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Modularity in the design and application of therapeutic interventions

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Abstract

This paper introduces the concept of modularity as an approach to therapeutic protocol design and application. Modularity is defined in terms of four key properties, and a detailed example of a modular psychotherapy protocol is presented. By explicitly outlining clinical strategies and algorithms, modular design of psychotherapy protocols provides a promising framework for testing many of the assumptions underlying traditional therapy protocols. Modular design also offers numerous potential advantages in terms of design efficiency (reusability of modules, ease of updating or reorganizing protocols) and effectiveness (e.g., greater adaptability for applied contexts, increased therapist satisfaction). Finally, preliminary evidence for the efficacy of modular protocols is encouraging, and suggests that such design should preserve and could even enhance the efficacy of existing therapy protocols.

Keywords: Modular; Therapy; Design; Protocol; Treatment

The promotion of human competencies and alleviation of human suffering are highly complex challenges. Simon (1996) has argued that most complex problems are amenable to multiple representations that have different strengths and weaknesses in guiding problem solution. Thus, it is not surprising that the psychological interventions to address these challenges represent a diversity of forms. For example, early efforts to understand and organize therapeutic activities were based on elaborating major psychological theories and principles (e.g., Psychodynamic, Humanistic, and Behavioral) that a therapist used to "design" treatments within the therapeutic setting (e.g., Freedheim, 1992). In this approach, the therapist uses theoretical principles to develop strategies or responses to the client as events occur in the therapy session. Alternatively, some contemporary interventions have tended to focus on the codification of therapeutic activities into standardized protocols (e.g., manuals), which are designed prior to therapy and tested in tightly controlled settings (Weisz, 2004). These traditions represent two extremes regarding the locus of treatment design (i.e., treatment setting or research laboratory).

Designing treatment based on theoretical knowledge within the treatment setting has the advantages of promoting more highly individualized services and providing the therapist with an expert role, but it may be excessively susceptible to clinical judgment biases, inconsistency, and limitations in generating cumulative knowledge. Designing treatment in the research laboratory supports stronger empirical tests of efficacy, promotes generalizable knowledge and the use of actuarial decision-making, but may not be as relevant to individual clinical situations and is less preferred by many clinicians (Addis & Krasnow, 2000).

Along with these contrasting approaches to psychotherapy design, a third genre has evolved representing somewhat of center point on this continuum. The majority of approaches within this genre fall under the heading of "prescriptive" approaches, and they are partially designed in the laboratory, but also allow for systematic design decisions to be made during the course of therapy. Examples include protocols that can be applied across multiple theoretical orientations using a set of general principles to match particular strategies or styles to client characteristics (Beutler & Harwood, 2000; cf. Norcross & Beutler, 2000), methods for systematically

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developing interventions based on a cognitive behavioral case formulation (Persons, 1991; Persons & Tompkins, 1997) or based on individual client characteristics—e.g., for depressed teens (Curry et al., 2000), children with autism (Durand, 1990; Durand & Crimmins, 1988), anxious school refusal in youth (Burke & Silverman, 1987; Kearney & Silverman, 1990), and childhood generalized anxiety disorder (Eisen & Silverman, 1998).

The above list is necessarily a partial sampling of the wide variety of approaches that use a prescriptive or matching strategy as a core principle. The collective ideas that inspire such approaches are promising and represent a movement toward reconciling earlier traditions of psychotherapy design (e.g., individualization within the clinic setting) with more recent design trends (e.g., manualization). Although some of the literature is quite positive regarding some prescriptive strategies (e.g., Eisen & Silverman, 1998), there is also evidence that flexibility in interventions implicitly harbors possible risks (e.g., Schulte, Kunzel, Pepping, & Schute-Bahrenberg, 1992), and debates cause one to ponder the challenges associated with prescription at the level of specific individuals (e.g., Jacobson et al., 1989; Persons, 1991; Wilson, 1996).

Despite their different locations on the design continuum, the various traditions of psychotherapy approaches all presumably have highly similar goals in mind (e.g., reduced human suffering, improved functioning, higher quality of life), and although diverse, presumably rely upon a finite number of techniques in pursuit of these outcomes. This raises the question of whether a general model of treatment design exists that allows for "continuous scaling" among these specific approaches, to take advantage of some of the best features of each. In other words, a single design model could perhaps yield a protocol at either extreme of the design traditions (i.e., highly individualized, designed in the session versus highly standardized, designed in the laboratory) as well as anywhere in between. The psychotherapy literature has outlined in some detail the dimensions of effectiveness and efficacy of specific treatments (e.g., Task Force on Promotion and Dissemination of Psychological Procedures, 1995; Task Force on Psychological Intervention Guidelines, 1995), and these dimensions can be suitably applied to the question of psychological intervention design as well.

We also introduce the additional dimension of efficiency by which to evaluate modular design. In this context, efficiency refers to the ability of a protocol to be designed or re-designed with reduced time or cost, effectiveness refers to the ability of a protocol to be generalizable or feasible in real-world contexts, and efficacy refers to the ability of a protocol to achieve its desired effect or outcome.

The present paper proposes that one specific design approach, modularity, represents a potential unifier of the multiple design traditions noted above. Although modularity in psychological intervention design cannot address all of the challenges raised so far, it appears to provide an optimal context for their eventual empirical resolution while conferring other potential advantages as well. Our exploration of modularity begins with a more precise definition and illustration of modular treatment design. Modularity is then evaluated in terms of its efficiency, effectiveness, and efficacy as a treatment design principle.

1. What is modularity?

1.1. Defining principles

Modularity is not a new concept in design or in psychotherapy. Some sophisticated examples have emerged of psychotherapy protocols that describe themselves as consisting of modules or being modular (e.g., Carroll, 1998; Clarke, Lewinsohn, & Hops, 1990; Curry et al., 2000; Wells & Curry, 2000). Aside from an author's proclamation that a protocol is modular, what characteristics are central to a "truly" modular protocol? Generally, modularity refers to breaking complex activities into simpler parts that may function independently. More specifically, modules are self-contained functional units that connect with other units, but do not rely on those other units for their own stable operations. Modular designs have been described as consisting of visible design rules (i.e., standardized guidelines for how modules interact with each other) and hidden design parameters (i.e., features within modules that govern their internal operations; Baldwin & Clark, 1997). Modular designs have been contrasted with so-called *integral* designs that combine parts into a single functional whole (cf. Ulrich & Ellison, 1999). Integral designs are characterized by a high level of interdependence and minimal differentiation among parts. For example, a traditional therapy treatment manual written as a highly interconnected, cumulative narrative would be considered integral in nature. Removal of one piece of that integral design might render the remainder of the protocol deficient or unusable.

We define modularity to include four key properties:

1. *Partial decomposability* (cf. Simon, 1996) refers to the notion that a complex system may be at least partially divided into meaningful functional units (i.e., modules). For example, a treatment protocol may be partially decomposed into various types of units such as sessions, within-session activities (e.g., homework review), or therapeutic practices (e.g., relaxation, problem-solving, etc.). Although some division of this nature is possible with integral designs, the difference with modularity is that the subdivision results in units with highly similar form (e.g., sessions, skills, paragraphs, exercises).
2. *Proper functioning* signifies that the operation of each module in the design is expected to produce the intended result. For example, if a therapy protocol uses relaxation as an intervention to reduce autonomic arousal, a relaxation module with proper functioning would be expected to reduce client arousal. This implies that modules must have a specified purpose, and are not simply a subdivision

based on other considerations. For example, a therapy protocol designed to span four months might be divided into four units, involving similar content, with Unit 1 corresponding to the first month, Unit 2 to the second month, etc. This type of subdivision would not be modular in that the proper functioning of each module is not specified. Rather, in this example, the "modules" are simply subdivisions that structure how long to engage in each aspect of the protocol.

3. *Standardized interface* denotes that modules within the design connect or communicate with each other in a structured fashion. In the most basic sense, this property is similar to the property of children's "lego" building blocks—pieces are designed so that one can plug into the next. This property thus highlights that although independently structured, modules interact to produce a whole with better functioning than the sum of the parts, just as building blocks can make a house. Among other things, the standardized interface allows the ability to rearrange modules without problems regarding how they connect (e.g., performing "relaxation" before "exposure" versus "exposure" before "relaxation").

   The "connection" of therapy modules involves more than just their sequencing. It also involves the needed information exchange from one module to the next. For example, a module might begin with a homework review procedure. Upon completion, that module might organize the following information: (a) the module has concluded successfully, (b) whether the module involved the assignment of homework, and if so, (c) the content of and criteria for reviewing that homework. If there is a standardized interface, the subsequent module should be able to integrate this information into its own procedures. That is, next module would prompt the therapist to check on (a) whether the previous module was completed successfully, (b) whether homework was assigned, and (c) whether and how to review that homework. Thus, the *standardized interface* helps to specify how much and what form of information can pass among modules, and ensures more generally, that one module can connect with another.
4. *Information hiding* (Parnas, 1972) is also known as "encapsulation" and refers to keeping the specific details of operation entirely within a module. For example, a therapist using a protocol that includes a relaxation module would not need to know how that module works to use any of the other modules. The relaxation module could involve any number of strategies, such as breathing exercises, deep muscle relaxation, or pleasant imagery, but prior to selecting the module to use with a client, the therapist would only need to know that a module was available for the purpose of relaxation. Further, other modules elsewhere in the protocol would not be dependent upon the manner in which that relaxation was achieved. For example, if a module for practicing public speaking followed this relaxation module, the public speaking module might require that the client use previously learned relaxation skills, but the specific nature of those skills would not be outlined in the public speaking module (i.e., that information is "hidden" in the relaxation module). Keeping information self-contained in this manner allows great flexibility in the arrangement or interchange of modules. Thus, in this example, assuming information hiding, one could substitute a breathing module for a muscle relaxation module, without affecting the subsequent module for practice of public speaking.

When defined in terms of these properties, modularity is not an all-or-nothing feature of designs but can be described in degrees (Mikkola & Gassmann, 2003). Although variability exists, the current "industry standard" for an evidence-based treatment protocol tends toward a highly integral design.[1] In particular, most current designs commonly lack the properties of information hiding and standardized interfaces. That is, although many protocols can be sub-divided by sessions (i.e., possess partial decomposability), sometimes with well-defined purposes for each subdivision (i.e., possess proper functioning), these sessions usually contain details about other sessions (i.e., lack information hiding), and sessions are rarely designed to allow them to immediately precede or follow any other session (i.e., lack standardized interfaces).

1.2. Modular protocol components: content and coordination modules

Given these four defining principles, a further distinction is warranted in psychotherapy design between *content* and *coordination* modules. *Content* modules contain information related to therapeutic activities and are similar to procedural descriptions in typical therapy manuals. For example, a content module might contain the procedures for a therapist to train a client in how to be more assertive with others. That module would therefore consist of specific instructions, typical of many manualized protocols, detailing how the therapist should perform various activities and exercises with the client to achieve that goal. According to the principles of modularity, those instructions would need (a) to be a unit that function as part of a larger system (partial decomposability), (b) to be designed to bring about their intended aim of training the client to be assertive (proper functioning), (c) to possess a standardized structure that would allow it to precede or follow other modules in that larger system and would allow needed information about homework, goal attainment, etc. to be carried along smoothly from module to module (standardized interface), and (d) to have all of its operational details fully self-contained, so that the omission or rearrangement of other modules in the system would not affect it (information hiding). Thus, content modules are the building blocks of

[1] Although practitioners may report that they use integral manuals in a modular fashion, doing so does not make integral manuals modular. This use merely reflects the natural tendency of those clinicians to make decisions in a "modular" fashion, even when using integral protocols.

modular interventions that contain the detailed descriptions of therapy procedures.

Coordination modules, on the other hand, act as the cement that binds those building blocks together. Coordination has been described as "managing dependencies between activities" (Malone & Crowston, 1994, p. 90). Thus, *coordination* modules outline the algorithms for managing decisions about whether and when to use the various *content* modules. For example, a coordination module might instruct a therapist to select a relaxation module if the client has a high degree of muscle tension or to select a problem-solving training module if the client has poor problem-solving skills. These algorithms can be outlined in narrative form or can be outlined in form of flowcharts, depending on the design structure of the coordination module. Although a narrative detail of the clinical algorithm has the advantage of not requiring the definitions of symbols (i.e., a flowchart "legend"), a flowchart has considerable advantages in terms of its ability to reference other coordination modules and its ability to represent complex algorithms efficiently.

Coordination modules adhere to the same four principles of modularity outlined above. For example, they, too, should operate as part of a protocol that can be divided into independent functional units (i.e., partial decomposability). Coordination modules should specify a particular function (e.g., to manage the sequence and selection of content modules for Attention Deficit Hyperactivity Disorder; i.e., proper functioning). They should ideally have a structure that allows them to reference each other (e.g., allowing one flowchart to link to another one) as well as content modules (i.e., standardized interface). Finally, coordination modules should be self-contained such that they can operate independently (i.e., information hiding). For example, if properly self-contained, a "depression" coordination module that selects and organizes content modules ("seeking alternative solutions," "cognitive restructuring") to produce a cognitive behavior therapy protocol for depression (e.g., Beck, Rush, Shaw, & Emery, 1979) could be exchanged with a different "depression" coordination module with an algorithm that selects and organizes modules representing the basic elements of Interpersonal Therapy for Depression (Klerman, Weisman, Rounsaville, & Chevron, 1984). The therapist using the system would not need to know about the workings of the "depression" coordination module until that therapist treated a depressed client, and could simply assume that the necessary information for treating depression was contained therein if needed.

1.3. Multiple dependencies in the modular approach

Coordination modules have more to manage than initially meets the eye. Relationships among content modules involve contingencies or "dependencies," i.e., conditions that can limit or constrain the way modules are allowed to interact or connect. At least four types of dependencies seem directly relevant to therapeutic activities (Malone & Crowston, 1994), and these are outlined here.

1.3.1. Shared resources

The first dependency involves *shared resources* in therapy. Whenever two activities have the potential to use the same resource there is an implicit dependency that needs to be coordinated. In other words, if one activity needs a resource, and another activity requires the same resource, a decision needs to be made about sharing (e.g., whether the activities should "take turns," or whether one activity should be denied access to the resource). In therapy, the types of resources to be managed include direct service time, client memory capacity, therapy cost, office space, etc. For example, engaging in many therapeutic activities in a given hour might tax a client's capacity to remember the information, require more time than is available, etc. This can be managed by selecting and prioritizing modules for implementation (e.g., implementing a single module now, another one later, and so forth).

1.3.2. Task–subtask dependencies

Second, *task to subtask* dependencies exist in therapy, such that overall goals must often be decomposed into activities or subgoals. Any time one therapeutic activity must be performed as part of a larger set of activities, a dependency must again be coordinated. For example, if the goal to produce a decrease in anxious responding (i.e., the *task*) requires modules for psychoeducation, relaxation, and exposure (i.e., *subtasks*), and if knowledge of anxiety and relaxation skills are components of effective exposure, then selecting these modules and coordinating their order is essential.

1.3.3. Producer–consumer dependencies

Third, multiple *producer–consumer* dependencies exist in the therapy, where one activity produces something that is used by a subsequent activity. For example, a module for self-monitoring can yield such products as thought records, behavior records or narrative diaries. Such products might be needed for proper implementation of subsequent modules, such as self-reinforcement or cognitive restructuring, which presumably involve interpreting and acting on the contents of the records or diary. One procedure for coordinating producer–consumer relationships involves sequencing of modules to ensure that such prerequisite conditions are always satisfied.

1.3.4. Simultaneity constraints

Fourth, *simultaneity constraints* may exist when certain activities must occur together or may never occur together. For example, a module for response prevention might be constrained only to occur simultaneously with exposure, whereas therapy engagement and therapy termination modules would not be allowed to co-occur.

2. Example of a modular protocol

Our specific example of a modular psychotherapy protocol comes from an effectiveness trial sponsored by the John D.

and Catherine T. MacArthur Foundation (i.e., the "MATCH-ADC: A Modular Approach to Therapy for Children with Anxiety, Depression and Conduct Problems"). The MATCH protocol is designed to target anxiety disorders, depression, and disruptive behavior in children aged 8–13. As such, it contains modules that represent common cognitive behavioral and behavioral parent training strategies for these disorders. One part of the study design involves the comparison of integral, evidence-based interventions (e.g., Barkley, 1997) to a modular intervention system (i.e., MATCH; Chorpita & Weisz, 2003). The design of the MATCH protocol was intended to incorporate the principles of modularity, while employing the same basic therapeutic strategies as the comparison interventions. Developing original intervention content for the MATCH protocol involved a number of steps and considerations, which are outlined below.

2.1. Example: content modules

2.1.1. Addressing decomposability: defining and identifying discrete practice elements

To construct the *content* modules, we first developed a list of 55 discrete psychological procedures (i.e., "practice elements," Chorpita, Daleiden, & Weisz, 2005; Child and Adolescent Mental Health Division, 2003). These 55 practice elements were nominated by several panels of practitioners, intervention developers, and other domain experts, and were selected as those most likely to appear in evidence based protocols or in usual care services for youth. We defined a practice element as a clinical technique or strategy (e.g., "time out," "relaxation") that can be used as part of a larger intervention plan (e.g., a manualized treatment program for youth depression). This definition is based on the assumptions that (a) practice elements can be explicitly defined (e.g., using a definition or coding manual), (b) their presence within psychological interventions can be reliably coded, and (c) different treatments may have practice elements in common. Because "modules" and "practice elements" can each refer to discrete therapy procedures, it is important to clarify that "practice elements" describe the strategies themselves, and imply nothing about the design features of how those strategies are codified. Thus, practice elements can be identified just as easily in integral protocols as in modular protocols [e.g., "cognitive restructuring" is a practice element in an integral CBT protocol for depression (Beck et al., 1979) and in the modular MATCH protocol]. On the other hand, a module is best thought of as a structured "container" that can contain one or more practice elements (e.g., the first module of the depression portion of the MATCH protocol contains the two practice elements of "engagement" and "rapport building").

Next, the content of the integral comparison protocols (e.g., "Defiant Children," Barkley, 1997; "Coping Cat," Kendall, Kane, Howard, & Siqueland, 1990, "Primary and Secondary Control Enhancement Training-PASCET," Weisz, Weersing, Valeri, & McCarty, 1999) was coded with respect to the practice elements used. This resulted in the identification of 29 practice elements. The 29 elements included some that were appropriate across different treated conditions—e.g., rapport building appeared in two protocols, and family engagement appeared in two protocols. Other practice elements were appropriate only for anxiety—i.e., child psychoeducation for anxiety, parent psychoeducation for anxiety, self-monitoring for anxiety, exposure, cognitive/coping for anxiety, and maintenance for anxiety skills. Other practice elements were appropriate only for depression—i.e., child psychoeducation for depression, parent psychoeducation for depression, problem solving, activity selection, skill building, social skills training, cognitive/coping for depression, and maintenance for depression skills. Another set of practice elements was appropriate only for treatment of conduct problems via behavioral parent training—i.e., parent psychoeducation for disruptive behavior, parent monitoring for disruptive behavior, limit setting, parent praise, selective attention, tangible rewards, time out, antecedent control, and maintenance for parenting skills.

Once these elements were identified, their functions were designed into discrete modules. For example, a "getting acquainted" module was constructed to reflect the practice element of relationship/rapport building. This module was applicable to both anxiety and depression conditions in the MATCH protocol. In some instances, practice elements that were highly integral in the comparison protocols (e.g., the use of rewards, which showed up in multiple sessions in all of the integral comparison protocols), were designed as a single module that could be accessed for any treatment condition as needed.

2.1.2. Addressing standardized interface and proper functioning: using templates and meta-data

Next, templates were developed to standardize the form of the modules and to provide the therapist with a consistent "look and feel" across all treatment conditions. This type of standardization is one of the core properties of modularity, and allows for the therapist to move freely from one problem area to another without experiencing a disruption in module format. The MATCH template included: a statement of objectives, a list of needed materials, and prompts to therapists to obtain a measure of progress, review homework, introduce new material, rehearse new material, assign homework, perform a rapport-building activity, and brief the family. Just as not every treatment case was expected to involve all modules, not every module was expected to include all parts of the template. For example, "review of homework" would not be an appropriate template entry for a module selected as the first therapy session. A partial illustration of a module from the MATCH protocol is presented in Fig. 1, which follows the template for many of the common activities outlined above.

A separate part of the template involved outlining the module "meta-data," or information about the module itself (ADL, 2003). Examples of meta-data include a list of the

Activity Selection

Objectives

1. Review and/or complete previous session lessons and practice assignments, discussing what the child did and learned.
2. Etc.

IF TIME IS TIGHT:

Your MAIN OBJECTIVES are to convey the link between our activities and our feelings and to help the child brainstorm a list of activities that he/she could do to feel better.

Materials

Therapist Record Form
Practice Worksheets for **Activity Scheduling**
Etc.

Weekly Ratings

Obtain the appropriate ratings from both the child and his/her parent(s). The rating obtained should correspond to the child's target area of concern and reason for referral…etc.

Review of Practice Assignment

Review with the child his/her experience with practice assignment(s) since the previous session, working to ensure that … etc.

Procedures

1. Discuss with the child that in this session, you will focus on four types of **activities**: (1) activities that I enjoy, (2) activities with someone we like, (3) activities that keep me busy, and (4) activities that help someone else.
2. Etc.

Leave 'Em Laughing

Close with some really funny, or enjoyable activity—something that will leave the child either laughing or feeling great.

Etc.

Briefing the Parents

At the end of this session and all other sessions, it is helpful to bring the parent in…. etc.

NOTES FOR THE THERAPIST

If you believe that focusing on or increasing activities with someone I like would be especially beneficial for the child…

Fig. 1. An abbreviated content module for childhood depression.

template contents (including number and type of exercises, role plays, etc.), a statement of conditions of use and expected functioning (see modularity property 2, above), sequencing constraints (whether a module needs to co-occur with another module, or be used at a particular point in a protocol), information transfer parameters (e.g., whether and what type of homework was assigned, as well as any other things that would require information to be obtained from prior modules or preserved for subsequent modules; see modularity property 3, above) application boundaries (e.g., age range, cultural limitations), ownership/authorship, references, and annotations. When catalogued, meta-data can be useful by allowing modules from different designers to be combined in future design efforts, without a loss of understanding of the origins, intentions, and general characteristics of each module.

2.1.3. Addressing information hiding: designing independence into the modules

One challenge that had to be addressed involved designing protocol content that was similar in intended therapeutic function without the explicitly cumulative material common to evidence-based manuals organized according to integral design principles. For example, a psychotherapy manual might introduce cognitive restructuring skills early in the protocol, and then review those skills repeatedly in all sessions that follow. Each session, therefore, might have traces of what could constitute many prior modules. One solution used in the design of the MATCH manual involved building conditional checks into modules that might reference other modules. For example, the module for in vivo exposure asks the therapist to check whether any cognitive modules have previously been covered. If so, exposure is to be performed with some additional enhancements, namely, cognitive exercises (from an earlier module) to precede or follow each exposure trial (e.g., the child might make a list of negative predictions prior to the exposure trial, counter those predictions before and during the exposure trial, and review the accuracy of those predictions after the exposure trial). Otherwise, in vivo exposure is performed alone. Such obstacles might not be pronounced when designing in a modular format without having to match strategies with an existing integral protocol as in our effectiveness trial design. However, such challenges force designers in any case to consider the full range of possibilities of what might come before or after any module, and to specify explicitly what information should transfer across modules (e.g., homework content, skill sets to be repeated indefinitely, etc.).

Sometimes repeated review of skill sets requires skill enhancement upon each performance. For example, in the MATCH module for "building talents and skills," youth are asked to pick a skill and work on it as part of a long-term plan. This requires weekly action on the part of the child, and thus weekly review of the plan by the therapist. Describing this cumulative process in the homework review sections of all other modules would be prohibitive, especially given that many modules besides the "building talents and skills" module involve cumulative homework. The solution was thus to make each homework review in other modules refer back to all previous homework and to consider whether cumulative assignments are active.

Another example of avoiding traditionally cumulative design in favor of modular format involved in vivo exposure. Rather than specify multiple sessions that involve exposure of increasing intensity or complexity, all in vivo exposure in the MATCH protocol is delivered through a single module that was to be repeated until an intensity or complexity criterion was met. This module was therefore written to account for the fact that it might be the child's first exposure exercise, the last, or somewhere in between. The "notes for the therapist" at the end of the exposure module were consequently designed to provide guidelines for the different circumstances under which exposure would occur and for the selection of increasingly challenging stimuli as part of the exercises.

Yet another issue encountered in the design of the MATCH manual involved how to effectively use characters or mnemonic acronyms. For example, in the anxiety manual selected for the clinical trial (Kendall et al., 1990), the homework review is described as a "Show That I Can" (STIC) Task. The homework review in the PASCET depression manual does not use such an acronym. Because any such acronym would have to work universally across all modules, such an acronym was not designed for the MATCH manual.

Similarly, some sessions from the integral PASCET depression protocol use an acronym that connects all of the session materials together. Because modular delivery might mean that some children do not receive every module, many of the modules were instead given internal acronyms. For example, in the integral version, one of the cognitive therapy modules contained three techniques denoted by the letters "H-I-N" ("Help from a Friend," "Identifying the Silver Lining," "No Replaying Bad Thoughts"), which fit together into the work "THINK" when performed in sequence with other sessions. Consistent with the principle of information hiding, this acronym was changed to "F-U-N" ("Friends Who Can Help," "Understanding the Silver Lining," and "No Replaying Bad Thoughts"), so that it would stand alone if that module were delivered in isolation or in a different sequence than specified in the integral PASCET manual.

Similar issues arose with themes and characters. For example, the cat character and theme from the integral anxiety manual (Kendall et al., 1990) created challenges for modular design that prohibited building this type of explicit theme into anxiety portion of the MATCH manual. Although an obvious way to handle this issue is to remove these devices from the protocols altogether, that solution may forfeit some useful and engaging properties of the therapy. An alternative strategy, and one deployed in the design of the MATCH manual was to encourage the selection of an individualized character, whose consistent appearance and involvement with the therapy material is managed by the therapists and prompted within various modules. Thus, one child might have a preference for a dolphin, another for a dog, and another for a tiger. Each would select or articulate a character early in the protocol, and the therapist would use this character and theme to illustrate various aspects of the protocol.

2.2. Example: coordination modules

A second aspect of the protocol that was designed for the MATCH manual was the procedure for deciding whether and when to implement its content modules. The selection of content modules was guided by algorithms that represent conventional clinical applications of cognitive behavior therapy or behavioral parent training (akin to formalizing prescriptive treatment decisions; e.g., Beutler & Harwood, 2000; Persons & Tompkins, 1997).

The coordination modules designed for the MATCH manual have important parallels with the content modules described above. Just as content modules may use a *template*

to represent *practice elements*, coordination modules may use a *flowchart* to represent an *algorithm*. Thus, the process of coordination module design was similar to that of content module design: in the same manner that we coded for practice elements and then designed therapy content which was outlined in standardized templates, so too we identified traditional therapy algorithms, and then outlined these in standardized flowcharts. For example, the MATCH coordination module for depression contains a flowchart that selects behavioral modules first (e.g., "problem solving," "activity scheduling") and then progresses to cognitive modules (e.g., "cognitive restructuring").

The final result was that the MATCH manual contained one high-level coordination module, which linked to three problem-specific coordination modules (i.e., one each for anxiety, depression, and conduct problems). The therapist therefore uses the initial high-level coordination module (see Fig. 2) to make an initial decision about the primary problem of the youth. If the problem is anxiety, the therapist is instructed to reference the anxiety coordination module, which contains a flowchart outlining the algorithm for the anxiety protocol. If the problem is depression, the therapist is guided to the depression coordination module, which contains a flowchart for the depression algorithm, and so forth.

Similar to how we defined narrative headings for the templates in the content module templates (e.g., "homework review," "role-play"), we also outlined the legend of symbols for flowcharts found in the coordination modules. The rectangles with rounded corners ("Begin," "End") represent entry and exit points into the algorithm. The diamond ("Already in treatment?") represents that a yes or no decision must be made regarding the question within. The rectangles ("Conduct Initial Assessment," "Conduct Brief Assessment") represent content modules that outline specific instructions for performing therapeutic procedures. The triangle ("Primary problem area") indicates that a decision must be made to select one of multiple options and the circles ("Disruptive Behavior," "Anxiety") represent criteria for the decision. Finally, the chevrons (e.g., "Depression Flowchart") indicate that the therapist should refer to another coordination module.

Coordination module meta-data was also outlined, and included a flowchart legend, a list of referenced modules, a statement of conditions of use and expected functioning (see modularity property 2, above), information transfer parameters (e.g., whether specific assessment information such as type of anxiety disorder should be indexed in a subsequently referenced coordination module; see modularity property 3, above), application boundaries for the algorithm (e.g., age range, cultural limitations), ownership/authorship, references, and annotations.

In terms of their algorithms, the problem-specific coordination modules each specify the set of practice elements, or content modules, along with their rationally determined arrangement. Fig. 3 shows the final algorithm for the MATCH depression coordination module, and offers an illustration of the different possible arrangements of content modules. In a classic article that helped launched the structured programming movement in computer science, Bohm and Jacopini (1966) showed that the three procedural constructs of sequencing (do A, then B, then C), alternation (either do A or do B), and iteration (repeat A until condition is satisfied) are sufficient to represent almost all arrangements of activities. Accordingly, these constructs may serve as the core elements in understanding coordination modules. For example, the first two modules in Fig. 3 illustrate the procedural construct of sequencing with "parent monitoring" starting upon completion of "self monitoring." The "able to proceed" diamond is a yes or no decision representing an alternation procedure. Specifically, the therapist either proceeds to the primary therapeutic sequence or implements procedures for handling therapeutic interference. Finally, the "module complete" diamond represents an example of an iteration procedure, wherein the practice element continues until a condition (i.e., "module gains complete" or "unable to proceed") is met.

This illustration is far from an exhaustive display of all possible combinations and arrangements of psychotherapy content; indeed, it illustrates only a fraction of even those procedural constructs found within the MATCH manual. The point is that the algorithms for coordinating psychotherapy content can be outlined according to a set of definable rules, just as is true of the narrative representation of practice elements in content modules.

These algorithms provide an excellent illustration of the information-hiding quality of modular design. If a problem-specific coordination module (e.g., Fig. 3) was found to be flawed (e.g., implementing relaxation was never associated with clinical improvement beyond that produced by other content modules for depression), a portion of that problem-specific coordination module could be reordered or deleted completely without affecting the other coordination modules (e.g., anxiety flowchart) or the other content modules (e.g., "psychoeducation for child"). In that sense, coordination modules follow the same rules regarding standardized interface (modularity property 3, above) and information-hiding (modularity property 4, above) as do the content modules.

3. Evaluation of modular design: efficiency, effectiveness, and efficacy

Having reviewed a concrete illustration of a modular psychotherapy design, we will now evaluate the qualities of modular design principles relative to integral treatment design. The relative strengths and weaknesses of integral versus modular designs have already been discussed in some detail in various business and engineering contexts (e.g., Baldwin & Clark, 1997; Garud & Kumaraswamy, 1995; Mikkola & Gassmann, 2003; Parnas, 1972; Ulrich & Ellison, 1999), and to provide background these are briefly reviewed here first.

Some of the identified strengths of integral designs in contexts other than psychotherapy are as follows: (1) much of the

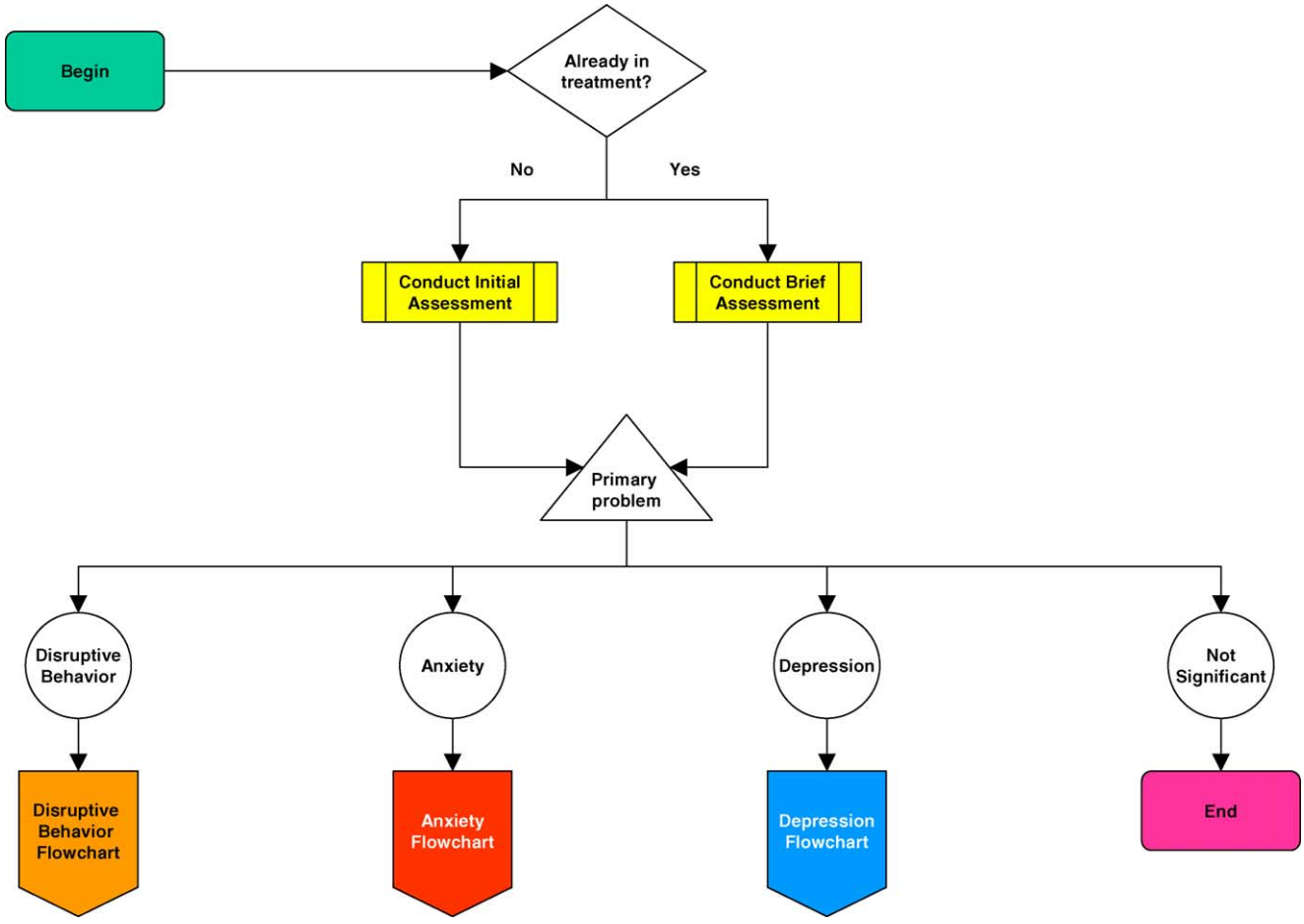

Fig. 2. Example of a high-level coordination module.

design work need not be allocated to developing templates or standardized guidelines for how modules should interact with each other, thus saving time and materials; (2) integral products can be streamlined, because there is no need to ensure that they can be disassembled into standardized parts (e.g., compare a common mail truck with a tractor-trailer); (3) integral designs can also provide for superior access to information, because any time a feature is needed, it is designed in directly, as opposed to having that single feature indexed or accessed from multiple places (e.g., a how-to book that repeatedly puts both English and metric amounts in the instructions, versus one that references a conversion table); (4) integral designs emphasize craftsmanship and form over function, given fewer constraints than would be required by modularity (imagine a traditional versus a modular couch); (5) they promote systemic innovation rather than incremental improvements by encouraging redesign of entire products rather than innovation of parts (compare single-lens cameras with those having interchangeable parts); (6) by that same logic, integral designs can protect innovations from imitation, and create high barriers for competitors who wish to enter the market (e.g., consider the two major traditions of desktop computer design); and (7) they similarly can increase market volume by making it difficult for consumers to select some parts but not others (e.g., consider the "extra value meal" versus ordering *a la carte*).

Among the many strengths of modular design are shortened development time and ease of incremental improvements, through the availability of standardized components. For example, a new product can be designed that uses many readily available modules in conjunction with one or two new modules (e.g., much modern software, updated through patches rather than installation of a revised version). Similarly, modular design promotes increased product flexibility and variety, by allowing for the rearrangement or combination of the existing module set (e.g., a rolodex versus a bound address book). Modular design facilitates rapid comprehensibility because components can be studied one module at a time (e.g., a box of recipe cards versus a narrative cookbook). Modular design incorporates efficiency through the reuse of modules, and reduced inventory and logistic expenses, in that many products can be built from a smaller number of parts (e.g., consider the greater variety of storage and placement options with modular shelves versus a single all-in-one shelf unit). Finally, modularity can promote improved system reliability due to higher production volume supporting greater experience with components (e.g., compare assembly line production with custom, start-to-finish designs). Many

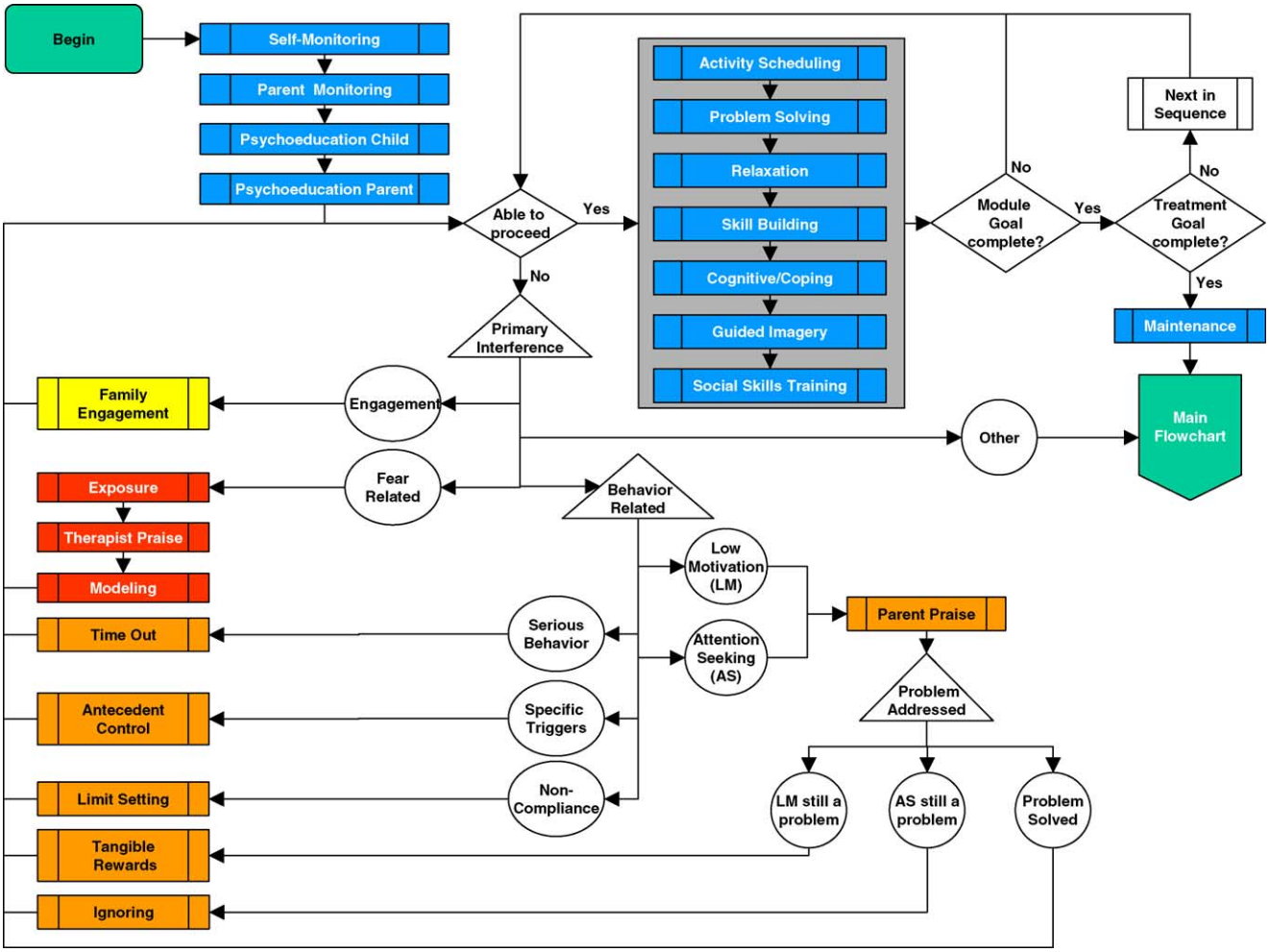

Fig. 3. Example of a problem-specific coordination module for depression.

of these strengths of modular designs that have been noted in industrial and business contexts may also be realized in the context of psychotherapy development.

To elaborate these benefits in a framework familiar to psychologists, we apply the notions of efficacy, effectiveness, and efficiency to the psychotherapy design context. As a starting point for this discussion, we offer the following rudiments. *Efficient* designs should be relatively parsimonious (include only the material that is necessary), comprehensive (apply to a broad class of psychotherapy problems), reusable (incorporate some interchangeable parts), fault tolerant (tolerate interruptions and unanticipated events without compromising progress), and cost-effective (i.e., benefits outweighing costs). *Effective* interventions are believed suitable for real-world problems because of their demonstrations of high feasibility and/or generalizability (Task Force on Psychological Intervention Guidelines, 1995), and the same is true of *effective* designs. Specifically, they should be scalable (integrate a framework for adaptation and generalization to different circumstances), transportable (readily implemented in new settings), and satisfying (elicit therapist or client satisfaction). Finally, much in the way that efficacious interventions should produce reliable, internally valid evidence of their ability to yield positive outcomes, efficacious designs should similarly produce working solutions to targeted problems.

3.1. *Efficiency of modularity*

3.1.1. *Parsimony*

A pilot demonstration by Chorpita et al. (2005) illustrated the potential efficiency of using modules to summarize treatment protocols. Specifically, a set of 49 protocols for childhood disorders classified as evidence-based using structured criteria (APA Task Force on Dissemination of Psychological Procedures; Chorpita et al., 2002) could be reduced to a set of approximately 20 practice elements. Further, within particular problem areas, multiple protocols could be reduced to an even smaller set of common elements (e.g., coding across 25 anxiety protocols showed a common set of approximately six practice elements). Were such practice elements represented in modular form, one could approximate the implementation of these 25 anxiety protocols through just a few different coordination modules.

Although modularity might show considerable potential for data reduction in this context, it carries the potential for greater complexity when viewed in an individual protocol-to-protocol design comparison. A "typical" manualized treatment reads like a linear recipe for how to provide a therapy program. Although a modular protocol could replicate a linear manual, our vision of a "typical" modular protocol does not. A modularized protocol reads like a tool kit of practice options that are organized by a collection of flowcharts guiding the user through their selection. When the other potential benefits of modularity are ignored, the linear, integral recipe could seem more user-friendly to treatment professionals The efficiency of modular design becomes most pronounced when multiple protocols are represented in a single treatment *system*, allowing for redundancies in content to be addressed (e.g., both a depression protocol and anxiety protocol could share a relaxation module—thus, the clinician need not learn a different relaxation strategy for each different protocol). In that sense, modularity is better viewed as a parsimonious approach to a treatment *system* rather than as a parsimonious approach to any one treatment program or protocol.

3.1.2. Comprehensiveness

Modular design yields the potential to address diverse variations in treatment targets. Using a counting rule for ordered combinations (assuming that order and not simply content is important) shows that the number of 10 session interventions drawn from a library of only 15 modules is nearly 11 billion (i.e., $15!/(15! - 10!)$). If certain orders are not possible (e.g., due to simultaneity constraints), the lower limit of distinct modular contents for an intervention is still over 3000 [assuming a counting rule for non-ordered combinations; i.e., $15!/10!(15! - 10!)$]. Of course, a large portion of these protocols would likely be of little incremental value. Nevertheless, such design potential would be able to replicate all existing 10-element integral protocols based on the same 15 practice elements, and would likely yield some new combinations of that could address variations of treatment targets. For example, the exchange of one new practice element for another in a protocol for eating disorders might yield a variation more suitable for a certain subset of clients with eating disorders, thus increasing the versatility of existing protocols.

The potential challenges associated with such prescriptive matching have already been discussed above. However, it should be noted that all current interventions are already prescriptive at some level of abstraction, so prescription is not the issue at hand. For example, most manualized treatments require matching of the intervention to a target problem or diagnostic area (i.e., use manual X for disorder Y). Such a level of matching can be maintained with a modular design, while allowing for a new level of prescription at the level of techniques (i.e., use module A for problem feature B). By making these prescriptive assumptions behind existing protocols more explicit, modularity can efficiently allow the evaluation of more assumptions about treatment matching and design, and potentially yield advances in the comprehensiveness of interventions more generally.

3.1.3. Reusability

Modular design can preserve particular elements of psychotherapy techniques found to be highly useful, while revising or designing new protocols. Some techniques are handled in this manner under current design strategies. For example, a variety of relaxation techniques (e.g., Deffenbacher, Lynch, Oetting, & Kemper, 1996; Laxer & Walker, 1970) emanate from Jacobsen's (1938) description of the technique. In a modular context, such a relaxation module could be inserted seamlessly into any protocol seeking to incorporate relaxation, without requiring developers of each new protocol to construct a new description of relaxation (or even to rewrite an old one). Over time, such development might allow for an accumulation of particularly effective modules, whose combinations and arrangements with newer techniques could be continually tested and refined.

This reusability aspect also allows for the efficient incorporation of therapy innovations. The psychotherapeutic knowledge base is rapidly expanding, and ongoing revision to treatment protocols should be expected. However, given that treatment developments are likely to be incremental, modular treatment design provides a structure for integrating new developments. Based on the specific modular framework we presented here, one can easily see how the development of new techniques could be integrated by generation of new modular content. Similarly, improvements in decision-making knowledge could be integrated by generation of new coordination modules. When these innovations are identified, a whole new treatment system would not need to be developed and implemented. To the degree the literature can advance psychotherapeutic activities and inferences, modular protocols can provide a means of rapidly incorporating these incremental innovations.

3.1.4. Fault tolerance

From the perspective of design and development, one of the major benefits of modularity is the *preservation of intermediate states of development*. This means that when an instruction set such as a psychotherapy manual is changed or adapted, it need not be completely dissolved and designed anew. In his articulation of a theory of design organization, Simon (1996) emphasized the importance of this partial decomposition of a full design into semi-independent functional parts. Were one to apply this notion to psychotherapy procedures, it would mean that interventions could be broken down into individual units or techniques that could be combined in different ways. Those combinations might create sets that could then be combined with other sets, and so forth. This hierarchical "tree structure" of design is the basis for avoiding complete decomposition in efforts to adapt or innovate existing instruction sets. Rather, portions could be preserved, and components or sub-components could be removed, added, or independently modified.

Simon (1996) illustrated this notion with the following "Watchmaker" parable:

There once were two watchmakers, named Hora and Tempus, who manufactured very fine watches . . . The watches the men made consisted of about 1,000 parts each. Tempus had so constructed his that if he had one partly assembled and had to put it down . . . it immediately fell to pieces and had to be reassembled from the elements. [Hora] had designed them [his watches] so that he could put together subassemblies of about 10 elements each. Ten of these subassemblies, again, could be put together into a larger subassembly; and a system of ten of the latter subassemblies constituted the whole watch. It is rather easy to make a quantitative analysis of the relative difficulty of the tasks of Tempus and Hora: suppose the probability of an interruption will occur, while a part is being added to an incomplete assembly is p. Now if p is about 0.01 . . . We arrive at the estimate as follows:

1. Hora must make 111 times as many complete assemblies per watch.
2. Tempus will lose on the average 20 times as much work as Hora.
3. Tempus will complete an assembly only 44 times per million attempts . . . Hora will complete nine out of ten. Tempus will have to make 20,000 as many attempts per completed assembly as Hora (Simon, 1996; pp.188, 189).

Although this numerical example was not intended as a serious quantitative estimate of the relative efficiency of hierarchical designs, it calls to light the powerful effect that stable intermediate states can have on the evolution of complex systems. Again, as will be argued below, such design principles have significant advantages for psychotherapy design and innovation.

In the psychotherapy design context, integral designs have less stable intermediate design states. For example, any time an integral manual needs to be changed, the entire manual needs to be examined from beginning to end, because of the lack of information hiding and standardized interface. Removing one session from an integral protocol might affect many later exercises in other sessions—so, like the watch, it must be recreated from a much earlier design state. In modular design, these contingencies are handled at the outset of design, so that deleting a single module should not require re-examination of any of the rest of the modules. In fact, the deletion needs only to be noted in the coordination module—the content module need not even be omitted from the protocol, but can remain as an "orphan module" that is never accessed.

3.1.5. Cost-effectiveness

At present it is unclear whether the benefits associated with modular treatment development will outweigh the costs. More research is needed on whether modular treatments are efficacious, on whether the complexity of the designs bears additional costs that are not sufficiently offset by the other efficiencies associated with modularity.

3.2. Effectiveness of modularity

3.2.1. Scalability

Scalability refers to the ability to increase or decrease a particular property of the protocol as part of the design process. For example, treatment length could be scaled, such that the protocol dictates a course of treatment that is long or short. Content can be scaled, such that the protocol can dictate which procedures (modules) are allowed and which are not. Logic can be scaled, such that the protocol can allow for many conditional decisions (e.g., "if no progress is observed, skip to module B") or few conditional decisions.

Scalability is not to be confused with flexibility. Scalability refers to adaptability of a protocol during its design; whereas flexibility refers to adaptability of the protocol during its delivery. A modular treatment – which is implicitly scaleable – can be inflexible, so long as its coordination modules dictate a linear relation of content modules with a minimum of choice points. And similarly, flexible treatments need not be modular and hence scalable. For example, Jacobson et al.'s (1989) protocol for flexible marital therapy does not possess discrete units meeting the four principles of modularity outlined above, nor does Multisystemic Therapy (Henggeler, Schoenwald, Borduin, Rowland, & Cunningham, 1998), yet both involve a great deal of flexibility and individualization in their delivery. Flexibility is best thought of as a property of therapy that itself is scalable (i.e., protocols can be designed to be highly flexible or highly inflexible), and modular protocols possess the ability to scale flexibility to be higher or lower during protocol design.

To further illustrate the notion of scalability, it is possible to represent the implicit algorithm underlying the integral PASCET manual for depression (Weisz et al., 1999) in a coordination module (see Fig. 4). The PASCET manual specifies that the therapist proceed from the first practice element to the last one, in straight sequence. No decisions to change the order or content of treatment are part of the implicit algorithm of the PASCET manual. In Fig. 5, the algorithm of the manual can be rearranged to allow the protocol to omit content selectively following successful completion of at least six practice elements (i.e., self-monitoring, parent monitoring, psychoeducation, and parent psychoeducation, activity scheduling, and maintenance). Successful completion would occur upon determination that the treatment goal has been attained. This protocol also allows for unsuccessful termination after administration of at least four modules. Thus, Fig. 5 demonstrates the use of a coordination module to scale the same set of therapeutic content with respect to treatment length.

Of course, one can go further to scale on the dimension of therapeutic content. The final depression coordination module chosen for the MATCH manual (see Fig. 3) specified not only changes to the original PASCET algorithm

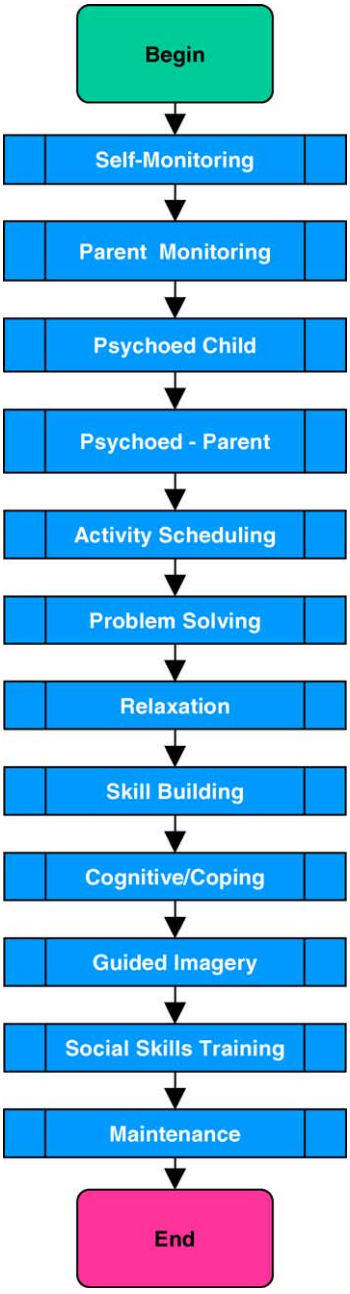

Fig. 4. A problem-specific coordination module corresponding to the standard PASCET algorithm.

in terms of treatment length, but also added a set of procedures for coping with therapeutic interference (e.g., a child's behavior becomes too disruptive at home to continue the cognitive behavioral regimen). The specific interference procedures were selected from the set of modules developed for problems in other evidence-based protocols (e.g., for disruptive behavior or anxiety). This allowed for a conditional "mixing-and-matching" of supplemental modules necessary to promote completion of the depression protocol (e.g., introducing a token economy or a time out procedure).

Given this kind of scalability, modularity can be seen not so much as an adaptation of the integral manual itself, but rather as a framework allowing adaptation across a variety of dimensions (e.g., content, length, flexibility). Thus, an advantage of modularity in general is that it provides an *explicit framework for adaptation*, without automatically dictating the adaptation of an existing protocol. Research strategies could easily be deployed to test whether gross variations in order, content, or logic of the intervention lead to differential efficacy, and empirically informed revisions to the protocol could be quickly deployed.

When moving beyond laboratory-based intervention design, this notion of adaptability becomes increasingly important. In general, the literature supports the idea that core technologies in many fields are adapted when put into use in the field (e.g., Rogers, 1995). Weisz's (2004) Deployment Focused Model argues that optimum intervention design requires evolution of a protocol based on interplay between the intervention program and the context in which it is to be deployed; this model makes a case for the idea that adaptation of psychological interventions is critical to their uptake and effectiveness in clinical contexts. That said, minimal research exists to date to suggest what types of adaptations are needed, and which adaptations might threaten the efficacy of a protocol. Nevertheless, whether or not we agree that adaptation may be of value, modularity provides a suitable context for adaptation if needed, and imposes few costs if adaptations are not needed.

In light of these properties, one challenge posed by modularity is that of complexity. In particular, modular protocols that use a flexible algorithm might introduce errors due to excessive reliance on clinical judgment. As alluded to above, this is not a problem with modularity itself, but rather with the notion of prescription or flexibility in treatment. Further, as mentioned above prescription is already a rather common feature of existing psychotherapy protocols, with the principal difference being that the prescription occurs at the level of the main problem or disorder (i.e., matching diagnosis or primary problem area to treatment protocols; Task Force on the Promotion and Dissemination of Psychological Procedures, 1995), and does not take into account potential individual differences that might warrant modification of the protocol. Thus, it is not even prescription per se that is the problem, but more likely the fact that decisions regarding flexible versions of modular treatments would require empirically informed and reliable decision rules, just as reliable psychiatric diagnosis is currently required to prescribe many psychotherapy manuals. The complexity remains, however, in that the evidence base required to inform decisions at a greater level of specificity is largely absent (e.g., how to treat depressed men versus depressed women, or anxious children without comorbidity versus anxious children with various kinds of comorbidity). Without such data, flexible treatments – whether modular or not – have the potential to introduce problems related to the requisite clinical decision-making. Although such protocols could possibly still be effective, it is likely that they can be further improved as the evidence base on client by treatment interactions becomes better developed.

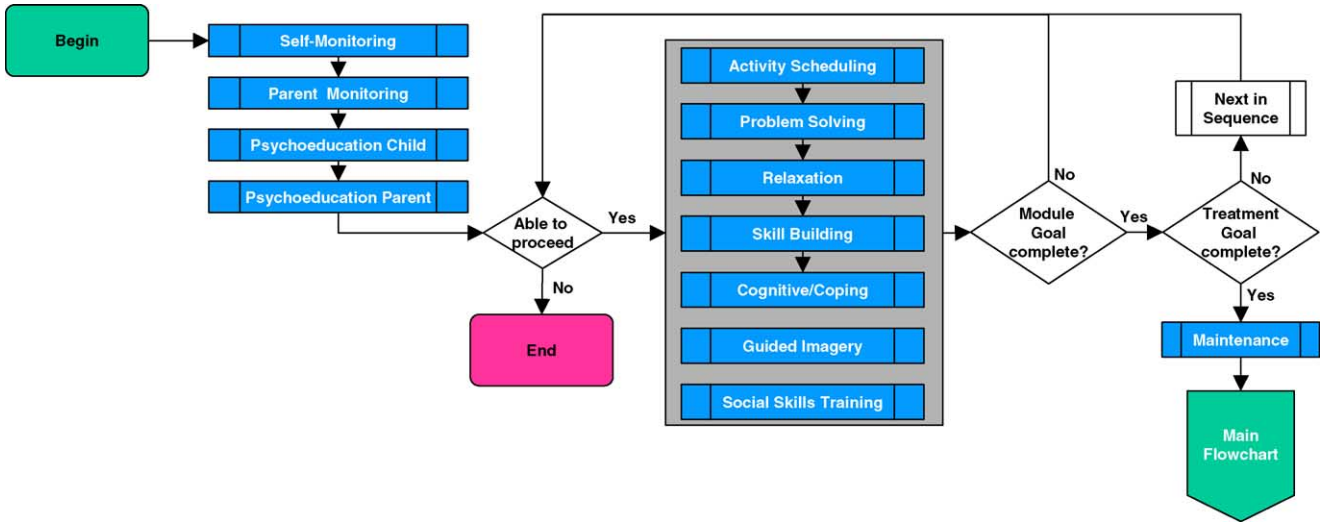

Fig. 5. A problem-specific coordination module corresponding to the PASCET algorithm, adapted for variable protocol length.

3.2.2. Transportability

Modularity can allow for rapid adaptation of a protocol for new contexts, thus increasing transportability. For example, a change to the protocol to match the intervention to a new target population (e.g., children versus adults; males versus females) could presumably tailor embedded behavioral rehearsal exercises or role-plays to the client by selecting from a library of possibilities, while preserving the other elements of the modules or session structure. The potential for transfer of protocols from one context to another is therefore greatly enhanced.

In a similar manner, this transportability has important implications for research. As noted by Kazdin, Bass, Ayers, & Rodgers, (1990), the notion of discovering which interventions work for whom and under what conditions requires a greater understanding of *why* interventions work (Kiesler, 1966). For example, does Panic Control Treatment (Craske & Barlow, 1993) for adults with panic disorder work because of its inclusion of breathing retraining, interoceptive exposure, or cognitive restructuring, or perhaps some combination (Barlow, Allen, & Choate, 2004)? Such research questions are more easily addressed in the context of modularity, which provides adequate controls for content and ensures that minimal problems will arise as a consequence of omission or reordering of particular pieces of the program.

One of the greatest potential benefits related to transportability of modular protocols can be seen in the context of clinical training. As we noted above when discussing the parsimony of modular designs, because different treatment protocols share common practice elements, the collection of practice modules is likely to grow more slowly than the collection of protocols. In the extreme case where a new protocol only involves a reordering of practice modules, training could focus on teaching a single new decision algorithm rather than say 16 new therapy sessions. The explicit identification of decision algorithms may make these rather abstract and covert processes more amenable to training, monitoring, and supervision. As noted above, the modular structure we illustrate here provides a framework to help users incorporate new practice modules and new decision rules without needing to learn a whole new treatment system. The existence of a schema to which incremental knowledge is added should facilitate the transfer of practice knowledge and innovation (e.g., Owens, Bower, & Black, 1979).

3.2.3. Satisfaction

Some preliminary data from a study in progress (e.g., Francis & Chorpita, 2003) showed promising findings regarding therapist satisfaction with modular procedures. The sample included 16 community therapists and 21 graduate trainees participating in a study on modular application of therapy procedures. Specifically, 83.3% of the combined sample agreed or strongly agreed that a modular approach to therapy was "very applicable to cases in clinical practice," whereas among that same group only 50% agreed or strongly agreed that a traditional (i.e., integral) manualized approach to therapy was "very applicable to cases in clinical practice." Similarly, 58.5% of the sample rated a modular approach as "more applicable to clinical cases" than traditional approaches, whereas 7.3% rated traditional manuals as more applicable to clinical cases than a modular approach. Obviously, more formal data regarding therapist satisfaction need to be collected, particularly data that are based not just on first impression but rather on continued experience with modular design.

3.3. Efficacy of modularity

Because modular designs can recreate manualized treatment protocols, in principle, they should be no less efficacious than traditional integral designs. There is the possibility that modular design could enhance efficacy, assuming that individualization in some contexts could increase the magnitude or the speed of the effects of a protocol. However, efficacy

likely results from a combination of the design structure (e.g., modular versus integral) and the design content. The structure in and of itself will not solve any problem without efficacious content.

That said, there are emerging data that modular designs can meet sufficient efficacy criteria to warrant further research and development (e.g., Chorpita, Taylor, Francis, Moffitt, & Austin, 2004). In this recent study, Chorpita et al. (2004) demonstrated positive outcomes for seven youth with anxiety disorders in an experimental, multiple-baseline design. Diagnoses represented in the sample included separation anxiety disorder, generalized anxiety disorder, panic disorder with agoraphobia, specific phobia, anxiety disorder not otherwise specified, major depression and trichotillomania. For all seven youth, primary diagnoses as measured by a semi-structured interview were absent at post treatment and 6-month follow-up assessments, and measures of anxiety symptoms and life functioning almost uniformly evidenced clinically significant improvements.

4. Conclusions

A final point worth noting is the argument concerning whether module content is all that is important. For example, the modular approach to design – as described so far – emphasizes specific clinical strategies as the "main ingredients" of psychotherapy, so to speak. Reasonable evidence exists to challenge this notion, for example in the literature on therapeutic relationship (Norcross, 2002). It should therefore be emphasized that representing therapy content as a division into practice elements and coordinating algorithms is not the only way to conceptualize the enterprise of therapeutic intervention and package it into modules. Other representations are possible that could yield a rather different example, yet could still be modular in nature (e.g., developing modules to represent therapeutic processes or relationships rather than specific clinical strategies). Decisions regarding which aspects of therapy (e.g., process, strategy) are most important for achieving its goals are somewhat orthogonal to the potential benefits of modularity in design. Such decisions will likely remain the subject of great debate in the field.

That said, modularity as a design principle appears to provide a promising approach for innovations in therapy and for the discovery of the optimal balance of flexibility, prescription, and structure. The potential benefits are organized along the three broad dimensions of efficiency, effectiveness, and efficacy. Importantly, these dimensions are independent of each other, such that if modular design does proves equivalent but not superior to integral design along one dimension, it can still offer advantages in the other two. For example, if a modular design is efficient and fits well into practice, but only equivalent in efficacy to traditional integral designs, the first two advantages would still support its use. Researchers and protocol designers are encouraged to consider these potential benefits in future efforts involving psychotherapy development and testing.

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