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Review

Sensory and Cognitive Malingering: Studies and Tests

Gesualdo M. Zucco [1,*] and Giuseppe Sartori [2]

[1] Department of Philosophy, Sociology, Education and Applied Psychology, University of Padova, 35100 Padova, Italy
[2] Department of General Psychology, University of Padova, 35100 Padova, Italy; giuseppe.sartori@unipd.it
* Correspondence: zucco@unipd.it; Tel.: +39-49-8276678; Fax: +39-49-8276500

Abstract: Malingering relates to intentionally pretending or exaggerating physical or psychologic symptoms to gain an external incentive, such as avoiding work, law prosecution or military service, or seeking financial compensation from insurance companies. Accordingly, various techniques have been developed in recent years by the scientific community to address this challenge. In this review, we discuss malingering within visual, auditory and olfactory domains, as well as in cognitive disorders and psychopathology. We provide a general, critical, narrative overview on the intermodal criteria for differential diagnosis, and discuss validated psychophysical tools and electrophysiology-based tests for its detection, as well as insights for future directions.

Keywords: visual malingering; auditory malingering; olfactory malingering; litigation; assessment; testing; cognition; affective disorders

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1. General Introduction

Throughout history, there have been numerous instances of individuals feigning physical or mental illnesses. This practice can be traced back to ancient times with Galeno, [1], who recorded cases of malingering in Roman times. In his pamphlet, *Quomodo morbum simulantes sint deprehendendi*, Galeno reported on two patients who faked illnesses, with one pretending to have colic to avoid a public meeting and the other feigning an injured knee to avoid accompanying his master on a long journey.

The legal setting is a context where malingering behaviours creep in, reaching 25–45% of faking attitudes [2]. However, it is difficult to accurately estimate the prevalence of simulation due to several reasons. One of the main challenges is that successful fakers, by definition, remain excluded from the statistics, resulting in an underestimation of the phenomenon but, despite this, the issue of faking should never be denied or overlooked.

Distortions can be of two types: the individual can exaggerate generic symptoms belonging to various psychopathological areas, such as anxiety or depression (generalized malingering), or symptoms related to a particular disease (specific malingering) [3].

One of the most useful distinctions to make when discussing deception is between fake-good and fake-bad [4]. Fake-bad, known as malingering, refers to a situation where a person feigns an organic/mental disorder, cognitive impairment, or exaggerated physical or psychological symptoms in a legal or civil setting to obtain compensation or a reduction in legal penalty [5].

On the other hand, fake-good, known as dissimulation, involves presenting oneself in a more favourable light to hide undesirable traits that could work against them. This could include exaggerating positive qualities or denying common human flaws. While malingering is recognized in DSM-5 [6], dissimulation is not explicitly mentioned. However, it can be described as the opposite of malingering, with an individual tending to provide positive self-descriptions.

Here we will specifically deal with malingering (namely, fake-bad) deceptions [7,8] through a critical narrative overview.

When trying to detect deception, experts must consider whether the subject has any incentives to fake symptoms and whether there is intent behind their actions. In legal contexts, fake-good is often observed when assessing driving skills during license renewals or parental skills in child custody cases. In everyday life, it is frequently seen during job interviews, where candidates try to present a more favourable version of themselves. Unfortunately, there is limited scientific literature and few tools available to identify dissimulation. Malingering, on the other hand, has received more research interest due to its significant social and welfare costs, such as in insurance compensation cases [4].

This review will address the following steps: (i) Distinction between malingering and genuine related disorders, (ii) general methods in malingering detection (the Slick criteria), (iii) detection of sensory malingering (visual, auditory and olfactory), and (iv) malingering in cognition and psychopathology.

2. Differential Diagnosis

Like lying, but not deliberate, as such, are certain forms of psychopathology. For malingering to be diagnosed, the following conditions must be ruled out systematically:

- *Conversion disorder along with other manifestations of somatoform disorders*. A conversion disorder is a form of altered voluntary motor or sensory function, in which clinical findings demonstrate incompatibility between the symptom and recognized medical or neurological conditions. It differs from malingering in that motivation is internal rather than external, and intentionality is absent. In contrast, in malingering, intentionality is conscious.
- *Dissociative disorders.* It is possible for the individual affected by the dissociative disorder to report psychic symptoms that are not attributable to a recognizable cognitive deficit or cerebral dysfunction. Dissociative disorders are characterized by a loss of continuity in the typical integration of consciousness, identity, memory, perception, behavior, and/or motor control. As opposed to conversion disorder, in dissociative disorders, symptoms are psychological rather than physical. Also, in this case, the differential diagnosis for malingering requires ruling out intentionality.
- *Factitious disorder:* faking physical or psychological signs or symptoms or inducing injury or disease to oneself to play the sick role, attaining all corollary advantages deriving from the potential benefits. Malingering and factitious disorder are two conditions that involve the intentional creation or exaggeration of symptoms. The primary difference between the two is the motivation behind the behaviour. Malingering is the intentional fabrication of medical symptoms for the purpose of external gain, such as financial compensation or avoiding legal consequences.

Conclusions regarding motivation can be challenging; for this reason, when distinguishing between factitious disorders and malingering, the role of context and a well-documented evidence trail is essential. Moreover, in clinical practice, deception is considered rare, whereas it is considered more common in specific legal contexts or when a patient attempts to evade punishment in the criminal justice system or to obtain something. On the contrary, factitious disorders are generally encountered in clinical settings [4].

Other Diagnostic Categories

These are still used today in clinical and psychiatric forensic traditions ranging between descriptions of malingering, dissociative or somatoform conditions, and factitious disorders. Despite that, they lack a formalized and standardized definition. Due to their extensive use in the Italian forensic field, we now mention four of them:

- *Münchhausen syndrome* [6]. This term was coined to describe those cases, predominantly in male individuals, that feigned physical symptoms and disorders. In this case, the aim is to perpetuate a pattern of hospital and care-related experiences, such as hospitalization, surgery, or quarrelsome relationships with medical professionals. It is distinguishable from factitious disorder because it is adopted to address more chronic and severe manifestations, less prone to recovery and where symptoms are

legitimately auto-induced (with injury or medications) rather than purely feigned or merely lamented.

- *Münchhausen syndrome by proxy*. Like Münchhausen syndrome, this term is applied to the more severe cases. However, in this syndrome, the symptoms are induced by the perpetrator to another person (the victim). This term is ambiguous and sometimes is used to malingering by proxy. Still, it differs from the latter because it is not motivated by external gains (e.g., keeping a son sick for financial gain).
- *Ganser syndrome* [9] is typically observed in carceral environments and was initially noticed in convicts awaiting execution who would manifest a generalized plunge in superior cognitive functioning (with severe amnesia, absurd speech, failed logical reasoning) with preserved understanding, orientation, and consciousness instead. These symptoms are interpreted as signs of a dissociative disorder due to a highly stressogenic situation.
- *Compensation neurosis* [10] describes an exaggeration of symptoms that occur due to the unique stressor of seeking legally awarded compensation. Motivation in these cases is primarily internal, coupled with less anticipation of secondary gain. The financial reward may be a part of the condition and may influence the course, but the overall pattern of symptoms is more than just the pursuit of money. Again, in malingering, exaggeration occurs solely or primarily for external incentives, while internal incentives in compensation neurosis are equal to or larger than external ones. Moreover, the diagnosis of compensation neurosis requires determining the conscious and unconscious motivation (frequently made in distinguishing factitious disorder from conversion disorder).

To sum up, the parameters to be considered are [1]:

- subject's conscious intentionality making psychic symptoms not based on a genuine dysfunction of the nervous system.
- presence of external incentives.

In addition, malingering should be strongly suspected when any possible combination of these factors is presented: (1) symptoms occur in a medico-legal setting; (2) is noted by a marked discrepancy between the individual's claimed impairment and the objective findings; (3) there is a lack in collaboration during the assessment and low compliance with the prescribed treatment regimen; and (4) the presence of antisocial personality disorder.

In the forensic context, particularly in forensic neuropsychology, it is good practice to identify the conscious intentionality of the subject and the existence of external incentives. If in a clinical setting, it is usual to go along with the symptoms that the patient reports; instead, in the forensic context, it is crucial first to take into account the two points listed above. Considering these parameters help the clinician to become a wiser expert. Depending on the form of simulation, intentionality may be absent or accentuated. The presence of consciousness about the planning of the disorder (challenging to ascertain) should be a criterion for identifying the symptoms of deception (see, however, ref. [11] for an unconscious, psychoanalytic interpretation of malingering). Moreover, in most cases, the external advantage may not be immediately recognizable. When doubt exists, it is essential to look in the case history for economic benefits that are not evident at first glance.

3. Intermodal Criteria for Detection of Malingering: The Slick Criteria

In the late 20th century, a significant breakthrough in detecting malingering occurred with the introduction of the Slick criteria. Originally proposed in 1999 and later updated in 2013, the Slick et al. [12] criteria represent a major contribution to the identification of malingering. In their initial classification, the authors outlined guidelines for recognizing "*Simulated Neurocognitive Dysfunction*" (MND), which they defined as "the deliberate exaggeration or fabrication of cognitive dysfunction to obtain significant material gain or to avoid or escape formal duty or responsibility". Slick and colleagues' classification included three subclasses of MND, each with its own inclusion criteria. The Slick criteria consist of four criteria to detect malingering:

Criteria A requires the presence of a clear and significant external incentive for exaggerating or fabricating symptoms during examination.

Criteria B assesses the evidence of exaggeration or fabrication of cognitive dysfunction on neuropsychological tests through six sub-criteria, including definite negative response bias, probable response bias, discrepancy between test data and known patterns of brain functioning, observed behaviour, reliable collateral reports, and documented background history.

Criteria C evaluates the evidence from self-report, such as discrepancies between self-reported history and documented history, symptoms and known patterns of brain functioning, behavioural observations, and information from collateral informants.

Criteria D requires that the behaviours meeting the necessary criteria from groups B or C are not fully accounted for by psychiatric, neurological, or developmental factors.

In this work, we will firstly outline the commonly used methodologies for identifying simulators of sensory deficits, namely visual, auditory and olfactory. Subsequently, we will review the methodologies for evaluating the simulation of cognitive deficits and psychopathological conditions.

4. Auditory and Visual Malingering

Although statistically less common, the feigning of sensory disturbances can be observed. In the case of simulating visual or auditory impairments, a series of methods have been developed [13]. Malingering presents itself as either mimicking an eye condition or contradicting an existing ophthalmic disease. In all instances of imitation or denial of eye conditions, the sole motivation is to obtain benefits or advantages. These benefits can be financial or non-financial, including evading military service or work, avoiding legal penalties, fraudulently obtaining compensation from insurance companies, or acquiring unnecessary free medications or medical equipment. Malingerers employ various tactics to deceive ophthalmologists or optometrists. Frequently, malingering is associated with concurrent diagnoses of depression, anxiety, panic attacks, fibromyalgia, and psychiatric disorders.

Visual impairment may result from an underlying organic condition, a functional visual disorder, or malingering when associated with secondary gain. Diagnostic challenges arise when organic and functional visual loss overlap. Distinguishing between functional and pathological visual loss requires a thorough and careful examination, employing fundamental ophthalmology principles and tools that the examiner is familiar with, but the patient is not. Ophthalmologists may encounter patients with non-organic vision loss during routine practice. Examining such patients necessitates numerous tests, including baseline visual acuity, pupillary reactions, slit-lamp examination of the anterior segment, fundus examination, visual field analysis, optical coherence tomography, visual evoked potential, and electroretinography. By verifying the integrity and functionality of the visual system, a diagnosis of functional visual loss can be confirmed [12].

Several tests and devices to disclose malingering have been described in the literature. Electrophysiological recordings provide the most helpful information when used in conjunction with the best clinical information available. For example, pattern electroretinogram (PERG) may be used to spot malingerers, as the amplitude of the PERG depends on the steadiness and quality of the pattern projected onto the retina. A normal PERG proves that the image on the retina was well focused and fixation by the patient was adequate and excludes the possibility that there were too many lid closures during the recording [14].

Evoked potentials may also be used to evaluate a correspondence between the subjective verbal report and the physiological assessment of the visual system. A normal pVEP in such a case indicates that the visual pathway is normal, at least to the level of the striate and extrastriate cortex [13].

Other objective tests for malingering in vision include Pupillary examination, Optokinetic nystagmus test (OKN), Pattern visually evoked potentials and the Psycho-galvanic test. For example, the Psycho-galvanic test, also known as a skin conductance test or

electrodermal activity test [14], is a physiological test that measures the electrical conductance of the skin in response to various stimuli. The test is based on the principle that visual stimulation can produce changes in the activity of the sweat glands, which can then be detected through changes in skin conductance. This test may be used to evaluate an eventual response to visual stimulus when there is no verbal report of a corresponding subjective perception.

The logic involves comparing the functionality of the visual system based on the symptoms reported by the patient and contrasting them with the objective data obtained from the objective assessment system used.

The phenomenon in which patients appear to exhibit significant hearing loss during general communication and pure-tone audiometry tests, despite not showing any indication of such hearing impairment during specialized or objective assessments, has been described using various terms. Clinically, terms such as malingering and feigning have been employed, which may have originated from reports of such behaviour during wartime, and these terms typically imply deliberate intent. The term psychogenic hearing loss is predicated on the assumption that this condition is purely psychological in nature. However, less loaded terms, such as functional hearing loss and non-organic hearing loss (NOHL) [15], are more appropriate.

Austen and Lynch [15] suggested a preliminary qualitative evaluation that takes into account various factors, including observable motivating factors, the type of gain (such as financial or positional), the level of intentionality, and the consistency of response during testing.

Objective (physiological) hearing testing, in the form of auditory evoked potentials and otoacoustic emission testing, has largely replaced the behavioural testing approaches. It does require patient compliance for extended test periods but can glean ear- and frequency-specific physiological thresholds [15].

A similar logic, based on the use of objective evidence, can be used to evaluate the credibility of reported auditory symptoms. For example, Evoked potentials and, specifically, the P300, may be used to evaluate whether the examinee is responding truthfully about his auditory impairment [16]. The proposed oddball task involves the patient's response to two types of stimuli, rare targets and common non-targets. This results in the generation of a sensory evoked potential (EP), as discussed previously, as well as a later component called the P300. The P300 is considered a cognitive component because it only occurs in response to rare target stimuli, and its manifestation is largely independent of the physical features of the stimulus. Instead, it is primarily influenced by cognitive factors such as the patient's attention and expectation. The P300 is classified as an event-related potential (ERP), which distinguishes it from the purely sensory.

5. Olfactory Malingering

Olfactory malingering has received less attention than visual or auditory malingering, even though it is relatively common. Although there are numerous causes of smell loss [17–23], most malingering occurs in cases where monetary incentives are involved. Smell loss in head trauma, for instance, (HT) is relatively common, with prevalence rates ranging from 20% to 61%, depending upon the severity of the trauma [24–32]. HT accounts for ~20% of all chemosensory disorders [17]. Other olfaction-related litigation cases arise from exposures to environmental toxins (e.g., swimming pool chlorine, pesticides, air pollution) and nasal or brain operations. According to a review [33], malingering was estimated in 14% of the 145 patients exhibiting a chemosensory deficit. In litigation cases, moreover, smell loss is often incorrectly identified as taste loss, and many patients claim loss of taste even when the taste system can be shown to be intact, reflecting the important role of olfaction in determining food flavor [17]. Although the overlap between the report of olfactory deficits and the time of the claimed incident is the primary basis for inferring causality, the possibility of other antecedent causes is often difficult to rule out. Importantly, return of function can occur in some instances [17–19], which is not reported by a litigant once his or her legal case

is underway. Validated quantitative olfactory tests with means for assessing malingering are commercially available or otherwise described in the medical literature. Most employ forced-choice methodology, in which the patient is required to report a recorded response on a given trial even if nothing is perceived (e.g., asked to determine which of several alternatives is the smell sensation). Based upon probability, one can discern whether the correct responses are being consciously avoided more frequently than expected by chance. Most tests of this caliber, which include tests of detection, identification, discrimination, and memory, have been validated in both clinical and experimental contexts (for reviews and specific contribution see, [34–61]. Stimuli are most commonly presented in the clinic by means of "sniff bottles", felt-tip pens, "wands", paper strips, or microencapsulated (scratch & sniff) labels. Although directly smelling the stimuli via inhalation is most common, they can also be presented orally in candies or powders where their vapors interact with the olfactory receptors through the nasal pharynx [62–67].

Only a small number of such tests are useful for detecting malingering, since an adequate number of items or trials are needed to obtain reliable estimates of improbable responses.

The most popular commercially available psychophysical olfactory test was developed at the University of Pennsylvania [68] and the University of Erlangen-Nürnberg [69].

The self-administered, 40-item University of Pennsylvania Smell Identification Test (UPSIT®; commercially known as the Smell Identification Test) [70], is disposable in 45 different languages and has been administered to several million people worldwide. In one study by the Michael J Fox Foundation for Parkinson's Disease, approximately 200,000 persons in the general population are being tested with this test. Although shorter versions of this test are widely used for olfactory screening (e.g., the 8-item NHANES Pocket Smell Test, the 3-odor Quick Smell Identification Test, the 12-item Brief Smell Identification Test, B-SIT®; also known as the Cross-Cultural Smell Identification Test or CC-SIT [71]), their ability to detect malingering is limited given the small number of odorants involved. The normative data for the UPSIT showing the test scores indicative of malingering on this test are presented in Figure 1.

Accordingly, scores below six indicate probable malingering (which means, 0.25 probability for a person with a real disease to answer correctly by guessing vs. 00.4 probability for a malingerer).

However, scores which fell in the range of anosmia or hyposmia can be considered response patterns indicating a true deficit, while those lower or close to zero suggest a fictitious sensory loss.

Also, developed at the University of Pennsylvania is a threshold test, which ascertains the lowest detectable concentration of a chemosensory stimulus an individual can detect, namely, the Snap and Sniff® Smell Threshold Test [72].

The Sniffin' Sticks test kit [73–76], now named ODOFIN, provided by Burghart Messtechnik, Hamburg, Germany, is a test of nasal chemosensory performance, based on felt tip, pen-like, odor dispensing devices. It allows the assessment of odor thresholds, discrimination, and identification. Odor threshold is evaluated using 16 different dilutions of n-butanol, prepared in a geometric series starting from a 4% n-butanol solution. More recent versions employ the odorant phenyl ethanol (a rose-like stimulus). In the odor discrimination task, 16 triplets of pens are administered in a randomized order, with two pens containing the same odorant and the third pen a different one. For each of the triplets, participants are requested to determine which of the three pens smells differently. Finally, odor identification is assessed with participants smelling 16 common odorants; identification of individual odors is performed selecting the appropriate label from lists of four descriptors. For a memory olfactory test based on the Sniffin' Sticks kit, see [39]. This test is a 16 item, multiple-choice, short-term, odor recognition test, requiring the participants to smell a target odor followed by the target and two distractors; the subject's task is to recognize the target.

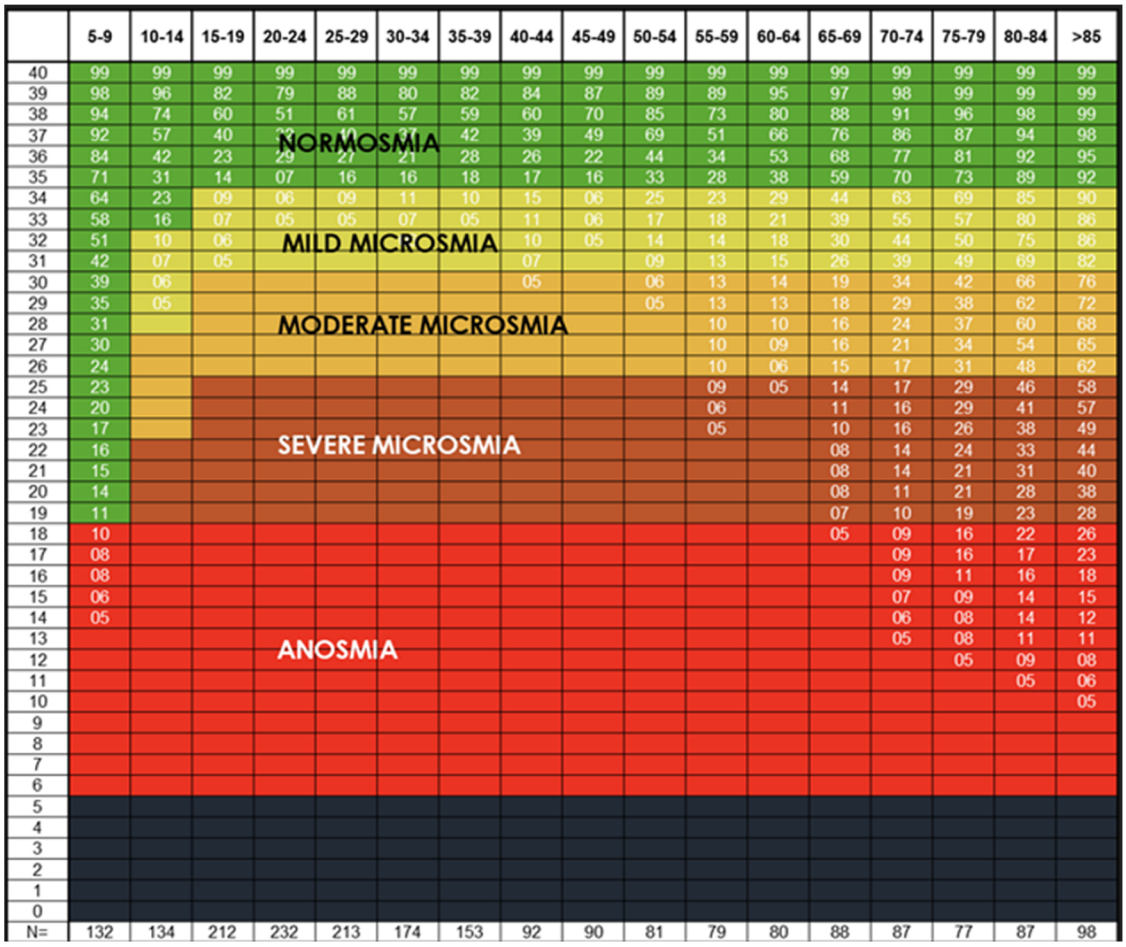

Figure 1. Normative scores for UPSIT.

Importantly, these quantitative olfactory tasks can be hypothetically ordered on a continuum from the most sensorial to the most cognitive, namely: odor detection, intensity discrimination, quality discrimination, odor recognition, cued identification and free (non-cued) identification [39], and may be linked to each other in a hierarchical and parallel fashion [77]. Reliability and normative data are available for these tests.

Along with psychophysical tests, some others are more sophisticated electrophysiology-based tests (e.g., Chemosensory event related potentials, Electroencephalography changes in response to odors, Electro-olfactogram, Trigeminal Negative mucosal potential), as well as structural and functional imaging tools, and computer driven self-administered olfactory tests using olfactometers being readily available [51,78–81]. However, these are largely expensive and require trained technical support, therefore, they stay within the realm of research instruments [81].

In addition, although the latter assess reactions not voluntary, as altered autonomic nervous system or electrical activity, most psychophysical olfactory tests provide a better sensitive evaluation of function than electrophysiological measures. Indeed, forced-choice psychophysical tests allow the detection of most malingerers based on unlikely responses, while, at variance, many supposed "objective" measurements are prone to malingering, since in order to be reliable, they require substantial cooperation from the subject, like sitting still while sessions are recorded [81]. Finally, along with the use of psychophysical tests and electro-physiological recordings, it is pivotal to look carefully at the clinical history of the suspected malingerer, to the absence of non-chemosensory diseases—that can be present together with the olfactory disease—to the lack of trigeminal and taste responses—that could not be affected following an olfactory damage—to inconsistent complaints, and

to incongruities in results between different tests (that would be a good practice to repeat more than once) [82].

Some significant studies from the literature devoted to detecting malingering will be reviewed. Tests used included the widespread UPSIT and Sniffin' Sticks, as well as their adaptations, or other measures like the Sniff Magnitude Test (SMA) and the Odorant Confusion Matrix (OCM).

6. Studies on Olfactory Malingering

Chemosensory dysfunctions include both quantitative and qualitative disorders; the first relates to a decreased or absent sensitivity (anosmia, hyposmia), or to enhanced sensitivity (hyperosmia); and the second to a distortion in the perception of odors that can be present or not (as for cacosmia and euosmia) or totally absent (as for olfactory phantosmia and hallucinations) [19,83–86]. Those who wish to accurately feign olfactory loss should then be aware of the wide range of olfactory disorders and of their physiological and behavioral signs, as well as of other both concurrent and confounding (e.g., past abuse of alcohol or drugs, recurrent episodes of migraine, post-viral infections, neurotoxic exposure, medication consequences, age, neurological diseases) [87–99] or non-concurrent diseases (i.e., unrelated to olfaction) that could reinforce the diagnosis of true smell loss (for which compensation, e.g., in litigation, is requested).

Considering the above, the successful malingerer needs to be familiar with olfactory testing and with the optimal scores allowing a true diagnosis of total (anosmic) o partial (hyposmic) olfactory loss. In a typical odor identification task [68,69], for instance, a common error that qualifies feigned responses is the tendency of the simulator to provide no correct responses at all or close to zero. The naïve malingerer may, indeed, have no knowledge of the probability laws which are behind olfactory tasks. For instance, The UPSIT test (described above) used to specifically investigate odor identification [68,70,81], requires a response among four alternatives (in a forced-choice task). This means that the probability to generate a correct answer is 25%; therefore, responses close to zero are clear indicators of a feigned olfactory dysfunction. The UPSIT is the only test with clear guidelines to detect lies. Accordingly, scores that fall in between five and zero suggest avoidance and malingering. Furthermore, an incompetent malingerer may not be aware of the difference between an olfactory driven response and a trigeminal driven response. Indeed, a person affected by head trauma could exhibit partial or total olfactory loss, in absence of a trigeminal impairment [100–102], and this is almost evident at a peripheral level [103]; it follows that odorant with a strong irritant trigeminal component (e.g., alcohol, ammonia, vinegar) or at very high concentrations, which should provoke answers and not denials [89], as the unsuccessful malingerer would do; however, see [104–106] for disputable cases. Additional uncontrolled physical signs (tear secretion, nose wrinkle, stimulus avoidance) may, moreover, help to diagnose malingering, as well as the use of specific psychophysical tests. On this ground, a useful tool is the Sniff Magnitude Test (SMT) [107] that allows the quantification of sniffing behavior by inducing sniff suppression. Accordingly, strong odors, administered at various concentrations, would inhibit the action of inhalation. Therefore, the relationship, sniffing's strength amplitude and stimulus's concentration degree, would be difficult to be checked and controlled by the simulator.

Beyond the above physical reactions to irritants, some other aspects should be considered to strictly picture a malingering behavior. Doty [108], for instance, examined the correlates that can allow distinguishment between chemosensory test malingerers and non malingerers. Notably, it has been observed that the best predicted malingering factors are related—in the simulator—to a lesser number of self-reported symptoms and behaviors (e.g., fewer allergies, nasal sinus problems, surgical interventions, cigarette smoked, use of medications), that, since underreported, could suggest to the examiner the presence of a true dysfunction. At variance, malingerers tend to exaggerate their chemosensory symptoms, as well as their psychological constraints; they also complain more than non-malingerers for the severely affected quality of their life. All these factors, together with

past medical records, need to be considered by the examiner to better detect chemosensory malingering. The perfect competent simulator, however, should also be aware that other, probably less significant variables (but those that are alarm bells for the examiner), can affect olfactory ability; among the others: satiety or hunger, daytime, seasons [109] medications [109,110], as well as behaviors like the absence of cooperation, responses' incongruities between and within tasks, involvement in litigation for compensation, can be further signs of deception [111].

Studies on olfactory malingering are sparse; they focused mainly on the vulnerability of the extant psychophysical tests to malingering, and to their effectiveness in detecting it.

In the classical paradigm, groups (either skilled or not) are requested to feign olfactory dysfunctions, with their performances being compared to those of a non-malingering control group.

Vulnerability of psychophysical olfactory tests to malingering has been evaluated by Bailie and colleagues [112] who asked three groups, varying in the degree of information they received (i.e., Naïve malingerers, informed malingerers, and coached malingerers), to try to fake an olfactory impairment on two olfactory tests (namely, UPSIT and SMT, [68,107]. Although both tests are usually capable of uncovering unsophisticated malingerers, the study showed that, according to the instructions received, effective malingering occurred. Participants, however, appeared more successful at simulating a deficit on the UPSIT than on the SMT, although UPSIT was more effective than STM in identifying cases of suspected malingering (37% vs. 23%). According to the authors, UPSIT would appear more prone to malingering by skilled individuals, since, on the one hand, it would be easier for them to choose the wrong name among the four alternatives, whereas on the other hand, it would be more difficult for the participants to control their sniffing behavior from trial to trial as SMT requires.

However, not only are instructed individuals able to successfully pretend olfactory deficits, but also highly educated subjects. This has been observed in a study [113], where future lawyers (i.e., second- and third-year law students) were asked to perform the UPSIT twice: honestly, on one occasion, and simulating smell loss at their best, on the second. Data Showed that about 50% of students with a normal olfaction were able to feign smell loss, as well as 61% of participants with a real (hyposmic) deficit that was successfully exaggerated. On these grounds, the authors pointed out that it would be more difficult for the clinicians to uncover malingerers with a normal olfaction than those with some true loss (see, also [114,115] (cited in [82])). This was probably due to it being demonstrated on an odor detection threshold task, thus making such a test more difficult to the respondent, e.g., checking response sequences of the examinee, which could be a promising insight to allow psychophysicists and clinicians to discover simulators [116]. According to the authors, the chance to correctly classify malingerers and anosmic patients will increase to 100% by using a response-sequence analysis measure.

Skilled individuals, both highly educated and coached, can therefore efficiently malinger. This has been earlier observed by Kurtz and colleagues [117], who carried out a significant study on feigning behavior on people coached and not coached to simulate. Here, differences in performance to trigeminal stimuli [118], on the Olfactory Confusion Matrix (OCM) test, appeared to be a cut-off between faking olfactory deficit and normosmic responses. Such tool is an odor identification test which, according to the authors, is less susceptible to deception since it is characterized by a huge number of trials and repeated presentations of the odorants (i.e., 121 questions on 10 alternative forced choice, with a performance chance of 10%). The authors found that the two groups significantly varied in performance when exposed to trigeminal stimuli (with malingerers providing few and incorrect irritant labels compared the other group), but not to non-trigeminal ones.

Few other studies ascertain if modified versions of preexisting psychophysical techniques may help in detecting malingerers, as well as they can for newly devised tools.

Erfanian and colleagues [119] modified the Iranian adaptation (ISIT) of the well-known UPSIT, asking, respectively, two groups to either try to feign at their best ability, or

to provide random responses. Interestingly, the second group was prevented to scratch and sniff the microencapsulated odorant but invited to choose, by chance, an alternative among the four foreseen, therefore behaving as a real anosmic. The modified version consisted of three steps, with available options deleted step-by-step (namely, four alternatives in the first step, followed by three in the second and only two in the last). According to the authors, these consecutive deletions ameliorated the sensitivity and specificity of the test in allowing malingerers to be detected. Nevertheless, ISIT itself appeared more sensitive in discriminates between anosmic patients and cheaters, if compared to that of Single-photon emission computed tomography (SPECT) methodology [120]; but see also [121], for a related, new-odor, 20 item discrimination test.

Taking stock, what precautions should be addressed by clinicians to successfully catch fraudulent behaviors? Firstly, the past medical history of the potential malingering, together with his/her presented behavioral and medical correlates (i.e., underreported symptoms, exaggeration of chemosensory dysfunctions, inconsistent complaints, a.s.o.) should be strictly considered. Also, the presence or absence of other diseases consistent with a true olfactory loss need to be verified (e.g., in case of a head trauma provoking a real olfactory damage, Varney [100] observed a series of concurrent symptoms, like confusion, absent-mindedness, difficult in planning). Furthermore, administration of a psychophysical test is pivotal but should follow some constraints; accordingly, clinicians should: 1, propose more than one test to detect malingering (inconsistencies, and incongruities in results between different tests are a sign of cheat behavior, as well as they are within the same test); 2, vary the kind of the administered test to evaluate both cognitive and sensorial functions (for instance, administering together with identification tasks—like UPSIT or Sniffin'sticks—some others as the Snap and Sniff® Smell Threshold Test or the equivalent Sniffin' sticks threshold test); 3, make the tasks difficult to the potential malingering by using tests (e.g., the Sniff Magnitude Test, the Olfactory Confusion Matrix) that make it hard for the malingerer to either simulate (as the first, which requires a constant control of sniffing behavior) or keep in mind the responses provided, because of the repeated presentations and the huge number of trials (as the second), or adopt complex procedures like the response sequence analysis in the administration of the tasks; and 4, be suspicious of responses close to a zero score, as well as to the absence of trigeminal ones.

7. Malingering of Cognitive Disorders

The coverage of malingering of cognitive disorders and psychopathology has been extensively examined in recent years (the reader can refer, e.g., to Merckelback et al., 2019 [122]); and Martin et al., 2022 [123]); accordingly, we will focus here on the most relevant issues.

Several techniques have been recently developed to aid in the detection of malingering in forensic settings [3,13,14]. However, despite the belief that experts can accurately detect lies based on their clinical experience, research suggests otherwise. Studies have shown that classification accuracy based on subjective impressions is markedly low, with psychologists achieving 62% accuracy compared to 54% for student research participants [112]. This suggests that relying solely on personal judgment is often inadequate when trying to assess malingering during a clinical interview. To address this challenge, the scientific community has developed various methods to detect deception.

The assessment of simulated cognitive disorders typically occurs through the presentation of questions in both auditory and visual formats. Therefore, the examined modalities are both visual and auditory. In a clinical setting, malingering (and ways to detect it) can be divided into two broad categories: neuropsychological and psychological malingering [12].

Neuropsychological malingering refers to individuals faking or exaggerating symptoms of neurocognitive disorders such as amnesia, dementia, and deficits in cognitive and executive functions during cognitive assessments.

To detect malingering, professionals use various techniques, such as the anatomic-clinical correlation method, the floor effect strategy, symptom validity testing, and the

violation of scientific laws. These techniques are used to identify discrepancies or inconsistencies in an individual's test results that may suggest malingering [124].

One major technique is the Symptom Validity Testing: a strategy that can be applied also to the assessment of malingering in all modalities. This strategy was originally developed by Pankratz [125] and consisted of a forced-choice test where answering by chance would grant a 50% accuracy. The procedure, however, can be generalized to all the tests that require choice between alternatives. The assumption is that genuine patients with an extremely severe deficit in a specific cognitive function (e.g., memory) will perform at a chance level. As well as for olfaction, a performance below chance is implausible. When observed, it indicates that the individual recognizes the correct answer but deliberately chooses not to select them, in order to select the wrong alternative.

This strategy is employed in many tests such as Test of Memory Malingering (TOMM) [126], Portland Digit Recognition Test (PDRT) [127], Victoria Symptoms Validity Test (VSVT) [128], Computerized Assessment of Response Bias (CARB), 21-Item Test, Coin In The Hand Test [129], and more. These tests may have both a visual and an auditory input.

Another strategy that can be used for evaluating malingering of cognition in both visual and auditory presentation is the floor effect strategy. This strategy involves assuming that individuals being assessed on a test may attempt to deceive the assessor by pretending to have worse abilities than they actually possess. To counteract this, psychologists embed simple tasks within more complex tasks. Very simple tests are also carried out satisfactorily by patients with severe cognitive impairment, but are mostly failed by malingerers. Any errors made by the test-taker on the basic tasks are considered to be indicative of a deliberate attempt to deceive. This approach is used in various tests, including Rey's 15-item test [130], Rey's Word Recognition Test, Rey's Dot-Counting Test, and the B Test [131]. For example, Rey's 15 Item, used to screen malingered memory impairment, consists of 15 different symbols set up in a table of three rows and five columns. The respondent is shown the table for 10 s. Then, they will be asked to draw everything they can remember. The traditional scoring method involves counting the total number of items correctly recalled, with scores of less than nine to raise the suspicion of malingering. The test is apparently difficult but is actually very easy.

Another example of an extremely easy test that may be used to spot the malingerer is the B Test. The B Test assesses the accuracy and speed in which a person can identify the letter 'B'. This test is based on three different levels of difficulty and is used to evaluate a person's letter recognition and recall capabilities. Malingerers fail to identify the letter 'B' embedded in other similar letters (e.g., 'D') while truthful responding patients have no major problems in this task.

8. Malingering in Psychopathology

Psychiatric disorders, such as depression, personality disorders, and so on, are easily faked and researchers have focused on the techniques to spot such form of malingering. The most efficient test is based on the logic of rare symptoms and unrelated symptoms. The evaluee may report rare symptoms infrequently, as seen in a clinical population, or might be recognized as indiscriminately endorsing a wide variety of symptoms without a specific set of symptoms or a specific diagnosis in mind. Malingerers can often feign obvious symptoms indicative of mental illness rather than those considered less associated with psychopathology. Given that, an examinee should be suspected of malingering if they exhibit unusual or improbable symptoms that are characterized by an extremely bad or fantastic quality or by extreme or unusual severity [132]. Indeed, usually, malingerers cannot predict how severe the symptoms should be. Finally, an ill-intentioned evaluee may "fail" in either interpreting a stereotypical role according to erroneous stereotypes (e.g., describing a schizophrenic condition as "having two personalities") or report symptoms that are not consistent with his behaviour.

Test representative of this logic are the following:

- Structured Inventory of Malingered Symptomatology (SIMS) [133].

This self-administered questionnaire composed of 75 dichotomous true/false items was constructed to detect deceivers' psychiatric and cognitive symptoms. This test operates through recognition of bizarre experiences and highly atypical symptoms focusing on the following domains: low intelligence (LI), affective disorders (AF), neurological impairment (N), psychosis (P), and amnestic disorders (AM). It provides a total score for probable malingering of psychological disorders with a sensitivity of 97.06%. See, ref. [134] for a Systematic Review and Meta-Analysis. Based on 41 studies, the authors concluded that this instrument could differentiate well between instructed feigners and honest responders; generating heightened scores in groups that are known to have a raised prevalence of feigning may overestimate faking in patients who have schizophrenia, intellectual disability, or psychogenic non-epileptic seizures, and is reasonably robust against coaching. Recent research by Orrù and colleagues [135] supports the application of machine learning techniques to develop a short version of the SIMS, with the final aim to reduce length while maintaining adequate accuracy of discrimination.

- *Minnesota Multiphasic Personality Inventory (MMPI-2)* [136]. This test is the most widely used and researched multi-scale measure of psychopathology.

It contains 567 dichotomous (T/F) items and provides information on the subject's personality and correspondence with specific nosography categories through 10 clinical scales, 15 content scales, and supplemental scales. This tool is handy due to validity scales that permit the generation of hypotheses of dissimulation and simulation checking for the reliability of the profile. These scales are: F (frequency), Fb (Back F), Fp (F psychopathology), Ds-r2 (Dissimulation-Revised), Fbs (Fake Bad scale), K (Defensiveness), S (Superlative Self-Presentation), F-K index (Dissimulation Index), L (Lie), Variable Response Inconsistency (VRIN), which assesses answering similar or opposite question pairs inconsistently, and True Response Inconsistency (TRIN), which assess answering questions that are all true or false. Additionally, there is a method of analysis of evident and subtle items. The F-K index has been proven to provide an accurate classification of malingerers (with accuracy reaching 90%).

While the SIMS represents a test whose sole objective is to verify the existence of simulation, the MMPI-2 is a general test that includes scales that allow for the verification of the presence of a simulation attitude. It should be noted that the accuracy in identifying a simulator using this test is high, exceeding 90%. However, current knowledge does not allow for the identification of the true psychopathological profile once the test taker has been classified as a simulator.

9. Conclusions and Future Directions

In medico-legal practice and assessing an examinee's mental state, detecting deception is one of the most critical and challenging issues. Malingering can be defined as an intentional production of faked or exaggerated physical, psychological or neuro-psychological symptoms, including psychopathology disorder, intellectual or neuro-psychological impairment (cognitive impairment), or medical syndrome.

When trying to spot deception, two important key features must be considered: (i) the intentionality of the subject in the production of symptoms; (ii) the presence of external incentives associated with the behaviour (e.g., economic/societal/legal gain).

While objective methodologies are available for assessing the simulation of visual, auditory, and olfactory sensory deficits, which allow for the identification of discrepancies between what the patient reports and the actual integrity of the sensory system, such procedures are not available for the simulation of cognitive and psychopathological symptoms. The developed procedures are therefore based on completely different logics in the case of methods for identifying cognitive or psychopathological simulation.

Since psychiatric and cognitive symptoms can be easily exaggerated/feigned and the incidence of malingering in a medico-legal setting, detecting deceptive efforts has become a priority in the forensic field.

Lying involves multiple cognitive tasks, including creating a plausible and consistent false narrative, remembering the details of the fabricated story, and maintaining deception cues. Motivation to lie may be driven by benefit, punishment risk and dissonance [133].

Lying consumes cognitive resources and increases the overall cognitive load experienced by the liar. Research on lie detection has highlighted that the act of lying is cognitively demanding, and this cognitive load, which is not observed in truthful responses, gives rise to elongations in response latencies. For instance, the Cognitive Load Theory of Lying [137,138] proposes that lying imposes an additional cognitive burden on individuals compared to telling the truth. According to this theory, the act of lying requires individuals to engage in additional mental processes, such as fabricating information, monitoring their own behaviour, and inhibiting truthful responses. The theory suggests that the increased cognitive load associated with lying can have observable effects on behaviour. For instance, liars may exhibit signs of increased mental effort, such as longer response times, more frequent pauses, and increased self-monitoring. They may also display nonverbal cues associated with cognitive load, such as increased eye blinking, fidgeting, or changes in speech patterns. Furthermore, the Cognitive Load Theory of Lying posits that the cognitive load incurred by lying can interfere with other cognitive processes, such as memory and decision-making. When individuals are focused on maintaining deception, their cognitive resources may be depleted, making it more difficult for them to recall accurate information or make rational decisions.

Malingering may be considered a way of lying about symptoms. While the usually investigated field of lying is about autobiographical events, there is no major difference between lying about an event and lying about symptoms [139,140]. Similarly to lying on autobiographical events, malingering causes longer reaction times when responding about the malingered symptoms [141] and, specifically, made-up depression [142].

In a similar fashion to lying, malingering is not a simple binary distinction of "present" or "absent". Various types of malingering have been identified by researchers and due to the complexity resulting from these nuances, measuring the prevalence of malingering in clinical and forensic populations proves challenging; we already mentioned the fact that the intensity of symptom exaggeration is an individual variable that renders difficult the detection of malingering. A challenge in identifying malingering arises from the fact that both genuine pathology and simulation can exhibit abnormal responses. Therefore, it is necessary to identify "symptoms" that are rarely reported by individuals with genuine pathology but are reported by simulators. The SIMS test, for instance, employs this logic by using items that individuals with true pathology rarely endorse. Consequently, simulators will endorse a high number of extremely rare symptoms.

Appropriate strategies, methods, and lie detection techniques have changed over time, especially for the malingering of cognitive and psychopathological disorders, passing from polygraph to computerized procedures, to the most recent application of machine learning techniques. This Artificial Intelligence (AI) approach to psychometrics is promising, as it is expected to boost classification accuracy. For example, some authors [143] have used neural networks to reconstruct honest responses to the MCM III: a test for evaluating personality disorders. The authors have shown that the reconstruction of the original honest response on the basis of the faked bad test is accurate at an individual subject level, not only at a group level. Taking this into account, there is another work [144] that has used machine learning to identify malingerers of depression. By the same logic, others [145] have boosted the diagnosis of malingers of cognitive disorders using the B Test.

In short, the use of AI tools is a promising research avenue that permits the development of more accurate tests, which can efficiently solve previously unaddressed issues, such as the reconstruction of honest responses to faked psychopathological tests. Despite that, none of them can be considered without limitations and be criticism-free, but combining their use with new developing automatized methods can increase the accuracy of the examiner's ability to detect malingering.

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