Psychology of Consciousness: Theory, Research, and Practice
2014, Vol. 1, No. 1, 3–19

2326-5523/14/$12.00 DOI: 10.1037/cns0000010

Measuring Agency Change Across the Domain of Hypnosis

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Building on Hilgard's (1965) classic work, the domain of hypnosis has been conceptualized by Barnier, Dienes, and Mitchell (2008) as comprising 3 levels that represent distinct aspects of hypnotic phenomena: a) responses to different types of hypnotic suggestions, b) varying patterns of response over the phases of a suggestion, and c) the impact of state and trait influences. The current experiment investigates sense of agency across each of these three levels. Forty-six high hypnotizable participants completed an ideomotor (arm levitation), a challenge (arm rigidity), and a cognitive (anosmia) item, with or without a hypnotic induction. In a postexperimental inquiry, participants rated their feelings of control at three time points for each item: during the suggestion, test, and cancellation phases. They also completed the Sense of Agency Rating Scale (Polito, Barnier, & Woody, 2013) for each item. Pass rates and control ratings fluctuated across the different types of items and the three phases of each item; control ratings and agency scores also differed between participants who passed and failed each item. In addition, whereas a hypnotic induction influenced the likelihood of passing items, it had no direct effect on agentive experiences. These results suggest that altered sense of agency is not a unidimensional or static quality "switched on" by hypnotic induction, but a dynamic multidimensional construct that varies across items, over time, and according to whether individuals pass or fail suggestions.

Keywords: control, effortlessness, hypnosis, involuntariness, sense of agency

In hypnosis, relatively straightforward verbal communications from the hypnotist can lead participants to experience marked alterations in their sense of agency (Barnier, Dienes, & Mitchell, 2008; Lynn, Nash, Rhue, Frauman, & Stanley, 1983; McConkey, 1991; Orne, 1967; White, 1941). Participants frequently report experiencing their actions in hypnosis as occurring without effort or conscious volition. This striking and consistent change in feelings of personal control has been considered an essential element of hypnotic responding (Bowers, 1981, 1982; Bowers, Laurence, & Hart, 1988; Woody & McConkey, 2003). Weitzenhoffer (1974, p. 259) named this phenomenon "the classical suggestion effect" and explained it as "transformations of the essential, manifest, ideational content of communication into behavior . . . (that has) a *nonvoluntary* quality." Weitzenhoffer claimed that without this marker of subjective experience, behavior could not truly be considered hypnotic (see also Woody & McConkey, 2003). Virtually all theorists, regardless of their position on the nature and cause of hypnosis, agree that high hypnotizable participants experience this reduction in the sense of personal agency during hypnosis (Hilgard, 1979; Kihlstrom, 2008; Lynn, 1997; Spanos, 1991; Woody & Sadler, 2008).

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We thank Steven Lynn, Etzel Cardeña, and Quinton Deeley for helpful comments on an earlier version of this article.

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Hypnosis is a complex social interaction with a number of elements that influence participants' behavioral responses and subjective experiences at any given moment. Although it is well recognized that sense of agency is reduced during hypnosis, the specific ways this reduction relates to the various elements of hypnosis are less clear. Drawing on earlier conceptualizations by Hilgard (1965, 1973) and Kihlstrom (1985), Barnier et al. (2008) described the domain of hypnosis as comprising three levels (detailed below). Each of these levels represents aspects of hypnotic phenomena and Barnier et al. argued that a complete theory of hypnosis should address each level. Likewise, a comprehensive account of sense of agency must outline the ways in which subjective feelings of control and effort change at each of these levels.

Level 1: Sense of Agency in Response to Different Types of Hypnotic Suggestion

The first level in Barnier et al.'s (2008) conceptualization of the domain of hypnosis is the distinction between classic types of hypnotic items (consistent with Hilgard, 1965). During hypnosis, the hypnotist administers suggestions to the participant, instructing them to experience alterations in action, perception, and cognition (Kihlstrom, 2008). However, these suggestions can take a variety of forms and it may be the case that not all of these influence sense of agency in equivalent ways (McConkey, 2008). An account of sense of agency at this level should address the full scope of traditional hypnotic phenomena and adequately investigate participants' experiences in response to a comprehensive range of hypnotic items.

Hypnotic suggestions are traditionally categorized as ideomotor, challenge, or cognitive items based on their content (Hilgard, 1965; Woody & Barnier, 2008). Ideomotor items involve instructions to make a motor movement (e.g., that an arm will feel light and float up toward the ceiling). Challenge items involve instructions to inhibit motor responses (e.g., that an arm will become stiff, rigid, and unable to move). Cognitive items involve instructions to experience altered perceptual or cognitive events (e.g., noticing a fly buzzing around the room). Converging evidence from factor analysis of large datasets of responses to hypnotic items (Woody, Barnier, & McConkey, 2005), case studies of specific hypnotic suggestions (Weitzenhoffer & Hilgard, 1963), and neuroimaging data (Ray & Pascalis, 2003) indicates that responding to items of different types depends on multiple, distinct component abilities (Woody & Barnier, 2008; Woody & McConkey, 2003). These different types of responses may involve quite different experiences of agency. For example, the degree and quality of agency alteration implicated in an ideomotor suggestion, which relies heavily on an individual making some physical movement, might be distinct from the type of agency alteration implicated in a cognitive suggestion, which predominately involves changes to perceptual experience.

Whereas K. Bowers (1981), P. Bowers (1982), and Bowers et al. (1988) looked in detail at the relationship between experiences of involuntariness and passing or failing standard hypnotic items, and we have reported on the sense of agency in participants completing standardized hypnotizability measures (Polito, Barnier, & Woody, 2013), little attention has been paid to the relationship between sense of agency and item types. In the present study, we investigated the specific effects of different types of suggestions on participants' sense of agency.

Level 2: Sense of Agency Across the Phases of a Suggestion

The second level in Barnier et al.'s (2008) conceptualization of the domain of hypnosis is responding across and within items. Responsiveness to suggestions usually is assessed in terms of whether observable actions meet specific behavioral criteria. This is the case in virtually all standardized hypnotizability measures (e.g., the Harvard Group Scale of Hypnotic Susceptibility, Form A; HGSHS:A; Shor & Orne, 1962; the Carleton University Responsiveness to Suggestion Scale; CURSS; Spanos, Radtke, Hodgins, Stam, & Bertrand, 1983; the SHSS:C; Weitzenhoffer & Hilgard, 1962). These simple pass/fail criteria make sense for behavioral responses but are less applicable for a construct such as sense of agency, which does not easily fit into dichotomous pass/fail categories. It may be that alterations to sense of agency do not occur immediately, but might build up gradu-

ally and then fade away as a suggestion is heard, tested and then cancelled (McConkey, 2008).

The dynamic quality of sense of agency alteration was addressed in part by Bowers et al. (1988). Qualitative reports of increasing and decreasing volition in the hypnotic context led these researchers to create a categorical scale for assessing subjective experiences, which included response options describing fluctuating feelings of control. This scale was geared toward investigating the consistency between behavioral and subjective responses in hypnosis; so whereas it acknowledged that sense of agency varies within items, it did not assess how these changes occurred, or match alterations with specific time points or phases of items. Cardeña (2005) also addressed changes in various dimensions of hypnotic experience over time by repeated applications of the Phenomenology of Consciousness Inventory (Pekala, 1991). He reported substantial variation in individuals' subjective experiences at different time points, across a range of different hypnotic contexts (including relaxed vs. physically active tasks).

A more detailed method for assessing variation within items was developed by McConkey, Wende, and Barnier (1999). These researchers used a mechanical dial to obtain continuous ratings of participants' subjective experiences. Rather than addressing sense of agency specifically, participants were instructed to use the dial to indicate the degree to which they were experiencing the effects of suggestions. Importantly, the dial was not used during the whole hypnosis session. Instead, McConkey et al. conceptualized a hypnotic item as having three distinct phases: the suggestion phase, in which the participant hears the instructions for the item; the test phase, in which the participant makes some response; and the cancellation phase, in which the participant is instructed to stop experiencing the previously suggested effects. In this way, the dial methodology focused on how participants' experiences varied during the phases of three specific suggestions: arm levitation, arm rigidity and anosmia. This was a significant innovation as most previous research had focused only on what participants did during the test phase of a suggestion, potentially missing important aspects of hypnotic responding. Conceptualizing a hypnotic item as comprising three distinct phases allowed for more detailed examination of the effect the item had on participants' subjective experiences. In the present study we investigated the same three hypnotic items as McConkey et al., with a focus on how sense of agency varied over the time course of each item.

Level 3: Sense of Agency With and Without a Hypnotic Induction

The third level in Barnier et al.'s (2008) conceptualization of the domain of hypnosis is state and trait. In addition to the well-known issue of trait hypnotizability, a key issue at this level is the role of the hypnotic induction and the effect it has on participants' responses. A hypnotic induction is a series of instructions (or some other less direct procedure) that establishes the context of hypnosis. Ideas concerning the role of the hypnotic induction are closely linked with positions on the existence (or not) of a hypnotic 'state.' An early view of hypnosis was that a hypnotized person entered into an altered state of consciousness and that hypnotic effects—including experiences of altered agency—were causally dependent on that state (James, 1890/1980 as cited in Kirsch, 2011). According to such a view, the hypnotic induction is a necessary requirement of hypnosis as it is the trigger that leads to the hypnotic state. Although some contemporary researchers endorse strong causal state views (Gruzelier, 2005; Kallio, Hyönä, Revonsuo, Sikka, & Nummenmaa, 2011; Kosslyn, 2000), most researchers either prescribe a reduced role for the hypnotic state (i.e., claiming that it facilitates rather than causes hypnotic responding; Hilgard, 1965) or they deny its existence altogether (Lynn, Fassler, & Knox, 2005; Sarbin & Coe, 1972; Spanos, 1991). In both these cases, the role of the induction is called into question—if the induction is not the trigger for a causal hypnotic state, then what is its role? Since the 1930s, one "generally accepted approach to hypnotic research" (Orne, 1979, p. 523) has been to compare the performance of participants who receive a hypnotic induction with those who do not. The assumption of such a design is that only those participants who receive an induction will respond hypnotically. Most research has focused only on how an induction affects behavioral responses and, for the most part, these effects have been minor (see Kirsch,

Mazzoni, & Montgomery, 2007 for a thorough review).

Less attention has been paid to the effect that an induction has on sense of agency. Woody and Barnier (2008) suggested that whereas direct effects of the hypnotic induction on behavior may be minimal, there may be a more significant influence on subtler effects such as the strategies individuals utilize in responding to suggestions and their subjective experiences more generally. This view is supported by Hilgard and Tart (1966), who found that altering an induction led to marked changes in how hypnotized participants felt. Similarly, McConkey, Szeps, and Barnier (2001) found that whereas behavioral responses to a hypnotic sex change suggestion were comparable between hypnosis and imagination groups, participants in the hypnosis condition reported a more rapid onset of hypnotic effects. Although these studies did not directly assess sense of agency, these results suggest that a hypnotic induction may alter significantly the ways in which an individual experiences all of the suggestions that follow the induction. In the present study we specifically investigated the effect of a hypnotic induction on high hypnotizable participants' sense of agency.

The Present Study

We recently developed a psychometric measure for assessing changes in sense of agency occurring during hypnosis (Polito et al., 2013). In the present study we combined this scale with participants' numerical estimates of personal control to investigate changes in sense of agency across the domain of hypnosis. In particular we addressed sense of agency alteration: a) related to different types of hypnotic items, b) over the time course of each suggestion, and c) with or without a hypnotic induction.

This experiment was based on the design of McConkey et al. (1999). Participants completed the same three hypnotic items (arm levitation, arm rigidity, and anosmia), either with or without a hypnotic induction and, like McConkey et al., we investigated participants' subjective experiences during the suggestion, test and cancellation phases. However, rather than using a mechanical dial to index the degree to which participants experienced suggestions, we focused on participants' sense of agency. Following these items, we asked participants to estimate their level of control at three different times throughout each item and to complete the Sense of Agency Rating Scale (SOARS).

Following from McConkey et al. (1999) we made three predictions. First, we expected that participants' experiences would vary between the three target items and that this would be reflected in different control ratings and SOARS scores. McConkey et al. found particularly high ratings of subjective involvement for arm rigidity and we anticipated a similar finding for sense of agency measures related to this item. Second, we expected that participants' experiences would vary considerably within the time course of each item, with control reducing most notably during the test phase. Finally, McConkey et al. found that although more high hypnotizable than medium hypnotizable participants passed each suggestion according to their behavioral criteria, mediums who did pass showed similar patterns of "dial ratings" to highs. In an analogous way, although we expected that participants who received an induction would be more likely to pass items, we anticipated that participants who did pass items would have comparable alterations to their sense of agency, regardless of whether or not they received a hypnotic induction.

Method

Participants

We tested 46 undergraduate students (26 female) at the University of New South Wales, Sydney, Australia, of mean age 20.49 years (SD = 4.11). We paid participants $25 or granted course credit for taking part in a two-hour study comprising this experiment and other unrelated tasks. Our sample were previously confirmed as high hypnotizable, having scored 7 or greater on both the HGSHS:A (M = 7.99, SD = .70) and the SHSS:C (M = 8.14, SD = 1.02). This study was approved by the University of New South Wales Human Research Ethics Committee.

Materials

The SOARS (Polito et al., 2013) is a 10-item scale that indexes subjective alterations to sense of agency. Participants rate their level of agree-

ment with a series of statements on a 7-point Likert scale from *strongly disagree* to *strongly agree*. This scale has two factors. The first factor, *Involuntariness*, includes items such as *I felt that my experiences and actions were not caused by me* and represents a subjectively experienced reduction in control over one's own actions that is characterized by a change in feelings of volition for actions and a focus on an external locus of control. The second factor, *Effortlessness*, includes items such as *My experiences and actions occurred effortlessly* and represents a subjectively experienced increase in the ease and automaticity with which actions occur that is characterized by a passive experience of events taking place without effort and feelings of absorption in the task at hand. Both factors show good validity and stability.

Design and Procedure

We randomly allocated participants to one of two experimental groups. The 'induction' group received a standard hypnotic induction taken from the SHSS:C (Weitzenhoffer & Hilgard, 1962). The 'no induction' group did not receive a hypnotic induction and were explicitly told that they would not be hypnotized. In place of an induction, this group instead completed two distractor puzzle tasks: the symbol-search task from the Wechsler Adult Intelligence Scale (Wechsler, 1997) and a geometric puzzle requiring them to bisect an L-shaped figure using a pencil, paper, and ruler (Nogrady, McConkey, & Perry, 1985). This design tests the specific effect of a formal hypnotic induction on the performance of high hypnotizable individuals.

Suggestions. Following administration of the induction or distractor tasks, participants received a number of suggestions. The three target items—arm levitation, arm rigidity, and anosmia—were each preceded by an additional standard item taken from either the HGSHS:A or the SHSS:C (moving hands apart, finger lock and arm immobilization). These additional items were included to give participants an opportunity to relax into the experimental context and to practice responding to items with which they were familiar. Each target item consisted of three phases: the suggestion phase, in which the experimenter read aloud the relevant instructions; the test phase, in which the participant was given time to respond to the suggestion; and the cancellation phase, in which the experimenter instructed the participant to stop experiencing the effects of the suggestion. The arm levitation item was an ideomotor suggestion in which participants were told that they would feel their left hand becoming lighter and lighter and that it would float up toward the ceiling. This item was scored as passed if the participant lifted their arm at least 15 cm above the arm of the chair within 10 seconds of the suggestion. The arm rigidity item was a challenge suggestion in which participants were told that their right arm would become stiff and straight and that they would not be able to bend it when asked to try. This item was scored as passed if the participant bent their arm less than 5 cm during the 10 seconds following the suggestion. The anosmia item was a cognitive suggestion in which participants were told that they would lose their sense of smell. This item was scored as passed if participants denied smelling a bottle of pungent wintergreen oil that the experimenter held under their nose after administering the suggestion (and if overt reactions such as wrinkling the nose were absent). At the conclusion of all experimental tasks the experimenter administered a standard hypnotic deinduction, taken from the SHSS:C, to participants in the 'induction' group. Participants in the 'no induction' group were simply instructed to count aloud from 20 to 1.

Postexperimental interview. The entire experimental session was recorded by video camera and saved to DVD. During a postexperimental interview (based on the Experiential Analysis Technique of Sheehan & McConkey, 1982), the experimenter showed participants video recordings of their performance and asked them to comment on their experiences at specific time points. For each of the target items (arm rigidity, arm levitation, and anosmia) the experimenter showed a short clip of the following: the suggestion phase, when the participant first heard the instruction for the suggestion; the test phase, when the participant was given time to make a response to the suggestion; and the cancellation phase, when the participant was told that the effects of the suggestion would cease. After showing the clip for each phase, the experimenter asked *What were you experiencing here?* and prompted the participant to describe their thoughts and feelings during that

phase.[1] The experimenter also asked participants to give a numerical rating of their level of control during each phase on a scale from 1 to 7 (where 1 means *you did not feel in control at all* and 7 means that *you felt completely in control*). After the three control ratings for each item, the experimenter administered the SOARS, asking participants to rate their overall experience of that suggestion. In summary, for each target item, each participant gave a qualitative description, a control rating for each separate phase (suggestion, test and cancellation), and completed a separate instance of the SOARS. At the completion of the interview the experimenter debriefed participants, thanked them for their time and concluded the experiment.

Results

These results focus on pass rates, control ratings, and SOARS scores. We organized our analyses to answer two questions: a) did participants' behavioral responses or sense of agency vary across the three target items (with and without an induction), and b) did subjective feelings of control vary over the time course of each item (with and without an induction). The first question addressed level one of the domain of hypnosis (types of hypnotic items; Barnier et al., 2008) by comparing performance across suggestions, and addressed level three (state) by assessing the effect of a hypnotic induction. The second question addressed how sense of agency operated across all three levels of the domain of hypnosis: level one (types of hypnotic items) by comparing suggestions; level two (responding within items) by looking at control ratings from each phase of each item; and level three (state) by comparing the performance of participants with and without a hypnotic induction.

Pass Rates and Sense of Agency for Different Types of Hypnotic Suggestion

Here we focused on participants' behavioral responses and reported experiences for the three target items. There were two parts to these analyses. First, we evaluated behavioral responses in terms of whether participants' observable physical actions met specific criteria for passing or failing each item. Next, we used the SOARS to assess participants' agentive experiences across items.

Table 1 shows the number of participants passing and failing each suggestion, with and without a hypnotic induction. To assess the effect of induction and item type on pass rates, we used repeated measures binary logistic regression (generalized estimating equations in SPSS), with induction (present vs. absent) as a between-subjects independent variable, item (arm levitation vs. arm rigidity vs. anosmia) as a within-subjects independent variable, and the dichotomous "pass/fail" outcome as the dependent variable. Pass rates varied significantly across items with a particularly high proportion of participants passing arm rigidity ($n = 37$, 80.4%), a moderate proportion passing arm levitation ($n = 27$, 58.7%), and a much lower proportion passing anosmia ($n = 14$, 30.4%), Wald's $\chi^2(2) = 28.21$, $p < .001$. This analysis also showed that receiving a hypnotic induction was a significant predictor of passing, Wald's $\chi^2 = 8.13$, $df = 1$, $p = .004$, with participants who received an induction more than five times as likely to pass items overall, Wald's $\chi^2 = 6.78$, $df = 1$, $p = .009$; $OR = 5.60$, 95% CI [1.53–20.49]. There was, however, no interaction between induction and item, Wald's $\chi^2 = 5.16$, $df = 2$, $p = .076$, indicating that a hypnotic induction did not make participants more or less likely to pass any specific type of item. Notably, a hypnotic induction had a considerable impact on pass rates overall.

Next we investigated participants' sense of agency. Table 2 shows SOARS scores for participants passing and failing each item, with and without a hypnotic induction. Average *Involuntariness*, collapsed across suggestions and induction groups, was 22.76 ($SD = 4.68$). Average *Effortlessness* was 26.80 ($SD = 3.60$). These scores were of a similar magnitude to earlier results for high hypnotizable participants rating their experiences during the SHSS:C (*Involuntariness* $M = 22.39$, $SD = 6.49$; *Effortlessness* $M = 28.42$, $SD = 3.46$; Polito et al., 2013). A set of 2 (induction: present vs. absent) × 3 (item: arm levitation vs. arm rigidity vs. anosmia) mixed-model ANOVAs with

[1] We did not conduct formal analysis on participants' qualitative responses but these comments assisted in interpretation of the pattern of results found.

Table 1
Participants Passing and Failing Each Item With and Without an Induction

	Suggestion					
	Arm levitation		Arm rigidity		Anosmia	
Group	*n*	%	*n*	%	*n*	%
Induction						
Pass	18	78.3	22	95.7	8	34.8
Fail	5	21.7	1	4.3	15	65.2
No induction						
Pass	9	39.1	15	65.2	6	26.1
Fail	14	60.9	8	34.8	17	73.9

SOARS scores as the dependent variables revealed no significant effects for either *Involuntariness* or *Effortlessness*. This indicated that, overall (ignoring pass vs. fail), participants' sense of agency was comparable for each of the three target items with and without a hypnotic induction. To investigate whether sense of agency was altered for participants who passed individual suggestions we ran a series of further analyses on each target item.

For arm levitation we ran separate 2 (induction) × 2 (passing) between-subjects ANOVAs with SOARS factors as the dependent variables. Although an induction made no difference, participants who passed arm levitation had significantly higher *Involuntariness* scores ($M = 25.44$, $SD = 5.72$) and *Effortlessness* scores ($M = 28.17$, $SD = 5.09$) than those who failed (*Involuntariness* $M = 18.79$, $SD = 7.05$; *Effortlessness* $M = 24.50$, $SD = 4.00$), *Involuntariness* $F(1, 42) = 9.72$, $p = .005$; *Effortlessness* $F(1, 38) = 4.83$, $p = .034$. Thus, raising an arm in response to the arm levitation item was associated with both a pronounced reduction in feelings of volition and the experience that the arm movement occurred without effort.

For arm rigidity, only one participant who received an induction failed the item, so we did not test the effect of passing. Instead, we ran separate independent sample *t* tests with induction as the between-subjects independent variable and SOARS factors as the dependent variables. As with arm levitation, hypnotic induction had no direct influence on SOARS scores (all ts $< .088$, all ps $> .930$).

For anosmia we ran separate 2 (induction) × 2 (passing) independent ANOVAs with SOARS factors as the dependent variables. Although an induction made no difference, participants who passed anosmia had significantly higher *Involuntariness* scores ($M = 25.07$, $SD = 6.20$) and *Effortlessness* scores ($M = 29.15$, $SD = 3.05$) than those who failed (*Involuntariness* $M = 20.06$, $SD = 4.94$; *Effortlessness* $M = 24.57$, $SD = 4.86$), *Involuntariness* $F(1, 42) = 7.42$, $p = .009$; *Effortlessness* $F(1, 38) = 8.87$, $p = .005$. Thus, individuals who reported not being able to smell following the anosmia suggestion felt that they were not causing their experience and that this inability to smell occurred without effort.

In summary, participants did not respond to hypnotic items in a uniform manner. Behavioral responses varied considerably across suggestions, with particularly high pass rates for arm rigidity. A hypnotic induction made passing suggestions more likely. In contrast, sense of agency was reasonably uniform across hypnotic items; participants reported that their experi-

Table 2
Mean SOARS Scores for Participants Passing and Failing Each Item With and Without an Induction

	Suggestion											
	Arm levitation				Arm rigidity				Anosmia			
Group	Involuntariness		Effortlessness		Involuntariness		Effortlessness		Involuntariness		Effortlessness	
Induction												
Pass	25.72	(6.42)	27.80	(5.47)	23.59	(6.01)	27.94	(3.44)	26.88	(6.51)	29.29	(3.55)
Fail	18.40	(5.77)	24.75	(4.35)	24.00	—	23.00	—	20.40	(5.99)	25.08	(4.74)
No induction												
Pass	24.89	(4.26)	28.78	(4.63)	25.70	(3.39)	28.07	(3.10)	28.07	(3.1)	29.00	(2.68)
Fail	18.93	(7.65)	24.43	(4.07)	20.13	(8.08)	27.00	(5.13)	19.76	(3.98)	24.21	(5.06)

Note. Values in parentheses are standard deviations.

ences were both involuntary and effortless. A hypnotic induction did not make participants more likely to experience altered agency. Rather, altered agency was related to passing or failing items. Participants who passed arm levitation and anosmia reported greater levels of *Involuntariness* and *Effortlessness* compared with those who failed. In other words, hypnotic induction had an indirect rather than direct effect on altered sense of agency in hypnosis.

To more formally evaluate the hypothesis that a hypnotic induction acts only indirectly on the sense of agency, bias-corrected bootstrap tests of mediation were conducted using Amos 21 (Arbuckle, 2012). Pass/fail scores across the three types of items were summed to index overall behavioral response, and *Involuntariness* ratings were summed across the three types of items to index overall sense of involuntariness. Figure 1 shows the estimated standardized path coefficients for the resulting mediation model. As expected, induction had a substantial impact on behavioral response ($\beta = .40$, $p < .01$), and behavioral response, in turn, had a substantial relation to sense of involuntariness ($\beta = .46$, $p < .01$). A bootstrap test of mediation showed that this indirect effect was statistically significant, $p < .01$. However, as shown in the diagram, induction appeared to have no direct effect on the sense of involuntariness ($\beta = -.01$, $p = .92$). The corresponding test of mediation for E*ffortlessness* yielded very similar findings: behavioral response had a substantial relation to overall sense of effortlessness ($\beta = .45$, $p < .01$), and a bootstrap test of mediation showed that the indirect effect of induction on effortlessness was statistically significant, $p < .01$. However, the direct effect of induction on effortlessness, like for involuntariness, was negligible ($\beta = -.08$, $p = .62$).

Feelings of Control Across Phases

Next we focused on participants' retrospective ratings of control during each phase of each item. We first looked at differences in ratings of control across items overall and then at the specific influences on participants' experience of control for each item. Control ratings by phase for each item are shown in Figure 2. Ratings were made on a 7-point scale with descriptors ranging from *you did not feel in control at all* (1) to *you felt completely in control* (7). Participants' responses covered the full range (1–7) for all control ratings. To test for differences in the experience of control across items we used a 2 (induction) × 3 (item) × 3 (phase: suggestion vs. test vs. cancellation) MANOVA with control ratings as the dependent variable. A main effect showed that participants who received an induction rated their control lower on average ($M = 3.57$, $SD = 0.26$) than those without an induction ($M = 4.68$, $SD = 0.25$), $F(1, 42) = 9.66$, $p = .003$. There was no interaction of induction with item or phase, indicating that whereas a hypnotic induction influenced participants' experiences of control, this effect was not specific to any particular item or phase.

A main effect of item showed that participants experienced the least control during the arm rigidity suggestion ($M = 3.77$, $SD = 0.21$) followed by arm levitation ($M = 4.13$, $SD = 0.25$) and then anosmia ($M = 4.48$, $SD = 0.23$), $F(2, 84) = 4.29$, $p = .017$. There was also a main effect of phase. Control started at a mod-

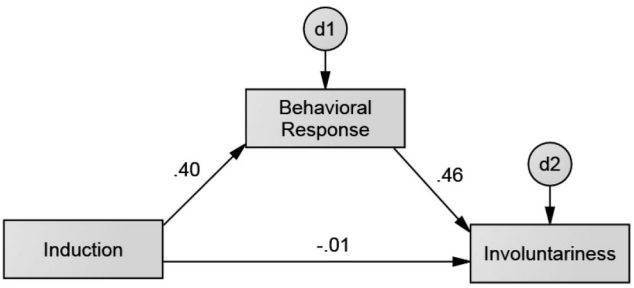

Figure 1. Mediation model of the impact of induction on behavioral response and *Involuntariness.*

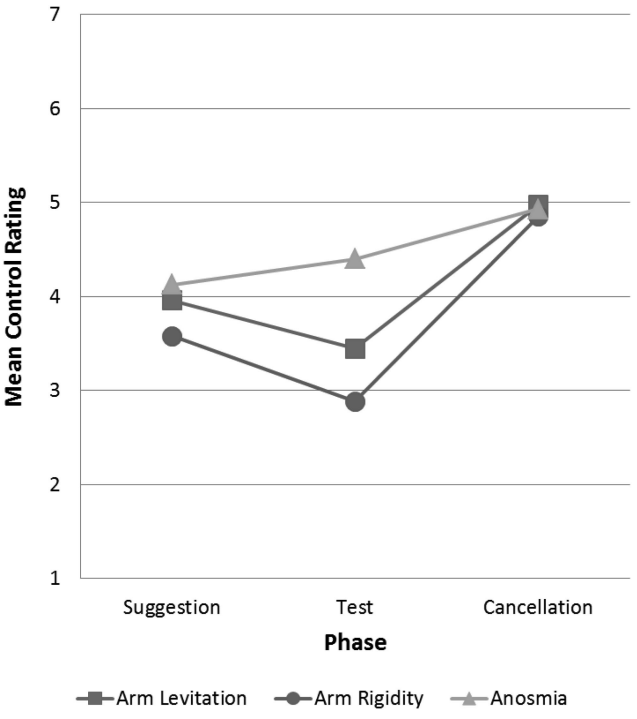

Figure 2. Control ratings by phase for each item

erate level during the suggestion phase (M = 3.89, SD = 0.20), dropped slightly during the test phase (M = 3.58, SD = 0.20) and then rose considerably during the cancellation phase (M = 4.92, SD = 0.23), Wilk's λ = .456, $F(2, 41) = 24.44$, $p < .001$. Finally, an interaction between item and phase showed that the differences between control ratings at each phase varied for the three target items, Wilk's λ = .713, $F(2, 41) = 3.92$, $p = .009$. This result indicated that sense of agency did not develop in a uniform way but rather that participants' experiences over the time course of the hypnotic items depended on the specific hypnotic suggestion administered. To more closely unpack these influences on participants' experiences of control, particularly the effect of passing suggestions, we next focused in turn on each target item.

Figure 3a shows control ratings for arm levitation. To assess variation in feelings of control during arm levitation we ran a 2 (induction) × 2 (passing) × 3 (phase) MANOVA with control ratings as the dependent variable. Overall, a main effect of phase showed that control varied significantly over time, Wilk's λ = .575, $F(2, 39) = 14.43$, $p < .0005$. Contrasts showed that there was a small but significant drop in reported control from the suggestion phase (M = 3.99, SD = 2.04), to the test phase (M = 3.48, SD = 1.95), $F(1, 40) = 6.97$, $p = .012$, followed by a significant increase in reported control during the cancellation phase (M = 5.00, SD = 2.03), $F(1, 40) = 21.96$, $p < .0005$. Contrasts also showed that control during the cancellation phase was significantly higher than control during the suggestion phase, $F(1, 40) = 6.33$, $p = .016$. An interaction between phase and passing reflected particularly low ratings of control during the test phase for participants who passed the suggestion (M = 2.74, SD = 1.67) compared with those who did not (M = 4.45, SD = 1.89), Wilk's λ = .849, $F(2, 39) = 3.48$, $p = .041$. The V-shaped curve of control ratings over time, evident among participants who passed the suggestion, suggests that hearing the instructions for arm levitation during the suggestion phase had little immediate impact on control ratings but that when participants reached the test phase and (for those who

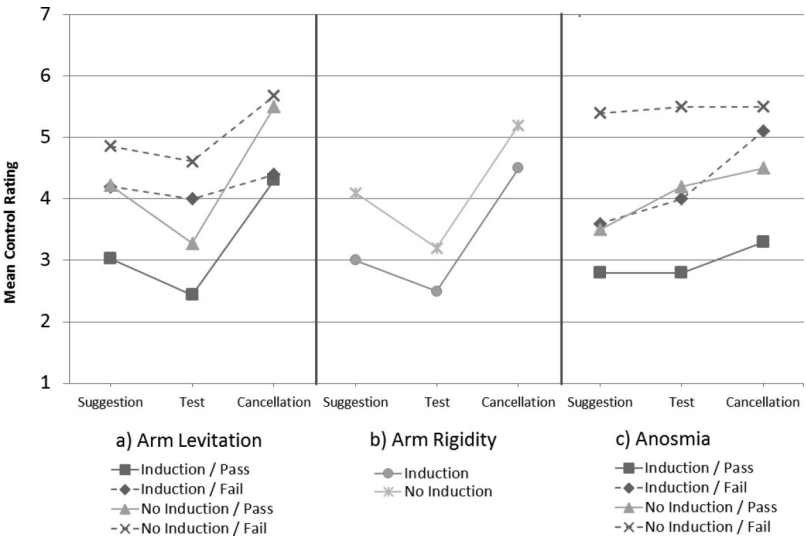

Figure 3. Control ratings during each phase for a) arm levitation, b) arm rigidity, c) anosmia.

passed) experienced their arm raising upward, there was a marked reduction in feelings of control. The cancellation phase then led to a sharp increase in feelings of control as the actions associated with arm levitation were terminated. Notably, as indicated by no main or interaction effects, induction had no impact on these patterns.

Figure 3b shows control ratings for arm rigidity. As all but one participant in the 'induction' group passed arm rigidity we did not enter passing as a factor in the analysis. We ran a 2 (induction) × 3 (phase) MANOVA with control ratings as the dependent variable. Overall, a main effect of phase showed that control varied significantly over time, Wilk's $\lambda = .423$, $F(2, 41) = 27.98$, $p < .0005$. Contrasts showed that control ratings following the same V shaped pattern seen for arm levitation; reported control dropped significantly from the suggestion ($M = 3.60$, $SD = 1.87$) to the test phase ($M = 2.90$, $SD = 1.75$), $F(1, 42) = 8.71$, $p = .005$, and then increased significantly during the cancellation phase ($M = 4.86$, $SD = 1.88$), $F(1, 42) = 45.71$, $p < .0005$. Contrasts also showed that control during the cancellation phase was significantly higher than control during the suggestion phase, $F(1, 42) = 10.83$, $p = .002$. Again, induction had no impact on these patterns.

For interest, we also ran a series of *t* tests to compare control ratings for the 37 participants who passed and the 9 participants who failed arm rigidity (regardless of induction). There was no difference in control ratings during the suggestion phase. During the test phase, participants who passed experienced significantly less control ($M = 2.31$, $SD = 1.23$) than participants who failed ($M = 5.17$, $SD = 1.66$), $t(42) = 5.77$, $p < .0005$. Similarly, during the cancellation phase, participants who passed experienced significantly less control ($M = 4.46$, $SD = 1.79$) than participants who failed ($M = 6.44$, $SD = 1.33$), $t(42) = 3.11$, $p = .003$. These results indicate that initially hearing the arm rigidity suggestion had very little impact on participants' feelings of control, but those who passed this item experienced markedly reduced control during the test and cancellation phases compared with those who failed. In other words, control felt altered when the suggestion was tested, not as it was administered.

Figure 3c shows control ratings for anosmia. We ran a 2 (induction) × 2 (passing) × 3 (phase) mixed-model ANOVA with control ratings as the dependent variable. A main effect indicated that participants who received an induction experienced less control ($M = 3.60$, $SD = .34$) than participants without an induc-

tion ($M = 4.76$, $SD = .34$), $F(1, 40) = 5.73$, $p = .022$. Similarly a main effect of passing showed that participants who passed the anosmia item (regardless of induction) reported feeling less control overall ($M = 3.51$, $SD = .41$) than those who failed ($M = 4.84$, $SD = .25$), $F(1, 40) = 7.62$, $p = .009$. There were no other main or interaction effects. Anosmia did not show the V-shaped pattern of control across phases seen in the other two items.

Taken together these results demonstrated that control varied considerably across items and also across phases within each item. Hypnotic induction led to reduced control overall, but the induction did not interact with any particular item or phase. For both arm levitation and arm rigidity, the suggestion phase was not associated with particularly low ratings of control; however, once participants had a chance to actually make a response, during the test phase, their feelings of control tended to reduce. For these two items, cancellation led to an increase in feelings of control. Control ratings did not vary across phases for anosmia with participants reporting moderate levels of control throughout the time course of this item. Participants passing suggestions generally had lower levels of control; in particular, participants who passed had lower control during the test phases of arm levitation and arm rigidity.

Discussion

This experiment examined influences on the phenomenology of hypnosis. Specifically, we investigated participants' behavioral responses and sense of control and agency over the time course of three suggestions—an ideomotor (arm levitation), a challenge (arm rigidity), and a cognitive (anosmia) item—with and without a hypnotic induction. Overall, our results show that sense of agency does not remain static during hypnosis but varies considerably in response to influences across the three levels of the domain of hypnosis (Barnier et al., 2008). Specifically, control ratings varied across the three target items (level one); feelings of control fluctuated over time within items (level two); and hypnotic induction led to higher pass rates overall (level three), which in turn led to higher *Involuntariness* and *Effortlessness* scores.

Sense of Agency in Response to Different Types of Hypnotic Suggestion

Our first prediction was that participants' experiences would vary across the three target items. This was supported by different pass rates and patterns of subjective control over time for each item. Consistent with McConkey et al. (1999), these results suggest a nuanced view of hypnotic responding whereby hypnotic items of different types are experienced in quite different ways. Rather than a hierarchy of difficulty among hypnotic items running from ideomotor items as the easiest through to cognitive items as the most difficult (Balthazard & Woody, 1985; McConkey, Sheehan, & Law, 1980), we found that arm rigidity had the highest pass rate, followed by arm levitation, and then anosmia. So, based on pass rates in this experiment, the challenge item was the "easiest." Control ratings also differed across items with participants reporting significantly less control for arm rigidity than for anosmia. Comey and Kirsch (1999) similarly reported that challenge items, including arm rigidity, were experienced as less voluntary than ideomotor or cognitive items. These findings imply that the three target items in this study made distinct demands on participants and required or led to different degrees of experiential involvement (McConkey et al., 1999).

This variation in participants' behavioral and subjective responses across items suggests also that, rather than depending on a single generalized capacity for hypnosis, these responses may depend on a range of underlying component abilities (Woody et al., 2005; Woody & Barnier, 2008; Woody & McConkey, 2003). Proponents of component models of hypnosis (e.g., Woody & McConkey) argue that different types of suggestions and different types of hypnotic responses require different combinations of hypnotic abilities (e.g., specific abilities related to imagery, dissociation or attentional capacities). Individuals differ in their particular combination or profile of hypnotic abilities, perhaps as a result of developmental or genetic differences (Barnier et al., 2008), and this variation explains the heterogeneity of hypnotic experiences. Some hypnotic responses (e.g., a complicated hallucination suggestion) may require very specific abilities (or combinations of abilities, e.g., visual imagery ability), whereas other responses (e.g., a simple ideomotor sugges-

tion) may be produced by any of a wide range of different component abilities (or combinations of them; McConkey, 2008).

Specific hypnotic abilities have sometimes been associated with particular response strategies (Barber, 1999; Brown & Oakley, 2004; McConkey & Barnier, 2004). For example, in a comprehensive analysis of arm rigidity, Galea, Woody, Szechtman, and Pierrynowski (2010) found that participants with the ability to hallucinate utilized a passive strategy of directly imagining arm rigidity, whereas participants with the ability to enact physiological changes utilized a much more active strategy of tensing and relaxing their arm muscles rapidly in order to simulate a difficult movement. An interesting direction for future research would be to further clarify connections between individuals' specific hypnotic abilities, the strategies used to respond to various hypnotic items, and the ways that these interact to influence sense of agency.

One surprising inconsistency in the current results is that whereas pass rates and control ratings varied considerably across items, SOARS scores were relatively consistent. Both *Involuntariness* and *Effortlessness* did vary, however, between participants who passed and failed items. It seems that straightforward numerical ratings of control tapped differences in participants' subjective experience of the various items that related to fluctuations of sense of agency over time, whereas SOARS scores tapped agency alterations specifically related to successfully experiencing the effects of hypnotic suggestions. These issues are taken up in more detail below.

Sense of Agency Across the Phases of a Suggestion

Our second prediction was that participants' experiences would vary across the time course of each item. This was supported by ratings of subjective control that varied considerably across the suggestion, test, and cancellation phases for both arm levitation and arm rigidity. For these items, participants' experience of control dropped during the test phase and then increased dramatically during the cancellation phase. There are two important implications from this finding. First, as highlighted by McConkey et al. (1999), the variation in participants' experiences across the phases of these three items demonstrates one limitation of asking participants to give a single rating of their experience during or after a hypnotic item (or indeed during or after hypnosis as a whole). Single ratings (such as those sometimes obtained as hypnotic 'depth' measures) require participants to experientially average a range of subjective phenomena occurring over substantial periods of time (Field, 1966; Laurence & Nadon, 1986). By contrast, the three ratings we obtained for each item (in addition to pass rates and SOARS scores for each item) showed a clear pattern of control waning and then waxing across the phases of arm levitation and arm rigidity.

Second, it is telling that control ratings during the suggestion phase did not reflect markedly reduced levels of control. Participants only reported a drop in their feeling of control during the test phase (and only for arm levitation and arm rigidity). This suggests that a reduction in control was not a state-like effect that occurred in response to the induction or to participants hearing and interpreting the hypnotic suggestion. Rather, this indicates that a reduction in control occurred only when participants were specifically required to make some motor response during the test phase. Strong state views of hypnosis claim that subjective and behavioral responses during hypnosis are attributable to a special altered state of consciousness (Gruzelier, 2005; Kallio et al., 2011; Kosslyn, 2000). If this were the case, then we might expect participants' sense of agency to change as a result of this hypnotic state before them making any particular actions. Notably, control ratings in this study were made retrospectively, so we cannot be sure of the exact triggers for changes in participants' feelings of control. It does appear, however, that a reduction in subjective feelings of control occurred during the test phase of arm levitation and arm rigidity, and that these feelings of altered control depended on participants' interpretation of their experiences while performing actions. This is demonstrated well by the postexperimental comment of one high hypnotizable participant in hypnosis describing arm rigidity: "I didn't feel in control. When I tried to bend my arm, it just wouldn't bend. It felt so hard to make it bend. Like trying to bend a piece of steel, I just could not bend my arm." Such comments suggest that feelings of reduced control or altered agency may not be inherent hypnotic experiences but may instead be spe-

cific qualities or properties of hypnotic actions. This idea is compatible with the work of Wegner (2004), who claimed that sense of agency arises from a post hoc self-attribution of causality over actions that are compatible with an individual's thoughts.

The consistency of control across phases for anosmia further suggests that the evaluative mechanisms that give rise to feelings of control may depend specifically on signals related to motor actions (Blakemore, Wolpert, & Frith, 2002; Frith, Blakemore, & Wolpert, 2000; Wolpert, Ghahramani, & Jordan, 1995). The notion that sense of agency emerges only as an action is performed is compatible with accounts of hypnosis that emphasize the subjective surprise of hypnotic responding (Barnier et al., 2008), with research that recognizes that subjective experiences may shift over time (Bowers et al., 1988; Kihlstrom, 2002), and also with the finding in this experiment that participants who passed each item had markedly different subjective experiences compared with those who failed (discussed below). Although there are clear clinical cases in which patients exhibit reduced agency for mental events such as thoughts (Bortolotti & Broome, 2009; Mullins & Spence, 2003; Stephens & Graham, 1994), the processes that give rise to such agency disruptions may be quite distinct from those that lead to agency alteration for ideomotor actions (Carruthers, 2012; Vosgerau & Newen, 2007). Barnier et al. (2008) suggested that whereas ideomotor and challenge items may best be characterized by the involuntariness of a suggested experience, cognitive items may best be characterized by the reality of a suggested experience. That is, whereas the arm levitation and arm rigidity items led to altered subjective experiences involving marked differences in feelings of control, the anosmia item may have led to subjective experiences involving a changed experience of reality but less discernible differences in feelings of control. For instance, when describing the anosmia item, one high hypnotizable participant said "I felt as if my nose was closing off. Like something was literally starting to block it as you were suggesting that I couldn't smell anything." Although the source of this experience sounds external (something was blocking her nose), the dominant feeling was the reality of her nose closing off. Bowers et al. (1988) came to a similar conclusion in a detailed study of subjective experiences related to range of hypnotic items, suggesting that although the subjective experience of nonvolition is more closely tied to ideomotor items, it may be of less importance for cognitive items.

Sense of Agency With and Without a Hypnotic Induction

Our final prediction was that participants who passed suggestions might experience marked alterations to their sense of agency regardless of whether they received an induction. This prediction was clearly supported for arm levitation and anosmia where participants who passed these items reported significantly higher SOARS scores than participants who failed. In contrast, SOARS scores did not differ between participants who passed arm rigidity and those who failed (since so few failed). Participants who passed arm rigidity reported lower control ratings during the test and cancellation phases compared to participants who failed. So across items, participants who passed reported distinct agentive experiences compared to those who failed. Importantly, among those who passed, SOARS scores were equivalent for participants regardless of whether or not they received an induction. Whereas participants given an hypnotic induction were more likely to pass suggestions overall, there were still a considerable proportion of participants without an induction who passed each of the three target items (39.1% arm levitation, 65.2% arm rigidity, 26.1% anosmia). These results demonstrate that whereas an induction facilitates hypnotic responding, it is not a requirement for passing suggestions, at least in terms of the required behavior (Kirsch et al., 2007). This implies that the increased involuntariness and effortlessness associated with hypnosis (i.e., the classic suggestion effect; Weitzenhoffer, 1974) may be less a direct effect of a hypnotic induction than an effect of enacting specific suggestions (Meyer & Lynn, 2011).

These findings indicate that the hypnotic induction is not a 'switch' that independently allows hypnotic responding to occur (Polito, Barnier, & McConkey, 2014). Rather, the induction may contribute to a generalized capacity to respond to hypnosis or activate combinations of underlying component hypnotic abilities (McConkey, 2008; Woody et al., 2005;

Woody & McConkey, 2003). In terms of theories of hypnosis, sociocognitive accounts (Lynn, Kirsch, & Hallquist, 2008; Spanos, 1991) would agree with the limited influence of the hypnotic induction evident in this experiment. Our findings are also compatible with Nash (2005) who argued that a formal induction is unnecessary for the elicitation of hypnotic phenomena. According to Nash's view, the first suggestion administered acts as the induction, regardless of its content. Whereas the content of an induction usually concerns instructions for the participant to relax, pay attention or close their eyes (e.g., Weitzenhoffer & Hilgard, 1962), this is functionally unimportant—any suggestion can establish the hypnotic context. This position is supported by research showing that an individual's experience of a particular suggestion is influenced by preceding suggestions regardless of the induction (Benham, Woody, Wilson, & Nash, 2006; Woody et al., 2005). These findings suggest that participants' agentive experiences do not result from the induction but follow from specific suggestions. Integrating this idea with the component model discussed, it follows that hypnotic items might activate specific component abilities (or combinations of abilities) that relate to altered sense of agency, in differing degrees. Importantly, not all suggestions, even when successfully passed, might lead to the same sorts of changes to subjective experience. Whereas ideomotor and challenge items might tend to affect an altered sense of agency, cognitive items may be more associated with the experienced reality of the suggestion (Barnier et al., 2008; Bowers et al., 1988). Taken together, these results suggest that altered sense of agency emerges as a result of particular suggestions for participants who possess compatible component hypnotic abilities.

Conclusions

We recognize a number of limitations of the current study and directions for future research. Most notably, we obtained control ratings and administered the SOARS retrospectively. Whereas participants watched video recordings of their performance to assist them in making these retrospective evaluations, future research might more accurately index sense of agency changes by administering the SOARS immediately after suggestions (although researchers would need to be wary of order effects and the influence that rating agency can have on both the performance and rating of later items). Second, our selection of target items was based on a traditional categorization of item types (Hilgard, 1965; Woody & Barnier, 2008). Future work could base item selection on more empirical determinations of item categories, for example, by including an amnesia item type as suggested by Woody et al. (2005) or by targeting a more comprehensive set of positive and negative, motor, and cognitive items as suggested by Woody and Barnier (2008). Finally, whereas this study attempted to address particular variables at each level of the domain of hypnosis (Barnier et al., 2008), further research could examine other untested influences on hypnotic responding, for example by testing participants across a broad range of hypnotizability (as in McConkey et al., 1999) or by carefully controlling for the influence of preceding items on hypnotic performance (as in Woody et al., 2005).

The core finding of this experiment is that the reduced sense of agency in hypnotic responding is a heterogeneous phenomenon that varies between suggestions and fluctuates throughout the time course of hypnotic items. Neither an induction nor simply hearing a suggestion directly activated alterations in participants' sense of agency. Whereas a hypnotic induction facilitated behavioral responses, it was the interpretation of the immediate experience of ideomotor actions that seemed to give rise to the subjective phenomenology of agency alteration. This study highlights the dynamic and variable nature of sense of agency across the three levels of the domain of hypnosis outlined by Barnier et al. (2008). Each of these levels impacted on participants' sense of agency and variables related to each level interacted in complex ways. The findings suggest that researchers should avoid generalizations about changes in sense of agency during hypnosis. Instead, it may be helpful to consider multifactorial perspectives of the phenomenology of hypnosis that take account of the specific suggestion, time point, and presence or absence of an induction. It appears that sense of agency in hypnosis is dynamic and fluctuating, and responsive to both the particular suggestion and the overall context.

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Received November 19, 2013
Revision received January 13, 2014
Accepted January 14, 2014 ■