Suppression Mental Questionnaire App: a mobile web service-based application for automated real-time evaluation of adolescent and adult suppression

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Abstract

The Suppression Mental Questionnaire System (mobile App, Web-Services, Cloud...) acts as a bridge among dynamic psychology, the cognitive studies, and modern information and telecommunication technologies (ICT). The adoption of digital tools speeds clinical investigations on defense mechanisms and makes clinical trials easier by reducing needed effort for manual scoring. It also enables faster and deeper research practices, also more appropriate to the times by enabling the real-time transfer of the results to digital archives for statistical and psychometrical purposes. Reliability of the scale was evaluated by using Cronbach's alpha; this numerical coefficient of reliability was calculated for the three factors and for the two psychodiagnostic tools. The digital tool melts together scalability and availability provided by the mobile application, power and flexibility provided by Web 2.0 portal. The statistical analysis show a good reliability of the scale and of different factors. Differences related to the factors are considered possible on the basis of the current literature.Mobile Operating Systems, Internet, Web 2.0, and the considerable computing capabilities provided by Clouds are powerful combinations of tools able to provide real-time Open Data/Results to scientists and users, and to spread up the use of the questionnaire all over the world.

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1. Introduction

The previous scientific experience in reference to the study of suppression (Settineri et al., 2016) highlighted the possibility of a quantitative study of defense mechanisms through the questionnaire (Suppression Mental Questionnaire).

This necessity is implemented by the actual studies regarding the involvement of the body in mental dynamics (Settineri et al., 2018; Motofei & Rowland, 2018) and vice versa. The emergence of three factors, respectively *Repressive function*, *Regression in the service of the Ego* and *Rationalizatio*n, it brings out the opportunity to study in depth and in detail the defense dynamic.

As suggested by Berney, Roten, Beretta, Kramer, and Despland (2014), the clinical study of defense mechanisms provides a way to understand the affective dynamics that occur in all individuals, a particularly useful practice in both clinical work and research in psychotherapy. Metzger (2014) emphasizes the adaptive meaning of suppression, so that in this sense it is included among the mature defenses also for psychological testing (Perry, 1990; Perry & Henry, 2004); proof of this is the Vaillant metaphor: "*When used effectively suppression is analogous to a well-trimmed sail*" (2000, p.94).

In detail, the defense state of suppression is expressed where the need to face conflicts is consciously recognized. Unlike most psychoanalytic concepts, suppression is part of our daily life because it is an immediate form of conscience, familiar to everyone (De Burge, 2001).

The particular commitment of this study focuses on the clarification made starting from S. Freud (1926) that differs the suppression destination (Unterdrückung) of the representation, from the repression of the affect related to it; this fact had been studied in detail by A. Freud (1936/1937) who refers to the consideration of suppression as a conscious phenomenon distinct from repression.

Like any consideration referable to a dimensional approach, even suppression as a psychic phenomenon is not exempt from the production of psychopathological outcomes. So as the emotional state is not fused with representation and therefore symbolization is not allowed, this results from being framed as a defense against intolerable emotions and fantasies (Busch, 2014), we are witnessing the somatization phenomena.

These phenomena are expression of psychological and emotional distress through the body (De Burge, 2001), such as to respond to the economic phenomenology of the destination of mental energy.

This psychosomatic aspect on the basis of psychoanalytic studies concerning *actual neuroses* is provided by the clinical practice of Marty and Fain (1952), where later the authors specify that the failure of psychic processing of the excitement would produce a drift, which does not admit the immediate extinction, but rather a somatic destination (1955).

This destinations as proposed by Dechaud-Ferbus (2009) in the studies of Green (1993) are called *"pathologies of the negative"* because it is linked to loss and destructiveness, also known as

predictive for further relevant pathological phenomena (Catalano et al., 2018). As reported by the previous study, which expresses the possibility of using a metric approach aimed at detecting and studying the dynamics of mental images and their affection, the current study extends the purpose to the current ICT prerogatives.

As suggested by research literature (Rogers, Carpentier & Barnard, 2016), the experience of control referred to the media interaction, could also improve the user's pleasure in automated real-time evaluation of suppression.

2. Methodology and technical solution

For these reasons, a "Suppression Mental Questionnaire System" (*SMQ system*) was created as a complex system where different ICT actors play together in building an innovative, advanced, user-friendly solution for a wide and effective questionnaire administration.

The main actor in the system is the mobile SMQ Application (SMQ App), a Digitalized Suppression Mental Questionnaire, offering an intuitive, fast, and easy-to-use user interface for filling the questionnaire in.
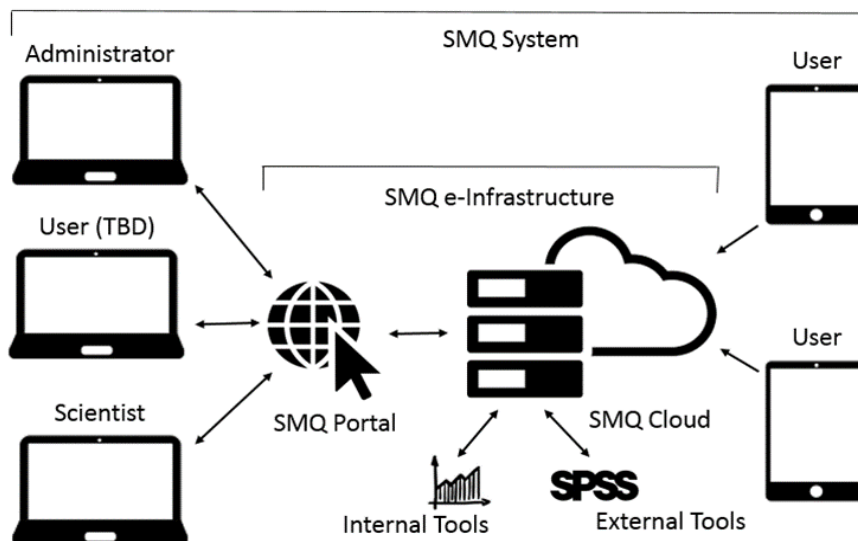

Figure 1 - The Suppression Mental Questionnaire System.

The App, available for mobile Android OS (version +4.4, on smartphones and tablet computers) on Google Play store (https://play.google.com/store/apps/details?id=net.swingit.mentalsuppression), shows an interactive automated implementation of the questionnaire and provides the calculation of the three factors bound to suppression defense mechanisms.

As stated by Leigh and Flatt (2015), while the focus of Internet-based interventions research and clinical practice is often on treatment, an equally important area is computerized testing using the Internet.

This does not explicitly refer only to online questionnaires (van Ballegooijen et al., 2016), but also to cognitive testing (Lindner et al., 2016), and more recently to data collection processes using smartphones (Luxton et al., 2011). This is confirmed by the long historical background that began with computerized testing and interventions (Marks, Shaw & Parkin, 1998) and early programs like Eliza (Epstein & Klinkenberg, 2001).

As it is clear nowadays, refactoring of almost any useful software application towards mobile Operating Systems and devices already started. In fact, mobile apps are now finally present as the natural evolution of computer-based applications to be used on a smartphone (Danaher et al., 2015).

As a plus, mobile devices are pretty much always connected to the Internet from one side and in tight connection with the individual on the other, so they can collect huge amount of data (location, user habits, etc) through an integrated sensor and deliver them in the right direction (either the Net or the human) (Chen et al., 2014).

Smartphones and several other mobile devices are equipped with features enabling the fast (even real-time and up-to-date) assessment of evidence-based information (Zhang, Cheok & Ho, 2015). This provides the mobile devices also with the ability to introduce new populations to mental health services (Andersson et al., 2008).

In a similar manner, as depicted in Figure 1, the user after downloading and installing the App on his/her own device, can experience the questionnaire. There is no limitation on users who can fill the SMQ Questionnaire on a given device.

No personal information is stored on the device, so no privacy issues arise. Furthermore, at the completion of every execution of the questionnaire software, after the reporting screen to the user, all results are deleted from the App.

Before deletion, the Questionnaire data are also anonymously transferred to the Cloud infrastructure and stored in the SMQ Database.

Web Service will made available to scientists and administrators through the SMQ Portal. Internal reporting tools and External Tools are available for data inspection, data mining, and statistical analysis. Web access for users to experience the SMQ Questionnaire is also by design foreseen (not yet, enabled).

Those factors are listed and briefly described in the following table, where levels are calculated using tertiles.

Factor	Name	Standard Suppression Levels	QKR Suppression Levels
A	Repressive Function	Low, Medium, High	Low, Medium, High
Behaviors for which the subject is able to remove from his mind ideas, disturbing images and engrams.			
B	Regression in the service of the Ego	Low, Medium, High	Low, Medium, High
Capacity of the represented function of resorting to the imagination as a protective factor.			
C	Rationalization	Low, Medium, High	Low, Medium, High
Ability to contain and put out antithetical emotions			

Table 1 - The Suppression Mental Questionnaire Suppression Factors.

The current version of the SMQ App is able to evaluate suppression levels in a standalone manner, through the scoring Factor Analysis formula:

$$\text{Total score s} = \sum_{i=1}^{k} w(i)\, s(i)$$

where:

k is the total number of items included in the questionnaire, k={18 | 30} (Settineri et al., 2016),

w(i) is the weight associated to the i-th item of the questionnaire (Settineri et al., 2016),

s(i) is the single score assigned by the user to the i-th item of the questionnaire.

The SMQ App returns two Factor Analysis total scores simultaneously: one is calculated from the standard approach where all weights *w(i)* are set to 1 (Standard Suppression Levels); the other from the subsequent Factor Analysis based on Quartimax with Kaiser Normalization Rotation Method (QKR Suppression Levels) where the weights *w(i)* are set to the values in Table 2 in Settineri et al. (2016).

The SMQ App lays on the powerness of Web Services to transfer information to the *administration platform* on the Cloud infrastructure, accessible through the SMQ Portal. Web services are Client/Server applications that communicate over the World Wide Web's (WWW) HyperText Transfer Protocol (HTTP). As described by the World Wide Web Consortium

(W3C), web services provide a standard means of interoperation between software applications running on a variety of platforms and frameworks. Web services are characterized by their great interoperability and extensibility, as well as their machine-processable descriptions, thanks to the use of XML and, nowadays, JSON. Web services can be combined in a loosely coupled way to achieve complex operations.

Programs providing simple services can interact with each other to deliver sophisticated added-value services. Two classes of web services can be identified: a. REST-compliant web services, manipulating XML representations of web resources through "stateless" operations; and b. arbitrary web services, where services expose arbitrary sets of operations (W3C, Web Services Architecture).

The SMQ e-Infrastructure, the combination of Cloud infrastructure and SMQ Portal, represents an obvious deployment of arbitrary web services.This way, the administration platform is able to collect anonymous data from users for further mining and analysis. Data can be grouped in campaigns by adoptions of unique campaign identifiers to be defined by administrators (e.g. scientists).

The administrators, through the SMQ Portal, can inspect their own data and/or download them for further analysis. The SMQ Portal can be reached at the following URL: http://portal.smq.cloud. Figure 2 shows the SMQ Portal homepage.
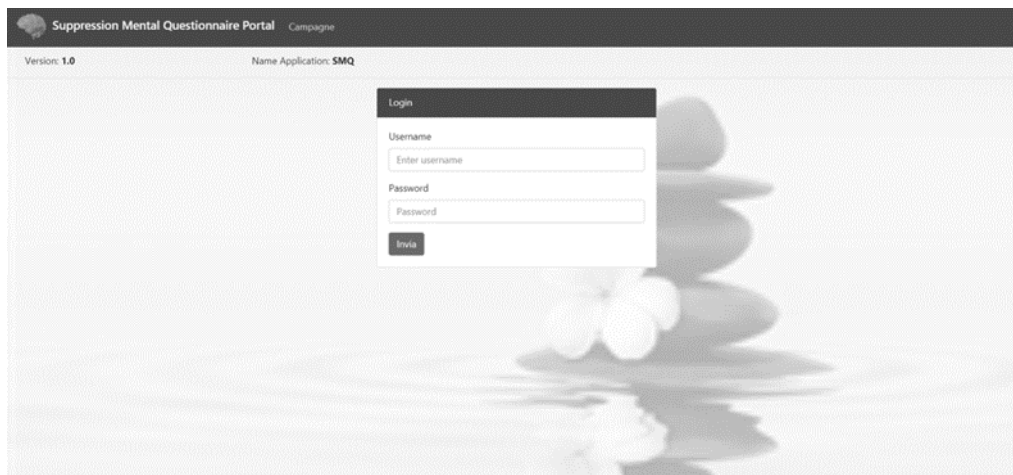

Figure 2 - The Suppression Mental Questionnaire Portal homepage.

The portal is also able to transparently call IBM Statistical Package for Social Science (SPSS Statistics) features to provide statistical Factor Analysis. SPSS Statistics is an IBM software package used for interactive, or batched, statistical analysis, now including former SPSS and AMOS (for e.g. Confirmatory Factor Analysis) software packages.

Figure 3 shows the start screen (formally, Activity) of the SMQ App.
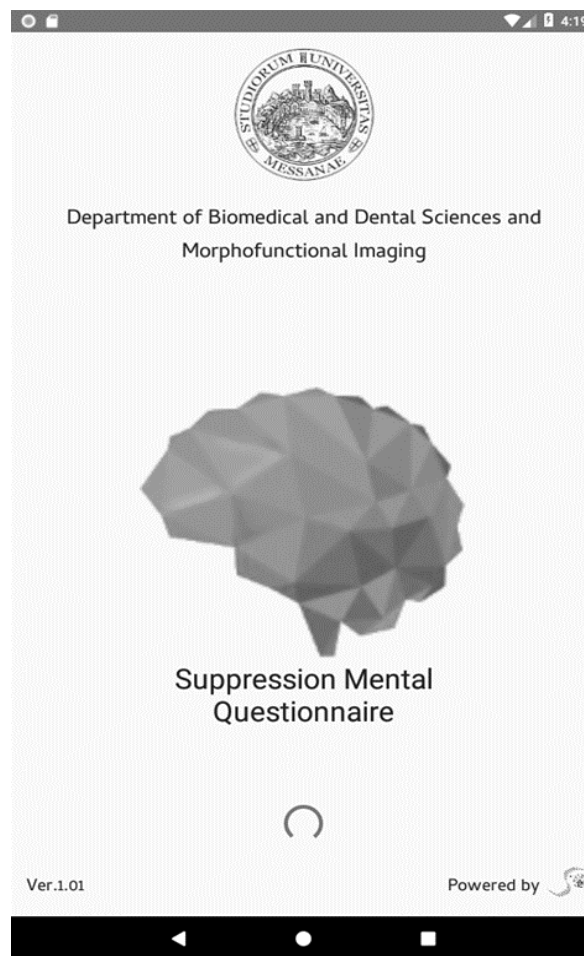

Figure 3 - The Suppression Mental Questionnaire App start screen.

As far as advantages are concerned, the adoption of digital tools speeds up clinical investigations on suppression mechanisms up and makes clinical trials easier by reducing needed effort for manual scoring.

It also enables faster and deeper research practices, also more appropriate to the times by enabling the real-time transfer of the results to digital archives in order to foster further computation and analysis for statistical and psychometric purposes.

Mobile Operating Systems, Internet and Web 2.0, and the considerable computing capabilities provided by Clouds are an extremely powerful combination of tools able to provide Open Data/Results in real-time manner to scientists and users as well, and to spread the use of the questionnaire all over the world.

The SMQ System also enables features for easy automatic localization in a plenty of languages and distributed access to questionnaire and data from every place in the world. The user-friendly interface also zeroes the training issues which usually represent a huge problem for all software companies.

3. Statistical Analysis of Results

In the following analysis, all data are expressed in terms of mean and standard deviation (SD). Campaigns were conducted, for both paper and pencil and digital questionnaire, by collecting responses from groups of fifth year students of medicine and surgery faculty at University of Messina.

The first sample, for paper and pencil format, was made by 102 participants. 120 students filled the Digital SQM by using the App.

Reliability of scale was evaluated by using Cronbach's alpha; this numerical coefficient of reliability was calculated for the three factors and for the two psychodiagnostic tools (paper and pencil test and digital implementation).

The work done strongly referred to the metodology used by Schmitz, Hartkamp, Brinschwitz and Michalek (1999) in the computer-based inventorying of interpersonal problems in psychosomatic outpatients.

Table 2 shows Cronbach's alpha coefficients for the two kinds of questionnaires.

Table 2.

Cronbach's alpha coefficients for paper and pencil and App administrating Suppression Mental Questionnaire

Scale	Paper & Pencil	App
Repressive function	0.74	0.73
Regression in the service of the Ego	0.80	0.77
Rationalization	0.70	0.76

The non-parametric approach was used since the scores were not normally distributed, such as verified by Kolmogorov Smirnov test.

Mann Whitney test was applied in order to assess the existence of possible differences between paper and pencil test and digital implementation, for each of the three factors.

Table 3. Mean scores and standard deviation for paper and pencil, app administrating Suppression Mental Questionnaire and Kolmogorov Smirnov test.

Scale	Paper & Pencil		App		Moses Test
	Mean	SD	Mean	SD	
Repressive function	3.11	0.57	3.10	0.34	0.79
Regression in the service of the Ego	2.21	1.17	3.46	0.09	0.00*
Rationalization	2.69	0.68	3.10	0.59	0.016

*significant at .05 level (2-tailed)

Even when operating with unchanged structure for questionnaires in different formats, the scores may sensibly vary from one implementation to another (Alfonsson, Maathz, & Hursti, 2014); this clarifies results produced by Moses test, shown in the last column of Table 3, for second and third factor.

Boxplot graphs were realized in order to visualize the distribution of scores in the two psychodiagnostic tools, for each of the three factors. The following figures respectively show scores distribution for Repressive function (Figure 4), Regression in the service of the Ego (Figure 5) and Rationalization (Figure 6) factors.
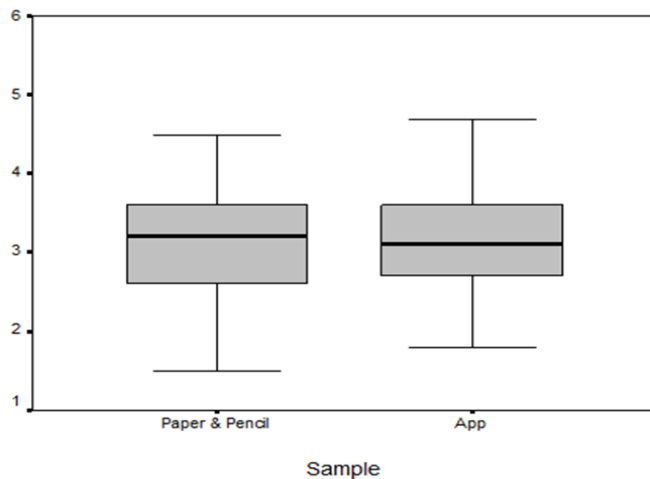

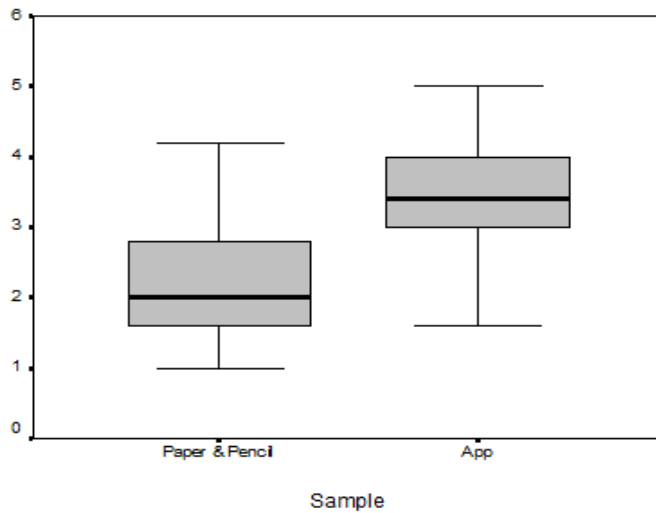**Figure 4** – Scores distribution for Repressive function factor

Figure 5 – Scores distribution for Regression in the service of the Ego factor
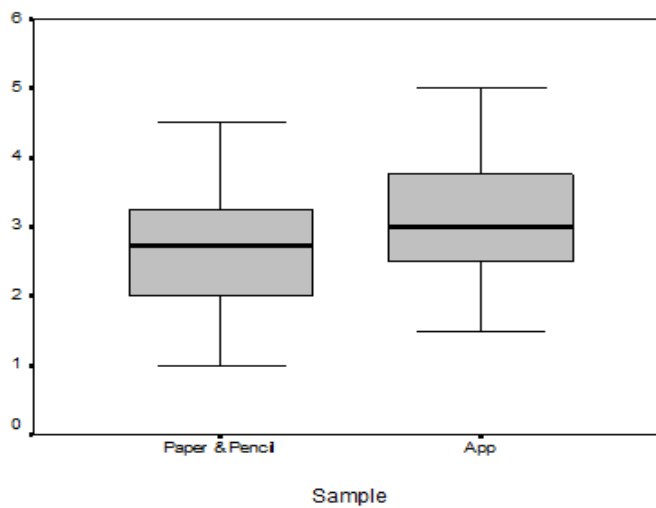

Figure 6 – Scores distribution for Rationalization factor.

Statistical analysis were performed using IBM SPSS Statistics for Windows, version 22 (Armonk, NY, IBM Corp.).

A p-value smaller than 0.05 was considered statistically significant.

4. Discussion and conclusions

As pointed out by Zhang et al. (2017), because of the continuous growing of smartphones' computing power as well as the eagerly increasing domination of digital engagement put in place by mobile applications, Apps represent the new frontier for advancing field experiments. In addition to the easy replication and adaptation of experiments, researches can use Apps to collect huge amounts of self-reported data even objective, controlling randomization and scaling up sample sizes.

App employment is a quite new methodology for field experiments, limited to last five years. Moving towards more complete experiment platforms, more than to experiment treatments, and sensors integration would strongly improve effectiveness. This is the idea the SMQ system started from. Apps provide new ways to study causal mechanisms with experiment Big Data.

Negative effects have been reported for Internet-based treatments (Boettcher et al., 2014), while no negative effects have yet been identified using smartphone applications for defense mechanisms analysis, mood disorders, etc (Torous & Powell, 2015). SMQ is monitoring side-effects as well as dealing with technical hurdles (buggy software, accessibility problems, etc. as pointed out by Miloff, Marklund and Carlbring (2015) in a general referring to e-Health Apps.

For those reasons, the Internet is nowadays a very popular way to administer self-report questionnaires, especially in the field of Internet delivered psychological treatments and evaluation. Collecting questionnaire data over the Internet has enormous advantages, such as ease of administration, and automated scoring (Hedman et al., 2010). Since psychometric properties cannot be assumed to be identical to the paper-and-pencil versions ex-ante, several studies were aimed to test the equivalence of paper-and-pencil and Internet administered versions of self-report questionnaires used in several fields of research.

Several scholars, through the same analysis process (or at least a highly similar one) done for SMQ and described in this paper, concluded that results represent equivalent psychometric properties across the two administration formats and that, e.g., phobia-related questionnaires (Hedman et al., 2010 for LSAS-SR, SIAS, and SPS), questionnaires for symptom evaluation in psychosomatic outpatients (Schmitz et al., 1999, for SCL-90-R and IIP-C; Schmitz et al., 2000), and screening questionnaires for postpartum depressive symptoms (Le, Perry, & Sheng, 2009, for Postpartum Depression Screening Scale and the Edinburgh Postnatal Depression Scale) can all be administered via the Internet with maintained psychometric properties.

The Suppression Mental Questionnaire system (the mobile SMQ App, the web services, the Cloud, etc) shows to be able to acts as a bridge among the dynamic psychology, the cognitive studies, and modern information and telecommunication technologies.

5. Current limitations

In the current version of SMQ App, the three ranges (Low, Medium, High) for scoring are determined through a client-side deterministic algorithm based on a static distribution of value-range in the foreseen interval between minimum and maximum total score for the A, B, and C Factors. In the upcoming version the scoring algorithm will be enhanced through introduction

of a new webservice dynamically calculating ranges on server side on the base of the statistical distribution of archived scores.

The spreading of the questionnaire and the consequent number of users will also be increased by two very important enhancement: i) porting the SMQ App to iOS allowing huge number of Apple universe users to download the App and fill the questionnaire in; ii) allowing the questionnaire filling in through the web by providing a dedicated section on the SMQ Portal which be open to users from all over the world. Also adoption of Open Data and Open Access paradigms could improve availability and spread the usage of data and services produced.

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