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# **Exploring Users' Attitudes towards Prosthesis Aesthetics in the UK and Greece**

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## **Abstract**

Previous studies have highlighted the importance of prostheses on users' well-being; however, the effects of the prosthetic appearance on users' lives have not been thoroughly explored. The aim of this study was to explore how the aesthetics of prosthetic limbs affected users in two countries with different cultures; the UK and Greece. Interpretative phenomenological analysis was used based on semi-structured interviews, alongside probes. Seven participants ( $n_{UK}=4$ ;  $n_{GR}=3$ ) were recruited, based on purposive methods. All the participants were adults, who had limb-loss due to amputation. The results regarding the role of prosthetic limbs, with respect to their appearance, revealed one theme related to users' personal life, and two opposing themes regarding users' social lives. Prosthetic limbs with unattractive appearance negatively affected participants' well-being, whilst expressive prostheses, an alternative prosthetic type that focuses on highlighting users' identity, could increase their self-confidence. Regardless of the extent to which participants were conscious about the aesthetics of their prostheses, they indicated that expressive prostheses were more attractive. Therefore, they could educate society and help users be more easily accepted. However, caution needs to be paid in the case of collectivistic societies, as expressive prostheses could increase users' stigmatisation.

**Keywords:** expressive; prostheses; aesthetics; interviews; amputees; probes

## **Introduction**

The appearance of products communicates meanings to people about the products, but can also make statements about their users (Demirbilek and Sener 2003; Sethna and Blythe 2016). Pullin (2009) highlighted the importance of these meanings in medical products, claiming if their design aims to be discreet to hide disability, it may show the disability as

something users feel ashamed of and consequently stigmatise them, whilst “a more confident and accomplished design could support more positive images of disability” (15). Stigma is based on the relationship between the person who is considered to have a difference and other people who evaluate and understand this difference negatively (Riddell and Watson 2003). According to Werner and Shulman (2015), there are three types of stigma; *public stigma* derives from the opinion of society towards stigmatised people, *self-stigma* is the consequence of individuals’ opinion based on society’s attitudes and *stigma by association*, where stigma spreads to people close to those experiencing stigma, such as their family members.

In accordance with Pullin (2009), Vainshtein (2011) and Hall and Orzada (2013) propose that if prostheses become fashionable, the users’ unique identity will be emphasised. Therefore, social statements can be made that reject ‘societal pressure to conform to the normative embodied ideal...and highlight yet another aspect of diversity within contemporary society’ (Hall and Orzada 2013, 27). Consequently, Hall and Orzada (2013) suggested that *Expressive Prostheses* (EP), alternative prosthetic limbs that focused on highlighting users’ identity, could reduce users’ stigmatisation by increasing their confidence. However, as their suggestions were based only on a literature research, Hall and Orzada (2013) stated that further qualitative research with expressive prosthetic users could give valuable information on the social significance of this application on medical products. Figures 1a and b show expressive prosthetic covers, whilst Figure 1c shows an expressive prosthesis.

Murray and Forshaw's (2013) review of studies that aimed to understand how prosthetic use affected participants’ lives, revealed that prostheses had an important role in users’ lives; although studies indicated that different types of prostheses satisfied different purposes in users’ lives, the effects of the appearance of prostheses were not thoroughly explored. Sansoni et al. (2015) highlighted limited research on aesthetics compared function.



Figure 1. Expressive Prostheses: a) Racer: modelled by Braydon Luscombe (adjusted by Alleles Design Studio); b) Prosthetic cover designed by Scott Summit (adjusted by SummitID); c) The Synchronised arm designed by Sophie de Oliveira Barata and Dani Clode. Photographed by Omkaar Kotedia and used by Kelly Knox (adjusted by The alternative limb project, a)

### ***The Meanings of Prostheses***

Breakey (1997) and Holzer et al. (2014) pointed out that alteration of amputees' body image can negatively affect their psychosocial adjustment to limb-loss and deteriorate their well-being by creating depression and anxiety. Rybarczyk et al. (1995), Atherton and Robertson (2006), and Cairns et al. (2014) also stated that the alterations of amputees' bodies can have consequences on their social lives, as they can create social discomfort; the use of prostheses could positively affect their well-being.

Gallagher and Maclachlan (2001) conducted focus groups with fourteen users to investigate how adults interacted with their prostheses. The analysis indicated that prostheses affected participants' self-image perception, regarding the 'normality' of the body, and their social interactions, mainly on the way others reacted towards amputation. Murray (2009, 2005) explored the meanings of prostheses in users' personal and social lives through interviews with thirty-five participants. The findings showed that prostheses play an important role in participants' identities, as they helped them perform required activities. The

results also revealed that prostheses satisfied different purposes; *Realistic Prostheses* (RP) imitating the natural appearance of human limbs (Figure 2a, b) were used to hide limb-loss or complete users' body-image to reduce stigmatisation. Contrarily, participants who focused on functionality perceived the appearance of their prostheses as less important; preferring to use *Functional Prostheses* (FP) despite them not imitating natural appearance (Figure 2c, d). Some participants emphasised the visibility of their prostheses to question the notions around disability (Murray 2009).

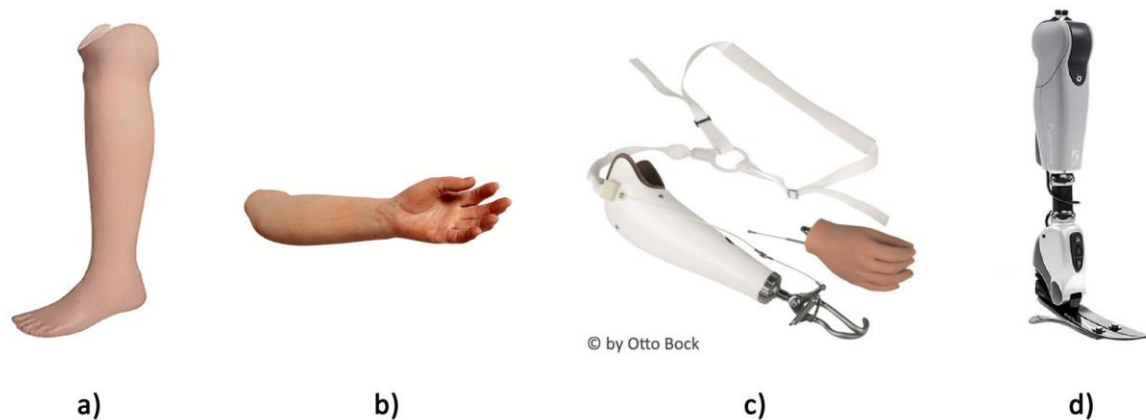


Figure 2. Realistic and Functional Prostheses: a) Dream Skin (adjusted by Fillauer); b) Realistic prosthesis made of silicone by Sophie de Oliveira Barata (adjusted by The alternative limb project, b); c) bebionic Hand designed by RSL Steeper (adjusted by Otto Bock HealthCare GmbH); d) The RHEO Knee (adjusted by Össur).

Saradjian, Thompson and Datta (2008) conducted interviews with eleven participants to explore how upper limb prostheses helped users cope with limb-loss. The analysis showed prostheses helped participants maintain a 'normal' identity by offering a 'normal' body appearance and the required functionality. By referring to Murray's (2004) two main prosthetic embodiment types, 1. emotionally connected to users (prostheses as integrated parts of users' bodies) and 2. prostheses as tools that helped them facilitate their activities; Saradjian, Thompson and Datta (2008) pointed out that users may experience their prostheses

in both ways, and highlighted that even if users perceived their prostheses as tools, that did not mean that users undermined their importance in their lives.

Schaffalitzky et al. (2009) highlighted the importance of understanding the needs, desires and preferences of each individual. For instance, a female participant rated FP functionality highly, but appearance low. Cairns et al. (2014), conducted a questionnaire with 153 participants finding that most participants were not satisfied with their lower limb RP, with respect to colour, shape and touch/feeling and pointed out the significance of improving users' satisfaction with appearance to increase their psychological well-being. Vlachaki et al. (2018), conducted an online survey with 136 participants finding approximately half of the participants were not satisfied with their prostheses. From those participants who believed that their prostheses negatively affected their appearance, 65% owned RP, whilst the rest owned FP.

### ***Society's Attitudes towards People with Limb-loss***

Previous studies showed that prostheses affected users' social lives. In individualistic societies, where people emphasise personal identity and focus on individual goals, people have more positive attitudes towards people with disabilities, than those in collectivistic societies, where people try to maintain group harmony and focus on group goals (Westbrook, Legge, and Pennay 1993; Zaromatidis, Papadaki, and Gilde 1999; Grames and Leverentz 2010). The study of Westbrook, Legge and Pennay (1993) in six communities (Chinese, Italians, Greek, Germans, Arabic speaking and Anglo-Australian), revealed that German (individualistic) had the highest acceptance towards amputees, whilst Greek and Arabic (collectivistic) the lowest, probably because of stigma that affected their behaviour. However, Papadopoulos (2009) highlighted that people's values in some collectivistic cultures, e.g. Greek, were becoming less collectivistic, probably due to globalisation increasing

homogeneity between cultures.

### ***Aim of the Study***

The literature suggests that people with limb-loss experience higher levels of stigmatisation in collectivistic cultures than those in individualistic. Therefore, the study was conducted in two different countries to give insights regarding the effects of culture on users' attitudes towards the aesthetics of prostheses. Two countries were chosen based on convenience; UK (individualistic) and Greece (collectivistic).

The aim was to explore how prostheses appearance affected users' lives, with respect to their culture; therefore, it was important to understand the role of prostheses on users' lives with respect to prosthetic appearance (Objective).

## **Materials and Methods**

### ***Study Design***

The aim was to explore how the appearance of prostheses affected users lives, by understanding how users make sense of their everyday lives, with respect to their situation and prosthetic use. Therefore, Interpretative Phenomenological Analysis (IPA) was used, based on interviews, as the theoretical approach and interpretation of findings. Interviews were combined with informational probes (Crabtree et al. 2003a, 2003b). In contrast to cultural probes, which consist of ambiguous tasks to trigger participants' inspiration and creativity to broaden designers' imagination (Mattelmäki 2005; Sanders and Stappers 2014), informational probes inform researchers about users' needs. They are usually used in sensitive contexts where information cannot be easily gained (Crabtree et al. 2003a, 2003b). Informational probes were considered valuable for gathering real-life data with respect to how participants interacted with their prostheses on a daily basis, as conducting observations

would be difficult.

### *A brief description of Interpretative Phenomenological Analysis*

Based on phenomenology, IPA is ‘a qualitative research approach committed to the examination of how people make sense of their major life experiences’ (Smith, Flowers, and Larkin 2012). In IPA, the researcher’s interest is on understanding how the specific participant experienced something important that happened in his or her life, based on his or her reflections. As participants are asked to think about what happened, reflect on it and interpret it to the researcher, IPA takes the form of hermeneutics, where the researcher tries to interpret users’ interpretations of their experiences (Smith, Flowers, and Larkin 2012). IPA is based on symbolic interactionism, focusing on how individuals interact with things based on social meanings (Biggerstaff and Thompson 2008). IPA does not try to investigate the objective aspects of the events, but the way people perceive and interpret their experiences (Smith, Flowers, and Larkin 2012).

### *Tools of the Study*

#### *Semi-structured Interviews*

Questions were separated into three areas; participants’ relationship with their prostheses (e.g. How do you feel about your prosthesis?), participants’ experience of their limb-loss and sense of self (e.g. How did the amputation affect your life?) and participants’ experience of their social life with respect to their prostheses (e.g. How does the appearance of your prosthesis make you feel in social situations?)

Interviews took approximately one hour and were audio recorded. Four interviews were conducted via video call; the rest were carried out in public places. The interviews were conducted in the participants’ native language to make it easier for participants to express



themselves. The three prosthetic types were not introduced to participants during the interviews to avoid bias. The categorisation of participants, with respect to their prostheses, resulted from the authors' analysis of the interviews and probes.

### *Informational Probes*

Observation System (EthOS), was used for the informational probes for two reasons. Firstly, it offered a variety of different tools (e.g. camera, text, scale questions) in one device (users' mobile phone), making the process easier for users. Secondly, it facilitated data collection in two countries at the same time, alongside real time communication with the researcher. The design of the informational probes was based on those of Crabtree et al. (2003a, 2003b).

Some examples of the required tasks were 'How do you feel about your appearance with your prosthetic limb now?', where participants were required to rank on a seven-point scale (1='Extremely sad' to 7='Extremely happy') how they felt, and 'Show me the clothes you are wearing now in the area of your prosthesis', where participants could answer by taking photographs. This information could be used as validation of the interviews to increase the rigour of the findings. Information gathered by the probes, e.g. images of participants wearing shorts, were also discussed during the interviews to give further insights, e.g. understanding why participants wear shorts.

The mobile application download link was sent to participants by email. An image with instructions was created explaining the stages participants had to follow and the use of each icon. Participants were asked to complete the tasks using the mobile application daily, for ten days, before the interview. The tasks and instructions were translated into Greek.

### *Participants*

Purposive sample methods were used for the recruitment of participants. Participants were chosen with respect to the prosthetic limb(s) they owned and those they would like to use.

Twenty-five people were asked to participate in the study, with seven consenting to take part (see Table 1).

Table 1. Participants' characteristics

	UK					Greece	
Participants' alias:	Rachel	Lucy	James	Sebastian	Margaret	Sarah	Andrew
Age:	29	50	56	47	19	32	49
Age of limb-loss:	27	35	44	10	3	26	20
Area of limb-loss <sup>1</sup> :	LLL	LLL	LLL	LLL	ULL	LLL	LLL
Level of limb-loss <sup>2</sup> :	Un	Bil	Bil	Un	Un	Un	Un
Prostheses Own <sup>3</sup> :	RP	FP	FP	EP	RP	FP	FP
Prostheses Want <sup>3</sup> :	FP	FP	EP	EP	EP	FP	FP
Cause of limb-loss:	Cancer	Accident	Septicaemia	Accident	Disease	Car Accident	Car Accident
Area of limb-loss <sup>1</sup> : Lower Limb-Loss (LLL); Upper Limb-Loss (ULL)							
Level of limb-loss <sup>2</sup> : Unilateral (Un); Bilateral (Bil)							
Prostheses Own <sup>3</sup> /Want <sup>3</sup> : Realistic Prostheses (RP); Functional Prostheses (FP); Expressive Prostheses (EP)							

## *Ethics*

Full ethical approval was obtained from the Ethics Sub-Committee for Human Participants of Loughborough University.

## *Data Analysis*

Interviews were transcribed immediately; interviews with Greek participants were translated into English by the bilingual researcher. The analyses of the interviews and the answers to the open questions of the probes were conducted using NVivo Pro11 software, according to IPA guidelines (Smith, Flowers, and Larkin 2012). During the first stage, notes and comments were created regarding the things that were important to the participants and the reasons for

their importance. In the second stage, key words were used that resulted in the creation of five main themes (nodes), regarding participants' relationship with their prostheses and their interactions with others. The themes that emerged were checked and reorganised, based on emerging connections, to produce the final themes. Themes that were not relevant to the study were excluded, whilst related themes were combined.

## **Results**

Four themes emerged regarding the role of prostheses on participants' lives, with respect to their appearance (Objective). Regarding prosthetic improvements, participants referred to problems with the socket, whilst female participants referred to problems with the weight of their prostheses. Beyond the role of aesthetics, participants emphasised the importance of participating in activities as a factor that helped them familiarise themselves with the capabilities of their prostheses.

Of interest was the fact that although the prosthetic types were not introduced to participants, some of them used the existing terms 'realistic' and 'functional'. Whilst none of the participants used the term 'expressive' some did refer to notions of EP, using phrases such as 'prosthesis with a specific design', 'stylish prostheses' and 'fashionable prostheses'.

### ***Hiding the Amputation (to Reduce Stigma)***

The use of RP to hide amputation to reduce stigmatisation, was pointed out by three participants; however, their incentives differed. Although Rachel maintained that after the amputation, emotionally and mentally she was the same person, since the amputation had affected her only physically, during the interview she repeated that she was 'disabled'. This suggests that Rachel was facing difficulties with her amputation and its effects on her life. Therefore, people's reactions and questions towards her amputation elicited unpleasant emotions in her (e.g. sadness, anger), as they reminded her of her cancer. Consequently, she

preferred to hide the limb-loss to avoid talking about the illness. The extracted text indicates that she felt obliged to wear her prostheses in social situations.

I am embarrassed to go outside without my prostheses...If I am going outside so people will see me, I have to wear a prosthesis. (Rachel)

Andrew explained that although he was comfortable with his amputation, he used RP to hide it because he lived in a close society. Thus, he was afraid of the consequences of the amputation for his children. Contrarily, Margaret used RP because she did not want to show immediately to people who did not know her who she was, as she was shy and introverted.

#### *Security Provider*

Margaret explained that the use of her upper limb RP in public was important to her mother to conceal the limb-loss and thus, act as a security provider, reducing Margaret's vulnerability towards muggers.

#### ***Enhances Self-confidence (by Improving Body Image)***

The use of prostheses to complete the body and improve participants' appearance was discussed during interviews; Margaret talked about the importance of using her RP in formal occasions, where clothes needed to look nice on her, even if she felt pain from the weight of the prosthesis. However, Margaret, Andrew and Sebastian highlighted that although their RP and FP completed their bodies, evoking confidence in their body image, at the same time the poor appearance of their prostheses made them conscious regarding the clothing choice as they were trying to hide the prostheses (e.g. by wearing long trousers). Figure 3a and b depict participants trying to hide their prostheses using clothes. Although Margaret tried to hide her prostheses, part of the socket on her shoulder was obvious (Figure 3a).

When I need to go out...I start thinking how it [the RP] won't look ugly...to not give to people a negative impression... (Margaret)

Participants pointed out that EP would complete their bodies which, alongside their nice appearance, would increase their confidence and improve their psychological condition, reducing the anxiety of trying to hide it. Sebastian mentioned that when he used RP or FP, he always wore long trousers, but after using EP, he felt confident to wear shorts. Figure 3.c depicts Sebastian purposely wearing shorts in order to show his EP.

The contribution of EP on teenagers' psychological condition and improvement of confidence was highlighted by Lucy, who said that teenagers 'need to feel better about themselves', as they have active social lives, and EP could help them achieve that.



Figure 3. Participants' clothes in the area of their prostheses.

#### *Help Limb-loss Acceptance*

As a result of the improvement in users' confidence, Sebastian and Andrew claimed that EP could help amputees accept limb-loss more easily. Sebastian stated that EP could take 'the big disaster' out of losing their legs, whilst Andrew emphasised the immediate connection of the aesthetics of prostheses with users' psychology. Lucy pointed out that for teenagers, EP could be useful. As teenagers need to live longer with their limb absence, having many

options would make it 'more acceptable to them to have a prosthetic leg'.

### *Nothing more than Accessories*

Although James expressed desire towards EP, he maintained that EP were like accessories, which could only be used in social occasions to improve the prosthesis appearance.

Therefore, James believed that EP would not change any part of his life, as they would not offer additional functionality, a view similar to that of Sarah who pointed out that EP can be used 'like shoes'. Margaret also maintained that she considered EP as accessories. As she had her amputation from a very young age, she does not need prostheses to facilitate her activities. Thus, their only use by her is to improve body image.

Andrew's opinion was different, stating that EP could improve the functionality of prostheses for above knee amputees. He explained that realistic foams restricted his movements and made the use of the prosthesis energy-consuming. However, the use of a prosthetic fairing that would stop before the knee joint, would allow the knee to bend more easily, improving his quality of life.

### *Show off the 'Real Self'*

A result of participants' confidence with their limb absence and consequently, their 'new' self, was the disclosure of their prostheses by the removal of the realistic foam covers. Participants had the impression that the poor design of their realistic foams increased their stigmatisation, indicating they were ashamed of themselves. Therefore, as long as participants felt confident with the amputation, they preferred using their FP without any covers to show they did not deny their identities as amputees by trying to imitate their normal limbs.

I think that it needs to start having a specific design to show that although it is a prosthetic limb...this does not mean that I have replaced it. That I replaced the reality

and now I have two arms. No. I have an arm and a prosthetic limb which just helps me do few things or I just like to wear it (Margaret)

Since I have it [the prosthesis] on me, I like it to be as it is [functional]. Not to make it as my own limb (Sarah)

Margaret also talked about occasions where she revealed her limb-loss to people who had not realised she was an amputee causing her embarrassment. She emphasised that by using EP she would always be ‘forced’ to show to people her ‘real self’.

Sebastian, James, Margaret and Lucy highlighted that EP would act as statements for users, showing that they feel confident with their identities. One of the UK participants, Sebastian, highlighted that EP helped him stand out in the crowd and show off his limb absence. Rachel also mentioned that EP could act as statements; however, she maintained she would not feel confident with that.

You can stand out and be proud about it and embrace your disability rather than trying to hide it... I moved to the next level of confidence and I like to be the centre of attention. Probably that’s why I wear shorts...and having the [expressive] leg cover really gives me that ability to stand out in the crowd (Sebastian)

I suppose it [EP] allows the user to make a statement, if he wanted to (James)

### *Help the Acceptance by Others*

All participants, regardless of their perceptions towards the importance of aesthetics, pointed out that the appearance of EP was improved and more attractive than RP and FP. Sebastian, James and Lucy said that EP could help amputees’ acceptance by others. Sebastian explained how people’s reactions towards his EP changed compared to those of the previous prostheses. As Sebastian said, people were smiling and making nice comments, whilst with the previous prostheses, people looked in a strange way which embarrassed him. Lucy claimed that the use of the EP is ‘to make the general public feel better’ in order to reduce pity towards people

with limb-loss, and not necessarily because individuals need to feel better about themselves. Therefore, according to Lucy, EP could alter others' behaviour, since they were 'things people are more positive to think [sic]' than those that attempt to mimic the natural form unsuccessfully. This was in accordance with Sebastian's experience with his previous prostheses. As Sebastian explained, the unattractive design of his previous prostheses, connected the prostheses with 'medical' products and thus, people subconsciously connected his amputation with other disability problems (e.g. mental), which resulted in his marginalisation as people considered he was incapable of socialising.

Although Margaret considered that wearing EP, would not help her acceptance by others, as she thought that EP would cause the same reactions to people to those of not wearing a limb at all (e.g. people look in a strange way), she also referred to occasions where the poor appearance of her RP evoked fear and embarrassment in the people around her.

### *Opportunity of Educating People*

All participants except Rachel highlighted the importance of educating others, especially children, about the life of people with limb-loss and their capabilities to reduce stigmatisation. Participants pointed out that others were not familiar, and the appearance of prostheses made them feel scared or embarrassed, as they did not know how to approach them. Sebastian said that with his RP and FP, people understood that he wore a prosthesis; however, they did not talk to him, as they were afraid of saying something offensive, whilst EP helped people realise that he felt confident and comfortable with his limb-loss. Thus, they approached him more easily.

According to Sebastian, James, Lucy and Margaret, EP could act as 'talking points', facilitating interactions with others. Sebastian highlighted that EP made 'a fundamental



difference' to his relationships with others, compared to previous conventional prostheses, as everybody wanted to talk to him and express their admiration towards the design of his EP.

...that [the EP] would be a good talking point (James)

When you wear a [expressive] leg cover, everybody wants to say something. Everybody wants to say that is a cool leg cover or something like that (Sebastian)

I think it [EP] might help people who are more open-minded to feel more comfortable to open themselves to others who present a difference (Margaret)

Two of the Greek participants, Margaret and Sarah pointed out that drawing attention to limb absence, from using EP, might also increase stigmatisation. People could perceive it as an effort by them to overshadow their confidence with their appearance and thus, dislike and disapprove of it.

### ***More than Prostheses***

The analysis showed that for participants with lower limb-loss, prostheses constituted tools ('It's a means to an end') allowing them to do everyday activities and 'to lead a nearly normal able-bodied life', e.g. driving their cars.

Although the unilateral lower limb participants separated prostheses from their natural human limbs, they did not underestimate their importance. This is more obvious with Sarah, who although used words such as 'normal' or 'my limb', to refer to her natural limb, and 'prosthetic' to refer to the artificial one, her relationship with the prosthesis was strong and she perceived it as a friend with its own personality.

Many times, I talk to him [the prosthesis]...I call him Robocop...We have a very good relationship (Sarah)

For the two bilateral amputees, the strong relationship with their prostheses was more obvious, as they perceived them as ‘extensions’ of their bodies and self; since they did not have natural legs, they referred to them as their ‘ability’ as without them, they would be in a wheelchair.

## **Discussion and Conclusions**

By dividing prosthesis into three types, those of Realistic Prostheses (RP), Functional Prostheses (FP), and Expressive Prostheses (EP), the study aimed to explore how their appearance affected users’ lives, with respect to their culture. Although this research applies to all types of limb difference, in this case, participants were all amputees. Four themes emerged from the interviews, with respect to the role of prostheses on users’ lives (Objective); three related to prosthetic appearance (Figure 4). As shown in Figure 4, one theme related to the effects of prosthetic appearance on participants’ personal lives, whilst the other two were related to the effects on participants’ social lives. Although the findings agreed with Murray and Fox (2002) regarding participants’ concerns towards prostheses, with respect to their sex, they indicated that male participants were also concerned about the aesthetics of their prostheses.

Although the fourth theme did not focus on the role of the aesthetics of prostheses, it highlighted the importance of prostheses to participants’ lives. The fact that some participants referred to their prostheses as ‘tools’, or distinguished them from their natural limbs, appeared to be a result of their acknowledgement of their situation as amputees, not an underestimation of the importance of the prostheses on their everyday lives. These results agreed with Saradjian, Thompson, and Datta (2008) towards Murray’s (2004) two prosthetic embodiment types, who pointed out that users’ experiences towards prostheses can be both emotional and practical.

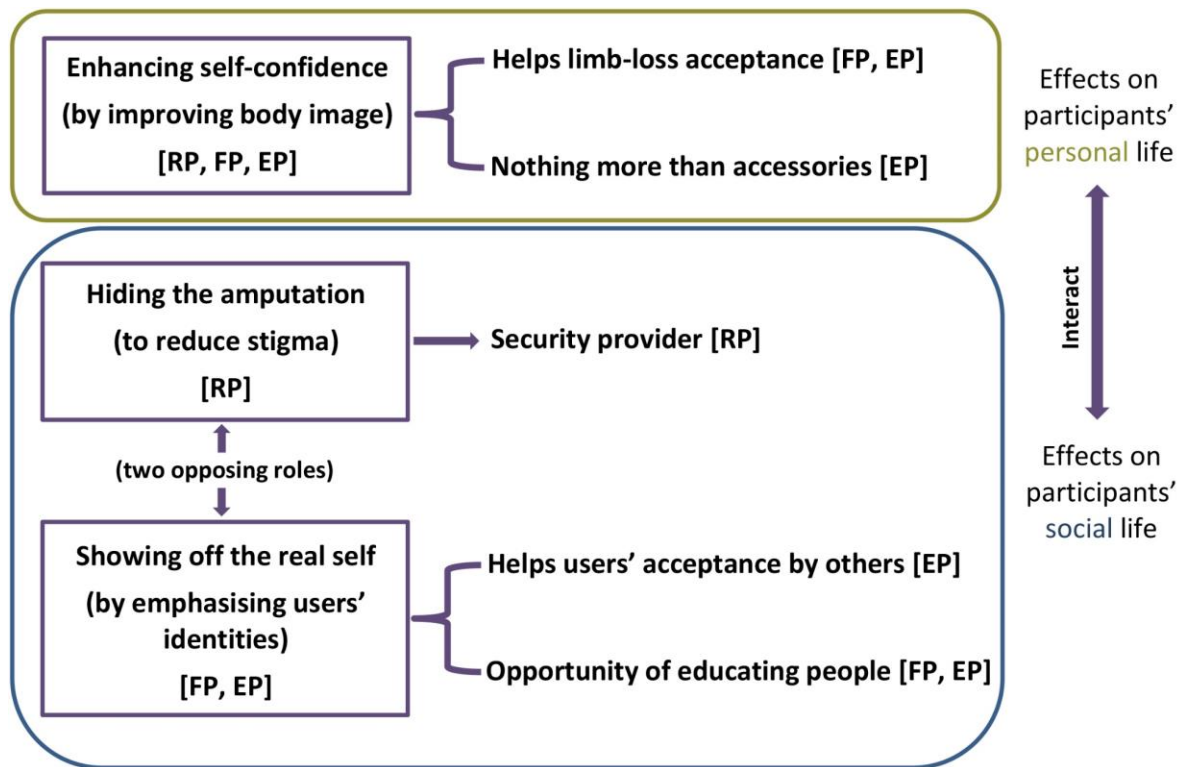


Figure 4. The three roles of prostheses on participants' lives, with respect to their appearance [RP: Realistic Prostheses; FP: Functional Prostheses; EP: Expressive Prostheses]

### *Effects on Personal Life*

Previous investigations (Rybarczyk et al. 1995; Gallagher and Maclachlan 2001; Murray 2005, 2009; Saradjian, Thompson, and Datta 2008) showed that prostheses, regardless of type, helped participants maintain a normal body appearance by completing their bodies. However, the quantitative studies of Cairns et al. (2014) and Vlachaki et al. (2018) showed that many participants were not satisfied with the appearance of their prostheses and believed that it negatively affected their body image. The findings of this study could provide insights regarding users' dissatisfaction with the appearance of their RP and FP showing that, for some participants, prosthetic use for the completion of the body was not an adequate factor in improving their well-being. Characteristics such as colour fluctuations between participants' body and prostheses, and prosthetic materials reduced participants' satisfaction with the appearance of their RP, in accordance with the findings of Cairns et al. (2014). Those

participants who felt confident with their limb-loss preferred to remove the realistic cover to avoid being stigmatised by sending wrong meanings to people. This verifies Pullin's (2009) claims regarding the effects of the poor appearance of medical products on users' psychology. In this case, the removal of the 'realistic' cover and the exposure of the FP made some participants conscious about the shape of their bodies and the way FP interacted with their clothes. In both cases, participants' dissatisfaction with the appearance of their prostheses evoked unpleasant emotions, such as anxiety, which derived from participants' efforts to conceal their prostheses to not negatively affect their appearance. Murray (2009) also referred to 'strategic use of clothing' (580), as participants' technique to hide their limb-loss. However, the participants of this study said that EP could improve their self-confidence, as EP would offer a normal body image, alongside an attractive appearance.

Nevertheless, even for the participants who only appeared to consider EP as accessories, EP was not necessarily less important, especially for the upper prosthetic user whose prosthesis function was only to improve her appearance. These results supported Pullin's (2009) claims regarding the positive effects of medical products with confident design on users' well-being. Furthermore, the contribution of EP on recent amputees' and teenagers' acceptance of limb-loss was highlighted by three participants, highlighting the importance of aesthetics on user's acceptance of prostheses.

### *Effects on Users' Social Lives*

Murray (2009) pointed out that there are two meanings of 'normalisation' in the disability literature; one is associated with users' effort to adjust to society and thus, mainly hide limb-loss, whilst in the second, users are incorporated into society by maintaining their identities as 'disabled'. The findings of this study regarding the two opposing roles of prostheses on participants' social lives, with respect to their appearance, were in line with Murray's (2009)

suggestions regarding the two meanings of normalisation. More specifically, FP and EP were used by participants to show limb-loss and highlight the 'real' self. This is in accordance with Murray's (2009) findings, which indicated that some users preferred to emphasise the limb absence to question the notions around disability. Although the extent to which participants were conscious of the aesthetics of their prostheses varied, all participants pointed out that EP were more attractive than RP and FP. Thus, they could be used as statements and starting points of conversations between participants and others, providing the opportunity to those who felt confident with their limb-loss to educate others. The dissociation of others and the difficulties in approaching people with limb-loss emerged from all participants. Sebastian highlighted that the use of EP had a 'fundamental difference' on people's reactions towards his prosthesis and him, as they were more positive, in comparison to the other prosthetic types which evoked embarrassment in people. These findings provide initial evidence on the assumptions of Vainshtein (2011) and Hall and Orzada (2013) regarding the social significance of EP. Additionally, the studies of Gallagher and Maclachlan (2001), Saradjian, Thompson, and Datta (2008), and Murray (2005, 2009) showed that in many cases, participants had to reveal their limb-loss to people, as people did not understand they were prosthetic users. Although in the study of Saradjian, Thompson, and Datta (2008), participants perceived that as positive, in this study and the studies of Gallagher and Maclachlan (2001) and Murray (2005, 2009) it evoked unpleasant emotions, such as embarrassment. Therefore, the participant indicated that EP could eliminate that by showing the prosthesis directly to people. However, two Greek participants pointed out that EP could also increase users' public stigma; people in collectivistic societies could object to EP by perceiving it as users' effort to overshadow their confidence with the limb absence.

The effects of society's attitudes on users' preferences towards the aesthetics of prostheses also appeared for RP, which were used for the opposite reasons of those of FP and

EP; to hide limb-loss to reduce stigma, which agreed with Rybarczyk et al. (1995) and Saradjian, Thompson, and Datta (2008). The IPA analysis revealed that even if participants used RP for the same reason, their incentives were different and were in line with the types of stigma suggested by Werner and Shulman (2015). Rachel did not feel comfortable with her limb-loss and thus, she experienced high levels of self-stigma derived from both the limb-loss and the illness. Conversely, the other two participants felt confident with their limb-loss and considered themselves as 'disabled' only regarding the social and institutional framework and not based on their capabilities as individuals. However, Andrew used RP for reasons related to stigma by association, whilst Margaret used RP to not enhance others' stigma towards her (public stigma). Participants in the study of Murray (2005) and Saradjian, Thompson, and Datta (2008) also maintained that RP helped them hide limb-loss to 'be evaluated by others as people rather than being immediately discredited based on their physical difference' (Saradjian, Thompson, and Datta 2008, 881-882). These results support the literature regarding the way societies affected people's social lives; in the case of the British participant the stigma was internally experienced, which agreed with the individualistic character of the UK, whilst the Greek participants experienced external stigma, which was in accordance with the collectivistic character of Greece.

### ***Contribution***

The majority of the literature in the area of prostheses focuses on Western and Scandinavian countries, such as the UK. However, the knowledge that has been gained by these studies cannot always be applied in the countries of Eastern and Southern Europe, such as Greece, which have different cultures. This study verifies the necessity of considering users' culture in the design of prostheses and shows that the nature of the cultural context is important, especially when considering EP, to not increase users' stigmatisation. This study provides

insights into how the appearance of prostheses affect users' personal and social lives in countries with different cultures, which had not been previously investigated. Finally, it provides evidence on the theoretical findings regarding the effects of EP on users' self-confidence and the societies' attitudes towards prosthetic users. These results are valuable for designers, prosthetists, clinicians and prosthetic companies.

### ***Limitations***

The main limitation of this study was the lack of a Greek EP user, which did not allow the comparison of users' experiences and societies' reactions towards EP in both countries. The small sample and IPA methods did not allow the findings to be generalised and thus, studies with different sample groups could give different findings. Another limitation of the study may be the conduct of the interviews via video call, which may have affected the quality of communication. Finally, it is important to mention that although the use of distinctive categories facilitated the conduct of the study and the comparison of the data, it is too simplistic as nuances may exist, e.g. prostheses that belong to more than one prosthetic types or countries which culture can present characteristics of both individualistic and collectivistic societies.

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### **Conflict of interest**

The authors declare that there are no conflicts of interest.

## References

- Alleles Design Studio. Alleles Design Studio. Image. Accessed April 17, 2018. [www.alleles.ca/](http://www.alleles.ca/)
- Atherton, Rachel, and Noelle Robertson. 2006. "Psychological Adjustment to Lower Limb Amputation amongst Prosthesis Users." *Disability & Rehabilitation* 28 (19): 1201–9. doi:10.1080/09638280600551674.
- Biggerstaff, Deborah, and Andrew R. Thompson. 2008. "Interpretative Phenomenological Analysis (IPA): A Qualitative Methodology of Choice in Healthcare Research." *Qualitative Research in Psychology* 5 (3): 214–24. doi:10.1080/14780880802314304.
- Breakey, James W. 1997. "Body Image: The Lower-Limb Amputee." *Journal of Prosthetics and Orthotics*, 9(2), 58–66.
- Cairns, Nicola, Kevin Murray, Jonathan Corney, and Angus McFadyen. 2014. "Satisfaction with Cosmesis and Priorities for Cosmesis Design Reported by Lower Limb Amputees in the United Kingdom: Instrument Development and Results." *Prosthetics and Orthotics International* 38 (6): 467–73. doi:10.1177/0309364613512149.
- Crabtree, Andy, Hemmings Terry, Rodden Tom, Cheverst Keith, Clarke Karen, Dewsbury Guy, Hughes John, and Rouncefield Mark. 2003a. "Designing with Care: Adapting Cultural Probes to Inform Design in Sensitive Settings" *Proceedings of the 2004 Australasian Conference on Computer-Human Interaction* 4(13).
- Crabtree, A., Hemmings Terry, Rodden Tom, Cheverst Keith, Clarke Karen, Dewsbury, Guy, Hughes James, and Rouncefield Mark. 2003b. "Using probes as exploratory devices in care settings." *Proceedings of the Eighth European Conference of Computer-Supported Cooperative Work*.
- Demirbilek, Oya, and Bahar Sener. 2003. "Product Design, Semantics and Emotional Response." *Ergonomics* 46 (13–14): 1346–60. doi:10.1080/00140130310001610874.
- Fillauer. The dream skin. Image. accessed January 31, 2018. <http://fillauer.com/Lower-Extremity-Prosthetics/cosmetic-covers/>
- Gallagher, Pamela, and Malcolm Maclachlan. 2001. "Adjustment to an Artificial Limb: A Qualitative Perspective." *Journal of Health Psychology* 6 (1): 85–100. doi:10.1177/135910530100600107.
- Grames, Molly, and Cortney Leverentz. 2010. "Attitudes Toward Persons with Disabilities: A Comparison of Chinese and American Students." *UW-L Journal of Undergraduate Research* XIII, 1–6. doi:10.1037/e566842012-669.



- Hall, Martha L., and Orzada, Belinda T. 2013. "Expressive Prostheses: Meaning and Significance." *Fashion Practice: The Journal of Design, Creative Process & the Fashion* 5 (1): 9–32. doi:10.2752/175693813X13559997788682.
- Holzer, Lukas A., Florian Sevelde, Georg Fraberger, Olivia Bluder, Wolfgang Kicking, and Gerold Holzer. 2014. "Body Image and Self-Esteem in Lower-Limb Amputees." *PLoS ONE* 9 (3). doi:10.1371/journal.pone.0092943.
- Mattelmäki, Tuuli. 2005. "Applying probes—from inspirational notes to collaborative insights." *CoDesign*, 1(2): 83–102. doi: 10.1080/15719880500135821.
- Murray, Craig. 2004. "An Interpretive Phenomenological Analysis of the Embodiment of Artificial Limbs." *Article. Disability and Rehabilitation* 26: 963–73. doi:10.1080/09638280410001696764.
- Murray, Craig D. 2005. "The Social Meanings of Prosthesis Use." *Journal of Health Psychology* 10 (3): 425–41. doi:10.1177/1359105305051431.
- Murray, Craig D. 2009. "Being like Everybody Else: The Personal Meanings of Being a Prosthesis User." *Disability and Rehabilitation* 31 (7): 573–81. doi:10.1080/09638280802240290.
- Murray, Craig D, and Jezz Fox. 2002. "Body Image and Prosthesis Satisfaction in The lower Limb Amputee." *Disabil Rehabil* 24 (17): 925–31. doi:10.1080/09638280210150014.
- Murray, Craig D, and Mark J Forshaw. 2013. "The Experience of Amputation and Prosthesis Use for Adults: A Metasynthesis." *Disability and Rehabilitation* 35 (14): 1133–42. doi:10.3109/09638288.2012.723790.
- Össur. Össur Announces World's First Integrated Bionic Prosthetic Leg. Image. accessed February 21, 2018. <https://www.ossur.com/corporate/newslist/670-ossur-announces-world-8217-s-first-integrated-bionic-prosthetic-leg>
- Otto Bock HealthCare GmbH. Body-powered prosthesis. Image. accessed April 14, 2018. <https://www.ottobockus.com/prosthetics/upper-limb-prosthetics/solution-overview/body-powered-prosthetic-solutions/>
- Papadopoulos, Chris. 2009. "Stigma towards People with Mental Health Problems: An Individualism-Collectivism Cross-Cultural Comparison." Middlesex University.
- Pullin, Graham. 2009. *Design Meets Disability*. London: MIT Press.
- Rybarczyk, Bruce, David L. Nyenhuis, John J. Nicholas, Susan M. Cash, and James Kaiser. 1995. "Body Image, Perceived Social Stigma, and the Prediction of Psychosocial Adjustment to Leg Amputation." *Rehabilitation Psychology* 40 (2): 95–110. doi:10.1037/0090-5550.40.2.95.

- Riddell, Sheila, and Nick Watson. 2003. *Disability, Culture and Identity*. Routledge.
- Sanders, Elizabeth B N, and Stappers Pieter J. 2014. "Probes, toolkits and prototypes: Three approaches to making in codesigning." *CoDesign* 10(1), 5–14: doi: 10.1080/15710882.2014.888183.
- Sansoni, Stefania, Andrew Wodehouse, Angus McFadyen, and Arjan Buis. 2015. "The Aesthetic Appeal of Prosthetic Limbs and the Uncanny Valley: The Role of Personal Characteristics in Attraction." *International Journal of Design* 9 (1): 67–81.
- Saradjian, Adam, Andrew R. Thompson, and Dipak Datta. 2008. "The Experience of Men Using an Upper Limb Prosthesis Following Amputation: Positive Coping and Minimizing Feeling Different." *Disability and Rehabilitation* 30 (11): 871–83. doi:10.1080/09638280701427386.
- Schaffalitzky, Elisabeth, Sinead Ni Mhurchadha, Pamela Gallagher, Susan Hofkamp, Malcolm MacLachlan, and Stephen T. Wegener. 2009. "Identifying the Values and Preferences of Prosthetic Users: A Case Study Series Using the Repertory Grid Technique." *Prosthetics and Orthotics International* 33 (2): 157–66. doi:10.1080/03093640902855571.
- Sethna, Zubin, and Jim Blythe. 2016. *Consumer Behaviour*. Edited by Waters Matthew. 3rd Editio. Glasgow, Great Britain: SAGE Publications Ltd.
- Smith, Jonathan A., Paul Flowers, and Michael Larkin. 2012. *Interpretative Phenomenological Analysis: Theory, Method and Research*. 2nd ed. London: SAGE Publications Ltd.
- SummitID. Prosthetic Fairings. Image. accessed April 14, 2018. <http://www.summitid.com/#/fairings-1/>
- The alternative limb project (a). Synchronised. Image. accessed April 25, 2018. <http://www.thealternativelimbproject.com/types/alternative-limbs/>
- The alternative limb project (b). Realistic limbs. Image. accessed April 17, 2018. <http://www.thealternativelimbproject.com/fullscreen/realistic-limbs/>
- Vainshtein, Olga. 2011. "I Have a Suitcase Just Full of Legs Because I Need Options for Different Clothing: Accessorizing Bodyscapes." *Fashion Theory - Journal of Dress Body and Culture* 16 (2): 139–70. doi:10.2752/175174112X13274987924014.
- Vlachaki, Anna, Abby M.J. Paterson, C. Samantha Porter, and Richard J. Bibb. 2018. "A Survey of Prosthetic Preferences in the UK and Greece." *Proceedings of DRS2018* 2 (7). doi:10.21606/dma.2017.232.

- Werner, Shirli, and Cory Shulman. 2015. "Does Type of Disability Make a Difference in Affiliate Stigma among Family Caregivers of Individuals with Autism, Intellectual Disability or Physical Disability?" 59 (march): 272–83. doi:10.1111/jir.12136.
- Westbrook, Mary T., Varoe Gegge, and Mark Pennay. 1993. "Attitudes Towards Disabilities Multicultural." *Social Science & Medicine* 36 (5): 615–23.
- Zaromatidis, Katherine, Aspasia Papadaki, and Alissa Gilde. 1999. "A Cross-Cultural Comparison of Attitudes toward Persons with Disabilities: Greeks and Greek-Americans." *Psychological Reports* 84 (3 Pt 2): 1189–96. doi:10.2466/pr0.1999.84.3c.1189.