, Wetenschapspark 2, 3590 Diepenbeek, Belgium*
(lidiazdz@gmail.com; byvoet@bivolino.com; fabian.difiore@uhasselt.be)

## ABSTRACT

The main objective of the iART project is to bring visual art into bespoke clothing so as to make apparel products more valuable compared to other garments in the market and to support artists to exploit their work. To reach this objective a set of innovative ICT solutions has been developed:

(i) Upgrade of the configuration toolkit from 2.5D to 2.5D/3D by including shadowing and rotating features without the need of plug-ins and easy extension of the catalogue to clothing.
(ii) Move to real-time online rendering (fabric draping), so as to speed up and increase the flexibility of the whole process from artist design over fabric creation to customized bespoke shirts and other garments (fabric rendering on 2.5D/3D clothing configurator).
(iii) Building of a B2C platform enabling co-creation and user generated art content, and development of an Advanced Artist Interface (AAI) with artist cockpit.

As iArt is built upon an existing B2C webshop for bespoke shirts (Bivolino.com), it will be replicable and so has the potential to create a wide impact.


**Keywords**: fashion, bespoke fashion, creative fashion, fabric rendering, artist

## INTRODUCTION

The creative industry, fashion industry, and clothing and textile branches in particular are undergoing meaningful changes as the clothing industry in the EU is in crisis. The production index is only 88.9% of its value from 2010. Revival of the sector should arise from research and innovative solutions.

Artists are also affected by the crisis and have difficulties in supporting oneself from their artistic activity. One of the main reasons for this situation is the lack of means to exploit their work effectively on the market.

The objective of the iART project is to support the clothing and textile industry and visual artists by providing new technical and commercial solutions which enable application of art in fashion. The main goal is to bring visual art into bespoke clothing to make apparel products more valuable compared to other garments on the market, and to support artists by exploiting their work (works of art).

To reach this objective a set of innovative ICT solutions has been developed. This

innovative approach will transform the business relations in the clothing sector along the phase of concept and design, from B2B to B2C, where artists and consumers will connect through platforms such as iArt.

The ambition of the iArt project is to create tools which help artists in virtual prototyping or on-line visualizing all over print designs. The results of using the tools should be visible in a fully automatized configurator. This in consequence eliminates the necessity of an interactive or manual intervention of the artist. It should enable the artist to evaluate in real time whether the new pattern design fits the given element. The artist being the one who generates the content will create and configure the new pattern in a fully automated model.

The idea of the project is based on a B2C internet shop (Bivolino.com) with custom made shirts, and its customer oriented web page. New advanced services have been designed and established in order to further facilitate and expand the scope of the shops' applicability. The web page has been enhanced with new 2.5D/3D functionalities. Easy creation of original patterns with the use of real time rendering and an innovative artist user interface with advanced artist's cockpit constitute the most important ICT iART solutions. The project iART is implemented in the framework the EU H2020-program.

## MATERIALS AND EXPERIMENTAL METHODS

In particular, the specific ICT developments of the project are:

- Move to real-time online rendering (fabric draping), so as to speed up and increase the flexibility of the whole process from artist design over fabric creation to customized bespoke shirts and other garments (fabric rendering on 2.5D/3D clothing configurator).

- Upgrade of the configuration toolkit from 2.5D to 2.5D/3D by including shadowing and rotating features without the need of plug-ins easy extension of the catalogue to clothing accessories and nightwear fitting with the shirts.

- Building of a B2C platform enabling co-creation and user generated art content, and development of an Advanced Artist Interface (AAI) with artist cockpit.

The iART project is based on original Bivolino algorithms, a 2.5D/3D configuration toolkit, granted patents and consumer data.

### RENDERINGS

Before new patterns can be imposed onto virtual pieces of garment, models of the garments need to be acquired. Bivolino employs a technique that consists of printing a colour-coded pattern onto a physical copy of a particular garment. A static photo camera on a tripod, surrounded by studio lighting, is then used for taking pictures of the garments.

Next, the pictures of the garments are segmented into different pieces and all virtual dots are identified . Finally a shadow map is extracted.

Using the positional information from the identified dots, a 2D mesh model of the garment is produced. Now having a 2D-model of the garment available, a virtual pattern is placed on top of the mesh model by using OpenGL texture rendering techniques.

### OPTIMIZATION OF THE COLOR-CODED MODELS

When placing a texture pattern on the virtual model, it will be deformed in exactly the same way yielding a visually realistic simulation of the garment.

Unfortunately, these renderings do not always deliver visually pleasing results as they sometimes suffer from jaggedness or aliasing (on edges or close interior lines) and unwanted moiré patterns.

This depends heavily on the virtual patterns being used; spatial aliasing occurs mainly when undersampled patterns (e.g., size less than 5 centimetres and pictured in low resolution) are being used while moiré patterns are imposed during rendering when patterns consisting of sets of parallel lines are displaced or rotated slightly from one another .

In order to improve the photorealistic look and feel of the rendered models the quality (i.e. higher resolution) of the virtual patterns and the photographed color-coded garments (and derived shadow maps) could be addressed. This, however, would require to redo the model acquisition step including the photo-shoot process (ranging from setting up a studio to placing garments on mannequin dolls), the segmentation and analysis of the dotted patterns, and creating new mesh models.

The option was chosen to only intervene in the rendering process as this can be done in an automatic (e.g., batch process) way. So, instead of re-shooting all models in a higher resolution, the application upscales all input (dotted garments, shadow maps and patterns) by resampling and resizing the pictures and by increasing the size of the orthographic viewing region. To this end, we employ a Mitchell-Netravali1 bicubic filter which basically is a compromise between two widely used filters: the B-spline cubic (which origins as a blending function) and The Catmull-Rom cubic (mainly used as reconstruction filter ).

Employing these higher resolution versions of the dotted garments improves the dot analysis (and thus generation of texture coordinates) and shadow maps, yielding a significantly better image quality of the final renderings.


*REAL-TIME DESIGN PREVIEW*

In the current setup much manual intervention is required ranging from running the rendering tool and providing necessary configuration files to post-processing the results.

Before running the tool, first the patterns and models need to be located following a consistent folder (one original and one for mipmapping) and file (indicating the physical dimensions) naming convention. Next, several configuration files have to be edited indicating which pattern, model and rendering parameters to use. When the offline rendering process is finished, the resulting images still need to be postprocessed (image conversion, renaming, compositing…) using batches of commercial software/plugins before being presented to the customer.

It is only at the end of the reproduction line that the final renderings can be inspected and, upon approval, be published online. Unfortunately, in case any adjustments (small or big) are needed the reproduction process has to be done all over again.

In order to enable "real-time" fabric rendering and instant visualization several issues have been addressed: the artist's interrupted workflow (due to offline rendering, offline image processing, offline file processing, no instant preview), the cumbersome manual intervention (due to graphical user interface), the platform dependency and the use of commercial software/plugins. To this end, a standalone application has been build that is fully parameterized using a command line approach, which is platform-independent and does not rely on external commercial tools or plugins. The other commandline parameters are related to the rendering (e.g., mirroring of the fabric, upscaling of input pictures) and assembling process. For batch purposes we also included the option to render models in

all available patterns at once (using 'ALL' as fabric name).

*SERVER-BASED CONFIGURATOR*

In iArt artists are not merely creative contributors but also content providers. Hence we have to come up with a fully automated solution enabling the artist to create, inspect and publish content online. Exploiting the instant visualization, the platform independency and commandline approach of our rendering tool, the application lends itself to be used as a service in a server-based setup.

As for the iArt case artists should be able to create their content online, Bivolino opted to bring the application as a webservice configuration tool. For demonstration purposes, we created two different webserver-based configurators, using the same rendering tool under the hood.

Our new tool is platform independent, eliminates any manual intervention and features a straightforward workflow including online rendering, in-line image processing and in-line file processing.

*UPGRADING THE CONFIGURATION PANEL FROM 2.5D TO 3D*

The prototype of the configurator will enable creation of clothing such as shirts (currently in Bivolino platform), as well as other customizable apparel and accessories. The project team explores new techniques for tracking and scanning to improve the photorealistic look of the simulated result with the use of application in real time. The 2.5D/3D configurator (desktop and mobile-app) for easy generation of new apparel items will be based on a straightforward technique which consist of printing a colour-coded pattern onto a physical copy of a particular garment and using 2.5D/3D image-based feature tracking to obtain a mesh representation of how the piece of garment has been deformed.

iART will employ an ultrafine grid of coloured dots in order to gain a better perception of depth, and hence, yield renderings with a better sense of realism.

Multiple cameras will further refine the process of feature identification as the different camera views can be matched in order to acquire missing image feature positions.

In addition, an interactive 2.5D mesh editing tool will be developed to semi-automatically refine the mesh representation of the garment model when overlapping areas of fabric are involved such as permanent and stubborn creases.

The project will develop a new way for placing a texture pattern on the virtual model, which will be deformed exactly in the same way, yielding a visually realistic simulation of the garment.

In existing setups the creativity and design options are limited to support only 'all over print' designs. Made-to-measure manufacturing processes, however, do not allow artists or designers to freely influence the placement of (parts of) their designs. The project will explore free-form design placement on apparel and examine to what extent artists need to be involved in the manufacturing process in order to not compromise their freedom of creativity.

A garment interface to control the design placement on apparel will help to create a garment prototyping tool that assists artists in complex tasks such as pattern placement and pattern grading. To this end we will introduce a technique for pattern placement and cutting into the creative process by letting the artist/designer apply virtual patterns directly on the artistic painting.

We will also have to come up with a fully automated solution regarding offline (back office) virtual prototyping support as well as online visualization for real-time design preview. This involves the creative contributor who ideally wants to visually assess in real-time how a new print design would fit to a given item, and in particular if the placing of the patterns on the design corresponds to the artistic expression he/she wants to convey.

*B2C PLATFORM*

The choice for our iART B2C platform started with the asp.net code from open source e-commerce software NOP COMMERCE 3.6, embedding a responsive design template, TIFFANY, bought on http://www.nop-templates.com/ (NOP Template Tiffany Theme).

Integration with the Tiffany theme is analysed and it was concluded to do the extra required coding to implement the Vendor application as the theme has a different layout (html markup changes, css, images, little javascript). The existing 10 available plug-ins contain 'Marketplace' functionalities. Nop-Templates (www.nop-templates.com) developed by third-party companies rely on stable code. As hosting provider, the company Arvixe was chosen. But after 2 weeks we were forced to change due to issues with Arvixe and finally opted for WINHOST.

The major challenge is to extend the product choice from the multi-vendor application to an iframe into the product configurator. As the AAI at this stage runs on a staging environment with local hosting and as the AAI (configurator toolkit) is built on .Net NOP commerce 1.2 and the platform www.iart.bivolino.com on NOP 3.6, we have extra challenges concerning the iframe and the publishing.

Following embedded tasks have been performed:

- iframe in vendor application

- add to gallery for publishing products onto www.iart.bivolino.com

For IPR and ethical reasons artists will only be allowed to publish shops after approval by Bivolino.

The technical challenge is to build webservices/API-PLUG-INS to integrate third party Galleries. Publishing configured shirts in third party e-commerce platforms is a key exploitable result and crucial to get impact in the fashion ecommerce business.

## *RESULTS*

The new rendering process solutions, upgrading of the configuration panel from 2.5D to 2.5D/3D and B2C platform developed by iART have contributed to the creation of advanced yet easily available ICT tools through automated and integrated solutions:

- optimisation of the existing color-coded input models and shadow maps; the rendered results no longer suffer from jagged edges or unwanted moiré patterns when fine regular patterns are involved;
- offline rendering tools and offline batches (rendering, scaling) have been transformed to independent solutions available as an option of server configuration. The results of this tool enable the artist to visually assess in "real-time" how a new print design would fit to a given item;
- upgrading of the off-line configurator to a 2.5D/3D optimized and online rendering tool supporting artists in virtual prototyping as well as online visualization of new 'all over print' designs. The artist visually can assess in "real-time" how a new print design

would fit to a given item; as a content provider, the artist can create and configure new content in a fully automated solution;

- addressing the image quality of the final renderings by optimizing the color-coded input models and shadow maps being used in the existing setup in an effortless, automatic and integrated way;
- establishment of a B2C platform for creative cooperation (iART Shop – http://www.iart.bivolino.com) with a user generated content, creating a user interface where the artist can embed new patterns, create collections, monitor messages, or count the consumer votes, and a consumer interface with commenting, evaluating and voting options.

## CONCLUSIONS

Innovative iART programme solutions change the bussiness relationships in clothing industry already at the idea and design phase from B2B to B2C where artists and consumers cooperate through enabling platforms such as iART.

The 'European Competitiveness Report 2010 (Büscher 2012) illustrates creative industry as the most dynamic sector in Europe with a significant capability for growth as the internet develops. The creative industry is dominated by SMEs. As the EC report states the future of the business is digital and depends on incorporation and the optimal use of the potential of ICT tools, which was already achieved in such branches of industry as design or computer games. This project is directly connected with digitalization. A development of a new generation 2.5D/3D tools and a virtual B2C platform will enhance the general industry digitalisation, especially in design, branding and marketing, which is of crucial meaning when the competitiveness on the market is concerned. Digital or virtual approaches to production seem to be relatively popular in many industries, especially those involving inflexible materials. However, textiles have proven to generate difficulties in design software development. In consequence not many textile and clothing companies apply digital design schemes.

The main influence of this project on the European fashion industry can be therefore summarized as follows:

- Empowering the consumer and producing on demand which results in less waste in the supply chain.
- Reducing the cost of production, in particular the cost of prototyping and sampling by consumers (Driven Design).
- Reducing the cost of promotion and marketing, especially in photography and sales collections by means of consumers interaction.
- Shortening the time of completion of the process from design to market dramatically by engaging the consumers.
- Increasing the number of developed models, and the overall choices for the consumers.

As far as the world of art is concerned, the arts on the internet seem to have a sizable potential. One such example being the *Deviantart* web site with a network of 30 million registered users and attracting over 65 million viewers every month. A number of 160 art works is posted daily, including a vast range of traditional art, such as paintings, digital and pixel art.

It leads to a conclusion that the solutions proposed match the trends already confirmed by the market. The artists on the other hand desire to express and exploit their creative work

in many modes to have the opportunity to create exclusive products for a wide public. Often they lack both human and financial resources to exhaust the innovative and advanced ICT services which enable new manners of presentation and employment of the art work.

It is expected that iART will create extra revenues for artists and the European fashion and Clothing industry. SMEs take up ICT enabling innovative supply-chains to generate more revenues through high-margin made-to-order collections which cannot be imported from mass production countries.

Finally, ICT providers are stimulated to offer innovative tools generating new business and turnover. As this sustainable business model is supported by easily accessible advanced ICT tools (through open API's) it will be replicable and so has the potential to create a wide impact.

## ACKNOWLEDGMENTS

## REFERENCES

Büscher, R. 2012. The European Creative Industries Alliance: from concept to reality. *http://ec.europa.eu/growth/industry/innovation/*.