ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

CRAFTING MASS CUSTOMIZATION: A STUDY ON INTEGRATING CRAFT CUSTOMIZATION ATTRIBUTES INTO USER CO-DESIGN TOOLKITS

M.Sc. THESIS

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Kerem ÖZCAN, a **M.Sc.** student of ITU **Graduate School of Science, Engineering and Technology** student ID 502091938, successfully defended the **thesis** entitled "**CRAFTING MASS CUSTOMIZATION: A STUDY ON INTEGRATING CRAFT CUSTOMIZATION ATTRIBUTES INTO USER CO-DESIGN TOOLKITS**", which he prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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Kerem Özcan

Industrial Product Design

To my family,

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CRAFTING MASS CUSTOMIZATION: A STUDY ON INTEGRATING CRAFT CUSTOMIZATION ATTRIBUTES INTO USER CO-DESIGN TOOLKITS

SUMMARY

The economic paradigm prevalent in today's world does not seem likely to change any time soon. As the mass manufactured standardized goods dominate the market more and more every day, the craftsmen who design and make bespoke products leave the scene one by one. Although firms regularly benefit from marketing strategies that encourage product diversity accompanied by an individualist rhetoric, most of these strategies fail to achieve desired success. However, it is considered that bespoke manufacturing will be easier in the future and the number of customization-based businesses will increase in the following years, as a particular technological advancement in the field of manufacturing, namely 'digital fabrication techniques' (e.g. 3D Printing) will find widespread use.

Although there are future scenarios that predict amateur users who have access to these technologies will design for their own wants and needs, a professional designer involvement in product customization process is essential to obtain satisfactory outcomes. However, it is economically not sound to envision a designer conducting each and every customization process, forasmuch in such case it would not be possible for customized products to compete with their mass-produced equivalents in terms of costs. For that reason, customers should be provided with user co-design toolkits in which designer contribution is already integrated.

Within the scope of this thesis, first the historical background, which has prepared the conditions that lead to the projected future scenario, is investigated. Subsequent to this, the key concepts of mass customization business model, which is anticipated to have more presence in future, is explained. This explanation is followed by designating the counterparts of these concepts in a product-based mass customization scenario of near future. Consequently, a literature review regarding these concepts were made and it was determined that the principal area that needs design research contribution is the design and development of the user co-design toolkits. Therefore, it was decided to construct the research in order to explore new means to improve these toolkits (especially digital user customization interfaces). In accordance with this purpose, a research was made on current modes of obtaining customized outcomes. However, the subjects of this research were not industrial designers who were trained to produced standardized end-results for the mass market, but craftsmen that have centuries of tradition in designing and making tailored outcomes. The motivation behind this preference was not only reaching information that is more authentic, but also finding contemporary means to preserve the accumulated customization knowledge disappearing trades through their last representatives.

In accordance with aforementioned motivations, a research in form of semi-structured interviews was made with craftsmen that design and make bespoke products. The questions in this research were designated regarding the flaws pointed out in literature review and co-design toolkits of mass customization businesses that are currently available. Although the questions were present at all times during the interviews, the craftsmen were given enough opportunity to share their thoughts and experiences about their own customization processes.

The findings of the research yielded to twelve characteristics that are intrinsic to craft customization. These characteristics can be grouped under four headers: 'communicative attributes', 'decisional attributes', 'reflective practice attributes' and 'experience enriching attributes'. Each of these twelve attributes point out to a quality that is inherent in the craft customization. Although presence of these qualities is essential for the success of customization processes, their adaptations are rarely (and in most cases only partially) observed in presently available user co-design toolkits.

In the final chapter of the thesis, it was aimed to reframe the findings of the research into a more explicit way, so that it is easier for designers to benefit from them. For this purpose, the twelve attributes of craft customization that are designated in the research were rephrased as questions, which can be used to evaluate available user-customization interfaces. Although the formulated questions serve primarily as a checklist for assessment purposes, they can also be utilized as a guideline by designers that are responsible for designing user co-design toolkits. In order to exemplify a hypothetical use, a series of web-based digital user customization interfaces were evaluated in accordance with these questions. Subsequently, the results were presented in the form of a table, where they can be seen comparatively.

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ÖZET

İçinde yaşamakta olduğumuz seri üretime dayalı ekonomik paradigma yakın gelecekte değişmeyecek gibi görünmektedir. Fabrika çıkışı standart ürünler her geçen gün piyasalara daha fazla hâkim olurken, kişiye özel ürünler ortaya çıkaran zanaatkarlar üretim sahnesinden birer birer çekilmektedir. Her ne kadar firmalar bireyselci söylem doğrultusunda ürün çeşitliliği yaratan pazarlama stratejileri geliştirseler de, bu yöntemler çeşitli sebeplerden dolayı istenilen başarıyı yakalayamamaktadır. Fakat "sayısal üretim" başlığı altında incelenebilecek çeşitli teknolojilerin (Ör: 3B Yazıcı teknolojileri) yaygınlaşmasıyla tekil üretimin kolaylaşacağı ve özelleştirme temelli iş modellerinin sayılarının artacağı tahmin edilmektedir.

Her ne kadar bu teknolojilere erişimi olan amatör son kullanıcının kendi istek ve ihtiyaçlarına göre tasarım ve üretim yapacağının öngörüldüğü senaryolar olsa da, bu süreçte tatminkâr sonuçlar elde etmek için profesyonel bir tasarımcı yardımı elzemdir. Fakat her özelleştirme süreci için bir tasarımcının son tüketiciye birebir yardım etmesi fikri ekonomik gerekçelerden dolayı makul değildir. Zira bu durumda kişiye özel üretilecek ürünlerin seri üretim ürünlere karşı rekabet avantajına sahip olmaları mümkün olmayacaktır. Bu sebeple tüketicilere tasarımcı katkısının önceden içine gömüldüğü ortak tasarım araçları sağlanmalıdır.

Bu tez kapsamında öncelikle öngörülen gelecek senaryosunun koşullarını hazırlayan tarihsel arka plan irdelenmiştir. Daha sonra bu gelecek senaryosunda daha fazla yer alması beklenen 'kitlesel özelleştirme' iş modelinin ana kavramları ve bu kavramların yakın gelecekteki ürün tasarımı temelli özelleştirme senaryolarındaki karşılıkları açıklanmıştır. Açıklanan bu kavramlar üzerinden kaynak taraması yapılmış ve tasarım araştırmasının en çok ihtiyaç duyulduğu alanın müşterilerin kullanımına sunulan ortak tasarım araçlarının tasarlanma ve geliştirilme süreci olduğu saptanmıştır. Bu sebeple araştırmanın bu araçların (özellikle de sayısal özelleştirme arayüzlerinin) nasıl iyileştirilebileceği üzerine kurgulanması amaçlanmıştır. Bu amaç doğrultusunda hâlihazırdaki kişiye özel ürün üretme süreçlerinin irdelenmesine karar verilmiştir. Fakat bu araştırmanın özneleri seri üretilecek ürünleri tasarlamak üzerine eğitim almış olan endüstri ürünleri tasarımcıları değil, yüzyıllardır kişiye özel üretim yapma geleneği geliştirmiş olan zanaatkarlar olarak belirlenmiştir. Bu tercihle hem ortak tasarım süreci ile ilgili daha sahih bilgiye erişmek, hem de sayıları azalan zanaatkarların yöntem ve yaklaşımlarını muhafaza edecek güncel mecraların yaratılmasına katkı sağlamak amaçlanmaktadır.

Bu doğrultuda kişiye özel üretim yapan zanaatkarlarla özelleştirme süreçleri hakkında yarı yapılandırılmış görüşmeler şeklinde kurgulanan bir araştırma yapılmıştır. Görüşmelerde sorulan sorular yapılan kaynak taramaları ve mevcut kitlesel özelleştirme iş modellerindeki ortak tasarım araçları göz önünde bulundurularak ortaya çıkarılmıştır. Her ne kadar sorular tüm görüşme esnasında hazır bulunsa da zanaatkarların kendi özelleştirme süreçlerine dair deneyim ve tespitlerinin uygun gördükleri bir biçimde anlatmalarına olanak verilmiştir.

Yapılan araştırma sonucunda zanaatkarların özelleştirme süreçlerine dair on iki adet nitelik tespit edilmiştir. Bu nitelikler 'iletişimsel', 'kararsal', 'yansıtıcı uygulama' ve 'deneyim artırıcı' isimli dört ana başlık altında derlenebilir. Bu on iki nitelikten her biri zanaatkar özelleştirmesine has özgün bir değere işaret etmektedir. Bu değerlerin varlığı özelleştirme süreçlerinin başarısı için elzem olsa da, mevcut ortak tasarım araçlarında bu değerlerin yansımaları nadiren (ve çoğunlukla ancak kısmi olarak) gözlemlenebilmektedir. Bahsedilen dört ana başlık ve onları oluşturan alt nitelikler bu tez dahilinde etraflıca bir biçimde incelenmiştir.

İletişimsel nitelikler, müşterilerinin istek ve ihtiyaçlarını en doğru biçimde anlamak için zanaatkarlar tarafından kullanılan bir grup iletişim aracıdır. Bu araçlar temelde dilsel olsa da çizim yapma, görsel ile anlatma gibi farklı iletişim yolları da gruba dahil edilebilir. Zanaatkarlar, müşterilerini daha iyi anlamak gayesiyle hem etken olarak (ör. soru sormak, çizim yapmak) hem de edilgen olarak (ör. dinlemek, kullanıcının getirdiği görselleri incelemek) bu araçlardan yararlanabilirler. İletişimsel nitelikler (1) anlamlandırma, (2) sade dil kullanma ve (3) eşzamanlı görselleştirme olarak üçe ayrılmaktadır:

Anlamlandırma, zanaatkarların kullanıcının açık veya örtük istek ve ihtiyaçlarını ortaya çıkarmak için kullandıkları iletişim araçlarıdır. Zanaatkarlar her zaman müşterilerinden tam olarak ne istediklerini ifade etmelerini beklemezler. Yapılan araştırmaya göre müşteriler çok farklı yollar kullanmaktadırlar. Örneğin bazı müşteriler taleplerini anlatmak için beraberlerinde benzer bir ürün veya dergilerden buldukları fotoğrafları getirmektedirler. Kimi zaman ise bir ürün tarif etmek yerine o ürünü nasıl kullanacaklarını ve neler yapacaklarını anlatmaktadırlar. Bu gibi durumlarda zanaatkarların görevi müşterilerin taleplerini anlamlandırmak ve gerekli biçimsel özelliklere sahip ürünlere dönüştürmektir. Bu nitelik bilhassa özelleştirme sürecin başlangıç kısmının daha hızlı ve efektif olmasını sağlamaktadır. Özelleştirme arayüzlerinde de benzer bir yaklaşım kullanılabilir. Özelleştirme sürecinin başında kullanıcıya bazı sorular sorarak veya belli hazır başlangıç noktaları sunarak müşterilerin taleplerini anlama süreci daha efektif bir hale getirilebilir.

Sade dil kullanımı, zanaatkarların başvurduğu diğer bir araçtır. Müşterilerin belirli bir mesleğe ait terminolojiye hakim olması beklenmemelidir. Bu durumun farında olan pek çok zanaatkar müşterileri ile olan iletişimlerinde kullandıkları dilde teknik sözcükler kullanmaktan kaçınmakta, bu teknik terimleri müşterilerinin anlayabileceği kavramlarla açıklamaktadırlar. Benzer şekilde özelleştirme arayüzlerinde de sıradan kullanıcıların anlamakta güçlük çekeceği bir dil kullanımından kaçınılmalıdır.

İletişimsel nitelikler grubunda yer alan son nitelik ise eşzamanlı görselleştirmedir. Zanaatkarlar müşterilerinin isteklerini doğru olarak anladıklarını teyit etmek için dil dışında çeşitli görselleştirme teknikleri kullanılar. Çizimler ve maketler bu yöntemlerin başında gelmektedir. Özelleştirme arayüzlerinde son çıktının eşzamanlı olarak görselleştirilmesi ve parametreler değiştikçe güncellenmesi kullanıcının taleplerinin doğru bir şekilde biçimlendiğini görmesi için elzemdir.

Kararsal nitelikler, zanaatkar özelleştirmesindeki tasarım karar alma süreçlerine dair özelliklerin incelendiği ana başlıktır. Bu nitelikler müşterilerin zanaatkarlar tarafından ne şekilde tasarım kararlarına dahil edildiği (ya da edilmediği) ile ilgilidir. Kararsal nitelikler (1) kritik karar verme, (2) tavsiye verme, (3) tasarımcının tarzı olarak üçe ayrılır.

Kritik karar verme niteliği, sonuç ürünün başarısına dair temel tasarım kararlarının tasarımcı tarafından verilmesi olarak tanımlanabilir. Zanaatkarlar özelleştirme süreçlerinde belli bazı kritik kararları müşterilerinin tercihine sunmazlar. Bunun yanında müşterileri tarafından verilen bazı tasarım kararları doğrultusunda diğer parametrelere dair seçenekleri kısıtlayabilirler (Örneğin, renkleri müşteri tarafından belirlenen çift renkli bir üründe, müşterilerinin seçtikleri ilk renk doğrultusunda ikinci rengin seçim yelpazesini ilk renge uygun olacak şekilde daraltabilirler). Böylece müşterileri ile beraber ortaya çıkardıkları son ürüne dair olası memnuniyetsizliklerin bir kısmını henüz ortaya çıkmadan engellemiş olurlur. Özelleştirme arayüzlerinde de benzer şekilde tüm tasarım kararlarının kullanıcıya bırakılması yerine tasarımcı tarafından belirlenmesi ve yapılan bazı tercihlerin diğerlerini etkilemesi ile daha tatminkar sonuçlara ulaşılabilir.

Tavsiye verme, zanaatkarların deneyimleri ve trend farkındalıkları doğrultusunda müşterilerini yönlendirmesidir. Her ne kadar özelleştirme sürecindeki öznel kararların son kullanıcıya bırakılması esas olsa da, zanaatkarlar sıklıkla bu tercihler hakkındaki fikirlerini müşterileri ile paylaşırlar. Kullanıcı özelleştirme arayüzleri de bu davranışı taklit ederek kullanıcıların daha başarılı sonuçlar elde etmesine yardımcı olabilirler.

Tasarımcının tarzı, son ürüne dair kimi öznel tasarım kararlarının tasarımcının şahsi beğenisine göre belirlenmesidir. Zanaatkarlar kullanıcıya bırakılabilecek bazı tasarım kararlarını kendi tercihleri doğrultusunda belirleme yoluna giderler. Her ne kadar bu durum müşterilerin tercih alanını daraltıyor gibi görünse de, aslında pek çok zaman neden belirli bir zanaatkarın tercih edildiği sorusunun cevabını da içinde barındırır. Kullanıcılar önceki işlerini gördükleri zanaatkarların stillerini belli bir yere kadar okuyabilirler ve kendi özelleştirecekleri ürünlerin de nihai olarak nasıl görüneceği konusunda bir öngörü sahibi olurlar. Benzer bir uygulama kullanıcı özelleştirme arayüzlerin için de yapılabilir. Belli öznel tasarım kararları modifiye edilemeyecek bir şekilde belirlenerek kullanıcıların karar verme süreçlerini kolaylaştırabilir ve müşterilerin nihai ürünün nasıl olacağı konusunda daha isabetli bir tahmin yapmasını sağlayabilir.

Yansıtıcı uygulama nitelikleri, zanaatarların içinde bulundukları özelleştirme ve üretim faaliyetlerinin sürece yaptığı öğretici katkıları ifade eden bir üst başlıktır. Bu nitelikler (1) uygulama vesilesiyle öğrenme, (2) müşteri geri-bildirimi vesilesiyle öğrenme ve (3) kişisel tatmin için üretme olarak üçe ayrılabilir.

Uygulama vesilesiyle öğrenme, zanaatkarların özelleştirme ve üretim süreçleri sırasında elde ettikleri deneyimleri bu süreçleri geliştirmeye yönelik kazanımlara dönüştürmeleri şeklinde özetlenebilir. Bu süreçler ne kadar tekrarlanırsa zanaatkar o derece yetkinleşir. Dolayısıyla her uygulama aynı zamanda bir sonraki uygulamanın nasıl daha iyi yapılabileceğine dair bir öğrenme sürecidir. Kullanıcı özelleştirme arayüzlerinin pek çoğunda ise statik bir yapı vardır ve yapılan uygulamalar sürecin geliştirilmesine yönelik bir katkı sağlamazlar. Halbuki bu süreçlerin sistematik bir biçimde gözlemlenmesi özelleştirme ve üretim uygulamalarının nasıl iyileştirilebileceğine dair yol gösterici olabilir.

Müşteri geri bildirimi vesilesiyle öğrenme, zanaatkarlarının süreçlerini geliştirmeye dair kullandıkları diğer bir yoldur. Zira zanaatkarlar sadece ustalarından değil, müşterilerinden de öğrenirler. Kullanıcılar gerek dile getirdikleri sıradışı fikirler, gerekse de ortaya çıkan ürüne ve özelleştirme sürecine dair eleştirileri ile zanaatkar için bir öğretici görevi görürler. Kullanıcıyı öğretici olarak görme yaklaşımı özellikle günümüz teknolojisini kullanarak oldukça isabetli bir biçimde özelleştirme arayüzlerinde de uygulanabilir. Özelleştirme süreçlerinin iyileştirilmesi için fare imleci takibi, göz takibi, ısı haritaları gibi kullanılabilirlik testleri uygulanabilir. Bu yöntemlerin yanında daha müşteri memnuniyetine dair geri-bildirim anketleri gibi daha konvansiyonel yöntemlerle de müşterilerin sürece öğretici olarak katılmaları sağlanabilir.

Kişisel tatmin için üretme, zanaatkarların ticari gayelerle hareket etmedikleri, kendi sınırlarını zorlamak ve/veya şahsi tatmin için kalkıştıkları üretme yaklaşımıdır. Ustalık mertebesine ulaşan zanaatkarların rakipleri artık kendileri olur. Gayeleri kendi becerilerinin limitlerini test edebilecekleri çalışmalar ortaya koymak haline gelir. Bu doğrultudaki çabaları – her ne kadar çoğu zaman kasıtlı olmasa da – bir öğretim süreci halini alır. Ortaya çıkan ürünler alışılagelen anlamda 'kullanılabilir' olmasa da pek çoğu zanaatkarların neler yapmaya muktedir olduğuna dair zafer hatıraları olarak atölyelerinin başköşelerini süslerler. Bu tarz ürünler bir yandan zanaatkarın becerilerine dair müşterilerin duyduğu güvenlerini tazelerken bir yandan da yapabilecekleri tercihler konusunda ufuk açma işlevi görürler. Buna mukabil olarak özelleştirme arayüzleri de parametrelerin rastgele belirlendiği, hatta kimi zaman tasarımcı tarafından tanımlanan limitlerin de dışına çıkılan son ürünler ortaya koyabilir. Böylece arayüz vasıtasıyla elde edilebilecek sonuçlar konusunda kullanıcılara daha geniş bir perspektif sunulabilir.

Deneyim artırıcı nitelikler, aslında somut olarak bakıldığında sürece direkt bir katkısı olmayan, fakat sağladığı endirekt katkılarla müşterilerin özelleştirme süreçleri sırasında yaşadıkları deneyimi zenginleştiren (ve dolayısıyla üründen aldıkları tatmini artıran) olgulardır. Bu nitelikler (1) biriciklik, (2) tasarımcı ürünü olma, (3) anlatılama olarak üçe ayrılabilir.

Biriciklik, zanaatkar özelleştirmesi ile elde edilen ürünlerin eşsiz olması durumudur. Fakat bu bağlamda bahsedilen eşsizlik olgusu, özelleştirilen her ürününde farklı tasarım parametreleri kullanılması hasebiyle ortaya çıkan bir benzersiz olma durumundan ibaret değildir. Zanaatkar üretiminin doğası gereği tüm değişkenler sabit tutulsa bile ortaya çıkan ürün farklı olacaktır. Zira tekil olarak yapılan üretimlerde kesin bir kusursuzluk elde etmek olası değildir. Her ne kadar bu durum ilk bakışta dezavantaj gibi görünse de, aslında üretilen her ürünü eşsiz ve biricik kılmaktadır. Çoğu kullanıcı özelleştirme sürecinde ise aynı parametreler girilmesi durumunda müşteriler özdeş son ürüne ulaşmaktadır. Bu durumun önüne geçmek için son üründe rastgele minimal değişikliklere yol açan bir değişken eklenebilir. Böylece bu arayüzlerde aynı değişkenler seçilse dahi eşsiz ürünler elde edilebilir.

Tasarımcı ürünü olma, önceki bölümlerde bahsedilen tasarımcı tarzı olgusundan farklı olarak ürünün belli bir zanaatkarın elinden çıkmaklığı olarak açıklanabilir. Burada yaratılan katma değer o ürünün ismi belli bir tasarımcı tarafından tasarlanmış olmasından ileri gelen tatmin duygusudur. Çoğu özelleştirme arayüzü kullanıcıyı tasarımcı olarak lanse etme pahasına çözüm kümesini oluşturan tasarımcının ismini vermekten imtina etmektedirler. Halbuki tez araştırmasının işaret ettiği üzere, müşteriler ürünlerini beraber özelleştirdikleri zanaatkarların ismiyle beraber anmayı bir tatmin olgusu olarak görmektedirler.

Anlatılama, zanaatkar özelleştirmesi sürecindeki deneyim artırıcı niteliklerin sonuncusudur. Bu nitelik doğrudan sürecin geçtiği ortam ile bağıntılıdır. Pek çok zanaatkar hala özelleştirme sürecini müşterileri ile yüz yüze görüşerek gerçekleştirmektedir. Bu sırada müşteri ile yaşanan etkileşim sadece tasarım kararları hakkında yapılan fikir alışverişlerinden ibaret değildir. Zanaatkarlar özelleştirme süreçlerini kimi zaman kişisel, kimi zaman da meslek ile ilgili pek çok yarı alakalı anlatı ile desteklerler. Bu anlatıların pek çoğunun direkt olarak son ürünün nasıl olacağı ile ilgili iletişim kurma gibi bir gayesi yoktur. Anlatılar daha ziyade kullanıcıların özelleştirme sürecini daha olumlu olarak algılamasına katkı sağlamaktadır. Özelleştirme süreci ile ilgili bu olumlu algı, kullanıcının son ürün hakkındaki görüşlerini de olumlu yönde etkilemektedir. Kullanıcı özelleştirme arayüzleri de benzer şekilde sadece nihai ürünü elde etmek için kullanılan bir araç olarak görülmemeli, kullanıcının ürün hakkındaki algısını da doğrudan etkileyen başlı başına bir faktör olarak kabul edilmelidir. Bu doğrultuda arayüzler zanaatkarların yaptıkları gibi çeşitli anlatılar ile desteklenebilir.

Bu tezde öncelikle zanaatkar özelleştirmesi süreçlerinin nitelikleri saptanmış ve bu niteliklerin kullanıcı özelleştirme arayüzlerindeki olası eşdeğer uygulamalar olarak nasıl karşılık bulabileceğine dair öneriler ortaya konmuştur. Tezin son kısmında zanaatkarların özelleştirme süreçlerine dair yapılan bu araştırmada elde edilen bulguların daha açık bir biçimde tasarımcılara fayda sağlaması amaçlanmıştır. Bu doğrultuda araştırma kapsamında tespit edilen on iki adet zanaatkar özelleştirmesi süreci niteliği, sayısal kullanıcı özelleştirme arayüzlerinin sınanması için kullanılabilecek sorular şeklinde kurgulanmıştır. Kurgulanan bu sorular mevcut özelleştirme arayüzlerinin değerlendirilmesi için kullanılabilecekleri gibi bu arayüzlerin tasarımından sorumlu tasarımcılar için de yol gösterici olacaklardır. Bu soruların kullanımına örnek teşkil etmesi açısından tezin sonunda bir grup ağ tabanlı sayısal özelleştirme arayüzü oluşturulan örnek sorular uyarınca değerlendirmeye tabi tutulmuş, sonuçları da karşılaştırmalı olarak görülebilecek şekilde bir tablo halinde okuyucuya sunulmuştur.

1. INTRODUCTION

Looking from the centennial of the introduction of assembly line, the battle between craft production and mass production seems to be long over. Past century has witnessed industrially produced goods take over the market while tailors, shoemakers and carpenters were slowly but surely replaced by sales clerks of the retail stores. Advancements in manufacturing technologies have unintentionally imprisoned the relationship between design and craft production to a niche realm. As mass produced goods dominated the market, unique tailored end-results by craftspeople were taken over by low-cost standardized outcomes. The last couple of decades have seen some efforts, such as 'personalized marketing' and 'mass customization' business models, which tried to mock the benefits of custom-made products. However, only a handful of these implementations were commercially successful and the vast majority of such products failed to compete on the price tag with their mass-produced equivalents (Vesanen, 2007). As a result, mass production to this day holds its place as the predominant manufacturing method.

Yet a new technological advancement, namely 'digital fabrication', might bring a new alternative to this situation. Digital fabrication is an umbrella term for anything that is materialized using digital data real time. This includes everything from laser cutting plywood to 3D Printing (Sass and Oxman, 2006). These production methods are pointed as the future of manufacturing since the late 20th century (Karapatis, Van Griethuysen and Glardon, 1998). Their potential use for mass production is often referred as a complete paradigm shift rather than just another incremental improvement, since it nestles a strong potential to revolutionize conventional business models (Anderson, 2010). These manufacturing methods have not yet seen wide use in final products for the market, since high production costs, low quality end-results and low production speed still stand as the major barriers. Nevertheless, as researchers bring these technologies to perfection, their use becomes increasingly feasible day after day (Berman, 2012).

One of the most exciting developments in the digital fabrication domain is ‘desktop manufacturing’ without a doubt. Low-cost domestic 3D Printers spearhead this concept. By the time this thesis is being written, there are over two dozen 3D printers in the market that are offered for $2000 or less (Evans, 2012). Such devices already made their way into the homes of many hobbyists, enthusiasts, tinkerers and hackers alike. The issue is so trendy that it is impossible to spend a day without seeing an article about it in a mainstream technology blog and/or magazine.

However there is another potential use made ever easier by the use of digital fabrication, which is usually overlooked: Product customization. Unlike the prevailing manufacturing methods, digital fabrication techniques require neither use of molds nor extensive manual labor. Therefore, their input data (i.e. digital design representation) can be customized to fit the wants and needs of individual customer, and final products can be produced one-by-one at almost at the efficiency of mass production (Tseng and Jiao, 2001). This approach can be classified under the concept of ‘mass customization’ – however, with an annotation: Many mass customization applications still work under mass production paradigm. They usually offer consumers only a few options to pick from. What is more, customized products are often put into production by slowing down the same assembly line used to manufacture their mass produced counterparts. This reflects to customers as high prices that companies need to compensate for the resources that they could have used to mass-produce a same type of product.

Yet if digital fabrication technologies’ feasibility increases as anticipated, this scene might change. The nature of this new production approach is much more suitable for the needs of mass customization business models. First of all, it does not have to restrain users with a few options to choose from. Since these fabrication technologies use real time digital data as input, they have the potential to have practically unlimited end-results. Furthermore, manufacturing of a unique, customized product with these technologies does not use more material resources than the mass-produced versions of the same product, since final products are produced individually in accordance with the digital data. Finally, manufacturing digitally fabricated customized products does not require a large production plant by conventional means or manual labor, making the need for overseas production redundant. Hence, products can be manufactured in vicinity to consumers, eliminating costs such as

shipping and import taxes while decreasing the delivery time and reducing product's carbon footprint (Reeves, 2009).

It is also claimed occasionally that this will lead to a future where users design and fabricate their own products using CAD Tools with low learning curve and digital fabrication techniques (with a special emphasis on desktop manufacturing) (Ratto and Ree, 2012). Although this scenario seems technically possible, the idea that common customers can/will design for their own wants and needs seems naïve. One can draw parallels with such DIY approach in digital design and fabrication duo and tailoring; the design tools and means of production are easily obtainable for all, but a common end-user would most probably lack the fundamental skills to produce a satisfactory outcome. Yet, given the necessary tools, a designer or an haute couture tailor shouldn't have any problems in realizing adequate end-results for the same challenge. The justification of this presupposition can be observed in the findings of researches about mass customization. Contrary to expectations, many user-customized products have a use life much shorter than their mass produced versions and users turn out to be much less satisfied with the products that they themselves have customized once the initial enthusiasm is gone (Piller, 2004)

1.1 Definition of the Problematic

In line with the evaluations in the earlier paragraphs, one can reach to following deduction: although emerging technologies seem to enable new opportunities for customized products, there is still a need for designer knowledge for the desired results[1]. This however would eventually limit digital fabrication's potential to mass-produce custom-made final products. A designer responsible for each customization process would cause such business models to lose not only their economic feasibility, but also their fundamental rhetoric, which is built around user creation.

What would possibly take the place of such designer requirement in the aim of customizing satisfactory products in mass? Initial thinking leads to a hypothetical automated user co-design toolkit, which would mimic designers' customization behaviors.

[1] The word designer here is used in a broader sense, not only to include product designers, but also other professionals who carry out a design activity – such as a haute couture tailor in above given example

At present there are numerous business models where user-customization takes place through web-based user-customization interfaces with several adjustable parameters. However, it is not possible to say that these co-design toolkits truly succeed in integrating designer contribution into customization processes.

There are several reasons behind this phenomenon: Unlike above-mentioned interfaces, customization process of a design professional is realized through 'associative thinking' (Treadaway, 2007) where relationships between parameters of a product are taken into account during the customization process (Yang, Zhang and Shan, 2007). In other words, change of a certain parameter in haute couture design process is most likely to require changes in other parameters as well in order to reach a satisfactory outcome (e.g. change in the length of a customized table might require more support material for structural reasons or change of a certain color can yield to change of the accompanying color). There are numerous software tools in the market (e.g. Grasshopper, Processing, Monkey Script etc.), which would allow designers to embed such relationships between design parameters into a design definition. However, most designers are either unaware of this potential or they lack the skills to use them. Thus such relationships between design parameters are usually omitted in user-customization interfaces. Furthermore, there is another element in designer-customization process that user-customization interfaces fail to mock. Designers usually serve as consultants for customers during a face-to-face customization process. They help users to make better choices and translate their wants and needs into forms. In many user customization interfaces guidance of a such designer/ consultant is not only absent, but also its absence is cheered and claimed to be done on purpose for the sake of putting users in the role of designer. At times, such vacancy is promoted with slogans like "Design your very own product" or "You are the designer!" (Von Hippel, 2001). Yet, research shows that while users initially seem to be pleased with products that they themselves customized, use life of products customized without professional assistance are much shorter in comparison to mass-produced standardized products designed by professional designers (Piller, 2004).

1.2 Purpose of the Thesis

The main argument of this thesis is that deficient user customization interfaces fail to provide the benefits provided by designer customization processes. It further claims that hereby-mentioned deficiencies could be overcome by integrating certain elements of designer customization into user-customization interfaces.

It is decided that a research on the attributes of designer-customization processes would be useful to identify the deficiencies that cause user-customization interfaces to fall short. It is anticipated that the findings of this research will be used to transform arid user-interfaces into pre-designed product customization systems that can still seem to leave control to user, while maintaining the essential advantages provided by designer-customization processes.

In accordance with the purpose, a research on designer-customization processes is made to undercover core qualities that user-customization interfaces fail to provide. However, before any further mention to the research, the term "designer" in its context should be clarified. The subject group of this particular research on "designer-customization" was not the university trained design professionals who work in conventional mass-production paradigm jobs, but rather the craftsmen who customize and produce their designs according to the wants and needs of their customers.

There are a few reasons behind this decision. First of all, contemporary product designers who received their design training in the institutions of higher education are mainly trained to become employees integrated into product development processes within the mass production paradigm. They are educated to come up with static end-results eventually to be produced in large numbers. Yet above articulated customization paradigm gives way for them to create design definitions that can generate numerous customized end-results defined by relationships between various parameters, which are eventually to be manufactured individually. Most designers have not received appropriate training to design with such associative thinking approach (Çolakoğlu and Yazar, 2009). Therefore, customizable products designed by them are almost always limited to a few parameters that do not have any association which each other. Such a design approach is distant from utilizing the true potential of parametric modeling tools. Furthermore, not many designers take

role in helping users to customize for their own wants and needs – which is understandable upon making a simple cost-benefit analysis. Hence it would not be unfair to presume that many designers would fail to master in the above suggested consultancy skill[2].

The customization workflow of craftsmen can be shown as one of the finest examples of associative thinking by nature – no matter how implicit it may seem. Craftsmen usually listen to their customers, understand their wants and needs, inform them about what can/cannot be done and make suggestions. They then translate these inputs into design parameters and rely on their past experience in order to make sure that there are no contradictory relationships between these design decisions. It can also be claimed that their manufacturing methods are analogue reflections of the digital fabrication processes. The craftsman use instant design data that they visualize in their heads and turn them into physical representations in real time.

Presence of this similarity, leads to the principal motivation to conduct this research: Revealing the core qualities of the craftsman's distilled knowledge in producing satisfactory custom-made products, and finding contemporary means to preserve them. In the past century, many archaic practices of craftsmanship and their deep-rooted traditions unfortunately failed to stand the test of time. They fell flat on the course of meeting the ever-more rapidly changing globalized world's demands and overwhelming technological advancements. Today it is still possible to find a handful of craft professionals here and there, who carry on customizing products relying on the centuries-old accumulated knowledge that they have inherited from their predecessors. While it would be unfair to say that these professionals will cease to exist completely in near future, one can say that a part of the cumulative knowledge is lost with each fellow tradesman that leaves the scene – even if there are people interested in preserving such knowledge (Wood, 2006). Therefore, this thesis will serve for documentation purposes for qualities that make traditional craft-customization processes successful, as well as providing suggestions on how to integrate those attributes into contemporary user-customization interfaces.

[2] The exceptions for this generalization would be the professional designers, who chose to work by the rules of a much ancient and long established tradition instead of taking their places in the modern workforce: craftsmen.

1.3 Thesis Research

Within the scope of this thesis, a research was done on the particular group of designer-makers that have a long tradition and extensive past experience in customizing bespoke end-results, namely the craftsman. A series of semi-structured interviews were conducted with craftsmen of different trades in order to gather as much data as possible from their customization methods. Consequently these interviews were turned into assessable information by analyzing, coding, evaluating and categorizing the obtained data. Thus, a set of qualities for craftsmen-customization was designated. The thesis is concluded by comparing craft-customization process to a number of presently available web-based user-customization interfaces and discuss why they possibly fail to offer benefits and end-result satisfaction provided by craftsmen/designer-customization processes. The conclusions derived by this thesis is anticipated to be used for creating more viable mass customization applications by creating user customization interfaces that imitate the success factors in craft-customization.

2. BACKGROUND: HISTORICAL TIMELINE, EXPLANATION OF THE KEY CONCEPTS AND LITERATURE REVIEW

Mass production, the market paradigm that dominated the last century (Pine II, 1993), can be summarized by Henry Ford's famous statement: "Any customer can have a car painted any color that he wants; so long as it is black" (Ford, and Crowther, 1922). Ford's main concern was minimizing the costs, yet he was not defining only an economical concept. The notion named after him, namely Fordism, was also a social system where the workers of his very own factory would become his customers as well (Tolliday and Zeitlin, 1986). In order to reach his goals, Ford has implemented the finest examples of Taylorist division of labor, assembly line production and standardization of his time (Gordon, 2007). In the times when needs prevailed over wants, it was not long before his cost-oriented company reached commercial success. The customers were more concerned with fulfilling their needs with an affordable price rather than the color of their automobiles.

As low-cost mass-produced products dominated the market, pre-World War I USA has started to experience a dramatic economic growth. During these years, cost-centered business planning was sufficient to maximize profits. Yet, in the 'roaring twenties' [3] following the World War I, this picture has started to change. Continental North America and especially USA, which has not suffered from war within its borders, have successfully managed to shift from wartime economy to peacetime economy, by transitioning the production of its defense industry to consumer goods, resulting a great manufacturing capacity surpassing the demands (Soule, 1947). Even Ford Motor Company has had to give in from its standardization policy for the sake of competing with GM, which was once the key factor that has brought the company its success (Er, 2009). Consumers, though indirectly, finally had their say on the design of the products. From thereon, except for a couple of brief interruptions due to

[3] The Roaring Twenties was the nickname given to the era of great economic growth and widespread prosperity driven by government growth policies, a boom in construction, and the rapid growth of consumer goods such as automobiles during 1920s. The North American economy, particularly the economy of the USA, which had successfully transitioned from a wartime economy to a peacetime economy, boomed... The United States augmented its standing as the richest country in the world, its industry aligned to mass production and its society acculturated into consumerism. In Europe, the economy did not start to flourish until 1924" (Soule, 1947)

the Second World War and post-war conditions of the Cold War era, more or less the same paradigm of mass production stayed as the prevailing manufacturing system due to its economic advantages.

Pine (1993) names ‘economies of scales’ as the foremost advantage provided by mass production. From bulk purchases of raw materials to molding standardized outcomes in masses, ‘economies of scales’ is surely the main factor creating mass-produced goods’ price advantage against one-off produced items. But this was not how it used to be; there was a time when customers were not limited with a few options coming through the assembly line. Until the Industrial Revolution spared design from manufacturing, designers were also makers who were offering custom fit solutions to their customers’ unique problems (Heskett, 1985). However, as the paradigm encouraged recurrent multiplication of craftsmen’s designs for economic reasons, the link between designing and making became history (Ibid). If one compares the production process in an assembly line with a craftsperson’s, it is not hard to understand what brings about the difference in the price tags. Despite one-off production’s countless advantages such as tailored outputs and fine quality, number of craftspeople wanes day by day, turning them to a diminutive community, which offer their boutique service to a small elite.

Common definitions of mass production emphasize its qualities of producing ‘standardized products’ in large amounts (Benavides, Segura and Ruiz-Cortés, 2010). From the perspective of mass-market manufacturers, it is essential to increase the size of manufacturing in order to minimize the costs and maximize the profits (Hounshell, 1985). In order to achieve this, the individual necessities of the users are ignored and potential customers are treated as a few homogenous groups (Istook, 2002). This approach is not much different from the industrial design discipline’s point of view: Even by the most contemporary industrial design theory, users are at best accepted as one of the ‘stakeholders’ that designers should take into consideration (Krippendorff, 2006). They are seen as subjects to be ‘studied’: subjects that are listened (questionnaires, focus groups etc.) or observed (design ethnography, video journals etc.) (Sanders, 2002). Yet new technologies and market competition in the last couple of decades gave birth to alternative concepts and approaches, one of the most popular being mass customization (Da Silveira, Borenstein and Fogliatto, 2000), where individual wants and needs of the users were

taken into consideration "with near mass production efficiency" (Tseng and Jiao, 2001).

2.1 Rise of Mass Customization Concept's Popularity

The idea of mass customization is not new. The early traces can be found in Toffler's book 'the Third Wave' where he introduces the concept of prosumers: the proactive consumers who actively take part in design processes (Toffler, Longul, and Forbes, 1981). However, it was Davis (1987) who coined the term 'mass customization', in his book 'Future Perfect'. Albeit these early anticipation, it was not until last decade before mass customization gained the attraction it has deserved. The significant advancements in manufacturing technologies, such as CNC (Computer numeric control) and FMS (Flexible manufacturing systems), laid the essential foundations for the idea of customizing for the masses to find more voices (Da Silveira, Borenstein and Fogliatto, 2000). Advantages that are generally attributed to craft production such as bespoke results and quality of the outcome could finally be achieved through such computer aided manufacturing technologies (Fan and Schodek, 2007).

By virtue of the competitive market environment, business literature was not late to discover the advantages promised by this new approach (Ibid). Pine, one of the thought leaders of mass customization, points out that businesses should benefit from including users in design process in his book 'Mass customization: the new frontier in business competition' as early as 1993. In his seminal text, Pine claims that mass customization will enable each and every customer to make purchases precisely according to his/her unique needs and/or wants, "for a price that he/she is willing to pay" (Pine, 1993). A research by Franke and Piller (2004) supports this view, showing that users' "willingness to pay" for a self-customized watch almost doubles the price of the top-selling mass-produced alternative. This example shows that the core advantages of craft-produced artifacts could be met with a price tag that is satisfactory both for the customers and manufacturers, and this mutually beneficial exchange would eventually lead mass customization to be a serious business model.

2.2 Reasons for Lack of Success in Mass Customization Business Models

Although ‘mass customization’ was regarded as the prevailing business model of the future since 90’s, to date there have only been a few economically viable mass customization applications (Salvador, Hollan and Piller, 2009). Literature points out various reasons for this phenomenon. Piller (2004), in his earlier text, lists some of the challenges leading to unsuccessful results as: absence of a common definition, ineffective co-design interfaces, lack of complementary aspects in corporate strategy, limited success of the previous attempts, earlier implementations that failed to present a true benefit to users, insufficient focus to process satisfaction and potential risks that customized products bear due to lack of tests. Piller is not the sole academic to claim that “Mass customization is not there yet”. Franke, Keinz, and Schreier (2008) also state that the interactions between customers and mass customization toolkits are not yet performing at a desired level and user interfaces need improvements. Another danger for such interfaces is causing ‘mass confusion’ by overwhelming the users with abundance of choices in an ill-defined structure (Huffman and Kahn, 1998). Reeves, Tuck and Hague (2011) on the other hand point out the lack of feasibility of the previous enabling technologies and claim that the recently spreading use of ‘additive manufacturing technologies’ might finally be the long yearned solution to turn designs into customizable 3D artifacts.

2.3 Key Elements of Mass Customization

Explanations from the literature do indeed hint about why mass customization still has neither succeeded in becoming an alternative for mass-production business model, nor totally wiped bespoke craft production. The concept has still not reached its full potential, since its enablers have not yet fully matured or they are not exploited enough. In order to understand what those enablers are, one needs to understand the key elements of mass customization business models.

Piller and Kumar (2006) list the basic principles for mass customization as (a) modular product/process structures, (b) on-demand manufacturing and (c) consumer co-design. They explain the first principle of modularity as a “flexible, responsive but stable solution space” built to fulfill individual customer needs within a predefined range. They interestingly position this as the main difference between

conventional craft customization and mass customization. This assumption is based on the fact that both the solution space and fulfillment process is rigidly defined in mass customization processes whereas in craft customization these elements are tailored for each individual user. Their second principle, on demand manufacturing, calls attention to the fact that the process of production is not finalized before the customers complete their orders and each product is manufactured individually. While it is obvious that this brings additional operational costs, they cite other researches that mention certain economic advantages in logistic operations, demand management and various post-sales factors (Kumar, 2004. Sanders, 2003). The last principle in the article, consumer co-design is about tools to include customers in the design process. It is emphasized that while the means and extends that customers participate in design process vary, they regard this principle as the main factor that differentiates mass customization from other agile manufacturing strategies. According to their paper, customer co-design is seen as the primal constituent that creates the added value of mass customization, thus co-design tools are the most important elements that will lead a mass customization application to success of failure (Piller and Kumar, 2006)

In a later work by Salvador, De Holan and Piller (2009) there is a similar but more comprehensive and precise definition for the fundamental mass customization principles. They still refer to (a) a solution space – but indicate that it should be build after truly interpreting customer needs, (b) a process design to provide the customers their customized products – which has parallels to on-demand manufacturing but covers other aspects such as logistics, and (c) a tool for "choice navigation" – which would help customer to reach his desired result without causing confusion (Salvador, De Holan and Piller, 2009)

2.3.1 Solution space

The core idea behind mass customization is meeting individual's needs while keeping production costs in feasible levels. In order to achieve such standards, the design range of the outcomes should be left flexible enough to meet customers' demands while being kept stable enough to avoid difficulties in the following stages of manufacturing. It is designers' duty to create such stable yet flexible systems (Pine, 1995).

Hereby mentioned systems can be regarded as a cloud of outcomes within certain boundaries. Mass customization literature gives these 'systems' various names with nuances, which differs according to authors' perspective. Jiao, Ma and Tseng (2003) regard these systems as an accumulation of 'building blocks'. From their perspective, the designers partition the possible end-results regarding according to certain design and production criteria. The customers then generate the final products using these building blocks. This definition, albeit being very clear in terms of explanation, is inductive in nature. However the design processes of such systems are almost always deductive – in other words, designers envision an outcome (or a stable set of outcomes) first and then divide it into building blocks that can be modified. Therefore while Jiao, Ma and Tseng's definition might make sense from the manufacturing and production process point of view, it is unsuccessful to reflect design perspective. Another definition is by Tseng and Du (1998), where such systems are described as 'modular product architectures'. This explanation is indeed deductive, yet it fails to serve as an overarching term. The concept of 'modularity' imposes a set of predefined set of components. However, not all customization systems constitute their outcomes through pre-defined pieces. Today it is possible for users to customize in a design space without having to use standardized modules, which are to be manufactured through advanced manufacturing methods – hence their designs still stay within the feasibility boundaries. Tseng and Du's definition fail to cover such opportunities in contemporary applications of mass customization. A third concept from mass customization literature, which also denominates the title of this section, is 'product solution space' (Piller and Kumar, 2006). This simple yet comprehensive name by Piller and Kumar manages to stay outcome oriented while also pointing out the process behind it. It also remains comprehensive through neutral use of words. The concept they define houses both the systems that are constituted through few pre-determined building blocks and algorithms that offer a design space that yields to practically innumerable end-results to co-designing customers. Regardless of how their system is formulated, all mass customization applications have a solution space that is consisted of the accumulation of all possible outcomes (Piller, 2007).

For product designers, the solution space can be translated as a hypothetical batch of potential end-results that are attained through the customer co-design process. Thus

enablers for creating such solution spaces can be defined as design tools that would yield to multiple outcomes through modifiable components.

2.3.2 Advanced manufacturing process

As important it is for designers to develop customizable designs that fulfill wants and needs of the customers, it is also crucial to plan the following stages. Those stages typically deal with means of materialization, marketing, sales and delivery of customized designs. Many of those aspects are case specific and differ by their respective business models. Nevertheless it can be claimed that mass customization business models are essentially shaped by decisions regarding means of materialization, namely the manufacturing method that is used. The nature of the type of manufacturing is the key element to define how other aspects of the business model will be formulated. Therefore, it is apt to designate the manufacturing issues as one of the key elements of mass customization businesses.

Pine (1993) argues that advancements in manufacturing processes are a key factor in mass customization business models. These advancements mean various degrees of flexibility in production, from modularity (Ulrich and Tung, 1991) to complete bespoke manufacturing (Campbell et al., 2003). Yet regardless of manufacturing method's degree of flexibility, manufacturing in mass customization is significantly different from mass production from one aspect – it must work with principles of "economies of scope" rather than "economies of scale" (Goldhar and Jelinek, 1983). In mass customization context, economies of scope can be understood as minimizing the costs in the manufacturing process of each customized object. This cannot be achieved by using the same tools that are used by mass production. Tools in this context are not only machinery, but also process related concepts such as large-scale manufacturing, standardization and division of labor. Mass customized goods are produced in low numbers at best, non-standard and work specialization for their production is very hard compared to their mass-produced counterparts (if not impossible). In order to have a competitive chance in the market, mass customized products should be manufactured through an unconventional means of production such as CNC (Computer Numerical Control), CAM (Computer-Aided Manufacturing), Robotics and other types of Flexible Manufacturing Systems (Duray et al., 2000).

The method of manufacturing is a very decisive factor on how customization process is shaped, since it directly affects the other key elements of mass customization – the way solution space is created and the nature of user participation to design (Duray, 2002). From product design perspective, the full potential of customization can only be achieved by using a fabrication method, which would maximize design possibilities for designers and co-design contribution for customers (Lampel and Mintzberg, 1996).

2.3.3 Toolkits for customer co-design

The driving element at the core of mass customization is undoubtedly inclusion of user in the design process (Piller, 2004). Though its degree and type may vary, customers in mass customization applications are always included in an elicitation process in order to reach the final design (Zipkin, 2001). However, it is economically impossible to keep a competitive hand by assigning designers to handle each user's inclusion in design process. Therefore, customer inclusion to design process is directed by certain intermediate configurators, which can be described more comprehensively as user toolkits for co-design (Franke and Piller, 2003). Zipkin (2001) designates this phenomenon as the foremost differentiating characteristic of mass customization, where he describes user co-design toolkits as "a mechanism for interacting with the customer and obtaining specific information in order to define and translate the customer's needs and desires into a concrete product or service specification". In other words, these toolkits are interfaces that interpret users' wants and needs as design decisions using different methods, such as providing options, creating representations and pricing the outcomes (Von Hippel, 2001).

Co-design toolkits in mass customization business models can be seen as the main value-adding element. These toolkits allow users to come up with outcomes that are better than the best standard product on market (Du and Tseng, 1999), by helping them tailor the end-results for their own wants and needs. These interfaces give users the feeling that they were the designers of the products (Franke, Schreier and Kaiser, 2010) and create the added value that compensates for the price difference customized products have compared to their mass-produced counterparts.

Design of these user co-design toolkits is a decisive issue on the success of mass customization applications. The whole mass customization concept after all, is built

on the assumption that users can tailor products according to their own wants and needs, and toolkits are the media to realize this. However most users are not accurate at determining which design decisions would meet their demands or they do not have the knowledge to successfully implement them (Franke and Piller, 2003). This essentially is an interface design problem, which can be solved through design methods. The indicated assertion takes us to our final enabler for product based mass customization: From product design perspective, these user co-design toolkits can be deemed as user customization interfaces. Hence, in order to obtain successful results, their problems should be approached in consideration of interface design ethos.

2.4 Enablers of Product Based Mass Customization

From the perspective of industrial design discipline, which has its focus mainly on tangible products, the above listed elements of mass customization can be interpreted with a slight disciplinal adaptation to have a better comprehension: The first element of solution space can be associated with design tools that produce more than one end-results, namely parametric modeling. The second element refers to means of bespoke production. In case of tangible objects, this principle can be covered by the overarching term ‘digital fabrication’, which includes advanced manufacturing technologies such as CNCs and 3D Printers. The final element, toolkits for customer co-design, is determined as the main issue to be analyzed within the scope of this thesis. It can be translated as the design of user-customization interfaces which enable users to create their own products within a pre-defined solution space.

2.4.1 Parametric modeling

As it is the responsibility of an industrial designer of mass production paradigm to bring forth product concepts that meet the needs of a designated user group in consideration of manufacturing constraints, it is indeed designer’s duty in mass customization paradigm to generate a reliable ‘solution space’ of feasible outcomes. Any outcome that is within this solution space should individually comply with the business aims and production capabilities. In order to achieve this, designers need adequate tools that will allow them to design solution spaces in consideration of the flexibility and stability issues of the process. Though this might be achieved through traditional design tools as well, many product designers use parametric computer

aided design (CAD) tools to acquire desired results more effectively. They parametrically model the family of outcomes and define which of its components are open to customer modification (Jiao and Tseng, 1999)

Barrios-Hernandez (2006) defines a 'parametric model' as "a computer representation of a design constructed with geometrical entities that have attributes (properties) that are fixed and others that can vary". Based on his definition, parametric modeling can be described as: 'a type of representation, where designs are defined in certain static components, dynamic parameters and geometrical constraints'. Designers create solution spaces for customizable products by deciding which properties to be kept static or flexible (i.e. open to user modification). In this approach, designers are virtually 'programmers', who design the whole product system that is consisted of the sum of all potential outcomes (Ceccato, Simondetti and Burry, 2000).

When launched in 1987, Pro/ENGINEER was the first CAD software to introduce parametric modeling. Since then many other software products that use parametric modeling approach for product design came to market, and their popularity has increased tremendously in the past decade due to their design and production advantages. Some of the most well-known examples of these software are CATIA, SolidWorks, Autodesk Inventor, SpaceClaim and Rhinoceros 3D's Grasshopper plug-in.

2.4.2 Digital fabrication

Arguably, the toughest challenge that product based mass customization applications face is bespoke production. The idea of manufacturing for each individual is fundamentally contradictory to the essence of the prevailing production approach. From the fabrication perspective, mass production paradigm seeks the largest production volume via as few varieties of products as possible. As the number of produced goods increase, fixed investment costs (e.g. molds) decrease and effectiveness of cost-reducing management tools (e.g. division of labor) maximizes.

Most mass customization applications today rely on manufacturing technologies of mass production paradigm. Bespoke production in this system is achieved through certain adjustments, such as extra tooling, modifications in the machinery or combining various pre-fabricated modules. These arrangements eventually increase

the prime cost of the product and find their reflections on the sales tag. Many mass customization applications fail to keep a competitive hand against the mass-produced alternatives on the market, since they are not successful at offering a meaningful added value with their increased prices.

In an interview, Extrude Hone Corporation's ProMetal division president Dove states that the success of mass customization applications correlates with their effectiveness at fulfilling the fundamental elements of conventional business, namely "cost, cycle time, and quality" (Bak, 2003). Sure enough, labor intensive and process interrupting arrangements in current bespoke production models raise the costs and slow-down the cycle times – while in many cases quality is also affected due to lack of standardization.

However, a certain group within advanced manufacturing technologies, namely digital fabrication, can bring an alternative to this situation.

Digital fabrication is the concurrent process of turning digital design data into tangible artifacts (Bull and Groves, 2009). They do not use physical molds to shape objects, but rather rely on the digital molds that are formed by ones and zeros. These methods can either be subtractive (e.g. CNCs) or additive (e.g. 3D Printers) (Seely, 2004). Unlike other 'net shaping' methods (such as casting, molding, sintering etc.), the modifications in the input data of such digitally fabricated objects can instantly be reflected on output artifacts.

As of early 2013, it can be said that 3D Printers are the crosshairs of these technologies. The main reason behind this phenomenon is the future predictions that place 3D Printers as the centerpieces of a new manufacturing revolution (Anderson, 2010). Indeed 3D Printers manage to overcome many of the problems that are faced in other digital fabrication methods. Since 3D printers build the final outcome through layers of material, they are neither as labor intensive nor waste feedstock. While it is true that currently their end-result quality is not in the desired levels and it is not possible to feasibly produce multi-material prints, the outcome quality of a $3,299 Formlabs Form 1 printer in 2013 is better than the 2001's cheapest 3D printer in market, which used to cost over $45.000 (Mota, 2011).

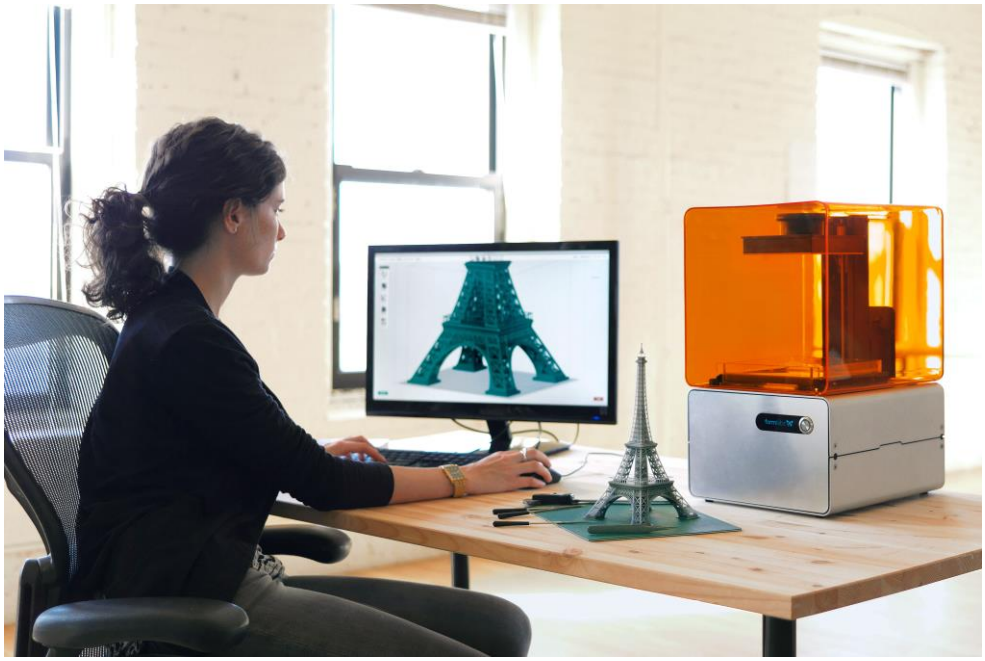

Figure 2.1: Formlabs Form 1 3D printer (Formlabs, 2013).

There was a time when these additive manufacturing techniques were seen as instruments to create rough physical models, and therefore rightfully called ‘rapid prototyping’ technologies. However, the significant improvement in their quality in the past decade turned them into manufacturing tools to obtain final products, shifting the name of the concept to ‘3D printing’ (Berman, 2012). Technological forecasts state that in foreseeable future use of 3D printers will spread even wider, eventually becoming a dominant manufacturing method to produce individually tailored alternatives in masses (Vance, 2010). Digital fabrication techniques’ advantages in producing customized products will become even more evident as their cost, material, precision and strength related limitations are overcame (Berman, 2012).

2.4.3 User-customization interfaces

The efficacy of the formulated solution spaces and the means of bespoke production are undoubtedly very important elements of creating a successful mass customization business. However, these factors can be regarded as background processes and none of them are confronted by the end-users. When customizing a product, consumers only engage with co-design toolkits that guide them within the solution space and eventually turn their design decisions into preconfigured bits that are comprehensible by manufacturers (Piller and Kumar, 2006).

In product based mass customization applications, these co-design toolkits are reflected as user-customization interfaces. There are different media to realize this, such as ordering via sales catalogues or creating combinations by assembling pre-manufactured parts in the sale point. Nevertheless, some of the most preferred toolkits today are web-based user customization interfaces (Kamali and Loker, 2006). The reason for this preference is their convenience for both parties (i.e. users and producers) from various aspects. From the user perspective, it can be seen as an opportunity to customize their products at privacy of their home, avoiding the hassle of a store, without the time constraints that could be associated with offline shopping (Forsythe et al., 2006). From the producer's perspective, it is even more advantageous. Web based "clicks and mortar" business approaches are much more scalable compared to tradition "bricks and mortar" businesses, since they do not require high investments to expand. They afford the potential of on-demand manufacturing, while eliminating the costs for substantial needs such as storehouses to stock-up, distribute and sell the products or outsourcing these necessities to other sub-contractors (Enders and Jelassi, 2000). Many firms such as Adidas, Nike and Dell already offer their customers the opportunity to customize their own products according to their needs through their websites. In these business models, producers mainly work as fabricators of products that are customized and ordered via their web-based applications (Mendelson and Parlakturk, 2008).

2.4.4 Motives of the research

In order to create a successful mass customization application, all of the above listed elements should individually perform at a satisfactory level and work together harmoniously. All of these elements have areas of improvement and from the design research perspective it is valuable to seek ways to make any of them better.

Nonetheless, this thesis will focus on the very last element, namely "user-customization interfaces", for a number of reasons: First of all, it is one of the lesser-studied areas although being a very valid design problem. Piller (2004) points out this issue, by stating that most of the mass customization research is focused on answering questions regarding agile manufacturing needs, while less of them are concerned on the toolkits customers make their choices with. What is more, literature on customer co-design toolkits is mainly consisted of research by academics with various business fields (Von Hippel, 2001; Zipkin, 2001; Franke and Piller, 2003;

Huffman and Kahn, 1998). The areas of design intervention for problems regarding the design of user elicitation interfaces are still vastly untouched and there is an apparent potential for design research. In contrast, the progress in two other elements (i.e. parametric modeling software and digital fabrication tools) is dependent more to the technological advancements than to conventional design research. Finally the user-customization interfaces in product-based mass customization applications are the only parts where the whole customization systems come across their users. Since users take a much more active role in mass customization business models, it can be said that better design of such interfaces would increase the quality of mass customization applications greatly.

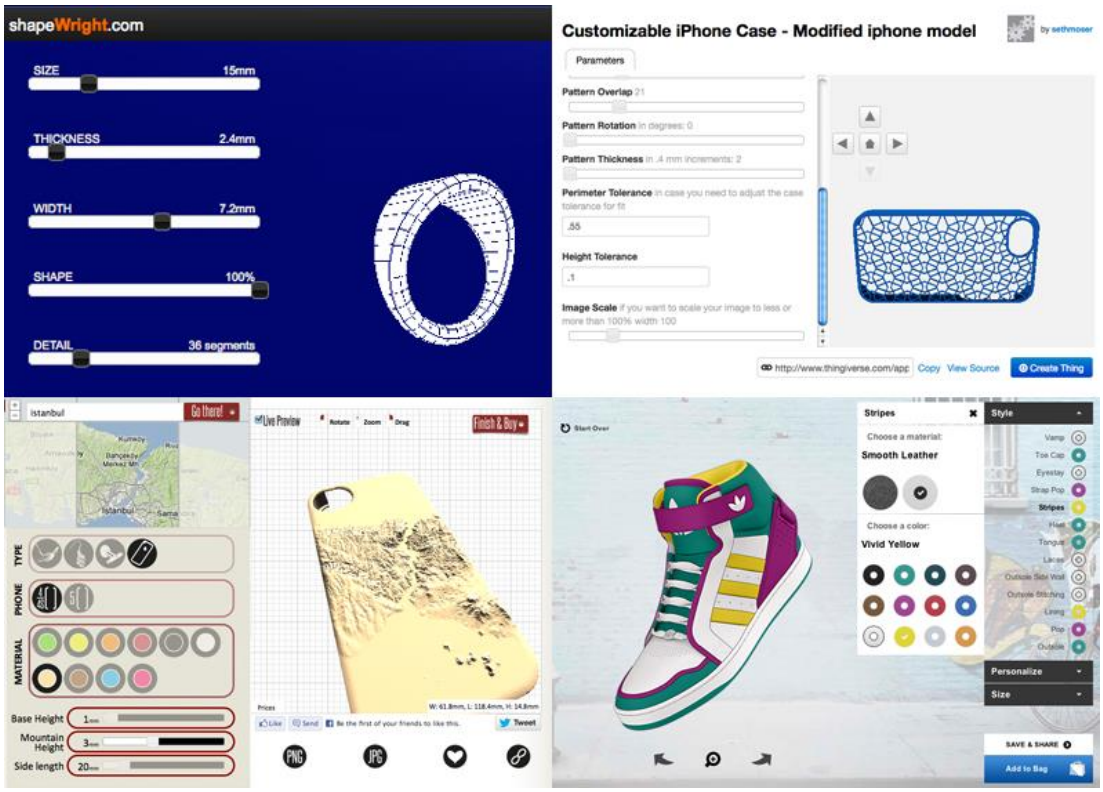

Figure 2.2: A few web-based user-customization interface examples with sliders and multiple-choice menus (Url-1, Url-5, Url-10, Url-6).

A quick overview of the design of presently available web-based user customization interfaces show that many of them use the language they borrow from other computer programs. Most of these interfaces are consisted of number sliders, dropdown menus and multiple-choice items. They rely on the proposition that users will create the final design according to their own wants and needs through modifications in building parameters controlled by these sliders and drop down menus. These interfaces treat customers as professional designers (or engineers),

who comprehend and command the implicit design system by altering certain parameters (Fischer and Girgensohn, 1990).

Yet there is a fundamental error in this view. Design research regarding the design of web-based user-customization interfaces are usually about how these toolkits should be developed in consideration of the human-computer interaction ethos (Helander and Khalid, 2001; Herd, Bardill and Karamanoglu, 2010; Kramer, Noronha, Vergo, 2000), rather than the very reason of their existence in the first place. While contributions of such discussions are not completely unavailing, they mainly lead to incremental improvements. Their main concern can be framed as 'making mass customization processes more efficient by helping customers perform the intermediary tasks of reaching the outcomes they desire' (Fischer and Girgensohn, 1990).

However, the practice of customizing products did not begin with mass customization – in fact, it was the predominant business model for certain products until the Industrial Revolution. Before the 'Age of Machines', craftsmen customized products regarding the needs and demands of each user, and they did not achieve it through co-design toolkits. Instead, they themselves have served as interfaces to identify individual needs and interpret customer demands. Their techniques were refined throughout ages to offer customers the most satisfactory customization experience and passed forward via years of mentor-protégé system. In the design of user co-creation toolkits for mass customization applications, this knowledge is usually undervalued, if not completely overlooked. Yet, in order to obtain significant information that would lead to remarkable improvements in the design of these co-creation toolkits, the focus of the research should be on the 'act of customization' rather than the interfaces that are currently offered. Since craftsmen have been the main group to undertake customization practice for centuries, they would be the most appropriate subjects to study in a research to reveal the key elements that lead to a successful customization experience. The designers of user-customization interfaces would have a lot to learn from the findings of such research on the repeatedly distilled techniques of craft-customization processes, and integrate these techniques into the interfaces they design in appropriate manners.

3. METHODOLOGY

Throughout this chapter, the methodology used in this research will be explained and specific details will be provided about why this particular research method was chosen and how it was applied.

3.1 Semi-Structured Interviews

The semi-structured interview technique was chosen as the main research method. The motivation behind this decision was to break the formal nature of the structured interviews in order to get more insightful and in depth responses from the interviewees.

3.2 Procedure

Prior to the research, a colloquial dialogue was undertaken with the participants, without immediate mention of the research. The subjects in these dialogues were mainly on everyday issues and can be categorized as small talk. This was done in order have a more insightful and relaxed talk by building a connection with the interviewees. After this brief acquaintance respondents were informed about the intent of carrying out a research about their practices. The interviewees were informed about the purpose of the interview, what makes them for a suitable potential participant and the anticipated duration of the interview (Less than 60 minutes). All of the interviewees were very positive and collaborative during the research. Although I showed up at their working environments without prescheduled appointments, all of them agreed to be interviewed immediately without any hesitation (The respondents were also told that the interview could be done at a later time if it was more convenient for them).

The style of the interviews can be described more like a casual conversation with certain agendas rather than a research with strict formalities. The tones of the interviews were also deliberately kept in a friendly manner; hence it was observed

that at times interviewees even forgot that a research was being undertaken. The questions were posed neither in a specific order, nor word for word. They were usually shaped along with the conversation and slightly reworded according to respondents. At times the interviewees provided the answers for the questions during the conversation even before they were asked. In such cases these questions were usually omitted in order not to interfere with the fluency of the conversation. In other cases they were asked from a different perspective to get additional insights on the topic or for the sake of double-checking if the answer given previously was interpreted right or not.

Interviews were not recorded for the very same purpose of having an interview in a relaxed nature. A pilot study (Appendix B.1) done before this research shows that presence of a recording device in the scene immediately turns the tone and the nature of the conversation into a formal one. It was concluded that this would affect quality of the results in a negative way since the accuracy and sincerity of the responses are subjected to distortion in interviews with formal character. Therefore, the responses given during the interviews were recorded as a series of written notes instead of voice recordings. These notes can be described as a mixture of keywords, shapes and stenos, which would be hard to comprehend for anybody other than the interviewer. The notes were transcribed into legible transcriptions in the form of sentences immediately after the interviews in order to prevent a possible loss of data. These transcriptions later on were conveyed to the interviewees to get their approval about their statements. The statements that were objected by the respondents were to be removed or amended, however there was not a case where this was required. Transcriptions of all the interviews can be found in the appendix section.

The interviews lasted from 40 minutes (Ahmet Dağhan - cabinetmaker) to 170 minutes (Hüsnü Altıparmakoğulları - cutler). The disproportional differences in time were due to the individual nature of each interview. Some factors leading to this result can be listed as time constrains of the respondents, the amount of off-topic conversation during the interview, the intensity of the relationship built between the interviewer and the interviewee, vice versa.

3.3 Participants

The research was done with 3 craftsmen who regularly generate customized products through a face-to-face customization process with their customers. In order to be able to make a coherent data collection and analysis, participants with similar backgrounds were selected. All of the participants were Turkish, over 40 years of age and trained in a mentor-protégé system. They are still involved in a certain domain of craft, which customization and craft production was once the main business model – but one that now became a highly commercialized industry within the rules of mass production paradigm. The interviewees are a cutler, an ironsmith and a cabinetmaker. They are still active at work and customization for the wants and needs of the customers is their main business model.

Two of the participants, the cutler Hüsnü Altıparmakoğulları and the ironsmith Ahmet Bayramça, were based in Kayhan neighborhood of Bursa, where there are clusters of craftsmen from various trades. These clusters are located roughly around the present day Kayhan Street, which is the main arterial of the 600-year-old Kayhan Bazaar. The neighborhood once housed forges that produced weaponry for the Ottoman army. As this need faded, the blacksmiths in this area began using their iron shaping skills to produce other products, such as knives or wrought iron gates. Although their numbers have decreased in years, a small blacksmith community is still present in the area.

One participant, Ahmet Dağhan the cabinetmaker, was based in Gülbahçe neighborhood of Bursa. Though this neighborhood is a residential one and has no significance in terms of craftsman presence, the participant stated that he recently chose to move to this neighborhood in order to be in vicinity with his potential customers.

3.3.1 Interview with Hüsnü Altıparmakoğulları, cutler

Hüsnü Altıparmakoğulları has a small workshop in the Kayhan neighborhood. His ancestors immigrated to Turkey from present day Kosovo in late 1800s and they have been crafting Albanian knives for over a century. In the earlier days – before "cheap Chinese goods took over the market" (interviewee's words) – he and his family used to produce knives for all sorts of uses. Now he is the last actively

working member of the family, which was once famous in the neighborhood for the quality of their knives.

Figure 3.1: Hüsnü Altıparmakoğulları, cutler.

Today most of the work he does is custom-made, since he finds it impossible to compete with mass-produced replicas. He is longing for the old days, when his workshop was full of the clinging sounds of the hammers. These days it is rare that somebody walks in his workshop to order a custom-made knife.

My interview with Hüsnü Altıparmakoğulları took around 170 minutes. It was by far the longest of my interviews. Mr. Altıparmakoğulları has shared his wisdom on many issues alongside his experience in producing custom-made knives. When the conversation had drifted away from the theme for a bit too long, I tried to put it back to track by asking a question about a knife in the showcase or a tool in his workshop.

3.3.2 Interview with Ahmet Bayramça (a.k.a. curly Ahmet), ironsmith

Ahmet Bayramça, also known as Curly Ahmet due to his thick curls, is another ironsmith located in the Kayhan neighborhood. He started as an apprentice with no prior vocational training and he has been in the business for over 25 years now. His main business is making custom-made wrought iron gates, fences and railings. The business is slow for him these days, since wrought iron has lost its popularity and

cheaper, more ‘modern looking’ (interviewee’s words) mass-produced counterparts that serve for the same purposes flocked the market.

Figure 3.2: Ahmet Bayramça, ironsmith.

Though his business slowed down, it does not seem to affect Mr. Bayramça’s positive attitude towards life. Throughout the interview, he never dropped the smile in his face. He states that he is a leftist and his ideology shapes the core values of his life. He is a devout member of the left-wing Workers’ Party (of Turkey). His sophisticated use of language and the command on Marxist terminology is surprising, regarding that he did not receive a lot of formal schooling.

My interview with Ahmet Bayramça took a little over an hour (70 minutes). Mr. Bayramça cheerfully answered my questions, though at times he seemed pessimistic – especially when the topic was the future of his profession or Turkey in general. The conversation was rarely off-topic, although there were some small talks on Turkish Politics.

3.3.3 Interview with Ahmet Dağhan, cabinetmaker

Ahmet Dağhan is a young man in his early forties. He has been working as a carpenter and cabinetmaker for more than half of his life. Like many of his colleagues, he also received almost no formal schooling. He is a skilled but a daunted man. In the past he was an idealistic apprentice walking in the path of traditional craftsmen; he was making fine custom-made furniture for the upper class. Nowadays he runs his own workshop in Gülbahçe neighborhood of Bursa, where it is easier to generate cash by making kitchen cabinets for the middle class. The residents of this neighborhood prefer custom-made kitchen cabinets made by Mr. Dağhan instead of the modular, adaptable ready-made ones from the construction market retails. There are two reasons for this: First and most obvious is the cost. Cabinets by Mr. Dağhan are surely more affordable. But there is another reason: most buildings in this district are fruits of urban sprawl, so it is hard to say that they follow a standard quadrilateral floor plan. In such cases, custom-made cabinets are a necessity rather than a choice.

Figure 3.3: Ahmet Dağhan, cabinetmaker.

After the Turkish Stock Market Crash of 2001, Mr. Dağhan was unemployed for a while. Upon finding another job, he spent the next five years to build up savings again to found his own little workshop and it is where he still works until this day.

My interview with Ahmet Dağhan was the shortest one. It took around 40 minutes. Mr. Dağhan was not talkative during the interview but this seemed to be due to his personal traits rather than an intentional uncooperative attitude against the directed questions. The interview hardly ever drifted away from the main topic and Mr. Dağhan seemed to try giving short but direct answers to my semi-structured questions within our informal conversation.

3.4 Interview Questions

Although the questions were asked neither verbatim nor in a specific order, they were always physically present in sight of the interviewer, attached to the notebook. The questions to be asked during the interview were initially structured in English. However, since the interviews were made in Turkish the questions were also translated accordingly.

The mainframe of the questions asked during the interview is as follows:

- How and to what extent do customers participate in design process?
- How do you communicate with the customers about certain design specifications? How does that language differ from what you would use when talking to a professional?
- What other "interfaces" do you use apart from talking to customers? (Ex. Showing photos of the formerly designed objects, drawing during the decision-making process etc.)
- How do you decide and finalize the design specifications?
- Who is the main decision-maker, you (designer) or customers? Can you explain the process of decision-making?
- Do customers come with a brand new design idea that is not specifically your style? If yes, how do you react in these situations?

- Are there any customers who entrust you with the design of the end-result after giving the brief, without providing you with any particular preferences? Can you give examples of such cases?
- Do customers feel the "I designed it myself effect" (Franke, Schreier and Kaiser, 2010) after a design process in which they were included? What is their perception on the ownership of design?
- Do customers classify their custom made artifact as a 'designer item'?
- Are customers satisfied with the end-results? Can you give examples of specific cases?
- Do you think that custom-made end-results carry the genes of your earlier works? In other words, do custom-made end-results bear characteristics of your earlier works?
- Have you ever experienced an error yielding to a positive outcome, which has altered or shown its reflections in your future work?
- Have your designs/techniques evolved during this process? If yes, How?
- Is there anything else you would like to add?

The main aim throughout the interview was to understand the nature of user engagement and craftsmen behavior in craft customization processes. Therefore the main flow of the interview was kept around these particular issues. However there were times where off-topic conversations were undertaken in order to maintain the semi-formal tone of the interview. In some cases additional questions were also asked to the respondents in order to obtain in depth answers on certain subjects.

3.5 Analysis of the Interviews

As previously mentioned, the interviews were recorded as written notes, which were transcribed in form of sentences immediately after each interview. Interviews were analyzed in their original language in order to prevent loss of meaning. Use of qualitative data software was not found suitable for this research, since the amount of data was manageable in size and it was already being filtered during transcriptions of the interviews.

Instead, obtained data was coded in consideration of Boyatzis' (1998) principles. The statements that bear resemblances were flagged to create thematic groups. Subsequently these thematic groups were labeled with a concept that defines the content of the group. The detailed examination of these concepts and the reasoning behind their categorization is explained under their respective titles. The results of the analysis is a schematized list of attributes that are intrinsic to craft customization processes.

4. RESULTS OF THE RESEARCH: THE ATTRUBUTES OF CRAFT-CUSTOMIZATION PROCESS

Through analysis of the interviews, twelve attributes that are intrinsic to craft customization were defined. These qualities can be grouped under four overarching titles, namely communicative attributes, decisional attributes, reflective attributes and experience enriching attributes. In this chapter these attributes and their sub-concepts will be explained by discussing the interviewed craftsmens' statements about their customization processes. Where needed the arguements have respective craftsmen statements referenced, in order to give reader the opportunity of reaching the original source. Each explanation is finalized by a brief comparison of the attribute in question to its equivalent in digital user customization interfaces. This was done to help reader better identify the contrasting elements in both processes.

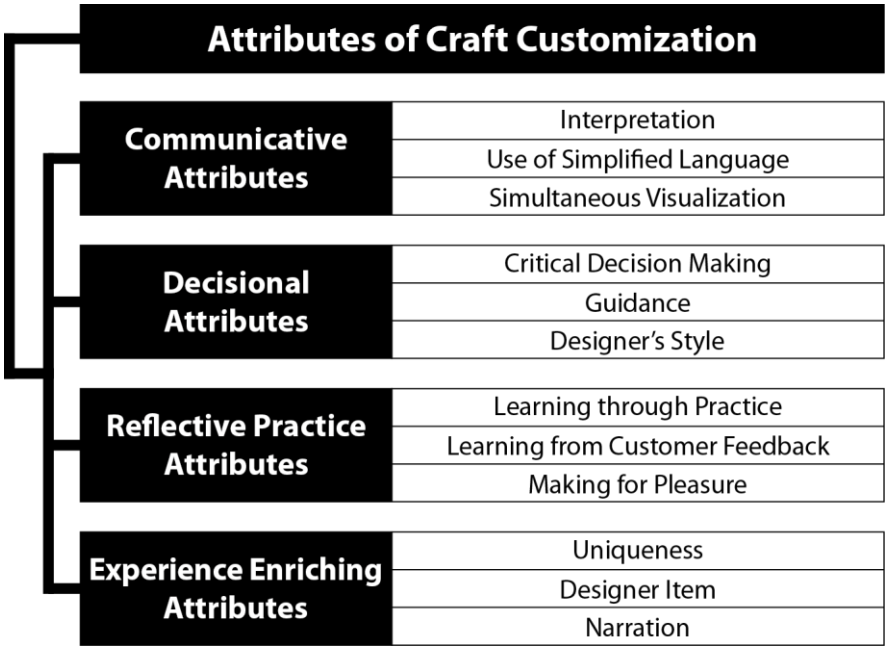

Figure 4.1: Visualization of craft customization attributes.

4.1 Communicative Attributes

Communicative attributes are a group of techniques and approaches that are used by craftsmen to clearly understand customers' wants and needs, as well as conveying back their own ideas.

The research yielded three concepts that will be explained in detail under the title of 'Communicative Attributes': Interpretation, Use of simplified language and Prototyping.

4.1.1 Interpretation

Craftsmen neither expect from customers to know what they want exactly, nor do they assume that customers will articulate their requests in the most appropriate way. They rather translate customers' demands into relevant parameters through their thinking processes.

The research shows that customers tend to use different modalities to voice their wants and needs. Some of them bring along similar products to communicate their demands [1], while others show several photos from magazines to explain their anticipations [2]. In certain cases customers use very specific terms to describe their expectations, which by itself would enclose a definite set of parameters within (e.g. the term 'grafting knife' is enough for cutler Hüsnü Altıparmakoğulları to have an idea about certain parameters of the final product, such as size, length and weight [3]).

Figure 4.2: An original design by Altıparmakoğulları crafted according to the demands made by one of his customers. He interpreted his needs and turned them into design parameters [45].

In most digital customization interfaces, by contrast, customers are expected to express their wants and needs through digital parameters (commonly abstracted as sliders or multiple choice inquiries) (e.g. Url-1, Url-6, Url-7, Url-10, Url-11). In such

interfaces, customers are erroneously treated as professional designers. The ability to aptly parameterize a request is a complicated task for regular users, since their demands are most likely to be comprised of various associative parameters affecting each other. This approach is very unintuitive for the users. In craft customization, designers are not only problem solvers; but they are also definers of the problem. There is a significant diversity in modes by which customers express their demands, and craftsmen are the ones to interpret those demands and turn them into appropriate design parameters [4].

Figure 4.3: Bayramça has various catalogues in his workshop that he utilizes as a medium to better understand customers' wants and needs.

4.1.2 Use of simplified language

When talking to their customers, most craftsmen use a language that is different from what they would use when talking to a professional. The sentences that they carefully formulate to exchange ideas with clients are stripped away from the unnecessary use of terminology [5]. In some cases, the words that they pick to elaborate their thoughts to the clients may not always be technically accurate. Nevertheless, from a layman's perspective they are much easier to comprehend [6]. The craftsmen rarely refer to technical terms, and when they are obliged to do so they usually accompany

them with explanations that style them as easy to understand fragments [7]. They have various methods to do this: They describe terms using similar notions from daily language, they bridge the meaning gaps with analogies[8], they expand abbreviations to clarify their contents [9] and at times they even go as far as deconstructing etymologies of concepts [10].

But the instances of simplified language use are not only found in ways by which the craftsmen express themselves – but also in the ways they listen. When customers put their wants and needs in words, they borrow concepts from their plain daily languages and craftsmen play along with them. For instance, when a customer tells cutler Mr. Altıparmakoğulları that he wants a knife made out of hard metal, the seasoned craftsman immediately knows that his client is talking about 'high-rigidity steel'. However, he does not correct his customer. Quite the contrary, he shifts to the language his customer uses to make him feel more comfortable about the way he expresses himself [11].

Figure 4.4: A 'five-star' knife by Altıparmakoğulları. Instead of milimetric dimensions which would potentially be confusing for the customers, cutlers use stars as indicators of size.

In many digital user customization interfaces, the language used in interfaces is not easy to comprehend by regular users (Kramer, Noronha, Vergo, 2000). Sophisticated terminology is used unreservedly for the sake of factual accuracy. However such

pursuit of accuracy generally means compromising user friendliness (Valerio, 2012). Digital customization interfaces are mediums for users to translate their wants and needs to computer readable data – so they should be treated accordingly. The focus should be on the interaction between user and computer, rather than terminological accuracy (Kramer, Noronha, Vergo, 2000). In craft customization, accuracy of language is usually compromised intentionally in order to have a better understanding of customer demands. The factual accuracy is eventually achieved in craftsman's thinking and clients are pleased to be able to express themselves without having to use a technical language [11].

4.1.3 Simultaneous visualization

Craftsmen primarily use lingual methods to communicate with their customers. They ask customers about their demands and share their own ideas with them. However in many situations spoken language is not the most efficient way to communicate. For such cases craftsmen develop non-lingual methods to exchange information more effectively. Some of these methods are more conventional, such as freehand sketching or showing photos of a similar object designed previously [12]. Others, like CAD drawings, are somewhat less expected and surprising (but not impossible) to see [13].

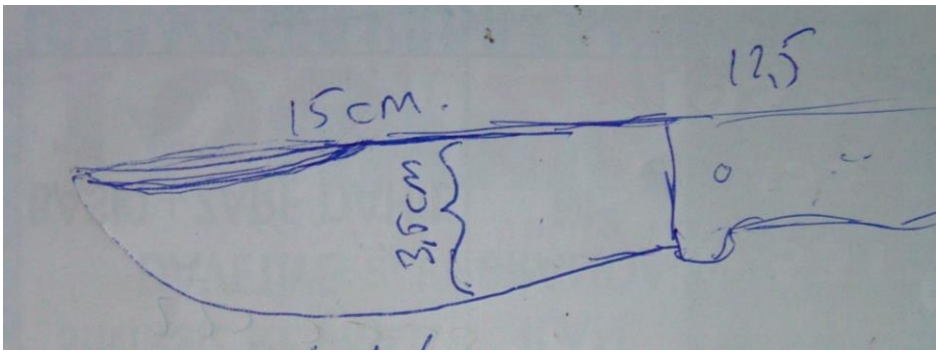

Figure 4.5: A quick freehand sketch by Altıparmakoğulları. Freehand sketches are one of the most frequently used ways of visualization in craft customization.

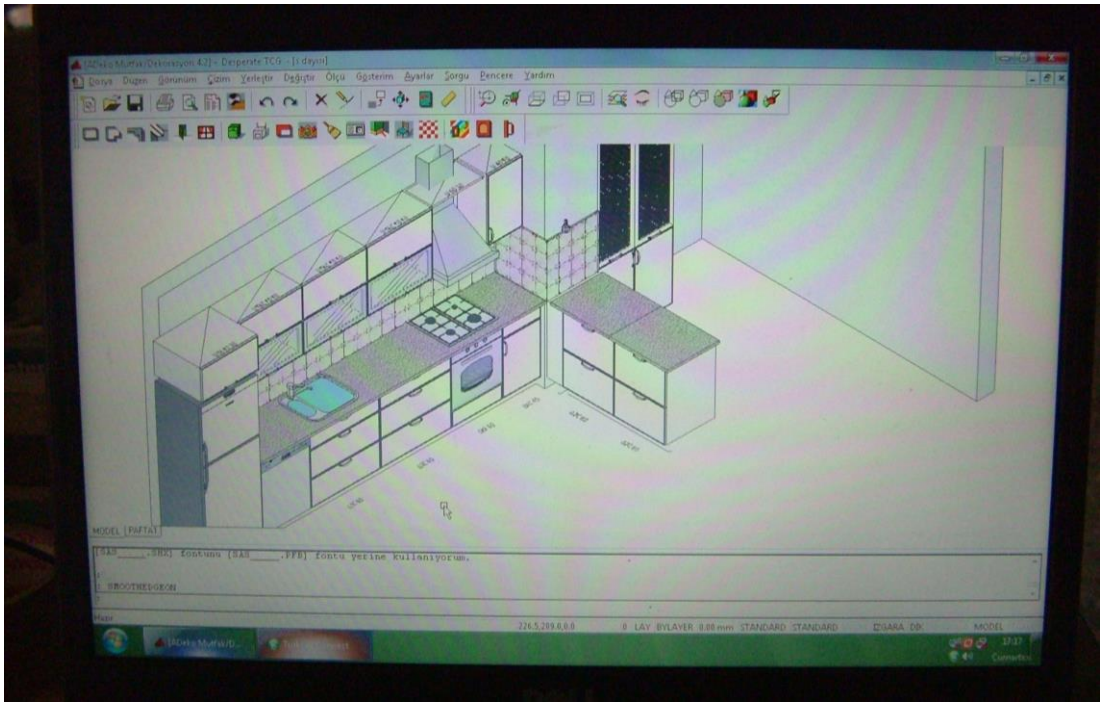

Figure 4.6: CAD drawing by Dağhan. CAD drawings are rare in craft customization scene, but not impossible to come across.

At first glance, this feature of craft customization may not seem like a competitive advantage against digital customization interfaces. After all, most digital customization interfaces provide accurate digital visualizations of the customized objects simultaneously according to the input given by the user. However although these digital visualizations are superior in terms of production speed and precision, they fail to reach the success of their analogue counterparts in certain aspects.

First of all, interventions to representations made by craftsmen require no additional knowledge of a particular medium. Customers can verbally explain craftsmen what they want to be changed, add some additional lines to drawings or shape clay prototypes with their own hands [14]. Contrarily, most digital user interfaces require a period of exploration and adaptation to intervene effectually (Piller and Kumar, 2006). Secondly, almost without exception, outputs of digital customization interfaces are intangible images. Craftsmen, on the other hand, have a tendency to use tangible representations [12] [15]. Their measureless prototypes may not be as accurate as digitally rendered 3D images. However, they nestle other qualities that digital images fail to provide. They accommodate tactile information that helps users better understand the material and they give a more concrete understanding of proportion by which users can have a better grasp of their relative physical existence.

Those qualities turn tangible prototypes into more accurate final products in the eyes of the customer though this might not be theoretically true. Lastly, representation in craft production can take place in real time; it can be seen as a reflection of craftsman's mental model [16]. Given that the customers are present during the course of representation's creation process, the design process becomes much more accessible for them to participate. In digital user customization interfaces, reaction to changing inputs (i.e. recreation of the image of customized product) is almost at an instant. Though this might seem advantageous at first, such process does not give any hints about designers' thinking processes and therefore prevent design representations to realize their full potential in user participation aspect.

4.2 Decisional Attributes

Decisional attributes are a group of craft-customization qualities, which can be observed during the course of shaping designwise decisions. They are the ways by which designers include customers in design process and integrate their wants and needs into customized products – or how they deliberately exclude customers' demands in some cases to obtain more preferred results.

The research yielded three concepts that will be explained in detail under the title of 'Decisional Attributes': Critical Decision Making, Guidance and Designer's style

4.2.1 Critical decision making

In colloquial understanding, product customization is almost synonymous to end-results designed by their respective users. While this might be true at a certain extent, it certainly does not give the true reflection of customization processes' nature. If we refer to the tailor analogy once again, even if a customer is very specific about his/her demands, most of the design decisions are still taken by the tailor. To an outer eye, many of these decisions may not be noticeable at first glance (e.g. providing a list of appropriate materials to choose from) or may seem irrelevant (e.g. how buttons are sewn). Nevertheless these decisions are very critical for the success of the outcome – they constitute the larger part of the design process and require expert knowledge.

The research shows that craftsmen are still the main actor in decision taking stages of customization processes [17]. The interviewees unanimously state that the user

contribution is minimal when looking at a product as a whole, while customers have their say on certain attributes of the end-result that can be addressed as expressive features [18][19]. This fundamental role craftsmen take in design process can be termed as 'Critical decision making'. Rieke, Sillars and Peterson (2009) define 'critical decision' as "…one that survives the test of a relevant set of criteria". In craft customization, the relevant sets of design criteria are obtained by the craftsmen through vocational training and consolidated by years of practice [20]. The clients are not expected to be familiar with these criteria; instead craftsmen conduct the customization processes so that the customers are not bothered by such procedures [21]. Craftsmen are the ones to take the critical decisions, and prevent users to make crucial mistakes due to lack of knowledge and/or experience [22].

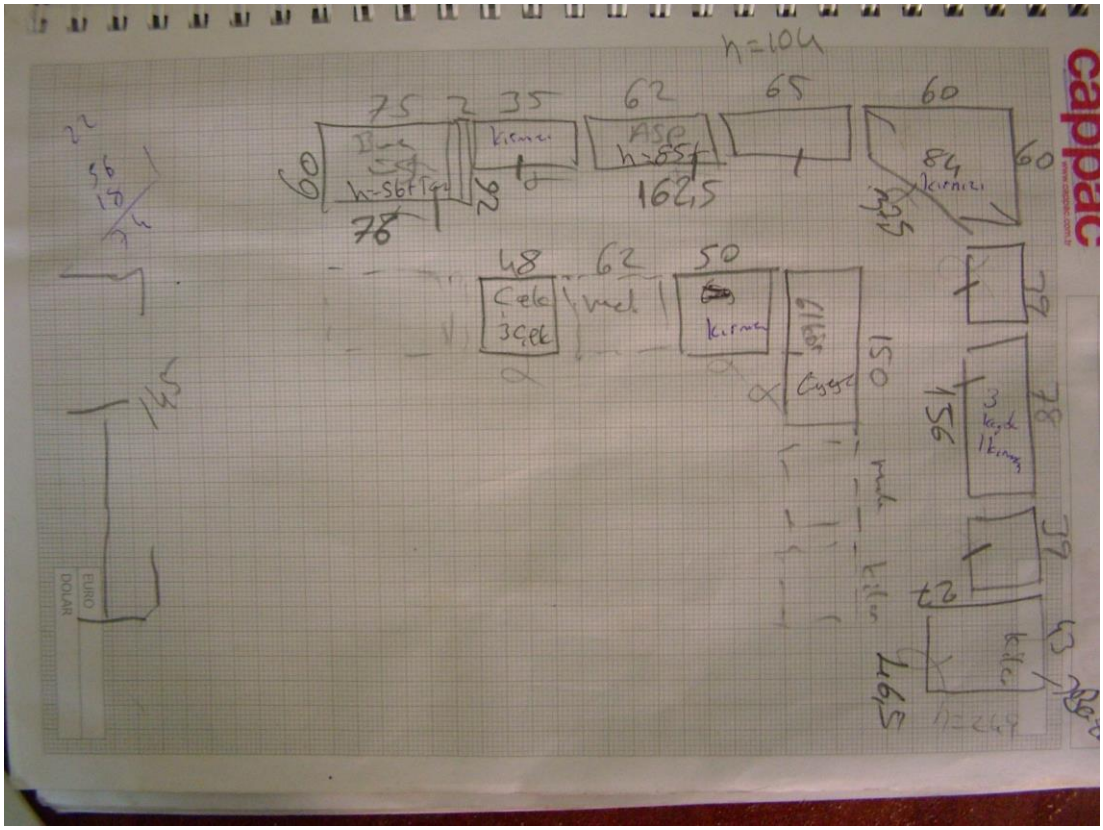

Figure 4.7: A quick hand-drawn plan by Dağhan. Though kitchens are co-designed with customers according to their demands, Dağhan is the one to designate certain critical design decisions such as the sizes of units or where to place the utilities.

Primary way for craftsmen to intervene design decisions is by limiting them. Relying on their previous knowledge and experience, they eliminate many potential design decisions in the beginning [23]. In certain cases this might mean eliminating some unconventional innovative ideas[24]. Yet it certainly serves as a way to dismiss a lot

of unfeasible possibilities [25]. These limitations may appear in all types of design decisions, such as the ones that are related to form, function, economical feasibility etc. (or combinative decision of many – e.g. material selection)[2][11]. In digital user customization interfaces such approach of limitation is deliberately avoided for the sake of putting users in the in the designer position, without consideration of whether they have the necessary qualifications (Franke, Schreier and Kaiser, 2010). The user is given the sense that he is the designer, leading him to create unfeasible outcomes, inappropriate solutions or aesthetically unpleasing forms (Huffman and Kahn, 1998). This erroneous approach might be the main reason behind mass customized products shorter use life (Piller, 2004)

There is also another approach by craftsmen to take certain design decisions, which is parallel to limitation method mentioned above: Fixating some design parameters according to the customers' demands [4][23]. This approach is much more radical, since it rules out all other possibilities for some design decisions and turns them into static parameters in accordance with the design brief. This can also be seen as a way to translate customers' specific wants and needs (as described in the 'Interpretation' aspect within the Communicative Attributes section above) into forms [26]. Sometimes even a basic definition such as 'kitchen cupboard' is enough to give definite information about certain parameters deemed appropriate in a relevant context (e.g. height and depth of the cupboard according to ergonomic constraints) or decisions that might seem subtle yet they are crucial (e.g. where to place the hinges) [21][27]. In some digital user-customization interfaces, this principle is successfully implemented (e.g. Supabold, Url-13). The user is secluded from design decisions, which would yield to inappropriate outcomes. In such examples, contextually defined design decisions are seamlessly integrated into design algorithm. In other, less successful applications (e.g. Thingiverse, Url-1), these decisions are left for user control. This hassles the user with too many options to choose from and increases his likeliness to obtain unsuitable end-results.

Interviewed craftsmen also refer to a material and making relationship, and how they regard it as a design domain that cannot be interfered by their customers. For instance, ironsmith Ahmet Bayramça defines design as "shaping material through conscience" [20]. This definition, though limited, points out a certain aspect of craft customization that is impossible to be interfered by customers even if they wanted to.

Craftsmen embed their design decisions in material through hammer hits. Since this aspect has no equivalent in mass-produced or digitally fabricated products, it cannot have its reflections in digital customization interfaces either.

4.2.2 Guidance

Although the research suggests that craftsmen are the critical decision makers in craft customization, user-customization business models do include users in the center of decision-making processes by definition. Craftsmen are not exceptions to this situation. They exchange information with their customers and apply their wants and needs into their designs by taking a more active role in crucial issues and leave the arbitrary ones to customers [19]. However craftsmen's usual stance towards these arbitrary decisions is not leaving them totally at customers' will. They share their opinions about these decisions as well [13]. In other words, they guide customers through their decision-making processes. This practice does not have to be done on purpose – many craftsmen guide their customers rather unwittingly [27]. Craftsmen generally customize similar objects over and over, therefore it can be said that they are more experienced about the outcomes of the respective arbitrary design options [4]. They also know the wants and needs of the mainstream market (i.e. fashion) [14]. They interject certain suggestions in their dialogues with the customers and help them shape their decisions.

Figure 4.8: Bayramça states that he regularly guides customers about which ornaments to use for decorating wrought iron gates [16].

At times the nature of these suggestions is not only based in factors related to personal appeal – but also for functional reasons [29]. In such cases craftsmen listen to their customers and offer them several alternatives explaining the pros and cons of each option [4][27]. The main issue in such comparisons is usually the cost factor. In situations like these although the craftsmen leave the final decision to customers, they often accompany it with their own opinion [27].

In digital user-customization interfaces, the notion of guidance is usually overlooked for the same reasons explained in the previous header. Most mass-customization applications prefer to overload customers with abundance of choices, for the sake of promoting them as the designers of the customized products. Though initially it might seem true that customers should be more satisfied with the outcome designs for being all by themselves in decision-making processes, research shows otherwise: Too many options to chose from affect users' customization experience in a negative way (Huffman and Kahn, 1998) and most products customized this way tend to have a shorter lifetime compared to mass-produced products (Piller, 2004). Therefore the absence of the guidance factor in digital user interfaces can be regarded as a deficiency rather than a positive contribution to users' customization experience.

4.2.3 Designer's style

In the last two headers it was explained that craftsmen actively take decisions for crucial issues and provide guidance for the arbitrary decisions. However the research shows that there is another practice: Craftsmen also shape some of the arbitrary options to their own liking. Alternatively, so to say, they apply their own style to the customized products. Most craftsmen refer to themselves as designers, and they do it for a good reason [30]. They leave their traces on the designed products in terms of subjective decisions [25]. The customers are not only aware of this situation, but in most cases they also treat it as a reason for preference amongst the craftsmen [31]. When customers visit a craftsman to get a customized object made for them, they usually take his previous works into account [32]. Craftsmen's style, along with his/her workmanship quality, is amongst the top reasons for deciding to work with them or not [33].

Figure 4.9: Altıparmakoğulları is certain that his work have consistent characteristics, in other words a 'style' that can be recognized even from the washers of the rivets in the knives he designs [51].

Craftsmen also proudly own and embrace these decisions that carry their style genes. Indications of this attitude are more apparent in the pilot research done with craftsmen that have designer background (Appendix B.1). One of the designers in that research states that no matter how much her customers took part in the design stage, the end-results would always bear characteristics of her own style [34]. She says that this happens through silent agreement with the customer, which leads to a state of mutual satisfaction where both parties are pleased with the outcome [34].

Hence in craft customization, craftsmen are satisfied to have traces of their own preferences in the end-results, and customers are pleased to have a customized design object that bear the signs of their preferred designer. Yet in digital user customization interfaces, the diversity in the design algorithm's outcome is praised and presented as a positive attribute. Many mass customization applications with digital user-customization interfaces promote their businesses emphasizing diversity in the end-results.Such diversity, usually lacking qualities defined earlier (i.e. guidance, use of simplified language, proper interpretation) cause frustration in users to obtain a preferred end-result (Huffman and Kahn, 1998)

4.3 Reflective Practice Attributes

Reflective practice attributes are a set of craft customization characteristics that are associated with continuous learning. Donald Schön (1983) defines reflective practice as "the capacity to reflect on action so as to engage in a process of continuous learning". Craftsmen learn during customization processes through their interaction with customers and materials.

The research yielded three concepts that will be explained in detail under the title of ‘Reflective Practice Attributes’: Learning through practice, Learning from customer Feedback and Making for pleasure.

4.3.1 Learning through practice

The primary mean by which craftsmen advance their work is through rigorous practice (Sennett, 2008). They imitate what they learn from their masters and try to achieve perfection through constant reiteration [35]. Mistakes are their best teachers in this course [36] and at times apprentices are deliberately left to stumble by their masters as a part of their learning routines [37]. In progress of time, craftsmen also learn from their interaction with the material and they develop new techniques and methods to improve their processes [38].

Figure 4.10: Altıparmakoğulları at work. The primary mean by which craftsmen advance their work is through rigorous practice (Sennett, 2008).

During the research, interviewees shared how their practice has improved over time without even being directed a question about the issue. They were particularly enthusiastic to talk about the techniques and methods they developed themselves [37]. In most cases, changes introduced by them are incremental. However the satisfaction of improvement bring along the enthusiasm to be more productive.

Most mass customization applications on the other hand completely disregard the concept of learning. They work with what-you-see-is-what-you-get principle and try not to leave room for mistakes to learn from. By all manner of means, their inputs are designed digitally for the sake of being accurate representations. Yet the situation is even more immutable if the mass customized items are manufactured through digital fabrication techniques. On the bright side, digital design - digital fabrication combination leads to very precise and consistent end-results. However it also causes the process to be a very static one. The iteration of process itself does not lead to improved outcomes, unless the input (i.e. digital data) or manufacturing methods are altered. The better portion of digital user-customization interfaces is also built in a static way. Their designers consider their job done after they finish building the interfaces. There are rarely modifications, once the applications are aired. Nonetheless most errors (or 'areas of development' from the opposite perspective) become evident after a series of customization procedures. While craftsmen succeed in using such errors as a way to improve their methods, digital customization interfaces fail to make use of similar opportunities.

4.3.2 Learning from customer feedback

While it is true that most craftsmen learn through following their masters' footsteps, there is another group of people that serve as their instructors: customers. Craftsmen learn from their customers, particularly while making customized designs for their clients. Clients teach the seasoned masters in many direct and indirect ways. For example, they push craftsmen's boundaries through uncommon requests and force them to develop new practices [17] or they share photos of the state-of-the-art examples and update them about the pulse of the market [14]. Their instructive role is not finished even after the customization process. They let the craftsmen know about what they liked about the process and the actual object, or share their ideas about what needs to be revised [31]. Thus craftsmen refine their customization practices in time and provide their future customers better customization experiences.

This characteristic of craft customization is one of the least benefitted attributes in digital user-customization interfaces. Although each customer that customizes a product through digital interface can be considered as a data, interface designers usually neglect the opportunity to learn from their users. Most digital customization interfaces are not built to be reevaluated according to the feedback from users, which is actually paradoxical to the core essence of customization concept.

4.3.3 Making for pleasure

The traditional route for a craftsman starts as becoming an apprentice, advances as developing into a journeyman and finalizes by being recognized as a master. The entrants who want to progress in a career have to improve their practice in every stage until they themselves become recognized as masters. But even masters are not prone to cease their development. They endeavor to improve their practice to become better and better. Craftsmen do not do this for the purpose of obtaining better results in the future (though it can be regarded as a favorable gain). They rather do it for their own gratification. According to Sennett (2008), this is where the true essence of craftsmanship lies; a pursuit of self-satisfaction.

Figure 4.11: A non-functional blade by Altıparmakoğulları, made purely for self-satisfactory purposes [39].

The research done on the craftsmen overlap with his observations. All of the interviewed craftsman mentioned an object that they have designed and made just for the sake of it [39][32]. They were neither assigned to do it, nor had any particular plans about what to do with the outcome. They used them mostly for exhibition and/or decorative purposes [39], and in some instances sold them to enthusiastic

customers [32]. A better portion of these objects can be classified as unconventional designs that challenge traditional making methods. However craftsman are not involved in designing and making such challenging objects in order to improve their making practice – but simply to fulfill their desires. Sennett defines this urge as "the way to secure deep inner satisfaction, to earn respect and self-worth" (2008).

However, whatever the motivation, all these practices function as formative processes. When one of the interviewed craftsmen, Ahmet Bayramça, was asked whether building that particular decorative object served as a medium to improve his means of making, he was initially puzzled by the question. Refining his methods was not the driving factor for him to make the object. Yet after a brief pause, he acknowledged that the activity helped him have a better control over shaping the material [32]. Craftsmen transfer the experience they gain from such ancillary exercises and use them to improve their design and making practices. These improvements eventually shed their reflections to craftsmen's customization processes.

The digital user-customization interfaces are very rigid when it comes to producing outcomes. The clouds of end-results are tailored in a purposeful manner. Few of the mass customization applications seek improvement, and if they do they are still done in a progressive and designed nature. In such business models there is not an equivalent to craftsmen's pursuit of self-satisfaction. Therefore the unique contribution potentials of such deep-set incentive are overlooked.

4.4 Experience Enriching Attributes

Experience enriching attributes are group of qualities that pertain to craft customization that indirectly enrich the customization process and the final product, although their contribution might seem insignificant at first glance. Those attributes can be listed as uniqueness of the outcome, the end-result being a designer item and descriptive narrations by craftsman that accompany the customization process.

4.4.1 Uniqueness

The notion of uniqueness is inherent in the definition of customization. The customized outcomes are shaped according to the wants and needs of individual customers, so it can be expected that the number of unique results to have parallels

with the number of individuals. Nevertheless, the concept of uniqueness in question here is a different one. While it is certain that different inputs that go through the same process will yield to different outputs, this statement also implies that same inputs that undergo the same procedure would result in identical outcomes. However this does not hold true for craft customization. Unlike digitally fabricated products, the objects that are crafted through manual labor lack the accuracy of the initial representations due to various reasons (e.g. flaws of manual labor, characteristics of raw material etc.) [25]. At times there are even significant changes in design decisions during the making processes [41]. Yet this characteristic of craft customization is not necessarily undesirable. It leads products to be unique, even if they have identical inputs. Ironsmith Ahmet Bayramça describes this phenomenon in a very poetic way by saying "Even if the same craftsman hits the same iron with the same hammer, you still do not get the same results. You get a different result every time" [42].

Figure 4.12: "Even if the same craftsman hits the same iron with the same hammer, you still do not get the same results. You get a different result every time" [42].

There are different ways through which the concept of uniqueness surface in customized products. For example, cutler Hüsnü Altıparmakoğulları cites how the natural pattern of the material he uses (cattle horn) differs, causing each knife handle to have a different aesthetic look that can be foreseen neither by his customers nor by himself [40]. Ironsmith Ahmet Bayramça refers to another instance where he made a

faulty turn by mistake in the bars of a wrought iron gate, which was found appealing to eye by his customer [41].

In digital user-customization interfaces such inaccuracies in the design representation are seen as errors and their potential positive contribution is disregarded. If these objects are fabricated digitally as well, then the possibility of coming across a surprise result is impossible – at least in theory. While this allows such mass customization applications to work with aforementioned what-you-see-is-what-you-get efficiency, it certainly fails to provide a unique benefit that is intrinsic to the nature of craft customization.

4.4.2 Designer item

The outcomes of craft customization bear a lot of traces from it is designer; the designers after all have their say on almost all stages of the design and making processes. They are the ones to take the critical decisions, guide their customers on arbitrary ones and reflect their own styles on the final product. All these contributions take their shares in turning a customized product into a designer item.

However, being a "designer item" in this context is different from the sum of all these individual elements. It can be considered as an attribute by itself. It does not refer to an anonymous craftsman who has participated in the design process – but one with a name. The customers who got their products customized by that specific craftsman know and recognize that it wouldn't be possible to obtain the same results with a different craftsman [43][34]. When customers speak of such customized designs, they do not forget to mention name of its craftsman. They praise their products with sentences such as "I got it made/designed by X", where X refers to the craftsman [43]. This phenomenon cannot be explained only by the actual contribution of the craftsman on the end-result. It also has something to do with the end-result being an exclusive item, designed by a particular craftsman. This adds another layer of value to the item, which cannot be found in mass customized products where designer is unknown [44].

The interviews made with the craftsmen that participated this research support this view. Craftsmen see themselves as the designers of the customized products as well – even in cases where their customers took active role in the decision-making processes. They refer to those objects as their own designs without hesitation [45].

Most of them document the end-results of their customization processes by taking photos [45], and some sign or label their products to show this exclusivity [46].

Figure 4.13: Altıparmakoğulları finishes off his knives by engraving his family's easily recognizable seal. According to him, his name is a brand by itself [43].

In digital user-customization interfaces, the designers of the algorithm usually neither have a name or face. Since the "user is the designer" delusion is pumped up for marketing reasons, the users fail to benefit from the satisfaction of owning a designer item. Instead they get an item, which they took an active part in its design process. This of course has its own satisfactory advantages. Yet if the outcome turns out not to be a successful one, then this feeling of satisfaction is replaced by disfavor of the customized product.

4.4.3 Narration

A fundamental characteristic of craft customization surfaces through the medium that it takes place. Most craftsmen still undertake the customization process via face-to-face negotiations with their customers. Such type of interaction can be regarded as beneficial for various reasons. First things to come in mind are the communicative factors that are explained in the first header of this chapter. Nevertheless there is another element, which might go unnoticed due to its seemingly lack of practical effect on the designed outcome. That element is narration: Craftsmen's tendency to accompany customization processes with semi-relevant stories.

Most craftsmen, particularly the more senior ones, are in the same trade for many years. They have been building similar products for many years and throughout those years they accumulate countless stories. Some of these stories are related to their profession and serve as an unwitting tool to ensure customers about their mastery –

such as the history of their trade [10], how long ago was it that they started this profession [47] or how a respectable authority praised their work [29][32]. Others are not related to craftsmen's profession at all but help establishing a bond between them and their customers – like small talk about family issues or politics [48][49]. One way or another, all these tiny narrative recitals function as enriching factors to the craft customization processes [50].

Figure 4.14: Craftsmen enhance customization processes through various ways, one of them being narration. Bayramça states that he informs his clients on many aspects of wrought iron, including its history and etymology [10].

Digital user-customization interfaces on the other hand are result oriented due to their nature. They regard customization process as an intermediate task to be completed. The main concern in digital interfaces is efficiency. They follow a standard scheme and do not diverge from the principal aims. Furthermore, such interfaces do not interact with their customers in the same ways that craftsmen do. Digital user interfaces are mostly static and do not aggregate their past experiences with the users. They are neither living bodies that gain experience or gather stories from their earlier customization processes, nor aware of the user appreciation of the previously customized products. Therefore it can be said that they were not designed to narrate in the first place. However this shortfall can be compensated by integrating

additional pre-programmed elements which would simulate the narrative qualities of the craft customization process.

5. APPLICATION OF THE RESEARCH: A GUIDELINE TO DESIGN AND EVALUATE USER CUSTOMIZATION INTERFACES

The research presented in the previous chapters and its findings on 'craft customization processes' is conducted eventually for the aim of applying renditions of these methodologies and approaches in user co-design toolkits. However, it is possible that the readers will find this information implicit in terms of their application to design. In order to overcome such potential loss, these qualities were adapted as a set of questions for designers' to use as a guideline/checklist when designing user customization interfaces or evaluating the currently available ones. To better demonstrate such use, a number of currently available web-based user-customization interfaces were comparatively assesed in regard to these questions. The evaluations were made for illustrative purposes only and rely on the subjective views of the author based on the interpretations of the research done in the previous chapter. These views are not tested with additional research, such as an evaluative questionnaire made with lay users who tested the interfaces, since the success of the customization process cannot be determined without a certain use period following the delivery of the customized products[4].

5.1 Evaluation Procedure

In an attempt to evaluate the web based user customization user interfaces in the light of the research, the presented qualities that are intrinsic to craft customization were rephrased as questions. Each question was formulated to look for a certain feature in the inspected interface, which would coincide with a certain characteristic of craft customization. These questions are used to create a chart which is designated to be used for evaluating user customization interfaces (An empty specimen of this evaluation chart can be found in Appendix D). Subsequently each web-based user-customization interface was discussed and analyzed by the author, in consideration

[4] This reasoning is in accordance with the article by Piller (2004), which defines one of the largest problems of web-based mass customization as customers who wish to return products expressing their disappointments with the end-results after receiving them.

of the prepared questions. The answers were then schematized to be able to have a comparative look. In this table;

"+" shows that the user-customization interface has successfully integrated the quality,

"~" shows the interface demonstrates certain elements that can partly be considered as the traces of the respective quality, but not fully/successfully integrates them,

"-" shows that the user-customization interface has failed to offer the quality,

"N/A" shows that the attribute is not applicable for the nature of this interface and,

"?" shows that it cannot be known if the attribute is available with the current methods of investigation.

Each web-based user customization interface was evaluated with the same questions, and the answers were sought in above given order. Using the questions, it was first checked if the interface displays the desired quality (i.e. "+"). If an interface found not to be fully successful in this manner, then certain elements that would partly resemble such approach were sought (i.e. "~"). If the interface fails in both these inspections (i.e. "-"), then it was examined if it is appropriate for the nature of this specific interface to offer such quality. In case the answer for this examination is no, then the interface is labeled as "not applicable" for that specific attribute (i.e. "N/A"). If not so, then it is decided that the used methods of investigation are inadequate to reveal the existence of the respective attribute (i.e. "?").

Although questions were prepared for the detection of 'learning through practice' and 'learning from customer feedback' as well, they were not included in this analyzes since it was not possible to investigate these qualities without contacting the designers of these interfaces.

5.2 Evaluation Questions

The characteristics, their respective questions and the thought processes behind them are as follows:

1) Interpretation: *Does the interface help user to reach the final design by showing preset options to modify over, or through certain inquiries to determine his starting point?*

As craftsmen translate their customers' wants and needs during the beginning of the customization process, so can user customization interfaces. Many users do not know what they exactly want and they are confused by abundance of choices (Huffman and Kahn, 1998). Yet most user customization interfaces appear before their users with a list of options to choose from and a representation of a presumably neutral combination of these parameters. The research on 'craft customization processes' on the other hand, shows that it is more satisfactory to interpret users' needs first and provide them with a base point, which would bring them closer to their anticipated end-result. Some exemplary ideas for such preliminary interface are: exposing users with certain specimen design representations to give them a better start point in modification phase or asking them several questions to understand and determine certain parameters in advance.

2) Use of Simplified Language: *Are the design parameters (Or technical terms – if there are any) expressed in a way easily comprehensible for a nonprofessional without need of any additional information?*

During customization processes, craftsmen correspond with customers by stripping their language from vocational terminology that would be troubling for them to understand. Web based user customization interfaces should take a similar path. Any information that is incomprehensible or difficult to envision for a user during customization process is likely to degrade his/her customization experience. Therefore, language used in such systems should be articulated in a way that no particular knowledge required other than that a nonprofessional would already know. A well-known human centered design ethos, "plausibility over accuracy" (Weick, 1995), has a similar connotation. It is not relevant to offer users an option to decide whether they want a customized pendant that is 5.2 or 5.3 mms tall, while simply representing the customized design next to a common paperclip is a much more meaningful way to exchange information.

3) Simultaneous Visualization: *Are the visualizations of user customized final results updated simultaneously to the changes in design parameters?*

Since it is difficult for a nonprofessional to envision the outcomes of their design decisions, craftsmen create prototypes to help customers have a rough idea about the eventual end-result. Regarding that they have a much greater potential to do so, web-based user customization interfaces should follow the same route. The users should be able to see the how their design decisions affect the outcome, preferably simultaneous to their modifications. Most web based user-customization interfaces take advantage of designing with parametric modeling tools for that matter, and results are visualized almost instantaneously through appropriate software or web apps.

4) Critical Decision-Making: *Are some parameters fixated and/or limited by the design system in accordance with certain modifications made by user in other parameters?*

The research shows that many craftsmen take an active role in certain design decisions. Upon listening to their customers' needs and preferences, they eliminate some unsuited options and limit the selection space in others. In other words, they make the critical decisions and leave the optional choices to their customers. On the contrary, many web based user customization interfaces allow users to combine all possible values within their limits. This can be translated as a solution space that is practically impossible to command. A calculation by Franke and Piller (2003) shows that a store to exhibit all possible sneaker combinations from customatrix.com would need 7000 earth-size planets completely covered with shops. Not surprisingly, large solution spaces include a vast number of products that are functionally or aesthetically unfavorable – or in some cases even impossible to manufacture. If necessary, designers should take precautions against the occurrence of such unfit outcomes by designing associative systems with interdependent relations between its parameters. Through these systems, designers' can still function as critical decision makers without the necessity of physical presence.

5) Guidance: *Does the interface recommend certain options throughout the customization process?*

Web based user customization interfaces tend to leave all design decisions to users. They refrain not only from making decisions, but also from recommending them. Yet, many craftsmen behave in a completely opposite way. Their contribution to customization process is not only in fundamental design decisions, but also in

subjective ones. Their cumulative knowledge about the demands of other customers and trends, along with the experience they have accumulated throughout the years, put them into an authority position where they can give valuable critics on customers' decisions. Designers of web-based user customization interfaces' can adapt the same approach. For instance, they can build a system that offers users certain options based on the data of the previous sales or current trends. Maybe one of the best-known examples of this recommendation approach is applied by Amazon.com for years, where customers are frequently shown suggestions based on what other items were shown interest by people who purchased a particular item (Dieberger et al., 2000).

6) Designers' Style: *Do all designs obtained through the interface share stylistic resemblances that make them look like products of the same designer?*

Each craftsman has his/her own style and in many cases that is one of the reasons for preference. When customers choose to get something customized by a specific artisan, they have a general idea about what to expect – after all they have chosen to work with that particular craftsman and not another. In the explanations of previous questions, it was shown that craftsmen exert their authority on crucial issues and share their opinions about the subjective ones. Nonetheless, whether deliberately or not, craftsmen also make decisions on some arbitrary options according to their own likings. In colloquial terms, this can be regarded as their style – reflection of their own tastes on products. Designers of user customization interfaces can also take the same path – and they often do. Instead of leaving all subjective design decisions to their users, designers can fixate or limit certain options (which would otherwise be considered subjective or arbitrary) for the sake of creating a design language. This approach not only makes it easier for users to foresee the outcomes of the process, it also helps by simplifying the user interface via elimination of excessive options (i.e. 'mass confusion').

7) Learning Through Practice: *Is the interface/system improved or refined over time in regard to the obtained end-results?*

Each manufacturing process in craft customization is also a learning opportunity where mistakes are the best teachers. In contrast, for mass customization processes where objects are customized through user interfaces mistakes are regarded as undesirable results. The loss of designer-maker relationship prevents designers of

mass customization paradigm to learn from manufacturing processes and to improve their practices. However, this does not necessarily mean that there is not a potential for such use. Each mass customized product can indeed be regarded as a learning material. The knowledge obtained from manufacturing these items can be used to improve both the quality of solution space and the interface to present them.

8) Learning from Customer Feedback: *Is the interface/system improved or refined over time in regard to order history or use information of the users?*

Craftsmen use their clients as a source to learn current trends and demands of the market. They also use customer feedback to evaluate their own customization processes and to find out which outcomes were the most satisfying. This approach has even a greater potential in web based user customization interfaces. Certain technologies that are used to gather usage information such as mouse tracking (heat maps) (Arroyo, Selker and Wei, 2006) or eye tracking (Nielsen and Pernice, 2010) can point out what parts of user interface can be improved. The data of the customers' previous orders can be treated as a source to learn as well. Frequency of customizable features' selection can be interpreted as signs to measure market pulse. User customization interfaces' designers can use these signs to revise their designs to achieve a better sales success. Another way to learn directly from customers is to ask for their feedback. Through such medium customers can write designers and developers what they were pleased about the customization process or the outcome they received in the end, and what could be improved.

9) Making for Pleasure: *Does the interface exhibit (or randomly generate) a few off-shot example outcomes to show the potentials of systems to customer?*

Research shows that there is a group of customers that craftsmen try very hard to please: themselves. Seasoned masters give their best efforts to bring out products, which will demonstrate the finest outcomes of their craftsmanship – and they do it just for their own pleasure. They enjoy exhibiting those products in their workplaces for decoration purposes. However, it can be said that these decorative objects also serve for the intent of sharing the bounds of their mastery with clients. Such objects would serve as a reference point for customers to have a better idea about what can be produced and they would also spark new ideas. User customization interfaces can mimic this approach by showing certain uncommon end-result examples, which would push the boundaries for customers. These examples would help customers

imagine beyond their initial preconceptions about what can be produced via the customization interface. It can also inspire them to come-up with ideas that they wouldn't have thought otherwise. Another way to achieve these objectives is to have a random product generation button in the interface. Thus, end-results with randomized parameters are generated to show the potentials of the system, which are not likely to be created by clients. Although the initial presuppositions tell that the success rates for these combinations would most probably be low, it should not be forgotten that these outcomes will also serve as eye-openers for the customers and they can still be open to desired modifications by clients.

10) Uniqueness: *Does the interface yield to different (even if subtly different) end-results given all the parameters are same?*

"Even if the same craftsman hits the same iron with the same hammer you do not get the same results. You get a different result every time" [42]. In these tightly packaged words of wisdom, ironsmith Ahmet Bayramça points out a quality that we have sacrificed long ago in the pursuit of our distorted perception of perfection. For the past century, mass-customization paradigm had been treating the concept of standardization synonymous to perfection. However, the research shows that one of the true beauties of craft customization lies in the uniqueness of its unstandardized outcomes. In the digital realm of zeros and ones, the preciseness is advocated as a quality that cannot be rivaled by the analogue processes. Yet in the case of customization through digital interfaces, this means that same inputs will always yield to identical outcomes. The objects that were tailored to be unique in the first place will end up as easily replicable artifacts given that the parameters to produce them are known. To prevent this via user customization interfaces, there can be a few alternative solutions. For example, designers of these interfaces can add a randomized k factor to the calculation, which would make the final design subtly different. Thus, even if the initially given parameters are kept same, the final design can be slightly different each time a new outcome is generated. Another way to achieve this would be to give a slightly different set of initial options to users. While this approach is hard to apply for options that are ought to be standardized for economical purposes (such as material selection), it can be more apt in other cases like to create pinpoint differences in the final form of a 3D printed decorative figure.

11) Designer Item: *Is the name of the designer who designed the algorithm mentioned? Is this name promoted for marketing purposes?*

There are two things that draw a customer to a particular craftsman and not to another. The first one is his/her style, which was covered in an earlier question in this chapter. The second one however, might be a little more latent and hard to discern at first sight: It is the name of the designer itself. Apart from carrying the style and workmanship quality, each craft customized item also bears the name of its designer. Research shows that although distinguished wants and needs of each client are taken into consideration during the customization process, the outcomes are still referred with the names of their respective craftsmen. This quality is different from carrying resemblances to a collection of previous work done by the same craftsman, or in other words craftsmen's style (If this was the case the artifacts with same style which are made by other craftsmen would have the same value as the artifacts crafted by the original craftsman). The craft-customized artifacts carry a value that is constituted solely by being an item by a specific designer. Some mass customization business models deliberately refrain from proclaiming the names of the designers for the sake of putting clients in the position of the sole creators of the objects, in order to make the end-result more desirable for the customers (Franke, Schreier, Kaiser, 2010). Yet the research made on craft customization process shows quite the contrary. The craftsmen state that their customers are proud to pronounce the names of the artisan that customized a product for them, and what is more they take it as an extra token of exclusivity. Most of the web-based user customization interfaces analyzed within this thesis refrained from proclaiming the names of the designers. In many of these websites the case is not only limited to avoiding the promotion of the artifact with the designers' name – but it is also not possible to find the designers' name on the website even if it is actively sought for. It can be assumed that the motivation for this avoidance is related to refer customers as the designers of the artifacts. However the interviews made with the craftsmen hint that the perception from the customers' point of view is completely the other way around. In order to fully benefit from this quality of craft customization, user-customization interfaces should not only include the names of the designers, but they also should promote these their businesses with designers' name.

12) Narration: *Are there any narrative qualities that would not directly contribute to generation process of the end-result, yet enrich the customization / purchasing experience of the customers?*

Even at a quick glance, it can be seen that the analyzed user customization interfaces are designed with a mainstay in mind: efficiency. They are viewed as arduous chores that users need to complete in order to reach their real aim, the customized final product. From this perspective, it is logical to design user interfaces, which would minimize the time spent for a client to customize an object. However, the interviews made with the craftsmen show that this is not the case for craft customization. Craftsmen see the aspect of narration as an indispensable part to customization process. Most of these narrative elements can be seen as small talk with the clients, which has little or no effect on the tangible end-result itself. However, they add-up to the customization experience of the customers, affect the way customers perceive the customized artifacts and ultimately increase the satisfaction of the purchased objects. User customization interfaces can adopt a similar approach by using the elements of narration. They can enhance the customization process by giving additional detail about their products, such us giving extra information about how it is being produced, who else has bought it or what are the qualifications of the designer vice versa. None of this information would directly contribute to the design decisions given by the customer (hence the outcome), yet they all will increase the perceived quality of the product.

5.3 Evaluation of Selected Web-Based User-Customization Interfaces

In this section, a few selected web-based user-customization interfaces were analyzed using the questions and methodology given above. The web pages were selected to represent a variety of interfaces, which differ from each other from certain aspects. In cases where a number of interfaces found to be similar in many aspects (e.g. the customization interfaces of NikeID, miAdidas, Puma Factory, Your Reebok etc.) a mediocre one was chosen to best represent the group. The analyzes are given below in alphabetical order:

5.3.1 Crayon creatures

Crayon Creatures is a web-based customization business, where children drawings are turned into 3D objects (Url-2). Its interface is technically invisible to user, since it works by users sending children's scanned drawings to the firm via a simple upload page.

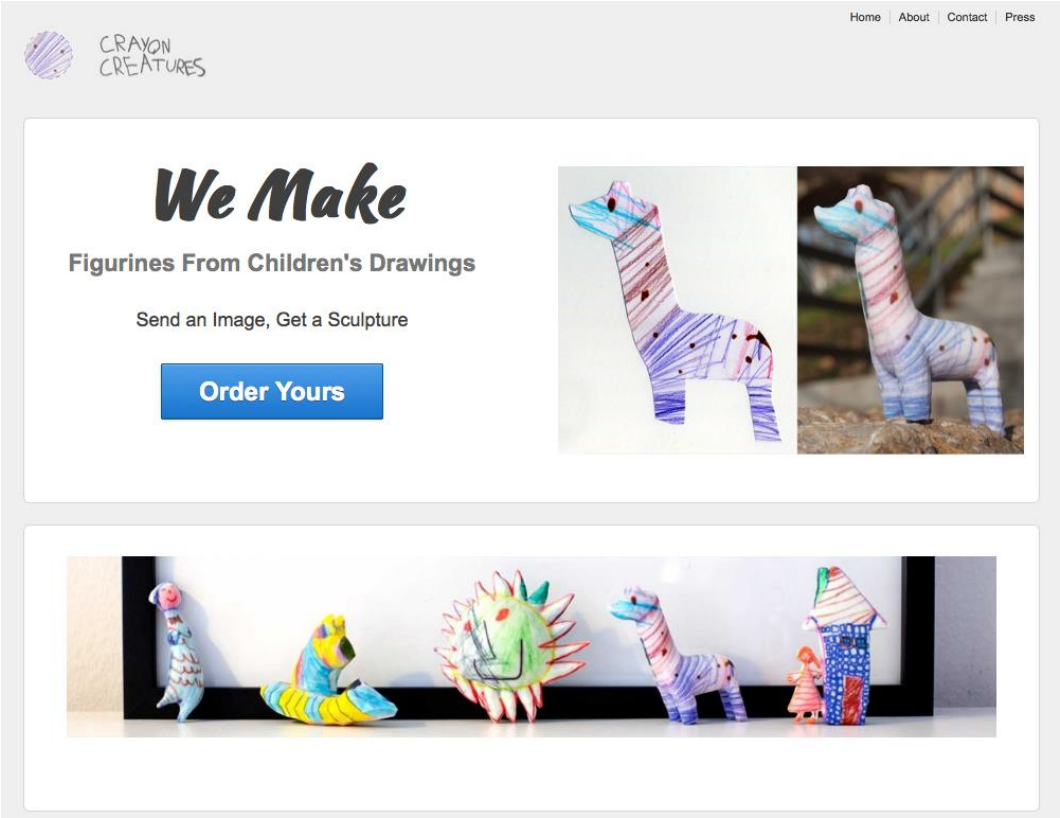

Figure 5.1: An image from Crayon Creature's website (Url-2).

Although it is dubious whether Crayon Creatures can be considered as a mass customization business model (since it requires a designer to spend time in order to create each figure) it can be said that it bears resemblances to many positive characteristics of craft customization. Among those, the foremost is uniqueness. Since a human intervention constitutes a part of the process, even if the same designer 3D models the same drawing at a different time it is certain that the customer will get a different outcome.

5.3.2 Electrobloom

Electrobloom Customiser is a mass customization business, which partners with Shapeways for fabrication of customizable rings and bangles (Url-3). In its somewhat arid interface, there are a few choices of charms and colors.

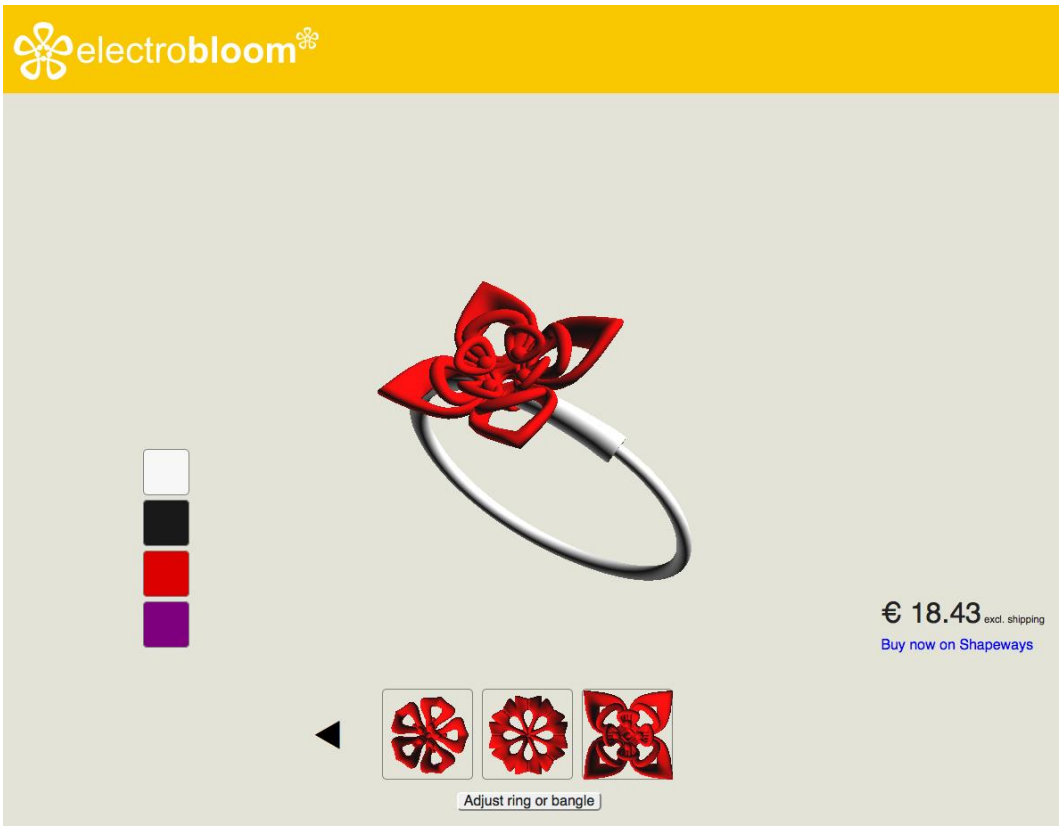

Figure 5.2: An image from Electrobloom's customization interface (Url-3).

The way users customize via Electrobloom Customiser can be used to point out lacking qualities of many similar web-based user-customization interfaces. Although limited options impose a certain design style and the simultaneous visualization is available, the interface fails to satisfy even at a mediocre level in almost all other aspects. There is no medium for interpretation of users demands, all the decisions are left to users without guidance, uniqueness was not a consideration and it requires extensive user effort to reach the designer's name or bits of narrative elements on the web page.

5.3.3 Flat clock

Flat Clock is a system for generating customized clocks (mainly their acrylic back panels) (Url-4). Their stylized expandable drop-down menu provides the users with certain options to customize faces, backs and hands of the clocks.

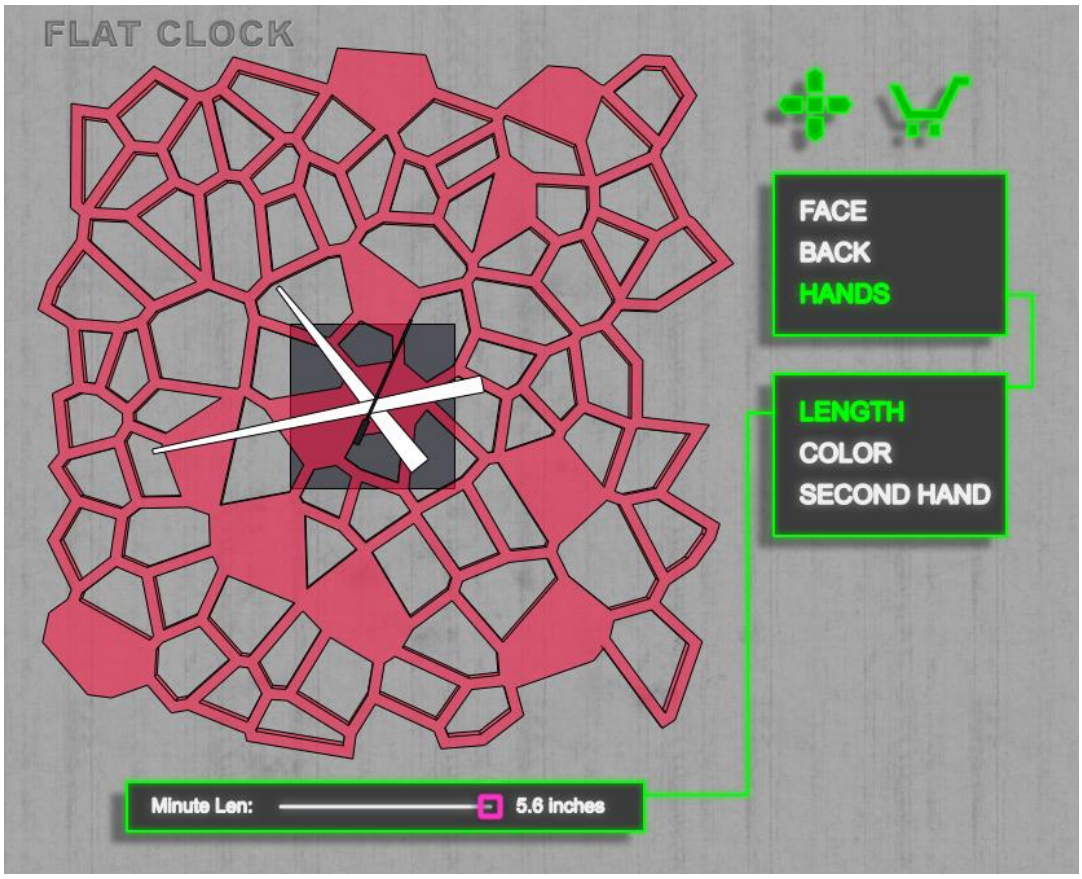

Figure 5.3: An image from Flat Clock's customization interface (Url-4).

A few elements in its interface are enough to put Flat Clock in front of many of its counterparts. Although it can be said that the customization interface can still be improved in terms of taking design decisions (i.e. Decisional attributes), it displays a well above average performance in mimicking certain craft customization aspects. Among those aspects are 'making for pleasure' – where generation process of a few distinct options are shared with users, and uniqueness – achieved by making continuous sliders (c.f. sliders with steps) which make it practically impossible to obtain the same results from the system.

5.3.4 i.materialise appear lamp

Appear Lamp from i.materialise's creation corner is an interface to apply a desired text onto one of the two lamp shaders provided by the system (Url-5). Customers can choose a lamp in the beginning and enter their texts inside of the shader and/or on top of it. Their area of intervention is limited to the fonts and the texture of the lamp.

Figure 5.4: An image from i.materialise's customization interface (Url-5).

The case of Appear Lamp shows that the limitation of user intervention actually serves good for the purpose creating stable and desirable outcomes. The options are restricted to a few and the outcomes might look similar to each other, yet the end-results are limited only to the 140 characters (or less) long bodies of text that can be formed. The language used throughout the interface is quite simple and users are provided with links to webpages that are constantly updated with quotes from famous personalities. A main improvement area for this interface is the lack of simultaneous visualization. Due to its absence, clients are not able to see a representation of outcome before they receive the products they have ordered.

5.3.5 miAdidas

miAdidas is Adidas's version of web-based sneaker customization interfaces (Url-6). There are many renditions of this business model from different competitors, such as NikeID, Puma Factory, Your Reebok, Vans Customs etc. Through these interfaces users typically modify the colors of a several pre-defined sections. A couple of these sections might also offer user a material or pattern selection. After the selection of desired options, the customization process almost without exception finalizes with a part where users are offered the option to engrave a short text in a predefined part of the shoe (most likely the heel) and/or change the logo. All the above given brands' user customization interfaces fit to this definition.

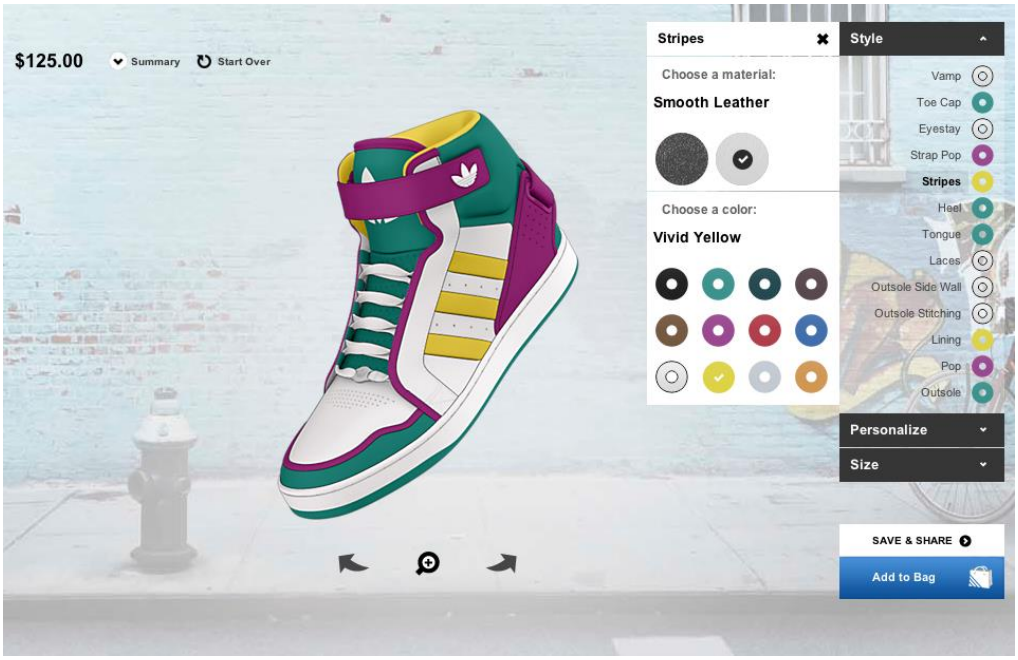

Figure 5.5: An image from miAdidas' customization interface (Url-6).

Although the adaptation of this business model by a variety of manufacturers hints that mass customization applications in this field are feasible, their customization interfaces are far from being perfect. Relying on the research made with craftsmen, it can be concluded that there are many areas of improvement. For example, the design process can start with a few pre-designed examples to take customers to their desired outcomes in a much quicker and effective way. Yet most of these sneaker customization interfaces treat footwear as empty canvasses that users will color as they wish, thus they start the process with totally white shoes. Due to the same reason, all the decisions are left to the users and no guidance is given throughout the

process. With this approach, it is very likely that customers can create unsuitable combinations, which would decrease user satisfaction after a brief period of use and deteriorate brand equity. Even in cases where users put together remarkable creations that will shine out amongst the standardized sneakers, it is very easy for someone to go online and create the exact same shoe using the same selections since there is no uniqueness factor.

5.3.6 Nervous system cell cycle ring

Nervous system is a design studio that is focused on generative design (Url-7). Their portfolio of tangible products, which are mainly consisted of computationally generated complex geometries produced via digital fabrication, also include a few user-customizable objects. Below is a screenshot from the interface of one of these objects, the 'Cell Cycle' ring (Url-7).

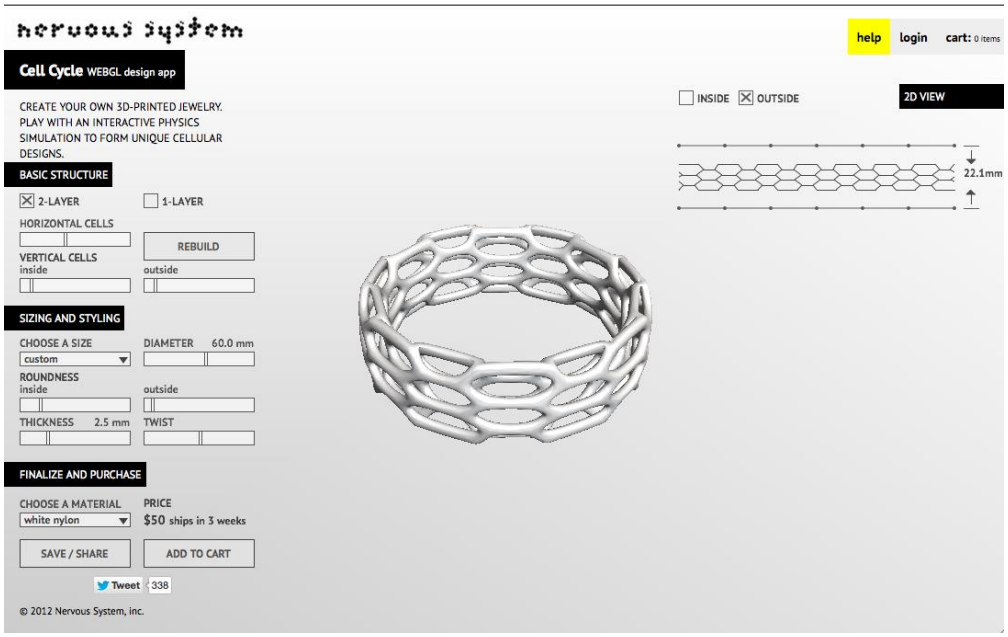

Figure 5.6: An image from Nervous Systems' customization interface (Url-7).

The user-customization interface for cell cycle is a very typical example. So much so that it can be used as a reference to illustrate both the superiorities and the inferiorities of a large group of similar web-based interfaces against craft customization. It intentionally treats the user as the main designer and serves as a very flexible tool for him/her to obtain the desired end-result. Although one can speak of a general resemblance in outcome forms, the name of the algorithm designer is not pronounced anywhere and the product is advertised with "create your

own design" slogan (Url-7). The interface is merely composed of number sliders and drop down menus, half of which are not articulated in a way that is easily comprehensible for lay-users. There are neither narrative elements nor assistive features to alleviate the design process for the users. Hence, this seemingly well-formulated product algorithm's user-customization interface fails to offer many of the benefits that are part of the craftsmen's customization routine.

5.3.7 Twikit

Twikit is an online business for creating customized awards (Url-8). It has 5 different types of medals and trophies that users can customize with their own words and choice of typefaces.

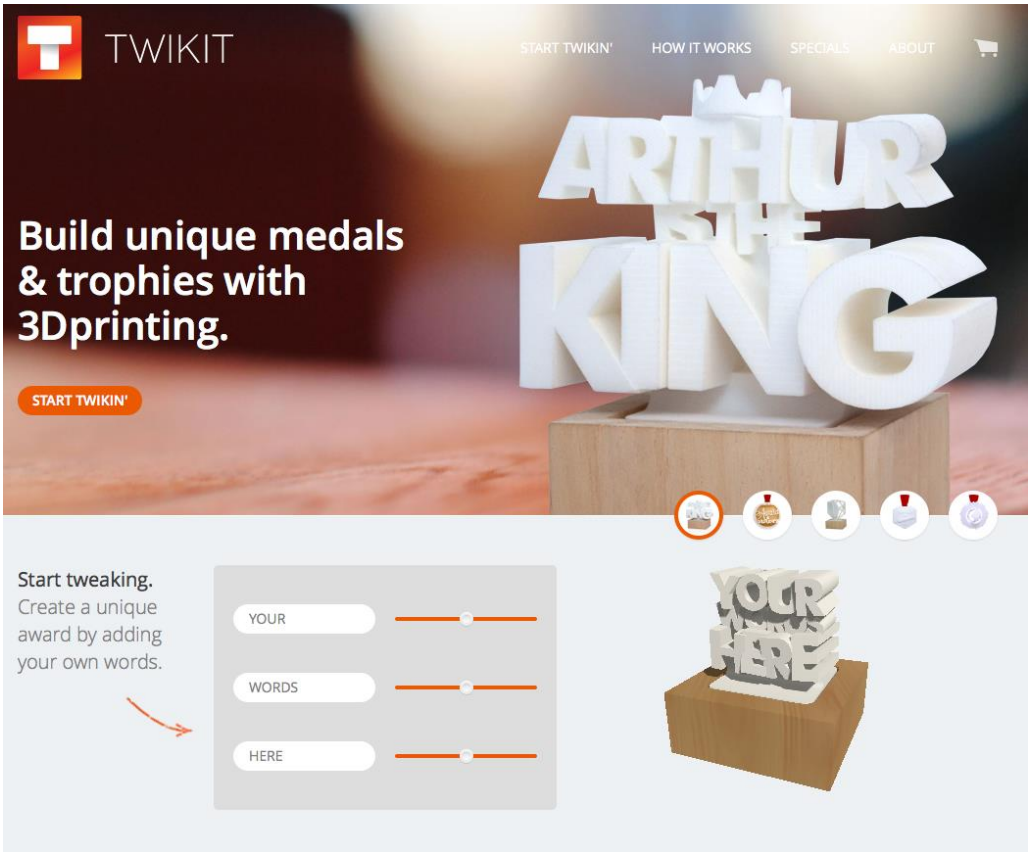

Figure 5.7: An image from Twikit's customization interface (Url-8).

Though the end-results seem somewhat limited, regarding the research done on the characteristics craft customization processes, it is interface can be considered as one of the better web-based applications. Though renditions of certain craft customization elements (e.g. uniqueness) are missing, the customization process is carried out smoothly via simplified use of language and the narrative aspects that are

scattered in the web page. Majority of the design decisions are taken by the designer, therefore the outcome is foreseeable from the very beginning.

5.3.8 Sculpteo

Sculpteo is a 3D printing service company, which also provides apps to create customizable designs (Url-9). It offers some of the most unconventional customization interfaces among its competitors, such as image tracing contours of users' heads to emboss them onto coins, pixelating user uploaded 3D files to create figurines or printing the potteries that users make digitally via an iPad app. The example analyzed below is the app to create mugs using users' face silhouettes.

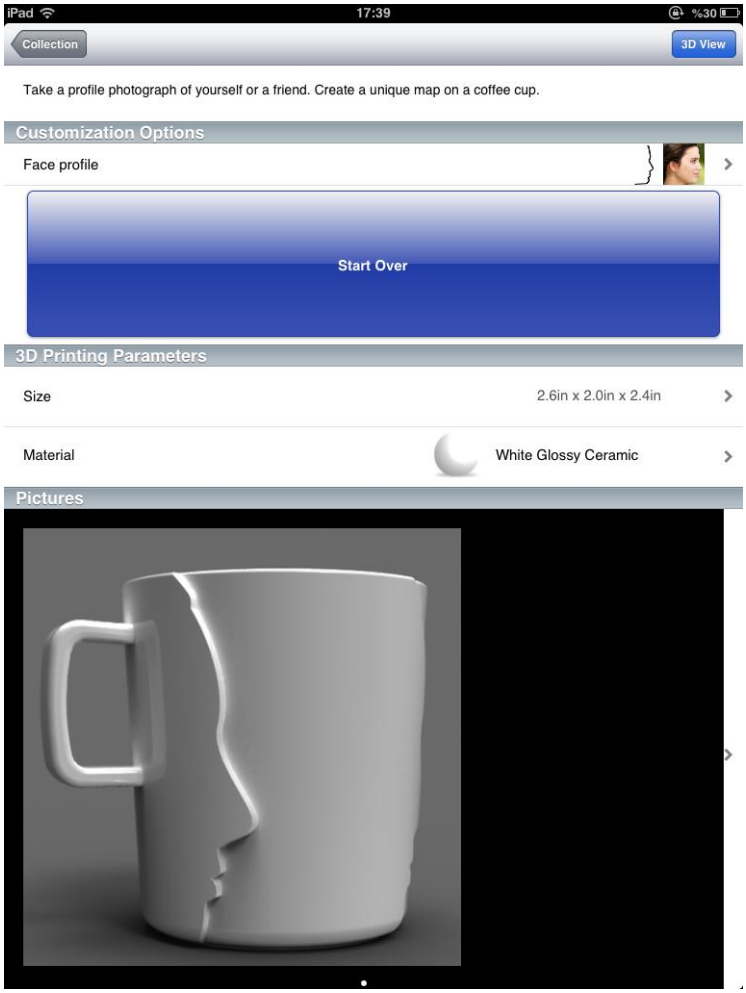

Figure 5.8: An image from Sculpteo's customization interface (Url-9).

Via this iPad app, Sculpteo traces the side view photo of user's face and embosses it to a mug. The customization interface is very simple and users are not offered any extra options other than the choice of color. The process is fairly straightforward but

somewhat arid. A main improvement area would be the addition of narrative elements, which would enrich user customization experience.

5.3.9 Society for printable geometry (SFPG)

Society for Printable Geometry is website to create pendants, earrings, cufflinks and iPhone cases using topological data of a place on earth that is selected by user (Url-10). It not only uses the data from Google Maps, but also directly benefit from its interface. Their business model was covered in the news stories of numerous magazines, including WIRED and Forbes.

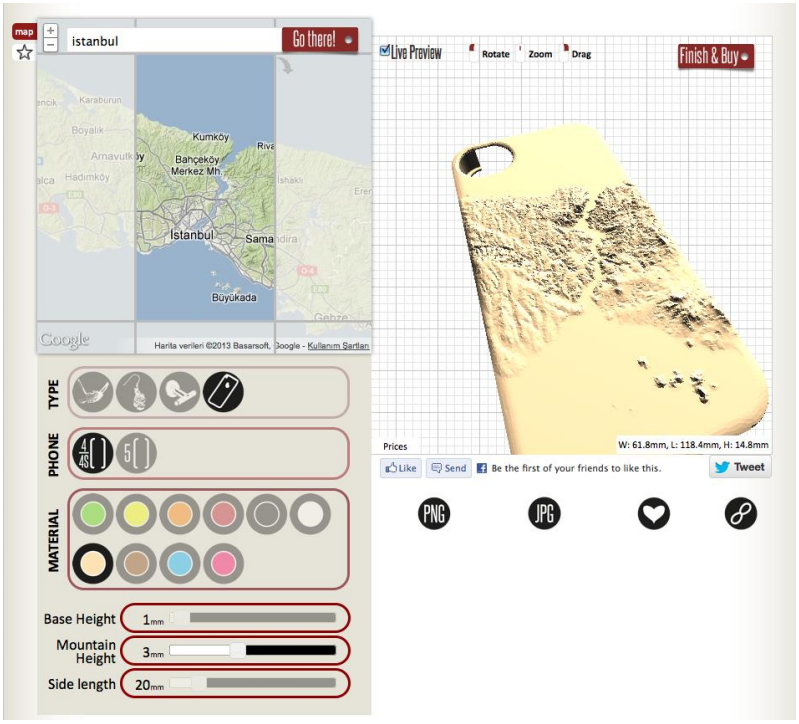

Figure 5.9: An image from SFPG's customization interface (Url-10).

The customization interface is relatively simple and easy to use. The Google Maps interface is familiar to many users and most of the options are simply illustrated to guide users throughout the customization process. However, regarding the interviews done with craftsmen on their customization processes, there are a few aspects that can be improved. For example, the size related sliders on the bottom left side are ambiguously explained in millimeters. This is less of a problem for the iPhone case since the measurements can be more or less understood through comparative reference of the device size. However for earrings and necklaces, this is a valid problem. The designers of this interface can overcome this problem by placing a representation of a familiar reference object (such as a paper clip) to make it easier

for users to comprehend this information. Also a few famous topologies could be given as example starting points to demonstrate the capabilities of the application.

5.3.10 Shapeways sake set

Shapeways is a ‘3D Marketplace’ by their own definition (Url-11). They provide 3D printing service and host an online market where designers can sell their 3D prints of their designs via Shapeways’ printing service. Shapeways also have a few web-based user-customization applications. Sake Set is one of them, where users can create their own 3D printed ceramic sake sets.

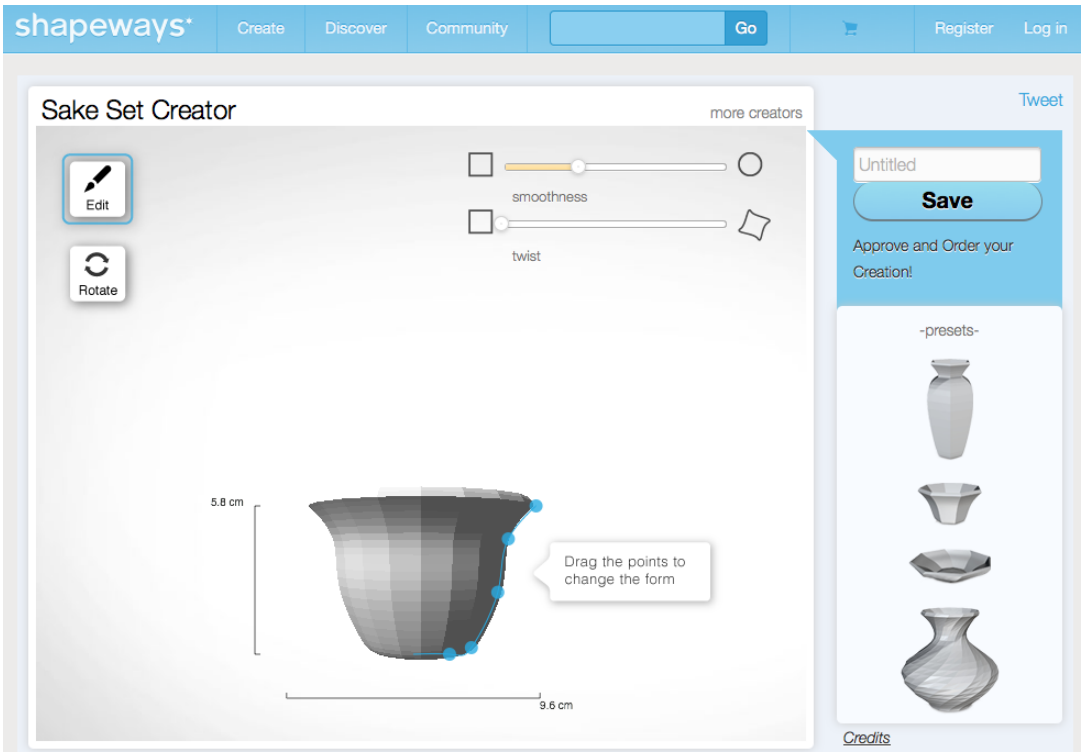

Figure 5.10: An image from Shapeways’ Sake Set customization interface (Url-11).

The Sake Set creator works by modifying parameters that control its profile curve, smoothness and twisting angle. The customization interface is clean and the potential outcomes practically limitless. It also covers some rarely thought aspects such as providing the user with a few initial beginning points to interpret their needs better or guiding them about how to use the interface throughout the process. Yet, the main problem in this interface is in the decision making stage. Through the application it is possible to create forms that are functionally impractical. For instance the interface does not prevent the users to produce flutes that are impossible to clean, cups that wouldn’t carry enough liquid or plates that are impossible to dip a piece of sushi

without spilling soy sauce. In comparison, a craftsman would never deliver such outcomes as a result of his/her customization process.

5.3.11 Shapeways sketch-sheet earring

Sketch-Sheet Earring is an unconventional customization interface by Shapeways (Url-12). It allows users to sketch their drawings on a sheet with necessary instructions, which can be downloaded from Shapeways' website.

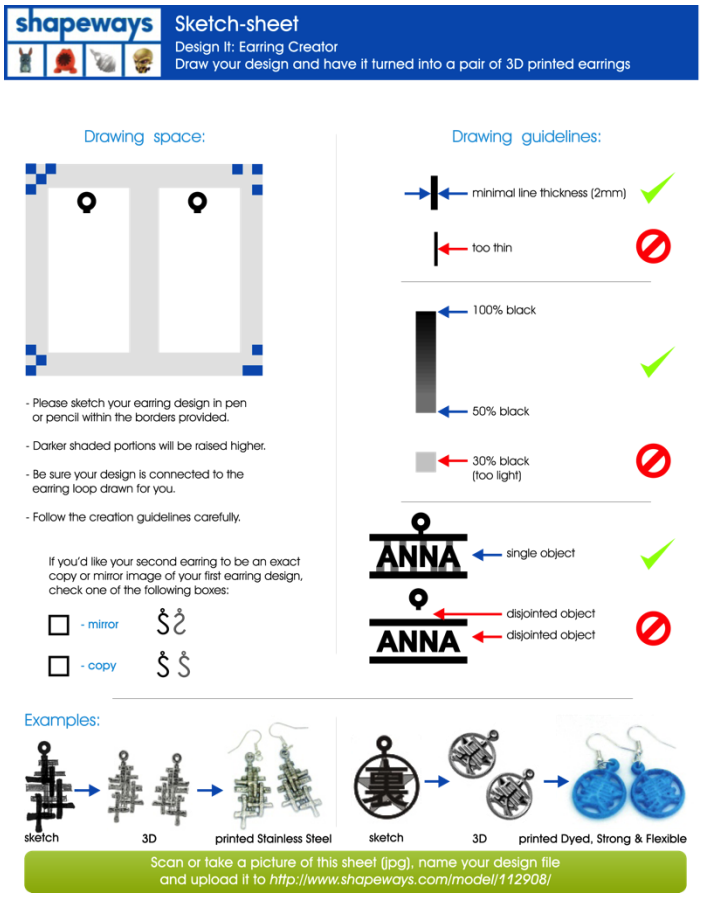

Figure 5.11: An image from Shapeways' Earring customization interface (Url-12).

The medium of customization used for this product is familiar to many users, and the instructions are cleverly designed to guide clients throughout the design process. There are also a few examples at the bottom, which illustrate some of the potentials outcomes. Although the users remain as the key person to define the form of the end-results, the final step in regard to fabrication is handled by the customization system, therefore it does not leave such critical decision to users. The interface could be improved by adding an intermediate stage, where client's drawings would be analyzed by the system and digital recreations of the hand drawn images were shown

as alternatives to customer drawings. Such intermediate stage would cover two of the currently lacking qualities, namely simultaneous visualization and guidance.

5.3.12 Supabold fluid vase

The last example interface to be evaluated is Supabold Fluid vase by Singaporean designer Fung Kwok Pan (Url-13). This web application allows users to make their own vases from a frozen animation frame of a virtually pouring liquid. Its distinctive interface has received wide media coverage and positive critiques from a number of design magazines and web portals, including but not limited to WIRED, Designboom and FastCoDesign (Url-13).

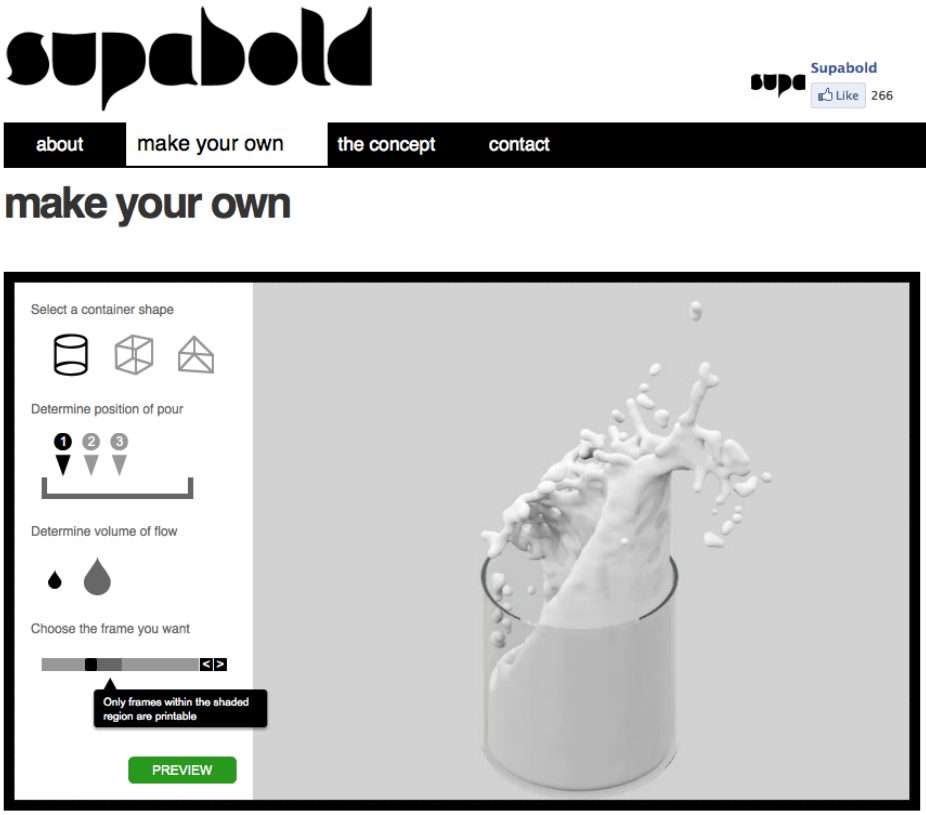

Figure 5.12: An image from Supabold Fluid Vase customization interface (Url-13).

Fluid Vase web application is the most successful user-customization interface amongst the evaluated interfaces. It provides renditions of almost all of the craft customization qualities that were revealed through the research. The language used is purified from all technical elements and it is easy to comprehend by users. The resulting effects due to the changes in parameters are simultaneously visualized. The decision-making is not wholly ceded to user control, as the system allows users to

pick within a few feasible frames defined by the system. The outputs of the system are distinct yet easily recognizable. The results are unpredictable and a unique design is generated with each pour. The designer Fung Kwok Pan's name is promoted throughout the site, while narrative elements such as 'behind the scenes' of the production process is shared with the customers in detail. Although there is still some room for improvement in the aspects of 'interpretation' and 'guidance' in terms of craft customization, Fluid Vase can be considered as one of the finest examples of web-based user-customization interfaces available.

5.4 A Comparative Table of the Evaluated User Customization Interfaces

Following the general evaluation of the individually analyzed websites, they were listed in a comparative table (Table 5.1) where the comprehensive evaluation of these websites are listed in accordance with the all twelve questions in the evaluation chart[5]. The details of this evaluation procedure and the legend of the table are provided in section 5.1 at the beginning of this chapter.

To have a better understanding of the above the described guidelines for designing new user customization interfaces or evaluating presently available ones, the readers are encouraged to access the evaluated websites and personally analyze them according to the questions listed in the specimen evaluation chart and subjective evaluations made by the author. This table merely serves as a medium to have a better comprehension of the concepts and guidelines defined within this thesis and should not be regarded as the final conclusion. It should rather be seen as a tool proposal to turn the findings in the previous chapters into a practical application scheme. Nevertheless, the professional designers are also encouraged to use this scheme while designing new user-customization interfaces and evaluating already existing ones, while researchers are advised to regard this scheme as a pre-study to base their further studies.

[5] The evaluation chart can be found in Appendix D

Table 5.1: Evaluation of web based user customization interfaces in the light of the research made on craft customization processes.

	Communicative Attributes			Decisional Attributes			Reflective Practice Attributes	Experience Enriching Attributes		
	Interpretation	Simplified Language	Simultaneous Representation	Critical Decision Making	Guidance	Designer's Style	Making For Pleasure	Uniqueness	Designer Item	Narration
Crayon Creatures	N/A	+	-	+	N/A	+	~	+	N/A	~
Electrobloom	-	N/A	+	-	-	+	-	-	~	~
Flat Clock	-	~	+	-	-	~	+	+	~	-
iMaterialise Lamp	N/A	+	-	~	+	+	-	-	-	+
miAdidas	-	+	+	-	-	~	-	-	~	-
Nervous System Ring	-	-	+	-	-	~	-	-	~	-
Twikit	N/A	+	+	+	N/A	+	~	-	-	+
Sculpteo	N/A	+	+	N/A	N/A	+	-	~	-	-
SFPG	~	-	+	-	-	+	-	N/A	N/A	+
Shapeways Sake Set	+	~	+	-	~	+	-	+	~	~
Shapeways Earring	N/A	+	-	~	N/A	N/A	+	+	N/A	-
Supabold Fluid Vase	-	+	+	~	~	+	~	~	+	+

(+) The user-customization interface has successfully integrated the quality,

(~) The interface demonstrates certain elements that can be considered as the traces of the respective quality, but not fully/successfully integrates them.

(-) The user-customization interface has failed to offer the quality,

(N/A) The attribute is not applicable for the nature of this interface and,

(?) It cannot be known if the attribute is available with the current methods of investigation

6. CONCLUSIONS AND RECOMMENDATIONS

We might still be living in the age of standardized products, but the steady footsteps of the third industrial revolution hints that it is about to arrive. Though only time can give a precise answer to the question of to what extent use of digital fabrication will chance the way customers shop, we can already be sure for one thing; it will have a drastic effect for mass customization business models, where one-off production is intrinsic to the roots of the concept.

This thesis serves as an early preparation in a specific aspect for such anticipated future projection, though it already has possibilities for present-day practical application. It provides the reader with a set of questions to benefit while designing a user-customization interface or evaluating a presently available one. These questions encourage designers to challenge the interfaces they build from twelve different notions, grouped under four categories. Each question presents a distinct perspective on one of these four aspects: (1) how customers should communicate their demands through the interface, (2) how certain design decisions should be taken, (3) how the idea of learning can be integrated to the process or (4) how the user customization experience can be improved.

All of the above-mentioned questions were derived from a research made on the craftsmen's customization practices; therefore they carry the characteristics of craft customization at their cores. Although the projected future scenario for mass customization does not include craftsmen as actors, they were purposefully chosen as the subjects of the research instead of university-trained designers. Professional designers that are graduates of mass production era universities are educated to design for masses. Their aim is to create products that would maximize profitability. In most cases, this can be translated as designing as few products as possible for the widest audience available. However, in the customization businesses the aim is the complete opposite – a wide range of products tailored for each individual's wants and needs. Unlike university-trained designers, craftsmen who work with the customization business model have been designing and manufacturing according to

these principles for centuries. Their mode of thinking during customization is a quintessential application of associative thinking, and their manufacturing approach is very similar to the idea behind one-off production technologies. Masters' techniques that stood the test of time are refined over the years and passed through generations via their apprentices, who themselves are to become masters of the future protégés. Therefore craftsmen were considered to be the appropriate subjects of the thesis research, rather than the designers.

A series of semi-structured interviews were realized in order to undercover the success elements behind craft customization process, which would eventually be integrated to user co-design toolkits of mass customization applications. Design of these toolkits is arguably the most important element of mass customization businesses, since it is the bridge between users and the whole customization system. Surprisingly it is one of the lesser-studied areas, especially from the design perspective (Piller, 2004). This research aims to contribute to the efforts to fill this gap by introducing certain suggestions to take into consideration while designing such interfaces. Combined with the advancements on the other enablers of product-based mass customization business models (i.e. parametric modeling tools to create appropriate solution spaces and advanced digital fabrication methods to make on demand manufacturing possible), the research conducted in this area will lead to much feasible customization businesses.

Even though we still live in the mass production paradigm, a quick historical analysis shows that the demand for individualized products is an ever-increasing trend. However no matter how much necessary design tools and manufacturing technologies become available to general public (both in terms of affordability and accessibility), a pursuit of designing a product from scratch is most likely end up in a bitter way for a lay user. A professional designer contribution will always be needed to attain satisfactory results in a customization process. While this might not be achievable through presence of a designer due to competitiveness related factors, it might well be possible via integration of designer contribution into user-customization interfaces. Given this integration is implemented successfully, it can take mass customization applications to a new level where "any customer can have a car painted any color that he wants; so long as it is possible".

6.1 Practical Application of This Study

The study is specifically shaped for two groups of people; (1) those who would like to design better customer co-design toolkits by integrating the success elements of craft customization to the tools that they design and (2) those who would like to evaluate existing user co-design toolkits on whether they carry renditions of craft customization characteristics[6]. It is presumed that integrating these qualities to customer co-design toolkits will increase the success of customization processes, while leading to more satisfactory products in the eyes of the clients. In relation to this, the study can also be used to find out the deficiencies in the current customization systems. The set of questions presented in the Chapter 5 and the specimen evaluation chart which can be found in Appendix D are prepared for this purpose. While they were used for evaluating web-based user customization interfaces within the scope of this thesis, the questions also serve as an exemplary medium to encourage readers to form their own inquiries of assessment for various user co-design toolkits.

6.2 Recommendations for Further Study

Even though the study provides a solid foundation for designers on how to implement craft-customization qualities in the design, success of such toolkit is not tested through a real-life mass customization application. The author suggests that a useful future study would be to implement these attributes to a mass-customization application and compare the success of it with other mass customization applications that are not designed according to this approach. Measuring user satisfaction in different types of customization processes and comparison of use-lives of the customized outcomes can be considered as some of the indicators of these success factors in further studies. Researchers are also encouraged to improve the list of guidelines and evaluation questions presented in the earlier chapters.

[6] The aforementioned characteristics that are native to craft customization and their modes of application are explained in detail throughout Chapter 4.

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APPENDICES

APPENDIX A: Transcription of the interviews made with Hüsnü Altıparmakoğulları, cutler (2012), Ahmet Bayramça, ironsmith (2012) and Ahmet Dağhan, cabinetmaker (2012)

APPENDIX B : Transcription of the pilot study interviews made with Nihan Lafçı, Bilge Köprülü and Asu Aksu (2011)

APPENDIX C : Transcription of the interviews made with craftsmen in Turkish, their original language.

APPENDIX D : Specimen chart for evaluating user customization interfaces

APPENDIX A

APPENDIX A1

Transcription of the interview made with Hüsnü Altıparmakoğulları, cutler

I have excerpted the following statements from my interview with Hüsnü Altıparmakoğulları and labeled each statement accordingly:

Interview with Hüsnü Altıparmakoğulları, cutler

1. Customers sometimes order a sword or a slaughter knife [TN: Kurban bıçağı – a special knife to be used in Islamic Holiday Eid-ul-Adha]. I make everything within my production capacity. Costumier Ali once ordered a ceremonial sword (TN: I have taken the picture). I have even made that. There are times that I also make a replica of whatever they bring to me.

   Labels: Interpretation

2. Customers tell me their choices like "I want it from wrought iron" or "I want the handle material to be horn". They sometimes mention their choice of color. There is hardly anybody that has an opinion on form.

   Labels: Critical Decision Making

3. Customers do not say much about things like diameter, length, and height. They just tell [that they want] a slaughter knife. [Thus] the dimensions and the form of the handle become clear [by itself].

   Labels: Critical Decision Making, Interpretation, Use of Simplified Language

4. [Once] somebody who owns a yacht walked in. He asked for a knife [by saying]: "I will dive, crack mussels, open bottles and break ice". Here it is (he shows a picture of the knife). The design of this object totally belongs to me.

   Labels: Interpretation

5. Customers do not usually know what they want. They tell [me] what they want to do with it. Then I designate [what they want] according to what they want to do [with it].

   Labels: Interpretation

6. I make drawings to explain [the final design] to the customers. I make a rough template (TN: by this he means making a rough cutout of the profile view from sheet metal – I have taken pictures of his drawings and sheet metal templates).

   Labels: Critical Decision Making, Simultaneous Visualization

7. For example, I used 460A in this product… (TN: I ask what 460A is and told me that it is a type of stainless steel and he described me its features in a simple language)

   Labels: Use of Simplified Language

8. Customers are not knowledgeable about the quality of steel. They tell [things like] "I need a hard knife [because] I will cut hard things". But I understand [them]. They do not ask me what [kind of material] I use to build [the knives] with. I decide what material to be used according to what to do with it. (TN: As a response to my question: "Do customers have specific choices about what type of steel to be used?"

   Labels: Critical Decision Making, Interpretation, Use of Simplified Language

9. Customers rely on my word. My word is my bond. Just recently somebody brought me the knife he has bought from me in 70 [1970] in order to get it sharpened. My knives are the "Mercedes" of Albanian knives.

   Labels: Designer Item, Narration

10. There are lots of details in this profession. First of all, the horn is alive (TN: referring to the horns that he use as a raw material to make the handles of his knives). You shouldn't work on them when they are wet [tender]. [Or else] the stud gets loose when it [the horn] gets dried up. Then the handle is useless.

    Labels: Learning Through Practice

11. Once a customer came and he begged for me to forge a wrought iron knife. Actually wrought iron knives are quite good. Their molecules are packed which make the [wrought iron] knives very sharp. However they rust away if they are not well taken care of. There were some customers before who had

complaints. I warned my customer and he told me that he is aware of this situation. I built that knife from 75 SD Strip Steel.

Labels: Use of Simplified Language, Guidance, Learning from Customer Feedback

12. For example there is something very special over there (shows a knife with a handle from unprocessed deer horn). I made it for myself for ornamental reasons.

    Labels: Making for Pleasure

13. I do not let anybody to get nosy about my work. They rarely get nosy anyways. [Even] if you have a dime's worth of flour, you should get it kneaded by an expert. This knife (points to a knife nearby) is priced 40 Liras at my place. You can find similar looking knives for 15-20 Liras in the shops above [the street]. The difference is the quality. I give life-time guarantee for all my knives.

    Labels: Designer's Style, Designer Item, Narration

14. They [customers] brag with my knives. The best knifesmiths engrave their names on the knives. Which master has made it? Who has made it? … I engrave my name in all my knives. I am a state-approved artist (TN: *Devlet Sanatçısı* - an honorary given by Turkish government to artist who has made significant contribution to Turkish culture). My name is a brand. It is like a ISO quality certificate.

    Labels: Designer Item

15. This is a very delicate work. It is very important to have a family tradition. However it does not mean that you can [successfully] do it [just] because you have a family tradition. My brother was a cutler as well. Yet my father did not hand him our seal, he handed it to me.

    Labels: Designer Item, Narration

16. I have received my first lesson when I was 4. The knife slipped away from my hand when I was grinding it. I bent down to grab it. My father saw me doing this, but he said nothing (TN: The knives get really hot due to the friction during grinding). As I touched it, my hand got burned. In our

profession there is an expression for this: “to get one’s hand swollen”. Had my father warned me by saying “Do not grab it, it is hot”, I would have never learned [my lesson]. Once my hand got burned, I never forgot. You should get your hand swollen to learn.

Labels: Learning through Practice, Narration

17. [Once when] I was an apprentice; we had an order [for a knife]. I have finished the knife and asked my father: “Is it alright?” He said “no” without even turning his head to me. I have made another one, just to get the same answer. Seven [times], eight [times], nine [times]… (TN: referring to the number of times he has made the same knife and got the same negative answer). Finally when I have made the tenth knife he told me “now it is alright”, again without looking at me. That is where I got my second lesson: You cannot [successfully] do something in your second or third try, if you have never done it before.

    Labels: Learning through practice, Narration

18. When you are cleaning the workshop with water, the fragrance of sunflower seed oil infests the room. [This is why] I myself have developed this chimney system. It aspirates the smell.

    Labels: Learning through practice

19. I can recognize the knife I made from the washer of its rivet. Even at a distance. They [referring to anybody] cannot make an identical knife to mine, even if they copy the profile of it.

    Labels: Designer’s Style

20. Once somebody entered to a competition with my knife. He erased the mark of our seal “Hüseyin-Kemal” and wrote his own name. They [The Jury] understood that it was my work at a single glance. I do not enter competitions anyways. Why should I? In order for me to enter there should be somebody who can evaluate my work. Those people are not in this profession anymore. They are dead.

    Labels: Designer Item, Designer’s Style, Narration

21. (TN: He took me to another shop where they sell knives. It was a much bigger retail-only shop located on a much busier parallel street) [Showing a knife in another store] Look at this: what a careless job, the edge is very thick. Is it how this part supposed to look like? I couldn't manage to teach them [referring to new generation cutlers] at all.

    (TN: After leaving the shop) I take my customers here, so that they see the difference [between my knives and theirs].

    Labels: Narration

22. My father's elder brother participates in a tender to provide the cleavers for a large slaughterhouse. Prices [per cleaver in the bids] of other participants are 2 Liras or 3 Liras. The price [per cleaver in the bid] of my uncle is 5 Liras. They ask him: "How can it be like that? What kind of a price is this?" He says: "strike a girder with my cleaver and see for yourselves". They strike a girder with his cleaver and a piece from the girder ruptures. Then my uncle asks: "Do not you have an engineer around here?" They bring an engineer to his presence and my uncle explains to him: "A proper cleaver should have a side like this, handle like this and width like this. My cleavers do not wear one's wrists out, so he saves energy". [Upon this scene] Everybody else withdraws from the tender and they [the slaughterhouse] buy his knives.

    Labels: Narration, Interpretation, Guidance

23. 'Aesthetics' lacks in factory made knives. What is aesthetics? It is not only the form or the texture. [But also,] quality, exclusivity… Somebody who buys a knife from me buys just one knife (TN: Referring to the durability). If there is a mistake, I take it back. If you buy a factory-made knife, you throw it away after three years. You throw it away even if it is still sharp. Why? Because it does not have aesthetic.

    Labels: Designer Item

24. For example they (TN: customers) come and ask for a grafting knife. They bring a sample product with them, I make a knife to be used for the same purpose

    Labels: Interpretation

25. It is up to your luck what type of texture you get in the handle that is made of horn or wood. Random. There is not another one with the same look.

    Labels: Uniqueness

26. But the handles for example, they do not differ a lot. Unless of course if it is made for somebody with very big hands. Other than that all the calculations for them were made long ago. I for one make my knives according to rule of thumb and 'course of my hands'. The apprentices use templates.

    Labels: Learning through practice, Interpretation.

27. They (TN: Referring to the blades) all have a star size. It is marked on them. Starts from 1 star, and goes up to 6, 7… 10 stars at times. Customers do not tell me the size of the knives in centimeters, but in stars.

    Labels: Use of Simplified Language

28. I ask them [the customers] where they are going to use it. Then I tell them which size is appropriate for them. I convince them. The handles and the widths differ. The sharpness also. Not every blade fits every purpose. You cannot use the bread knife to cut meat. I give a 'knife culture' lecture to people who have no idea about these. This type of knife is used for that and that type of knife is like that because of this… You cannot use sheet steel for this type of knife. You should temper it with coal one by one… They should learn about all these like a story, so that they can perceive the difference. Or else there are also knives in front of the mosque for 3 Liras, 5 Liras… (Referring to the street vendors).

    Labels: Narration, Interpretation, Guidance, Critical Decision Making

APPENDIX A2

Transcription of the interview made with Ahmet Bayramça (a.k.a. Curly Ahmet), ironsmith

I have excerpted the following statements from my interview with Ahmet Bayramça and labeled each statement accordingly:

Interview with Ahmet Bayramça (a.k.a. Curly Ahmet), ironsmith

1. I have started this profession in 1986. Back then it would take a full day for two people to roll a 3 meters long iron. Now it takes a few minutes for machines to roll a 6-meter long one. What left for us are the authentic, one of a kind stuff that cannot be made in machines…

   Labels: Uniqueness, Narration

2. They bring me the drawings made by architects or photos. Photos from Spain or Italy. There are also people who bring their own drawings but it is rare. There are many aficionados of this profession (Referring to making iron wrought gates). They know what can be built or not so it is not a big deal [to build their designs]. These types of customers teach us [the new trends] as well.

   Labels: Interpretation, Learning from Customer Feedback

3. You need accumulation of vocational knowledge… Material knowledge… In fact 'design' is shaping material through conscience.

   Labels: Critical Decision Making. Designer's Style.

4. Sometimes there are things that architects do not know. We [the ironsmiths] rationalize his work.

   Labels: Critical Decision Making, Guidance

5. Sometimes they say: "it is the designer – not the maker– who is the master" or "It is not the maker but the one who has something made is the master". (TN: at this point he smiles with irony) If somebody brings a proper design we make the same of course. Then they show it [to other people] as their design.

   Labels: Critical Decision Making

6. If they [the customers] manage to define their problem well, I make what they want. There are also customers who leave everything (TN: referring to the design decisions) to craftsman. Once one brought me a page from Qur'an. He asked me to make a suitable frame for it. I designed it. The design and all the artistic value belonged to me. Then I received a thank you call [from him].

   Labels: Critical Decision Making, Designer's Style, Interpretation, Learning from Customer Feedback

7. Once I made a flowerpot holder shaped as an old bicycle for decoration purposes. A journalist friend who can appreciate its value bought it. There were some other people who saw that and walked in my workshop to ask for other uncommon work.

   (TN: Upon my question if this work has improved his techniques) I do not know… That work was harder (TN: probably comparing it to shaping wrought iron gates). It might have given me a better understanding of the material.

   Labels: Making for Pleasure, Designer's Style

8. When somebody brings their own drawing, I usually get back to them with a price quote. Then they do not call me again (Laughs).

   Because their drawings are not made regarding the manufacturing constrains. (Upon my subsequent question about what makes the prices so high for the customer drawn designs)

   Labels: Critical Decision Making

9. There are [not more than] 10-12 people in 48 years (TN: his age, so he refers to his whole life), whose drawing I made [without any modifications]. Usually they trust me and leave it [the design] to me. They give me the size, pick a model from catalogues and show me what kind of a thing they want. Craftsmen immediately know the most appropriate and affordable design to build.

   Labels: Interpretation, Designer's Style

10. When they leave the design to me, this gives me a positive psychological pressure. I feel like I should do the best. This gives me a psychological pleasure. A kind of self-aggrandizement.

    Labels: Designer's Style, Making for Pleasure

11. Once I made a faulty turn. The customer liked it a lot. He asked me to leave it like that. Sometimes you make an extra turn and this turn can look nice. I ask the customer his/her opinion. If he also likes it I leave it as it is.

    Labels: Uniqueness

12. There are customers who want names or shapes [made out of wrought iron]. Mostly in the gates of the apartment buildings. They only give a measurement like, say, 80x120 [centimeters]. They do not even tell the typeface. I show them [some examples] from the catalogues and make something similar. Unless the customer has a specific demand that should be enough to satisfy him.

    Labels: Interpretation, Simultaneous Visualization, Guidance

13. When a customer is interested, I also tell him about history of wrought iron… (TN: At this point he talks for a few minutes about the history of wrought iron, including it is etymology)

    Labels: Use of Simplified Language, Narration

14. The customers usually want to include a lot of die-cast flower and leaf ornaments. However using too many of these ornaments overcrowd the design. They usually leave it to me how many [of the die-cast ornaments] to put and where. If they insist to put a lot [of ornaments], I make them a quick composition on the counter to show that they overcrowd the design.

    Labels: Simultaneous Visualization, Guidance, Designer's style

15. Even if the same craftsman hits the same iron with the same hammer you do not get the same results. You get a different result every time.

    Labels: Uniqueness

16. Manufacturing should be for people’s sake. We are not a gear wheel. Perfection is not working like machine. It is a humane element. It is associated with the soul.

    Labels: Making for Pleasure

APPENDIX A3

Transcription of the interview made with Ahmet Dağhan, cabinetmaker

I have excerpted the following statements from my interview with Ahmet Dağhan and labeled each statement accordingly:

Interview with Ahmet Dağhan, cabinetmaker

1. What I do most is turnkey kitchens.
2. Many customers come, who think that they know what they want… Those who have been to the other workshops as well and made a market research. They tell me "I have learned that the best material to use is membrane. Let's use that". Membrane looks nice like lacquered-wood. However it is worthless if it gets swollen [due to contact with water or humidity]. It is also prone to get scratched. MDF, that is hazelnut shell fiber, is cheaper but durable like stone. Customers usually look at the price and have the misconception that 'the more expensive the more appropriate'.

   Labels: Use of Simplified Language, Guidance
3. Of course, I give them (the customers) my recommendations. From samples, models from different catalogues, CAD drawings… I show them the most appropriate

   Labels: Guidance, Simultaneous Visualization
4. Customers usually just tell me the material and the wood-pattern [that they want]. They also have their say on details such as handles and glass cupboard doors. If there are ones who have exclusive demands, we can also talk about other accessories. These all have their reflections on the price. But customer does not know things like where hinges go, where rails are placed, how handles are fastened, how cabinets mounted to the wall etc… They wouldn't ask questions like that anyways.

   Labels: Critical Decision Making, Interpretation,

5. They do not even know the number of cupboards or drawers. Sometimes I find it more appropriate [during the making process] and make a three-door cupboard instead of a two-door version in the original drawings. They do not even notice such changes and if they do they are pleased about it.

   Labels: Critical Decision Making, Interpretation

6. I give them [the customers] my opinion of course. For example, it is not appropriate for a glass cupboard door to be located next to an aspirator. The aspirator mists the glass door over. [Another example:] If there are two devices (TN: referring to dishwasher, washing machine, cooker etc.) under the counter next to each other, this situation reduces its reliability. But the final decision belongs to the customer.

   Labels: Guidance

7. They [The customers] find [what they want] from catalogues or magazines. They bring projects. If it is by an architect we generally build it as it is. If the customer himself draws the project it is usually not appropriate for daily use. For example there is a hob-sink-fridge triangle. If you do not pay attention to this while designing, you need to go all the way over to get a spoon. Then the customer becomes the first one to complain.

   Labels: Interpretation, Critical Decision Making, Learning from Customer Feedback

8. We make the fundamental decisions. As I said before, the customer usually gives the measurements and which wood pattern to use. They keep their fingers off the pie from that point on. Sometimes they ask “is it possible to make it like this?” I evaluate the idea and tell my own opinions. If possible, we make it like that. If not, we propose a different idea.

   Labels: Critical Decision Making, Guidance, Learning from customer feedback

9. Although rarely there are people who are not pleased with the results. I do my best to satisfy them. If they are still not happy I ask them why they were not happy and take their responses as lessons. But they are usually pleased with

the results. We mostly get new customers thanks to the recommendations. Our work itself serves as our promotion.

Labels: Learning from customer feedback

APPENDIX B

Pilot Study

Semi-structured surveys with Nihan Lafçı (industrial designer – designs/makes custom made notebooks for lindanihan), Bilge Köprülü (industrial designer – designs/makes custom made shoes for her own name) and Asu Aksu (fashion designer – designs/makes custom made dresses for Asu Aksu Design) were conducted. Surveys were made in Turkish and each survey lasted about an hour. The surveys initially started with designers defining their usual process of designing/making a bespoke product for their customers. Surveyees' talks were not interfered even when they were slightly off-topic. At times when conversation slowed down, questions below were put into use;

- How and to what extent do customers participate in design process?
- Who is the main decision-maker; you (designer) or the customer?
- Do customers come with a brand new design idea that is not specifically your style?
- Are there any customers who entrust you with the design of the end-result after giving the brief, without providing you with any particular preferences?
- Do customers feel the "I designed it myself effect" (Franke, Schreier & Kaiser, 2010) after a design process in which they were included?
- Do customers classify their custom made artifact is a 'designer item'?
- Are customers satisfied with the end-results?
- Do custom made end-results carry the genes of your earlier works (Or, do custom made end-results bear characteristics of your earlier works?)
- Have you ever experienced an error yielding to a positive outcome, which has altered or shown its reflections in your future work?
- Have your designs/techniques evolved during this process? If yes, How?

Personal Interview with Nihan Lafçı (2011)

1. Nihan Lafçı is of industrial design background and she designs and makes customized notebooks.
2. Lafçı states that a common design process of her starts with customer giving the brief.
3. She listens to what customers wants and shares her idea, especially on the technical issues such as the number of pages or thicknesses of the paper according to the customer's needs.
4. She also gives her ideas about colors, but usually customers stick with their original wants.
5. She thinks that uniqueness is very important, so she does not share the images of her previous custom-made outcomes with her new customers, in order to prevent possible bona fide inspirations.
6. Yet she also mass produces a couple of her designs, which her customers use as a basis to define their own wants & needs.
7. Although the customers somewhat take a part in the design process, they still acknowledge Lafçı as the designer, but are also very pleased with the end-results and many later on mention about a feeling of belonging.
8. Lafçı thinks that this is due to the feeling of owning a unique designer made item.
9. She articulates that her design process usually is not finalized until the very end of making process, so the users do not know how exactly the design will look like until the very end.
10. Lafçı finds this somewhat problematic; as customers almost always want to be sure that the end-result matches their taste before they finalize the deal.
11. Lafçı says that until now she has never had a case where her customers were displeased with the end-result, but many of her customers would still prefer to see the outcome before it was made.
12. Conversely, a few of the customers were pleased with the idea of results being a surprise to them.

13. Lafçı also states that, no matter how much her customers took part in the design stage, the end-results would always bear characteristics of her design, hence they are recognizable.
14. Upon directing a question on learning by designing/making, Lafçı confirms that making mistakes has been a great learning tool for her, and both her technique and designs evolved by what at first considered as errors.

Personal Interview with Bilge Köprülü (2011)

1. Bilge Köprülü is of industrial design background and works as an independent shoe designer.
2. While most of her designs are made to be produced in numbers, she occasionally designs customized shoes for her customers.
3. She states that one-off production is generally not economically reasonable, so majority of her customers do not demand bespoke designs due to high costs.
4. Her process of designing a customized product begins with a customer approaching her with a brief about the purpose of the shoe and specific preferences, if there are any.
5. Most of her customers who ask for a customized design use her previous work to define and communicate their wants and needs.
6. Köprülü routinely comes across cases where her customers ask for mix & match designs from her previous work.
7. Another customization issue she comes across a lot is the modifications of textures/colors.
8. Köprülü expresses that in such cases of color modifications, salespeople in retail stores usually handle the situation with makers, without even including her in the process.
9. She thinks that this is acceptable, since the end-result is still her own design with a slight user customization.
10. In cases where Köprülü makes customized designs, she sees both herself and the customer as the decision maker.
11. Yet, since the customer approaches her to get a shoe designed in Köprülü's style in the first place, Köprülü acknowledges herself as the main designer

and remarks that the end-results carry a %70 resemblance to her previous works.

12. Yet there has also been an unusual case where she has designed a customized shoe strictly according to directives given by a customer, but Köprülü was not pleased with the end-result and therefore she does not include its photo in her portfolio.
13. Köprülü states that usually both she and her customers are pleased with the custom-made end-results, yet customers are usually hesitant about the success of outcome until they see the finished results.
14. She stated that she has not had a case where she observed her customer considering himself/herself as the designer of the end product, but she had situations where people were happy to have designer item shoes.
15. Köprülü also agrees that the feedback loops in designing/making processes are very instructive, as both her craftsmanship and designs are constantly progressed in time.

Personal Interview with Asu Aksu (2011)

1. Asu Aksu is a self-employed fashion designer.
2. She designs and makes customized clothing (mainly dresses) for women.
3. Aksu began her talk stating that it is difficult to generalize her bespoke design process, since she has experienced diverse processes very different from each other.
4. Therefore Aksu preferred to group her experiences in clusters.
5. A big part of the customization request from her customers is the demands of redesigning/adapting/making one of her earlier designs according to customers' own sizes.
6. Another common occurrence are customers who like her general design but would like to customize it by adding/removing small details, changing colors or using a different cloth material.
7. Even in such minor cases, Aksu usually exchanges her ideas with her customers.
8. She has a shade card, pre-made color combinations and a material library to help customers with their decisions.

9. Aksu claims that her designs have very distinct characteristics.
10. According to her, in cases where only minor user participation takes place, her design would be easily recognizable within a couple hundred other designs.
11. Yet there are also cases where customers have their original wants and/or needs, in which they design together with the customer.
12. Aksu articulates that she makes sure that end-results of her bespoke design processes carry characteristics of her work, so she still considers herself as the main decision-maker through her suggestions and application of the design.
13. However, Aksu also recounts a few cases where customers portray themselves as the main designers and her as the needle worker.
14. There were also other cases in which she was given a broad brief, such as the purpose of the dress to be made and clothing style of the customer.
15. Aksu interprets the motivation behind such demands as the customers' wishes to have unique designer-made clothes.
16. Her customers are usually content with the end-results but rarely fully pleased.
17. Aksu thinks that this approach is in the nature of bespoke production of fashion design.
18. Aksu is also a strong advocate of learning by doing.
19. She recalls many occurrences in which what she have initially regarded as mistakes later on became characteristics of her designs.
20. She also learns from errors with negative consequences, preventing her to repeat the same mistakes again.

APPENDIX C

Transcription of the interviews made with craftsmen in Turkish, their original language.

Hüsnü Altıparmakoğulları, Bıçak Ustası

- Kurban bıçağı, kılıç falan da istiyorlar. İmalat olanaklarım dâhilinde her şeyi yapıyorum. Kostümcü Ali merasim kılıcı da istemişti (fotoğrafını çektim). Onu bile yaptım. Getirilenin birebir aynısını yaptığım da oluyor.

- Müşteriler dövme demirden olsun, boynuz saplı olsun gibi seçimlerini söylüyorlar. Renk seçimleri varsa onu söylüyorlar. Biçime karışan pek olmuyor.

- Çap, uzunluk, boy gibi şeyler hakkında kullanıcılar çok bir şey söylemezler. Kurban bıçağı derler. Büyüklüğü - sapının şekli ortaya çıkar.

- Yatı olan biri geldi. Suyun altına dalacağım, midye ayıklayacağım, gazoz kapağı açacağım, buz kıracağım diye bir bıçak istedi. İşte bu (fotoğrafını gösteriyor). Bunun tasarımının tamamen bana ait.

- Müşteriler genelde nasıl bir şey istediklerini bilmiyorlar. İşi tarif ediyorlar. Yaptıkları işe göre ben belirliyorum (Eylem odaklı çalıştığını, tasarıma karışılmadığını söylüyor).

- Müşteriye anlatmak için çizim yaparım, kabataslak kalıbını çıkarırım (kalıptan kastettiği saç metalde profil görüntüsünün kesilmesi) gibi yöntemler kullanıyorum (Çizimlerin ve kalıbın fotoğraflarını çektim).

- Bu üründe mesela 460A kullandım... (Sorum üzerine 460A'nın bir paslanmaz çelik olduğunu söylüyor)

- Müşteri çelik kalitesinden anlamaz. Bana "sert şeyler keseceğim, o yüzden sert bıçak lazım" der. Neyden yaptığımı soramaz. Fakat ben anlarım. Onu yapılan işe göre ben belirlerim. (Müşterinin kullanılacak çelik üzerine tercih belirtip belirtmediğine dair bir sorum üzerine).

- Müşteri benim sözüme güvenir. Benim ağzımdan çıkan söz senettir. Daha geçen gün birisi 70 senesinde benden aldığı bir bıçağı biletmeye geldi. Benim bıçaklarım arnavut bıçaklarının Mercedes'idir.

- Bu işin detayı çoktur. Bir kere boynuz canlıdır (bıçakların saplarını yapmak için kullandığı boynuzdan bahsediyor). Islakken işlersen olmaz. Kuruyunca çivinin yeri yuva yapar. Ondan sonra plastik bir daha hayretmez.

- Müşterinin biri geldi, dövme demirden bıçak istiyorum diye yalvardı. Dövme demir bıçaklar aslında çok iyidir. Moleküller sıkışır, bıçak çok keskin olur. Ama iyi bakılmazsa paslanır, daha önce şikayet eden müşteriler oldu. Uyardım, bildiğini söyledi. O bıçağı için 75 este (SD de olabilir) çelik şeritten kestim.

- Şurada mesela çok özel bir şey var (İşlenmemiş geyik boynuzu saplı bıçağı gösteriyor). Onu süs olsun diye kendime yaptım.

- Ben pek işime karıştırmam kimseyi. Pek karışmazlar da zaten. Üç kuruşluk unun varsa uzmanına kardıracaksın. Şu çakı (eliyle bir çakı gösteriyor) bende 40 Lira. Aynısından yukarıdaki dükkânlarda 15-20 Liraya da bulursun. Farkı kalite. Ben yaptığım her bıçağa ömür boyu garanti veriyorum.

- Benim bıçaklarımla övünürler. Usta bıçakçılar bıçağın üzerine isimlerini yazarlar. Hangi usta yaptı, kim yaptı... Ben tüm bıçaklarımın üzerine ismimi yazarım. Ben devlet sanatçısıyım, benim ismim markadır. ISO kalite belgesi gibi bir şey.

- Bu çok ince bir iş. Aileden gelmesi çok önemli. Ama aileden geliyor diye yapabileceksin diye bir şey yok. Benim abim de bıçakçıydı, ama babam damgayı ona teslim etmedi, bana teslim etti.

- İlk dersimi 4 yaşında aldım. Çakıyı taşlarken elimden fırladı. Almak için eğildim. Babam gördü ama bir şey demedi. Çakıya değer değmez elim yandı. Bizim meslekte buna el kabarması denir. Babam "sıcaktır, tutma" dese öğrenemezdim. Elim yanınca bir daha unutmadım. El kabaracak ki öğrenesin.

- Daha çırağım. Sipariş gelmişti. Bıçağı yaptım, babama sordum "Oldu mu?". Kafayı çevirmeden "olmamış" dedi. Bir tane daha yaptım, yine aynı cevap. 7,8,10... En son onuncuyu yapınca yine sordum. Yine bakmadan bu sefer "olmuş" dedi. İkinci dersimi orada aldım. Hiç yapmadığın bir şeyi 2-3 defada yapamazsın...

- Sulama yaparken odayı çiçek yağı kokusu sarar. Bu boru sistemini ben yaptım. Çalıştıkça kokuyu atar.

- Ben kendi çakımı pulunun perçininden tanırım. Uzaktan bile anlarım. Benim çakımın porfilini çıkarsınlar, hatta isterse üstüste koysunlar yine aynısını yapamazlar.

- Bir kere benim çakımla biri bir yarışmaya katılmış. Hüseyin-Kemal yazısını silmiş, kendi ismini yazmış. Bakar bakmaz anlamışlar benim işim olduğunu. Ben zaten yarışmalara katılmam. Neden katılayım? Katılmam için ona kıymetini verecek birinin değerlendirmesi lazım. O adamlar da artık bu meslekte değiller. Öldüler.

- (Beni hazır çakı da satan tanıdık başka bir dükkana götürdü) (Başka bir çakı göstererek) Bak şuna; özensiz, sırtı kalın. Böyle sırt mı olur? Şunlara bir türlü

öğretemedim... (Dükkandan çıktıktan sonra). Buraya getiriyorum müşterileri ki farkı görsünler.

- Babamın abisi Et Kombinasının satır ihalesine giriyor. Herkesin fiyatı 2 Lira, 3 Lira... Amcamınki 5 Lira... Soruyorlar ona "Bu nasıl iştir, böyle fiyat olur mu?". O diyor ki, "Benim satırımla vurun bir putrele". Putrele vuruyorlar satırı, putrelden parça kopuyor. Sonra Amcam soruyor, "sizin burada mühendis yok mu?". Bir mühendis getiriyorlar, ona söylüyor; "Satır dediğinizin yüzü şöyle olur, sapı şöyle olur, genişliği şöyle olur. Benim satırlar bileği yormaz, güçten tasarruf ettirir". Herkes ihaleden çekiliyor, onun satırlarını alıyorlar.

- Fabrika bıçaklarında "estetik" eksik. Bu estetik nedir? Sadece bıçağın şekli deseni değildir. Kalite, özel olması... Şimdi benden bir bıçak alan bir tane alır. Hata oldu mu geri alırım. Fabrika bıçaklarda alırsın, üç sene sonra atarsın. İsterse kessin, gene atarsın. Neden? Çünkü estetik yok...

- Mesela gelirler, aşı çakısı isterler. Bir tane örnek getirirler, ben aynı işi yapan bıçağı yaparım...

- Boynuz ve ahşap sapın deseninde ne çıkarsa bahtına. Rastgele. Bir tane daha ondan yok. (Eşsizlik konusundaki bir sorum üzerine)

- Ama saplar falan pek değişmez. Ancak çok büyük elleri olan biri olursa onun eline göre yapılır. Yoksa bunların hesapları falan hep yapılmıştır. Ben artık göz kararı, elin gidişatına göre yaparım. Mesleğin başındakiler kalıp kullanır.

- Bunların hep yıldız boyu vardır. Üzerine de işaretlenir. 1 yıldızdan başlar 6,7... 10 yıldıza kadar çıkar bazen. Müşteriler bana bıçağın santimetresini değil yıldızını söyler.

- Nerede kullanacağını sorarım. Sonra ona uygun olan bu boy derim. Müşteriyi ikna ederim. Sapları, enleri de başka olur. Keskinliği... Her bıçak her yere olmaz. Ekmek bıçağı ette olmaz. Ben bilmeyene de sıfırdan bıçak kültürü veririm. Bu tarz bıçak bunun içindir, şu tarz bıçak şundan dolayı böyle olur... İşte mesela buna tabaka çelik olmaz, tek tek kömürde tavlamak gerekir... Hikaye halinde dinleyip öğrenecek ki, ayırt edecek. Farkı öğrenecek. Yoksa cami önünde de çakılar 3 Lira, 5 Lira.

Ahmet Bayramça (Kıvırcık Ahmet), Ferforje Ustası

- 86 da Ferforje işine başladım. O zamanlar 3m demiri sabah akşam iki kişi anca çekiçlerdi. Şimdi makinede 6m demirler bir kaç dakikada halloluyor. Bize anca makinede yapılamayacak kadar özel, tek parça işler kaldı...

- Mimarın yaptığı çizimi getirirler, resim getirirler. İspanya'da, İtalya'da çektikleri fotoğrafları... Sık değil ama kendi çizimini, kendi tasarımını getiren de olur. Bu işin meraklısı çok, onlar ne olur ne olmaz iyi bildiklerinden problem olmaz. Bu tip müşteriler bize de öğretirler

- Mesleki bilgi birikimi gerekir. Malzeme bilgisi gerekir. Zaten tasarım, istediği şeyi malzemeden bilincinde yönlendirebilmektir.

- Mimarın bazen bilemediği şeyler olabiliyor. Onun üzerinden değiştirip uygunlaştırıyoruz.

- Bazen diyorlar ki, "yapan değil çizen ustadır". "Yapan değil yaptıran ustadır". İşi uygun getiren olursa aynısını yapıyoruz tabii. Sonra ben tasarladım diye gösteriyorlar. (Müşterinin kendi tasarladığı ürünler ile ilgili övünüp övünmediğini sormam üzerine)

- Derdini iyi anlatırlarsa istediği gibi yaparım. Tamamen ustaya bırakan da çok olur. Bir keresinde kuran sayfası getirdi biri. Ona uygun çerçeve istedi. Ben tasarladım. Sanatsal değeri, dizaynı benden. Sonra teşekkür telefonu aldım.

- Bir kere burada dekorasyon için bir velespit şeklinde bir çiçeklik yapmıştım. Değerini bilecek gazeteci bir arkadaş aldı. Onu görüp gelen, başka farklı tarz işler isteyen birkaç kişi oldu.

  (Bu çalışmanın tekniklerini geliştirip geliştirmediği sorum üzerine)

  Bilmem… O iş daha zordu… Malzemeyi daha iyi anlamama yaramış olabilir.

- Kendi çizimini getirene, fiyatla geri dönüyorum. Zaten sonra bir daha beni aramıyorlar (Gülüyor) (Sorum üzerine fiyatı yüksek tutmasının sebebinin çizimlerin genelde üretim için uygunluk düşünmeden yapılması olduğunu söylüyor)

- Getirdiği çizimi yaptığım 48 senede belki 10-12 kişi vardır. Genelde benim zevkime güvenip bana bırakırlar. Ölçüleri verirler, katalogdan bakarlar, şu tarz olsun derler. Ustalar ona göre hem en uygun, hem de en ekonomik olanını bilir.

- Tasarımı bana bırakınca bende psikolojik anlamda bir baskı da olur. En iyisini yapmak isterim. Bu da bana psikolojik bir haz verir. Bir nevi ego tatmini.

- Bir kere eksik dönme yapmıştım. Müşterinin çok hoşuna gitti. Böyle kalsın dedi. Bazen burgu fazla olur. Bu fazlalık hoş da görünebilir. Müşteriye sorarım, o da beğenirse öyle bırakırız.

- İsim yazdırmak isteyen, şekil isteyen olur. Genellikle apartman girişlerine. 80'e 120 gibi bir ölçü verirler. Yazı tarzını bile söyleyen olmaz. Kataloglardan gösteririm, o tarzda bir şeyler yaparım. Çok özel bir talebi yoksa müşteri böyle ikna olur zaten.

- İlgili müşteriye tarihçesini de anlatıyorum. Ferforje orta çağdan kalma bir meslektir. Kelime Fransızca kökenlidir. Fer, demir; forje dövme demektir… (1-2 dakika boyunca ferforjenin etimolojisinden, sözlük anlamından, Dünya'daki ve Türkiye'deki tarihçesinden bahsetti)

- Presle basılan çiçeklerden, yapraklardan çokça koymak isterler. Ama fazlası kalabalık yapar. Genelde nereye nasıl koyulacağını bana bırakırlar. Çok koymak isteyen olursa hemen tezgah üstünde bir kompozisyon yapar, kalabalık yaptığını gösteririm.

- Aynı demire, aynı çekiçle, aynı usta vursa her zaman aynı sonuç çıkmaz. Başka sonuç çıkar.

- Üretim de insan için olmalı. Biz bir makine dişlisi değiliz. Mükemmeliyetçilik makine gibi çalışmak değildir, bir insan unsurudur. Ruhsallık ile ilintilidir.

Ahmet Dağhan, Mobilya Ustası

- En sık yaptığım iş anahtar teslim mutfak dolapları.

- Genelde hazır malzeme üzerine kaplama kullanıyorum.

- Bize gelip bildiğini sanan müşteri çok… Araştırmış, gezmiş, görmüş. Diyor ki; "En iyisi, en sağlamı membranmış. Ondan olsun". Membran lake gibi güzel görünür, ama kabarırsa kıymeti olmaz. Çizilmeye de yatkındır.

- MDF, yani fındık kabuğu lifi, daha ucuzdur ama taş gibi dayanıklıdır. Müşteriler genelde fiyata kanıp pahalısının en uygun olduğunu düşünürler.

- Anlatıyorum tabii. Yönlendiriyorum. Numunelerden, katalogdaki modellerden, bilgisayar çizimlerinden en uygununu gösteriyorum.

- Müşteri genelde sadece malzemeyi ve deseni söyler. Bir de kulp, cam kapak gibi detayları seçer. Çok özel düşünen varsa aksesuarları da konuşuruz. Fiyata yansımak durumunda kalır.

- Ama menteşesi nerededir? rayları nerededir? Kulp nasıl takılır? Duvara nasıl montelenir? Bunları müşteri bilmez. Sormaz da zaten.

- Dolap - çekmece sayısını bile bilmezler. Bazen daha uygun gelir, yaparken iki kapaklı dolabı üç kapaklı yaparım fark etmezler bile. Fark eden de memnun olur zaten.

- Tavsiye veriyoruz tabii. Mesela davlumbaz yanına cam kapak olmaz, buğu yapar. Davlumbaz duvar kenarı olmaz. Makineler yan yana olursa tezgâhın dayanıklılığı düşer. Ama son karar müşterinin yine.

- Kataloglardan, dergilerden bulurlar. Proje getirirler. Mimar çizerse genelde aynısını yaparız. Müşterinin çizdiği ise yerine göre kullanıma uymaz.

- Ocak-Evye-Buzdolabı üçgeni vardır mesela. Buna dikkat edilmezse ta öteye gitmesi gerekir kaşığını alması için. Sonra ilk müşteri şikayet eder.

- Ana karar verici biziz. Müşteri genelde ölçü verir, desen seçer. Gerisine pek karışmaz. Bazen "şöyle olabilir mi?" diye sorar. Tekrar bakar, fikrimizi söyleriz. Olabilirse öyle yaparız, uygun değilse farklı fikir sunarız. (Ana karar vericinin kim olduğuna dair sorum üzerine)

- Sonuçtan memnun kalmayan tek tük de olsa oluyor. Onları da ne yapıp edip memnun etmeye çalışıyoruz. Memnun kalmayana da soruyoruz; "Neden memnun

kalmadın?". Ama genelde memnunlar. Zaten en çok tavsiye üzerine iş alıyoruz. Yaptığımız işler bizim reklamımız.

APPENDIX D

Specimen chart for evaluating user customization interfaces

Table D.1: A Checklist for Evaluating User Customization Interfaces in Consideration of the Attributes that are Intrinsic to Craft Customization.

Communicative Attributes	
Interpretation	*Does the interface help user to reach the final design by showing preset options to modify over, or through certain inquiries to determine his starting point?*
Use of Simplified Language	*Are the design parameters (Or technical terms – if there are any) expressed in a way easily comprehensible for a nonprofessional without need of any additional information?*
Simultaneous Visualization	*Are the visualizations of user customized final results updated simultaneously to the changes in design parameters?*
Decisional Attributes	
Critical Decision-Making	*Are some parameters fixated and/or limited by the design system in accordance with certain modifications made by user in other parameters?*
Guidance	*Does the interface recommend certain options throughout the customization process?*
Designers' Style	*Do all designs obtained through the interface share stylistic resemblances that make them look like products of the same designer?*
Reflective Practice Attributes	
Learning Through Practice	*Is the interface/system improved or refined over time in regard to the obtained end-results?*
Learning from Customer Feedback	*Is the interface/system improved or refined over time in regard to order history or use information of the users?*
Making for Pleasure	*Does the interface exhibit (or randomly generate) a few off-shot example outcomes to show the potentials of systems to customer?*
Experience Enriching Attributes	
Uniqueness	*Does the interface yield to different (even if subtly different) end-results given all the parameters are same?*
Designer Item	*Is the name of the designer who designed the algorithm mentioned? Is this name promoted for marketing purposes?*
Narration	*Are there any narrative qualities that would not directly contribute to generation process of the end-result, yet enrich the customization / purchasing experience of the customers?*

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